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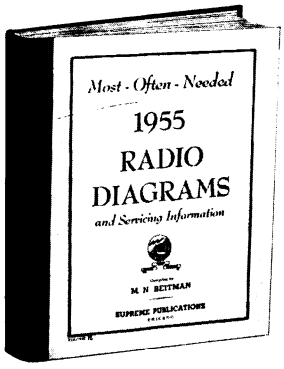

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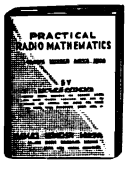

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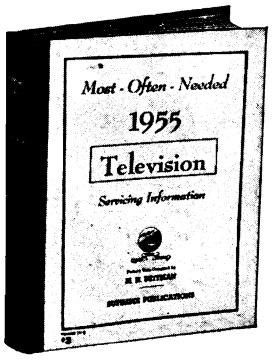

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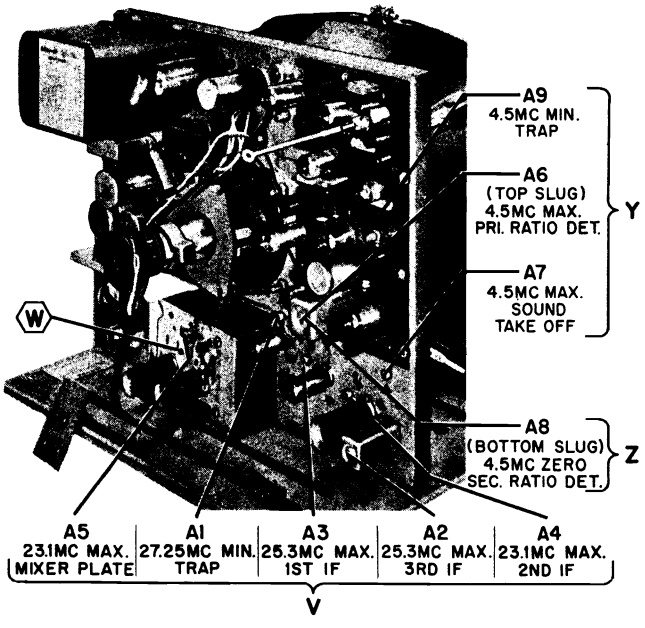
Chassis 17X3Z, Models T18A1, T18A2, T18A3,
Chassis 17SX3, Models TS1801, TS1802, TS1806, TS1807,
Chassis 17SX3Z, Models TS18A1, TS18A2, TS18A3.

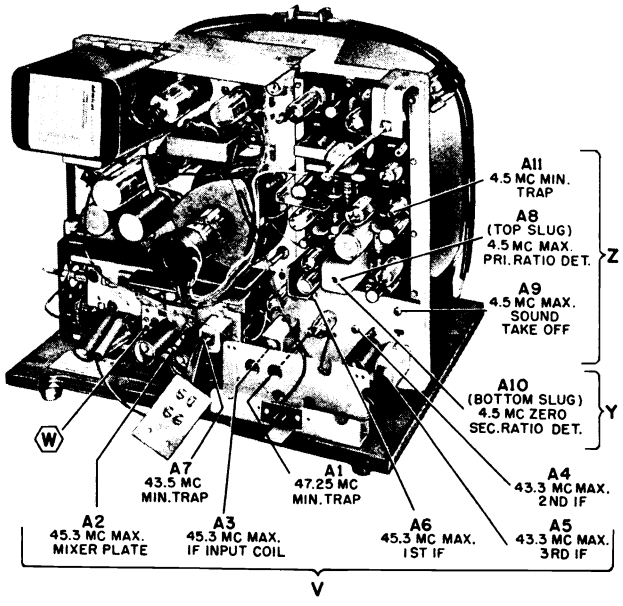
All sets listed above use the same basic circuitry with the exception of the tuner, IF amplifier, and minor differences in the video detector and AGC circuits. The principal chassis differences are described below.

Chassis 17XP3 and 17X3Z are 17-tube VHF receivers with a 24 MC IF system. Early production 17XP3 chassis use switch type tuners, part 94D85-1. Later production 17XP3 chassis use turret type tuners, part 94D91-1. Chassis 17X3Z uses VHF tuner, part 94D97-1, and aluminized face-plate picture tubes, type 17AVP4A. The circuit diagram of 17XP3 (early) on pages 8-9 should be used in servicing these chassis.

Chassis 17SX3 and 17SX3Z are 18-tube VHF-UHF receivers. These chassis are similar to the VHF chassis with the exception that they have combination VHF-UHF tuners (part 94E75-3 or 94E75-13) and use a 44 MC IF system. A type 17AVP4A picture tube is used in the 17SX3Z chassis. The circuit diagram of 17SX3 on pages 10-11 should be used in servicing these two chassis.



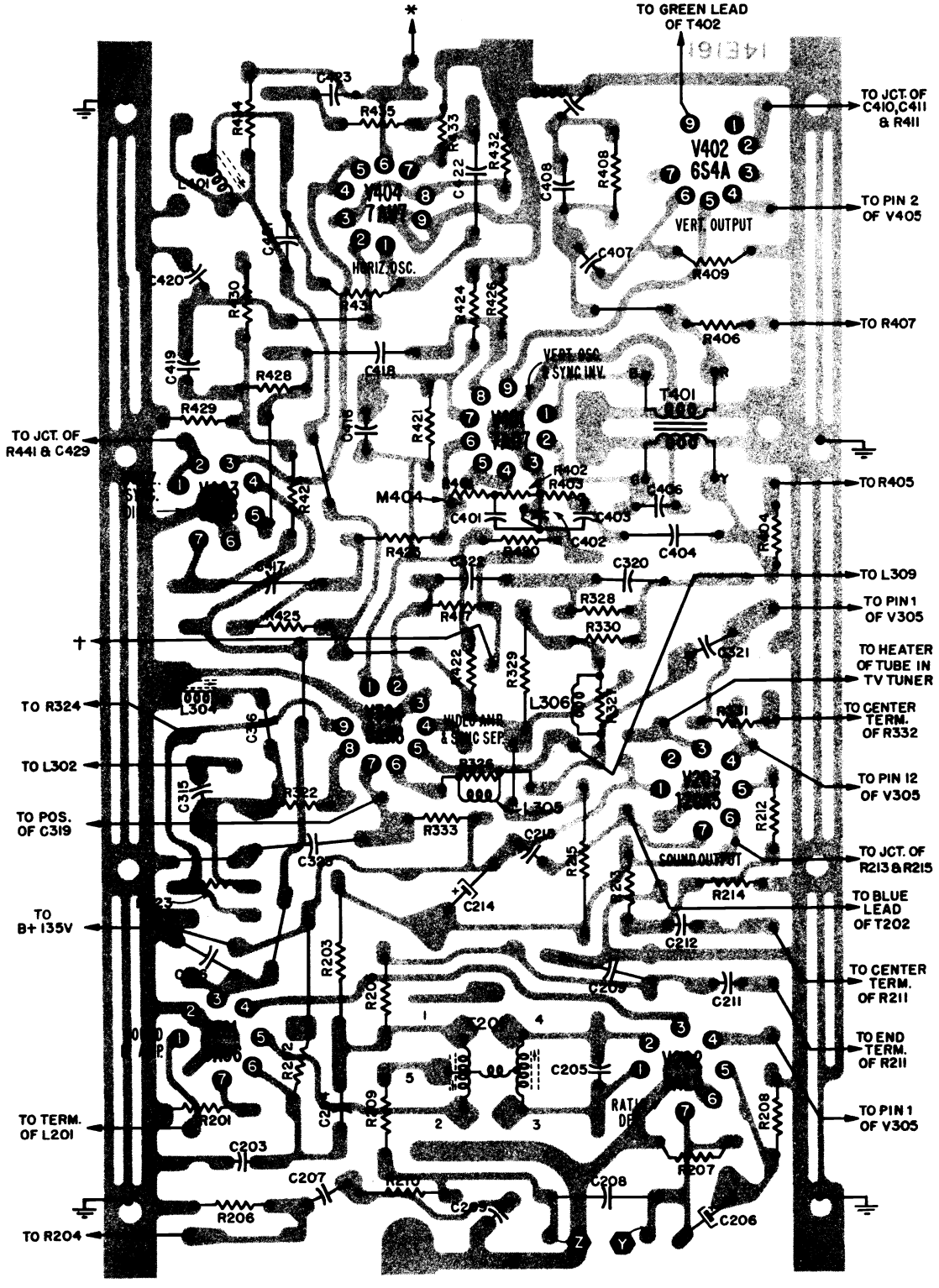
Rear View of 17XP3 Chassis Showing Test Point Connections and IF Alignment Data.



Rear View of 17SX3 Chassis Showing Connections and IF Alignment Data.

ADMIRAL (Continued)

VHF (21 MC IF) 17XP3 CHASSIS
VHF-UHF (41 MC IF) 17SX3 CHASSIS



* Connects to C424 in early production sets and to C430 in later production sets.

† In all VHF chassis, terminal of R417 connects to junction of R306 and R317. In early production VHF-UHF chassis, terminal of R417 connects to junction of R304 and R506. In later production VHF-UHF chassis, terminal of R417 connects to chassis ground.

Wiring Side of Printed Wiring Assembly Showing Locations of all Component Connection Points. NOTE: Gray area represents printed wiring, black symbols and lines represent components, wiring and connections on opposite side.

ADMIRAL (Continued)

ELIMINATING CORONA AT CAP OF V406 (1X2B)

If corona discharge is present at the cap of V406 high voltage rectifier (1X2B), replace the spring type clip (used in some early production receivers) with an insulated type tube cap. A one inch length of heavy polyethylene tubing can be slipped over the tube cap to further eliminate possibility of corona.

AUDIO BUZZ

If the ratio detector tube V202 (3AL5) should become inoperative, sound may still be heard. However, sound will be slightly weaker and audio buzz will be heard.

If audio buzz is present in sound, check the ratio detector tube V202 (3AL5) before aligning ratio detector secondary (adjustment A8 in 17XP3 chassis and adjustment A10 in 17SX3 chassis).

(The material below in this column is exact for 17SX3, 17SX3Z. When using it for 17XP3 and 17X3Z, substitute A8 for A10, and A9 for A11, in the instructions.)

TOUCH-UP OF RATIO DETECTOR SECONDARY (A10) USING TELEVISION SIGNAL

Adjustment need be made on one channel only.

Proceed as follows:

a. Turn set on and allow about 15 minutes for warm up.

b. Tune set for normal picture and sound.

c. Carefully adjust the secondary slug (A10) of the Ratio Detector Transformer using a non-metallic alignment tool with a hexagonal end (part number 98A30-12). Both slugs (A8 and A10) have hollow cores. Either slug may be adjusted from the top or bottom of the chassis by passing the alignment tool through the core of the first slug encountered. A10 is the slug closest to the chassis.

Adjust A10 for best sound with minimum buzz level. Do this carefully as only slight rotation in either direction will generally be required. Correct adjustment point is located between the two maximum buzz peaks that will be noticed when turning the slug back and forth about ¼ to ½ turn.

d. If necessary, repeat individual channel slug adjustment and conclude with retouching the ratio detector secondary. Note: If oscillator adjustment is required for other channels, it will ***not*** be necessary to repeat the ratio detector secondary adjustment after ***once*** correctly adjusting it.

ALIGNMENT OF 4.5 MC TRAP A11, USING A TELEVISION SIGNAL

Beat interference (4.5 MC) appears in picture as very fine vertical or diagonal lines, very close together, having a "gauze-like" appearance, the pattern will vary with speech, forming a very fine herringbone pattern.

The trap can be tuned by watching the picture and adjusting the slug A11 for minimum 4.5 MC interference.

VHF (21 MC IF) 17XP3 CHASSIS
VHF-UHF (41 MC IF) 17SX3 CHASSIS

For schematic diagrams see pages 8-9 and pages 10-11.

SCHEMATIC NOTES

②, ③, . . . etc. indicate production changes covered by a Run number. Run numbers are stamped at the rear of the chassis. Brief description of Run changes given on schematic.

Ⓐ1, Ⓐ2,.....Ⓨ, Ⓩ, etc. indicate alignment points and connections.

IMPORTANT: Before making waveform and voltage measurements, see instructions below.

Fixed resistor values shown in ohms ± 10% tolerance, ½ watt; capacitor values shown in micromicrofarads ± 20% tolerance unless otherwise specified.

NOTE: K=x 1000, MEG=x 1,000,000 MF=microfarad.

CONDITIONS FOR OBSERVING WAVEFORMS

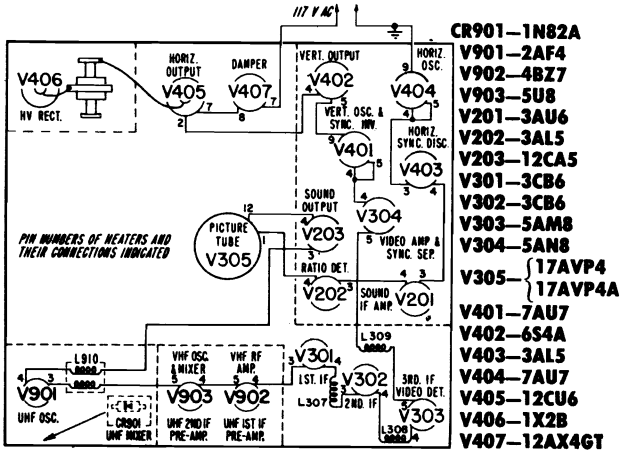
Caution: Pulsed high voltages are present on the caps of V405 and V406, and at pin 3 of V407. **Do not** attempt to observe wave forms at these points unless suitable test equipment is used. Waveforms at these points may be taken with a capacitive voltage divider probe. The waveform at pin 3 of V407 may also be taken by clipping or twisting the lead from the high side of the oscilloscope over the insulation on the lead connecting to pin 3. If the waveform is taken in this manner, its shape will be the same, but the peak-to-peak voltage will be somewhat lower, depending on the degree of coupling between the oscilloscope and the lead connecting to pin 3 of V407.

- Waveforms should closely resemble those shown on the schematic.
- Waveforms are taken with a transmitted signal input to the television chassis.
- Set all controls for a normal picture. After the receiver is set for a normal picture, turn the **Contrast** control fully clockwise.
- Oscilloscope sweep is set at 30 cycles for vertical waveforms and at 7,875 cycles for horizontal waveforms to permit 2 complete cycles to be observed.
- Peak-to-peak voltages will vary slightly from those shown on the schematic, depending on the test equipment employed and chassis parts tolerance.

CONDITIONS FOR MEASURING VOLTAGES

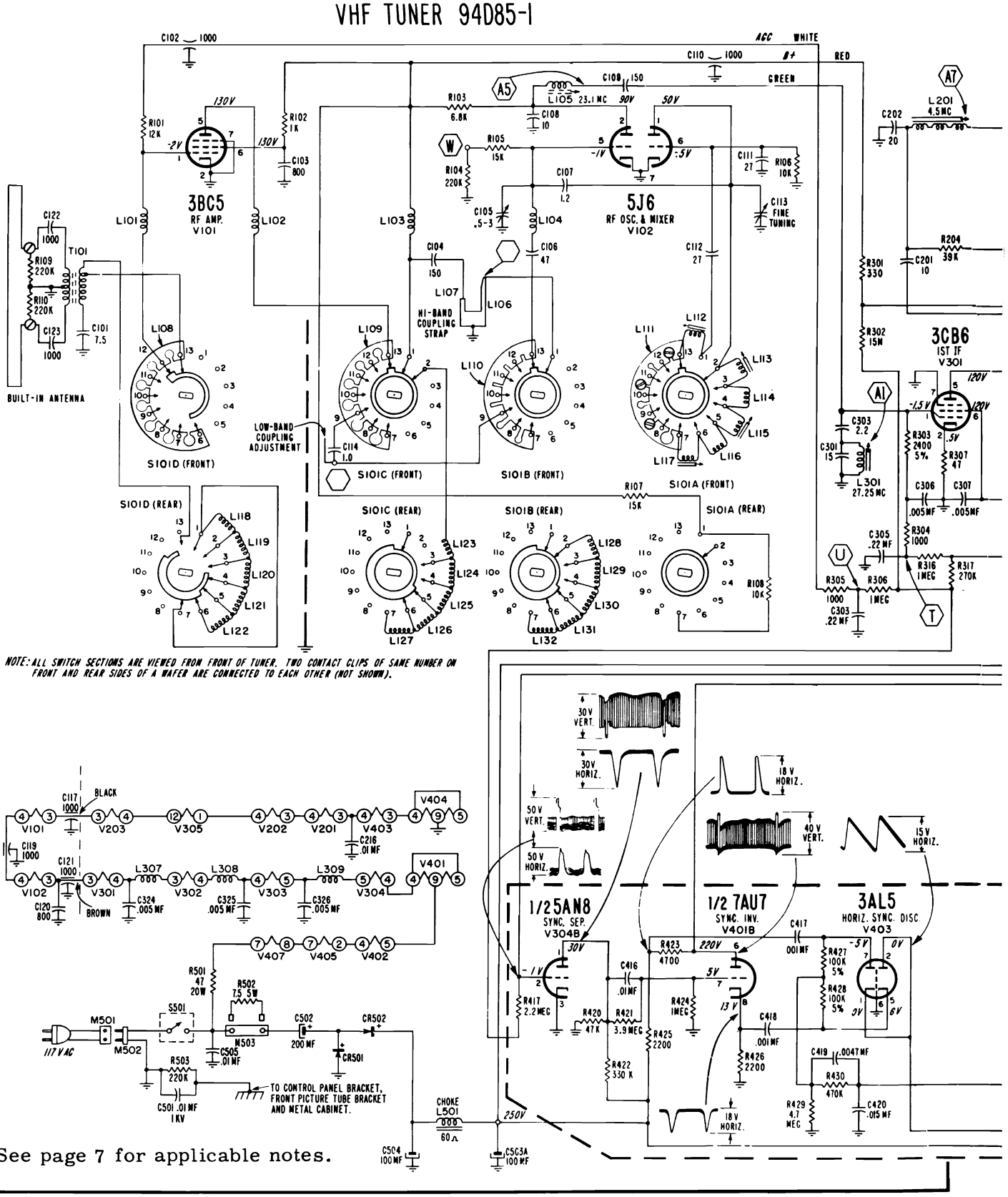
Caution: Pulsed high voltages are present on the caps of V405 and V406, and at pin 3 of V407. **Do not** attempt to measure voltages at these points without suitable test equipment. A VTVM with a high voltage probe may be used when measuring picture tube 2nd anode voltage.

- Set the **Channel Selector** on an unused channel. **Contrast** control fully clockwise. All other controls counterclockwise. Do not disturb **Horizontal Hold** or **Horizontal Drive** adjustments.
- Antenna disconnected and terminals shorted together.
- Line voltage: 117 volt AC.
- DC voltages measured with a VTVM between tube socket terminals and chassis, unless otherwise indicated.
- Voltages marked (*) will vary widely with control settings.



View of 17SX3 CHASSIS

ADMIRAL 17XP3 Chassis, Schematic Diagram

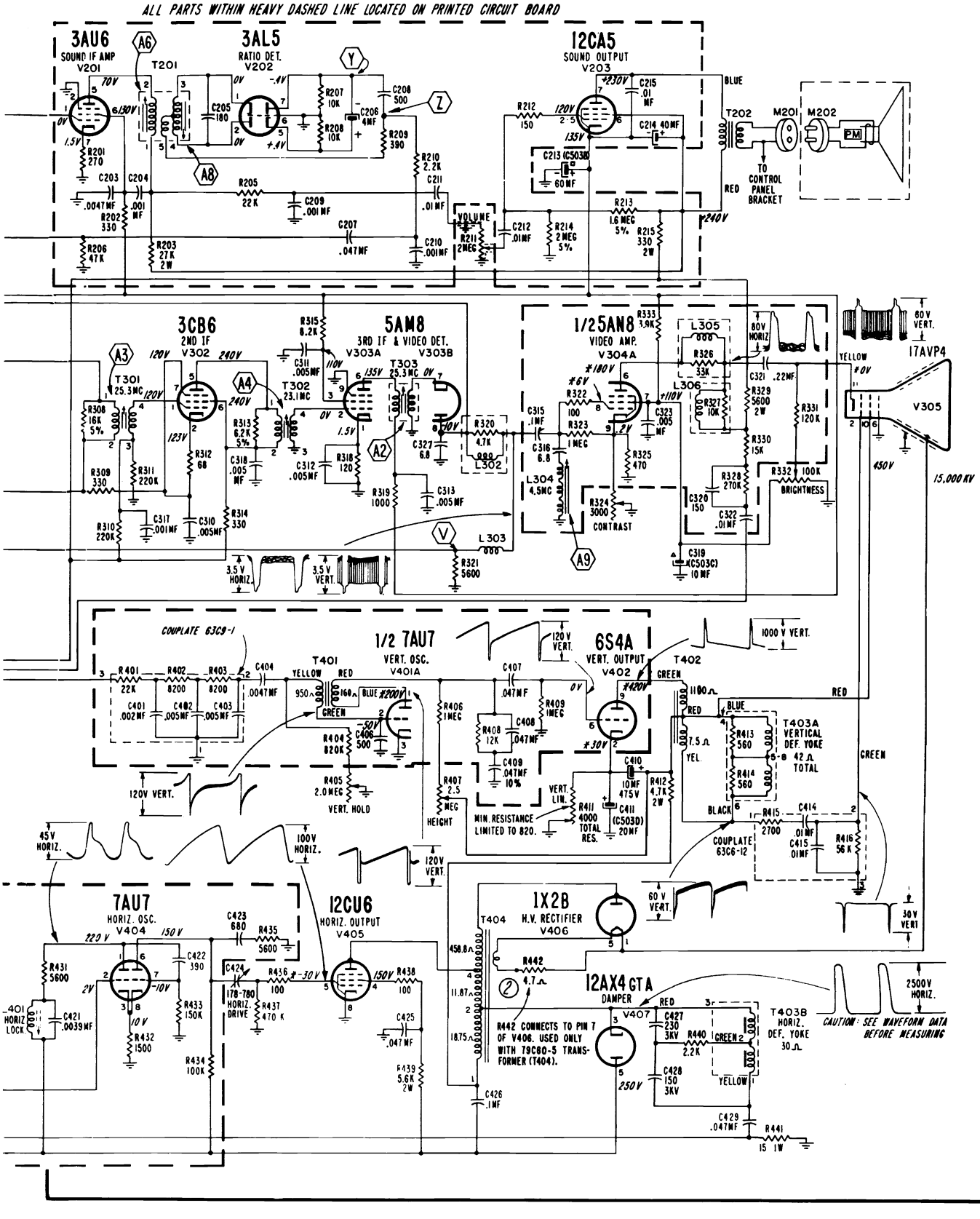


NOTE: ALL SWITCH SECTIONS ARE VIEWED FROM FRONT OF TUNER. TWO CONTACT CLIPS OF SAME NUMBER ON FRONT AND REAR SIDES OF A WAFER ARE CONNECTED TO EACH OTHER (NOT SHOWN).

See page 7 for applicable notes.

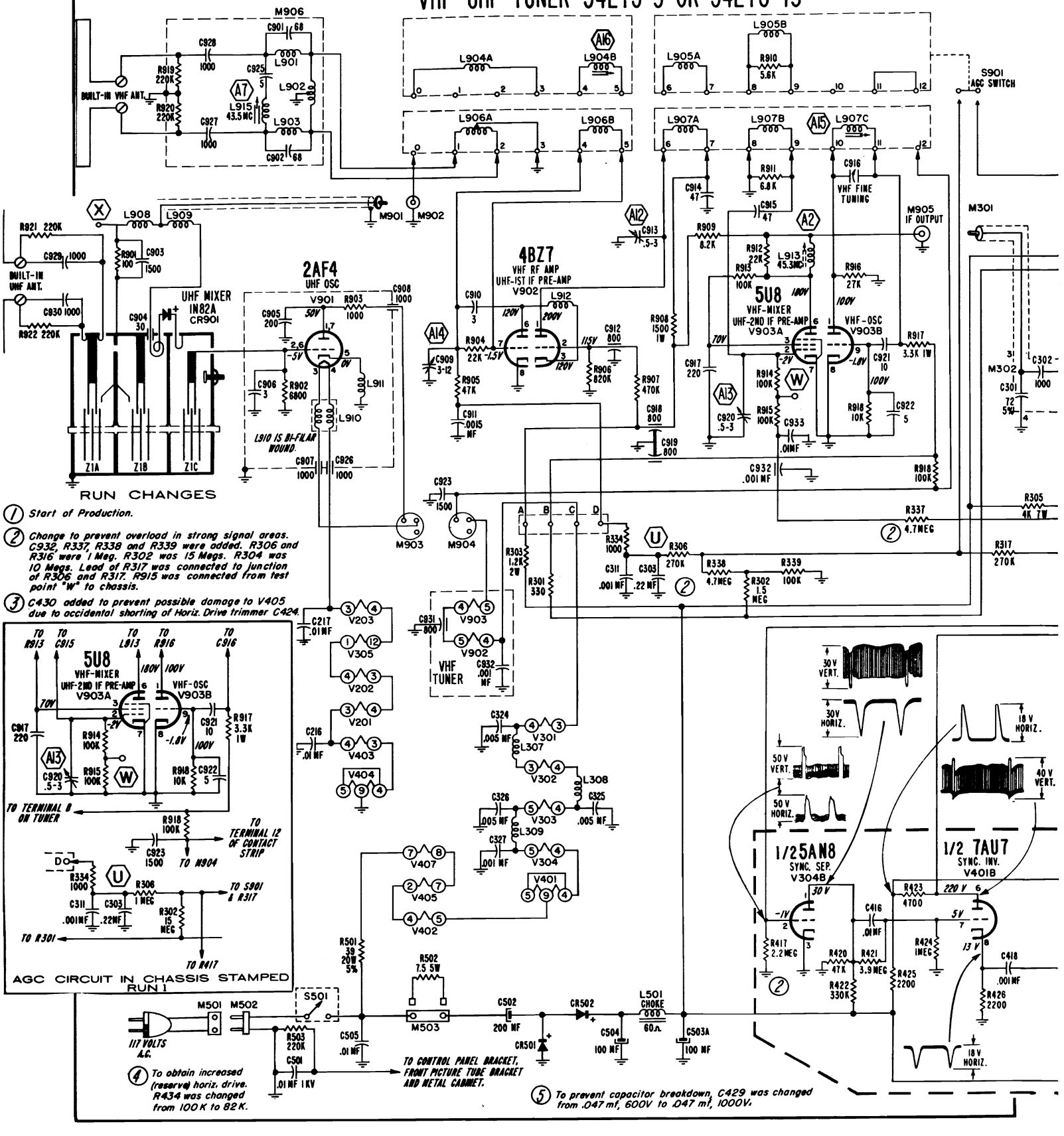
ADMIRAL

Schematic for 17XP3 Chassis.



ADMIRAL Schematic for Chassis 17SX3 (See page 7 for Schematic Notes)

VHF-UHF TUNER 94E75-3 OR 94E75-13



RUN CHANGES

(1) *Start of Production.*

(2) *Change to prevent overload in strong signal areas. C932, R337, R338 and R339 were added. R306 and R316 were 1 Meg. R302 was 15 Megs. R304 was 10 Megs. Lead of R317 was connected to junction of R306 and R317. R915 was connected from test point "W" to chassis.*

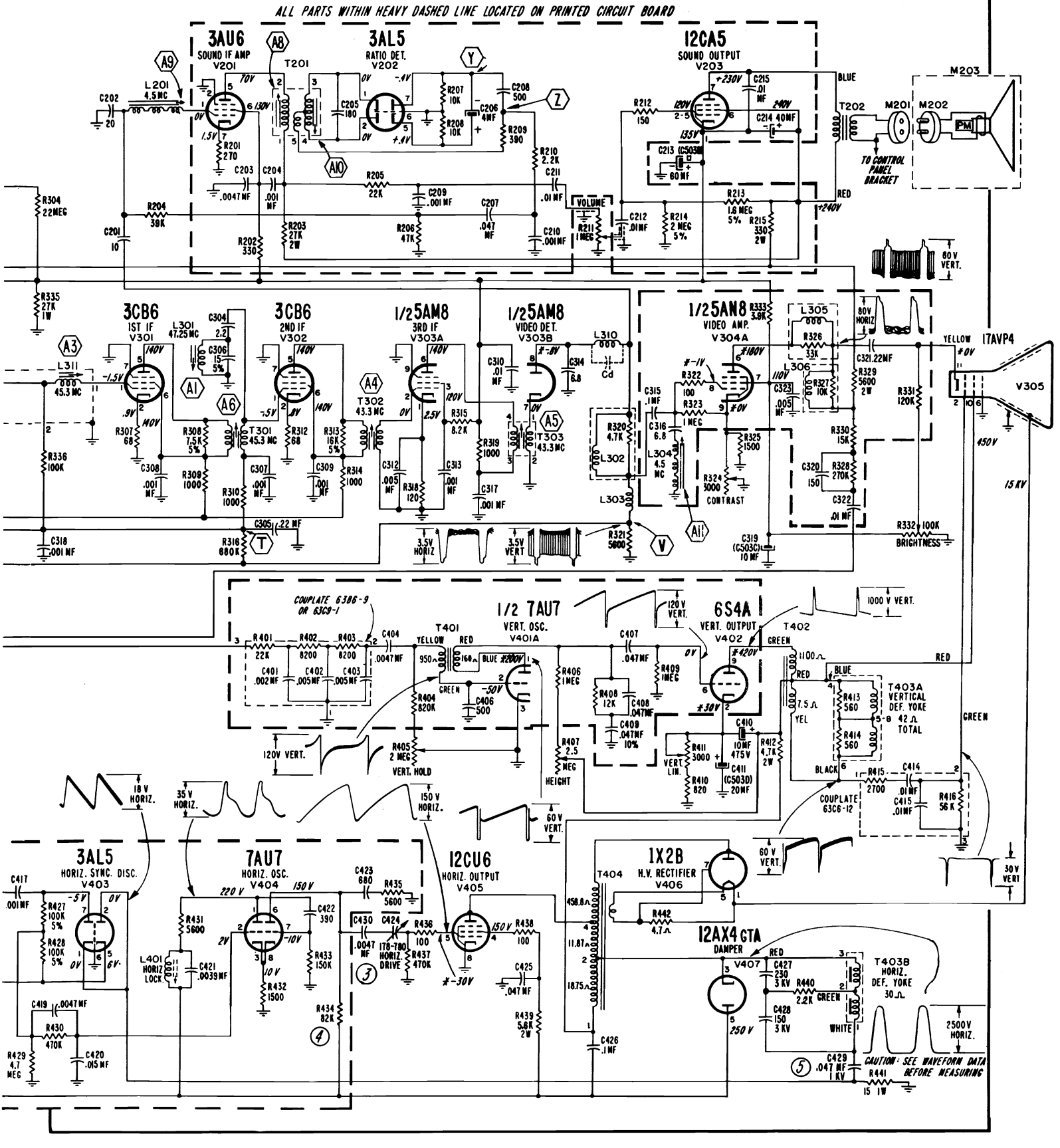
(3) *C430 added to prevent possible damage to V405 due to accidental shorting of Horiz. Drive trimmer C424.*

(4) *To obtain increased (reserve) horiz. drive. R434 was changed from 100K to 82K.*

(5) *To prevent capacitor breakdown, C429 was changed from .047 mf, 600V to .047 mf, 1000V.*

ADMIRAL

Schematic for 17SX3
Chassis Stamped Run 1 through Run 5.



Admiral

Models Using 21 MC IF Chassis
21A3Z, 21A3AZ, 21C3Z and 21G3Z

Models Using 41 MC IF Chassis
21B3Z, 21D3Z and 21H3Z

DIFFERENCES BETWEEN CHASSIS

The 21A3Z chassis is a VHF television only receiver with a 21 MC. IF system.

The 21A3AZ chassis is the same as the 21A3Z chassis, except that power supply filter choke and the output transformer are mounted on the chassis and not on the speaker.

The 21B3Z chassis differs from the 21A3Z chassis in that it is a VHF-UHF television only receiver with a 41 MC. IF system.

The 21C3Z chassis is used in VHF-TV-Radio-Phonograph combination models. It is similar to the 21A3Z chassis, except that it is equipped to have a 3D1A Radio Record Changer unit connected to it.

The 21D3Z chassis is used in VHF-UHF TV-Radio-Phonograph combination models. It is similar to the 21B3Z chassis, except that it is equipped to have a 3D1A Radio-Record Changer unit connected to it.

The 21G3Z chassis is similar to the 21A3Z chassis, but is designed for a 27RP4 picture tube.

The 21H3Z chassis is similar to the 21B3Z chassis, but is designed for a 27RP4 picture tube.

Use the circuit of 21A3Z, pages 16-17, when servicing 21A3Z, 21A3AZ, 21C3Z, and 21G3Z chassis.

Use the circuit of 21D3Z (combination) on pages 20-21 when servicing 21B3Z, 21D3Z, 21H3Z. This material includes the circuit of 3D1A radio.

ADJUST THE ION TRAP

To prolong the life of the picture tube, it is important that this adjustment be made upon installation, after centering the picture, or after repositioning the focus assembly.

Set the **Brightness** control for normal brightness.

Position the ion trap on the picture tube close to the tube base. Very carefully move the ion trap forward or backward and at the same time, rotate it slightly in either direction until maximum brightness is produced.

Note that there may be two locations where the brightest picture can be produced. The second ion trap location, which is farther from the tube base, should not be used or tube damage will result.

Reset the **Brightness** control for normal brightness. Readjust the ion trap for maximum brightness.

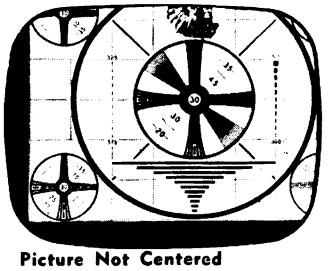
Important: If the corners of the picture are shaded, be sure the ion trap has been properly adjusted for maximum brightness. Do not reduce picture brightness to remove shaded corners.

MODEL IDENTIFICATION CHART

MODEL No.	MODEL NAME	TV CHASSIS	VHF TUNER
T2311Z	Coral Gables	21A3Z	94D61-2
TA2311Z	Coral Gables	21B3Z	94D64-4
T2312Z	Bel-Aire	21A3Z	94D61-2
TA2312Z	Bel-Aire	21B3Z	94D64-4
T2316Z	Beverly Hills	21A3Z	94D61-2
TA2316Z	Beverly Hills	21B3Z	94D64-4
T2317Z	Bermuda	21A3Z	94D61-2
TA2317Z	Bermuda	21B3Z	94D64-4
T2318Z	Bar Harbor	21A3Z	94D61-2
TA2318Z	Bar Harbor	21B3Z	94D64-4
T2319Z	Park Avenue	21A3Z	94D61-2
C2316Z	Catalina	21A3Z	94D61-2
CA2316Z	Catalina	21B3Z	94D64-4
C2317Z	Casablanca	21A3Z	94D61-2
CA2317Z	Casablanca	21B3Z	94D64-4
C2319Z	Santa Barbara	21A3Z	94D61-2
C2326Z	Del-Monte	21A3Z 21A3AZ	94D61-2
CA2326Z	Del-Monte	21B3Z	94D64-4
C2327Z	California	21A3Z 21A3AZ	94D61-2
CA2327Z	California	21B3Z	94D64-4
C2826Z	Trinidad	21G3Z	94D61-3
CA2826Z	Trinidad	21H3Z	94D64-4
C2827Z	Hollywood	21G3Z	94D61-3
CA2827Z	Hollywood	21H3Z	94D64-4
F2326Z	El Dorado	21A3Z 21A3AZ	94D61-2
FA2326Z	El Dorado	21B3Z	94D64-4
F2327Z	Riviera	21A3Z 21A3AZ	94D61-2
FA2327Z	Riviera	21B3Z	94D64-4
F2328Z	Deauville	21A3Z 21A3AZ	94D61-2
FA2328Z	Deauville	21B3Z	94D64-4
L2326Z	Westchester	21C3Z	94D61-2
LA2326Z	Westchester	21D3Z	94D64-4
L2327Z	Westwood	21C3Z	94D61-2
LA2327Z	Westwood	21D3Z	94D64-4

ADJUST PICTURE CENTERING

The picture can usually be centered with the picture positioning lever. Loosen screw "A". Move the lever sideways or up and down until the picture is centered. Tighten screw "A".



Picture Not Centered

ADMIRAL (Continued)

HORIZONTAL DRIVE ADJUSTMENT

If the **Horiz. Drive** adjustment (on rear of set) is not properly adjusted, it may be difficult to obtain sufficient picture width and brightness.

NOTE: In early sets, a shaft extending from the rear of the chassis can be rotated for making the horizontal drive adjustment as shown in figure 8. In late sets, adjustment is made by turning the trimmer screw which replaces the shaft (see figure 7).

a. Turn the **Horiz. Drive** control (or trimmer screw) fully clockwise.

   If a white vertical line appears on the screen, slowly turn **Horiz. Drive** control (or trimmer screw) counterclockwise until the line disappears.

b. Check **Horizontal** control (on front panel) to see that its range is proper after making the **Horiz. Drive** adjustment.

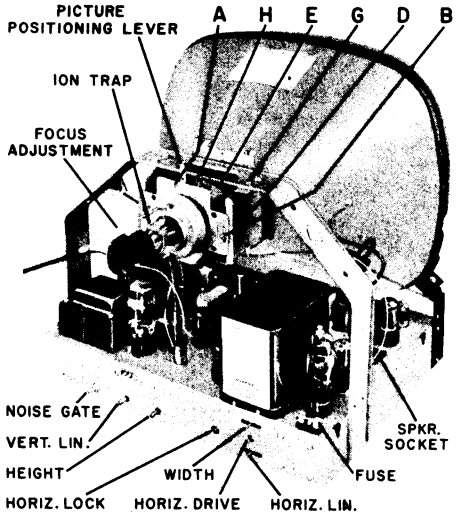


Figure 7. Rear View of 21A3Z, 21A3AZ, and 21B3Z Chassis, Showing Adjustment Locations.

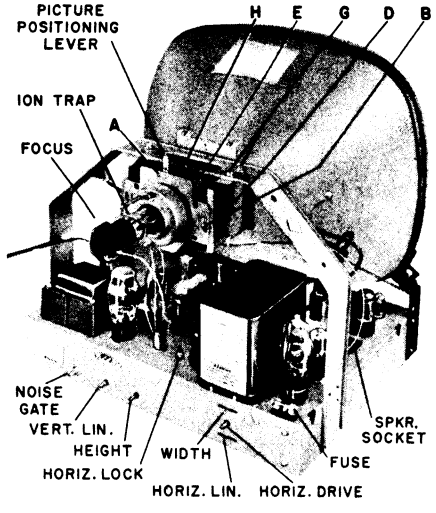
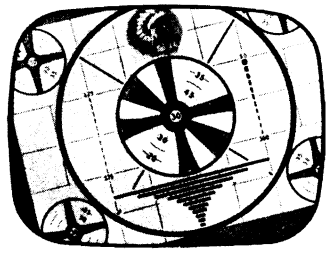


Figure 8. Rear View of 21A3Z and 21B3Z Chassis, Stamped Run 11 or Lower, Showing Adjustment Locations.

VHF (21MC IF) 21A3Z, 21A3AZ, 21C3Z, 21G3Z CHASSIS
VHF-UHF (41MC IF) 21B3Z, 21D3Z, 21H3Z CHASSIS

ADJUST PICTURE TILT

In early production models: If the picture is tilted, loosen the wing screw "H" on the deflection yoke "E" and slightly rotate the yoke until the picture is straight. Before tightening the wing screw, be sure that the yoke is moved as far forward as possible, otherwise corners of the picture may become shaded.



Picture Tilted; Adjust Deflection Yoke.

In late production models: If the picture is tilted, hold the yoke retaining plate stationary with one hand and slightly rotate the yoke with the other hand until the picture is straight.

HORIZONTAL OSCILLATOR ADJUSTMENT

In early production chassis the **Horizontal Lock** adjustment was located on the rear apron of the chassis (see figure 7). In later production chassis this adjustment was located at the top-rear of the chassis (see figure 8). In latest production chassis this adjustment is again on the rear apron of the chassis as in figure 7.

When switching channels, the **Horizontal** control (on front panel) should keep the picture in horizontal sync through at least three fourths of its range. If the picture does not remain in horizontal sync, it will be necessary to make the **Horiz. Lock** adjustment. However, before making the adjustment, be sure that the picture can be made to remain stationary up and down (sync vertically) as lack of both vertical and horizontal sync is an indication of trouble in the sync circuits such as a defective tube or component. Make the **Horiz. Lock** adjustment as follows:

a. Allow the set to warm up. Tune in a station and adjust the **Brightness** and **Contrast** controls for average settings. Important: Before proceeding, be sure that **Noise Gate** control is adjusted according to the instructions given in this manual.

b. Turn the **Horizontal** control (on front panel) fully to the left. Slowly rotate the **Horizontal** control to the right while interrupting the video signal by switching the **Channel Selector** off and on a station several times. The picture should pull-in (sync) through at least three fourths of the range of the **Horizontal** control. If it does not, set the **Horizontal** control to the center of its range. Slowly turn the **Horiz. Lock** control to the right or left, until the picture synchronizes. It may require a few turns to make the range of the **Horizontal** control proper.

ADJUST FOCUS

Focus adjustment can be made on these sets without removing the cabinet back from the receiver by rotating the flexible shaft extending from the rear of the focus assembly. Set the **Contrast** control for normal picture and the **Brightness** control at slightly above average brightness. Rotate the focus control shaft to the right or to the left until the picture is in sharp focus. If the picture was greatly out of focus, readjust the ion trap.

ADMIRAL (Continued)

VHF (21MC IF) 21A3Z, 21A3AZ, 21C3Z, 21G3Z CHASSIS
VHF-UHF (41MC IF) 21B3Z, 21D3Z, 21H3Z CHASSIS

TROUBLE SHOOTING CHART

DEAD SET

Symptoms	Check
Dead receiver (no sound, no raster).	a. Power line circuit (interlocking connector). b. Rectifier circuit (V501). c. Power transformer (T501). d. "TV-RAD-PHO" switch in "Pho" position in combination models. e. Plug M704, in combination models.

PICTURE

No picture, or intermittent picture. Raster and sound OK.	a. Video amplifier circuit (V304) for defective tube or other component. Check contrast control for open, and setting of Noise Gate control. b. Waveform at V304. c. Gated AGC tube V306 (6AU6). d. RF and IF amplifier tubes.
Weak picture (insufficient contrast). Sound and raster OK.	*a. Alignment of individual channel slugs. b. VHF tuner circuit (V101, V102) for weak tubes, components, or alignment. c. IF amplifier stages (V301, V302, V303A) for weak tubes, components, or alignment. d. Video detector circuit (V303B) for defective component. e. Video amplifier circuit (V304) for weak tube or open peaking coil.
Poor horizontal linearity. Insufficient width. Insufficient brightness.	a. Horizontal drive setting (R433 or C421). b. Horizontal output tube (V406) by substitution. c. Damper tube (V408) by substitution. d. Rectifier tube (V501).
Picture jitter (sideways).	a. Check adjustment of Noise Gate. b. Horizontal hold and/or lock adjustment in weak signal areas. c. Change horizontal output tube (V406) if sections of the picture are displaced. d. For noisy or microphonic tube(s) or poor connections in the RF, IF, video and sweep sections of the receiver. Check horizontal output tube (V406) by substitution. e. Noise pick-up in antenna or transmission line. Adjust Noise Gate.
Smeared effect in picture (poor low frequency response).	*a. Setting of Tuning control. b. Trouble may be at transmitter. Check on another station. c. Video detector (V303B) and circuit components. d. Video amplifier tube (V304) or open peaking coil. e. Alignment of VHF Tuner and IF stages.
Poor picture detail (poor definition).	*a. Setting of Tuning control. b. Antenna and transmission line for reflections (fine ghosts), possibly due to incorrect termination or routing. c. RF and IF alignment. d. Video detector (V303B) and circuit components. e. Video amplifier tube (V304) and circuit components.
Sound bars in picture.	*a. Setting of Tuning control. b. Microphonic tube (V102 most probable) in RF or IF circuits. c. Oscillation in IF system; check for open by-pass capacitor. d. Alignment of RF and IF stages.
"Snow" in picture background.	a. Antenna and transmission line; may be due to incorrect termination, routing or orientation. b. For weak signal input by comparison to set known to be good. Location may be beyond normal service area of station. c. Noisy tubes in VHF tuner; V102 most probable cause. d. Second anode power supply for corona discharge.
Vertical bars on right side of picture.	a. Horizontal oscillator tube (V405) by substitution. b. Horizontal output tube (V406) by substitution. c. Damper tube (V408) by substitution.
Light and dark vertical bars. Bad horizontal linearity.	a. Damper tube (V408) by substitution. b. Horizontal output tube (V406) by substitution. c. Horizontal drive R433 or C421 and adjust.
Two heavy black horizontal bars covering picture tube screen.	a. Power supply circuit for open or leaky filter capacitor. b. Voltage in B+ circuit for shorted capacitor.
Picture Bending at top of picture.	a. Hor. Lock adjustment L401. b. See Run 12 under "Production Changes."

* Individual channel oscillator slug may be misaligned.

ADMIRAL (Continued)

VHF (21MC IF) 21A3Z, 21A3AZ, 21C3Z, 21G3Z CHASSIS
VHF-UHF (41MC IF) 21B3Z, 21D3Z, 21H3Z CHASSIS

SOUND and PICTURE

Symptoms	Check
***No sound or picture. Raster OK.**	a. VHF tuner circuit (V101, V102); check tubes and coil contacts. b. IF stages (V301, V302, V303A); check tubes and components. c. Check video detector V303B and peaking coils L307 and L308. d. Waveforms at video detector V303B and video amplifier V304.

SYNC

Poor horizontal and vertical sync in extreme fringe areas.	a. Adjust Noise Gate.
No vertical sync. Horizontal sync OK.	a. Integrator network for defective components. b. Waveform at pin 1 of V402.
No horizontal or vertical sync. Picture signal OK.	a. Tubes V401 and V402A by substitution. b. Sync separator (V401) by substitution. c. Sync inverter tube (V402A) by substitution. d. Waveforms at sync circuits. e. Noise Gate setting.
No horizontal sync; vertical sync OK.	a. HOR. LOCK L401 adjustment. b. Sync inverter tube (V402A) and circuit components. c. Sync discriminator tube (V404) and circuit components. d. Horizontal oscillator tube (V405) and circuit components. e. Resistor R428. f. Waveforms at V402A, V404, V405.
Picture "locks in" only at center of Hor. Hold control. Falls out on both sides.	a. Sync discriminator tube (V404) and circuit components. Check tolerance of capacitors and resistors; R424 or R425 is common cause.
Vertical roll, horizontal jitter.	a. Setting of Noise Gate.

RASTER

No raster. Sound OK.	a. Fuse M503. b. Ion trap adjustment. c. Tubes V305, V404, V405, V406, V407, V408. d. Horizontal oscillator circuit (V405). e. Horizontal output transformer (open). f. Horizontal output circuit (V406). g. Damper circuit (V408). h. Leaky or shorted coupling C419, C420, C421. i. 2nd anode power supply (V407, V408). 2nd anode voltage (rectified by 1B3GT rectifier) is obtained by the auto transformer action of the primary circuit of the horizontal output transformer. Failure of the horizontal oscillator (V405) or horizontal output tube (V406) wlil cause no voltage to be developed in the 2nd anode supply circuit, since no sweep voltage is introduced in the primary of the horizontal output transformer. Waveforms at V404, V405, V406, V408.
Bright vertical line. No horizontal deflection, no raster.	a. Open deflection yoke (M402B). b. Open capacitor (C428).
Raster too small (insufficient height and width).	a. Height and width adjustments (R417 and L402). b. Tubes V406 and V501. c. Power supply voltage (V501); check for open filter capacitor. d. Low AC line voltage. e. Gas contents will decrease the deflection sensitivity of the picture tube (improper focus will also result).
Excessive raster brilliance. Brightness control has no effect.	a. Picture tube (V305) by substitution. b. Picture tube circuit; R332 open.
No raster, fuse M401 blows when set seems to be operating OK.	a. Damper tube V408. b. V406, V408 circuit for shorted capacitor. c. High voltage arc-over; check V407 tube socket.
Vertical lines or "wrinkles" on left side of raster.	a. Spurious oscillations in horizontal output (V406, V408); replace tubes. b. Deflection yoke; check C427, R444. c. Horizontal drive (R433 or C421) setting.
Dim raster. Brightness control operation reversed. No sound or picture.	a. V204 sound output tube.
Raster "blooms" (gets larger) as brightness is increased.	a. Horizontal output tube V406. b. 2nd anode rectifier V407 (1B3GT).

* Individual channel oscillator slug may be misaligned.

ADMIRAL (Continued)
Circuit for 21A3Z Chassis

TV TUNER 94D61-2

TURRET SWITCH SETTING SELECTS PAIR OF COILS L101 & L102 FOR CHANNEL DESIRED

PRODUCTION CHANGES

② Pin 2 of V203 (6AV6) was grounded. R211 & R212 were not used.

③ R331, 1 Meg, connected from pin 11 of V305 (21AMP4A) to ground was removed. R333 changed from 270K to 180K. R413 was 1.2 Meg.

④ Pin 6 of V306 (6AU6) was connected to unfused +270V. R316 was 1K. R331, 1 Meg, added from pin 11 of V305 (21AMP4A to ground. R333 was 180K.

⑤ R338 was 180K.

⑥ Outside foil of C212 moved from pin 4 of V204 (6DG6GT) to pin 8 of V204.

⑦ Outside foil of C424 moved from ground to junction of R319 & R327.

⑧ R329 changed from 270 K to 100K. R311 & R315 changed from 8.2K, 2W to 15K, 2W. R345 & R346 added across R311 & R315 respectively.

⑨ R421 was 1000Ω, 2W.

⑩ R347 added. Noise gate wired to also function as AGC delay control in sets stamped with the letter "H" in front of the code date.

⑪ Horiz. Drive changed from variable resistance type to to variable capacitor. Components on chassis shifted back to allow use of different 21AMP4A picture tube with letter "K" molded on its bowl.

⑫ R333 changed to 180K, R437 changed to 8.2K, C429 added to Horiz. Osc.

⑬ Same change as run 10 except chassis have letter "B" stamped in front of code date.

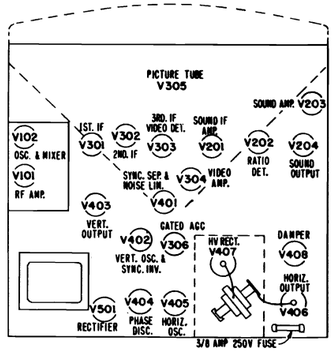
⑭ R325 deleted. C331 added. R302, R303 deleted. R336 changed to 1 Meg. R305 changed to 5.6Meg and connected to pin 5 of V306. R304 connected to B+.

SCHEMATIC NOTES

②, ③, . . . etc. indicate production changes covered by a Run number. Run numbers are stamped at the rear of the chassis.

Ⓐ1, Ⓐ2, ... Ⓨ, Ⓩ, etc. indicate alignment points and alignment connections.

See page 19 for complete explanation of notes applicable to conditions for observing waveforms and measuring voltages shown on this diagram.

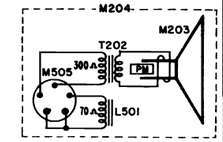


Top View of 21A3Z Chassis.

V101—6BZ7
V102—6J6
V201—6AU6
V202—6AL5
V203—6AV6
V204—6W6A or 6DG6GT
V301—6CB6
V302—6CB6
V303—6AM8
V304—12BY7
V305—21AMP4A
V306—6AU6
V401—6CS6
V402—6SN7GT
V403—12B4
V404—6AL5
V405—6SN7GT
V406—6CD6G
V407—1B3GT
V408—6AX4GT
V501—5U4G

Schematic for 21A3Z Chassis Stamped RUN 1 Through RUN 14.

Use this circuit when servicing Chassis 21A3Z, 21A3AZ, 21C3Z, and 21G3Z. This circuit is exact for 21A3Z and 21A3AZ. Chassis 21G3Z uses a 27RP4 picture tube and has other minot differences. Chassis 21C3Z is used in combinations and includes 3D1A radio.



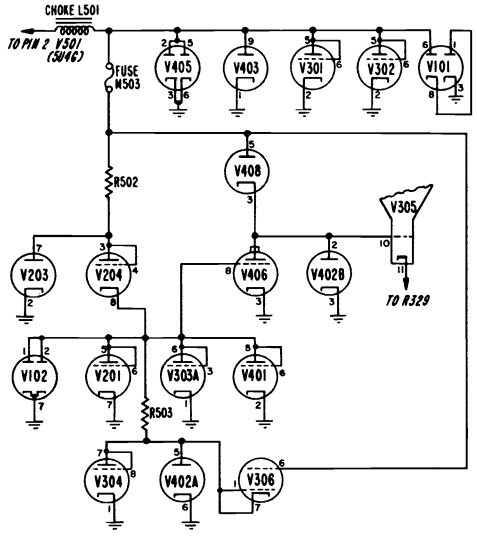
PIN VIEW OF 6W6G INSIDE CHASSIS VIEW OF 6594.

ADMIRAL (Continued)

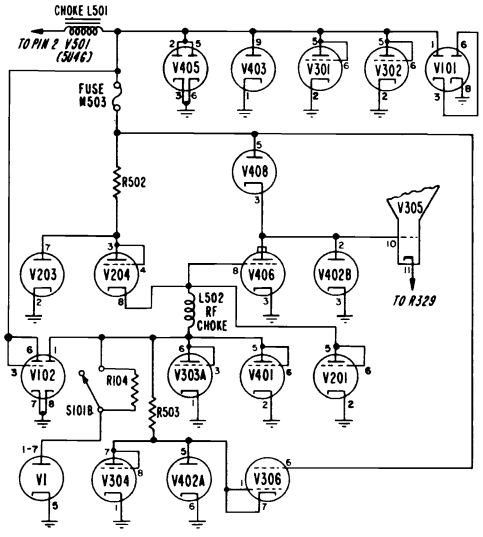
VHF (21MC IF) 21A3Z, 21A3AZ, 21C3Z, 21G3Z CHASSIS
VHF-UHF (41MC IF) 21B3Z, 21D3Z, 21H3Z CHASSIS

B+ DISTRIBUTION

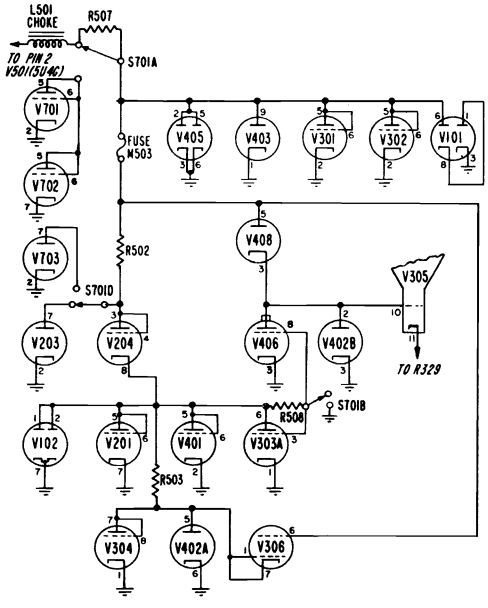
The power supply (after being filtered) provides approximately 265 volts of DC voltage for application to the receiver circuits. The distribution of this voltage to the various stages is a series-parallel arrangement. The horizontal and vertical deflection circuits, 1st and 2nd IF amplifiers and VHF amplifier require approximately 265 volts and thus are connected directly across the 265 volt line. All other circuits require approximately one-half of this voltage and obtain it from the cathode of the sound output tube V204 which functions as a series voltage regulator. All the current drawn by these circuits passes through V204, hence the B+ voltage (265 volts) is divided nearly equally between V204 and the stages connected to its cathode. The control grid of V204 is connected to a voltage dividing network consisting of R214 and R215, resulting in a fixed potential of approximately 130 volts being applied to the control grid. A change in the cathode voltage of V204 due to AGC fluctuations, tube current variations, etc., will cause a change in the grid to cathode voltage of V204. The resulting change in cathode current tends to maintain the 145 volt supply nearly constant. High value capacitors (C503 and C504) are necessary in the cathode circuit of V204 to reduce any fluctuations in current due to the audio current components flowing in this stage.



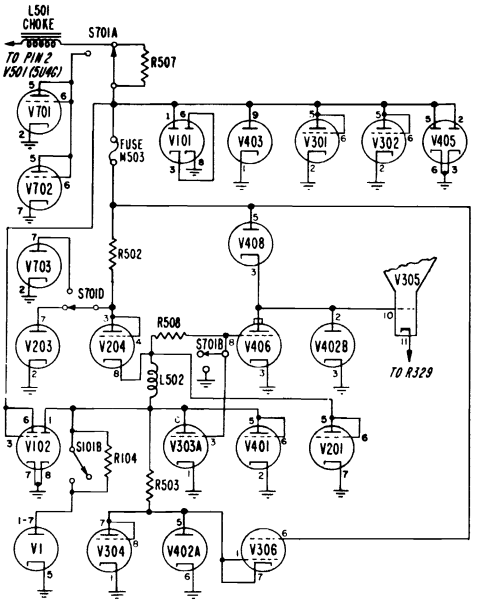
Simplified B+ Distribution Diagram Used in 21A3Z, 21A3AZ and 21G3Z Chassis.



Simplified B+ Distribution Diagram Used in 21B3Z and 21H3Z Chassis.



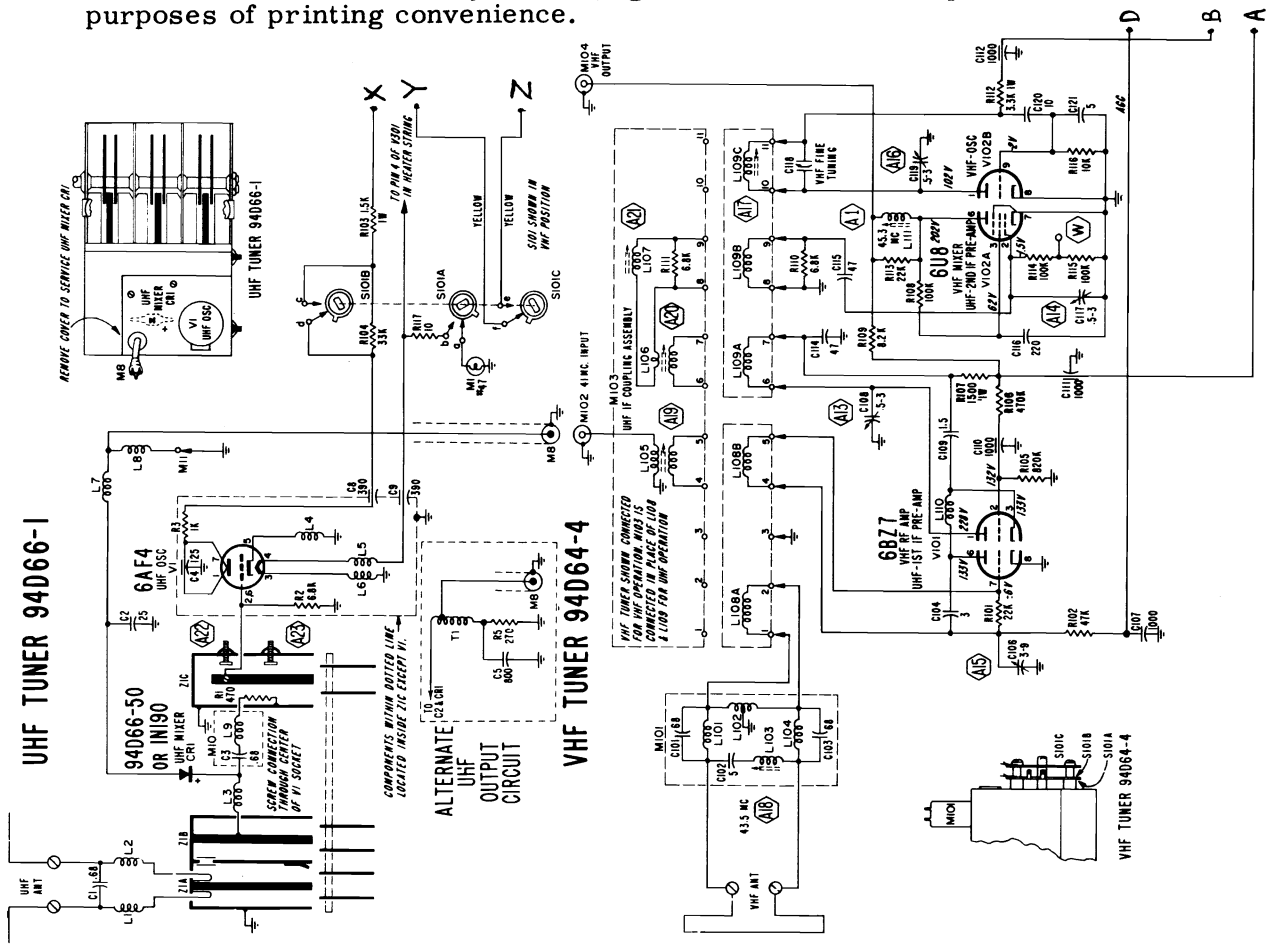
Simplified B+ Distribution Diagram Used in 21C3Z Chassis.



Simplified B+ Distribution Diagram Used in 21D3Z Chassis.

ADMIRAL (Continued) UHF Tuner 94D66-1 and VHF Tuner 94D64-4

Wires marked X, Y, Z, and A, B, D, connect to correspondingly marked wires of the main schematic diagram on page 20, over. This separation is made for purposes of printing convenience.



SCHEMATIC NOTES

②, ③, . . . etc. indicate production changes covered by a Run number. Run numbers are stamped at the rear of the chassis.

Ⓐ1, Ⓐ2,.....Ⓨ, Ⓩ, etc. indicate alignment points and alignment connections.

IMPORTANT: Before making waveform and voltage measurements, see instructions at right.

Fixed resistor values shown in ohms ± 10% tolerance, ½ watt; capacitor values shown in micromicrofarads ± 20% tolerance unless otherwise specified.

NOTE. K=R × 1,000. MEG=R × 1,000,000. MF=microfarad.

CONDITIONS FOR OBSERVING WAVEFORMS

Warning: Pulsed high voltages are present at the caps of V406 and V407, and at pin 3 of V408. **Do not** attempt to observe waveforms at these points unless suitable test equipment is used. Waveforms at these points may be taken with a capacitive voltage divider probe. The waveform at pin 3 of V408 may also be taken by clipping or twisting the lead from the high side of the oscilloscope over the insulation on the lead connecting to pin 3. If the waveform is taken in this manner, its shape will be the same, but the peak-to-peak voltage will be lower, depending on the degree of coupling between the oscilloscope and the lead connecting to pin 3 of V408.

- Waveforms should resemble those shown on the schematic.
- Waveforms are taken with a transmitted signal input to the television chassis.
- Set all controls for normal picture. Be sure that the **Noise Gate** control is not advanced too far clockwise, as the picture may disappear entirely or the synchronizing waveforms will be distorted. After the receiver is set for a normal picture, turn the **Contrast** control fully clockwise.
- Oscilloscope sweep is set at 30 cycles for vertical waveforms and at 7,875 cycles for horizontal waveforms, to permit 2 complete cycles to be observed.
- Peak-to-peak voltages will vary from those shown on the schematic, depending on the test equipment employed and chassis parts tolerances.

CONDITIONS FOR MEASURING VOLTAGES

Warning: Pulsed high voltages are present at the caps of V406 and V407, and at pin 3 of V408. **Do not** attempt to measure voltages at these points without suitable test equipment. A VTVM with a high voltage probe should be used when measuring picture tube 2nd anode voltage.

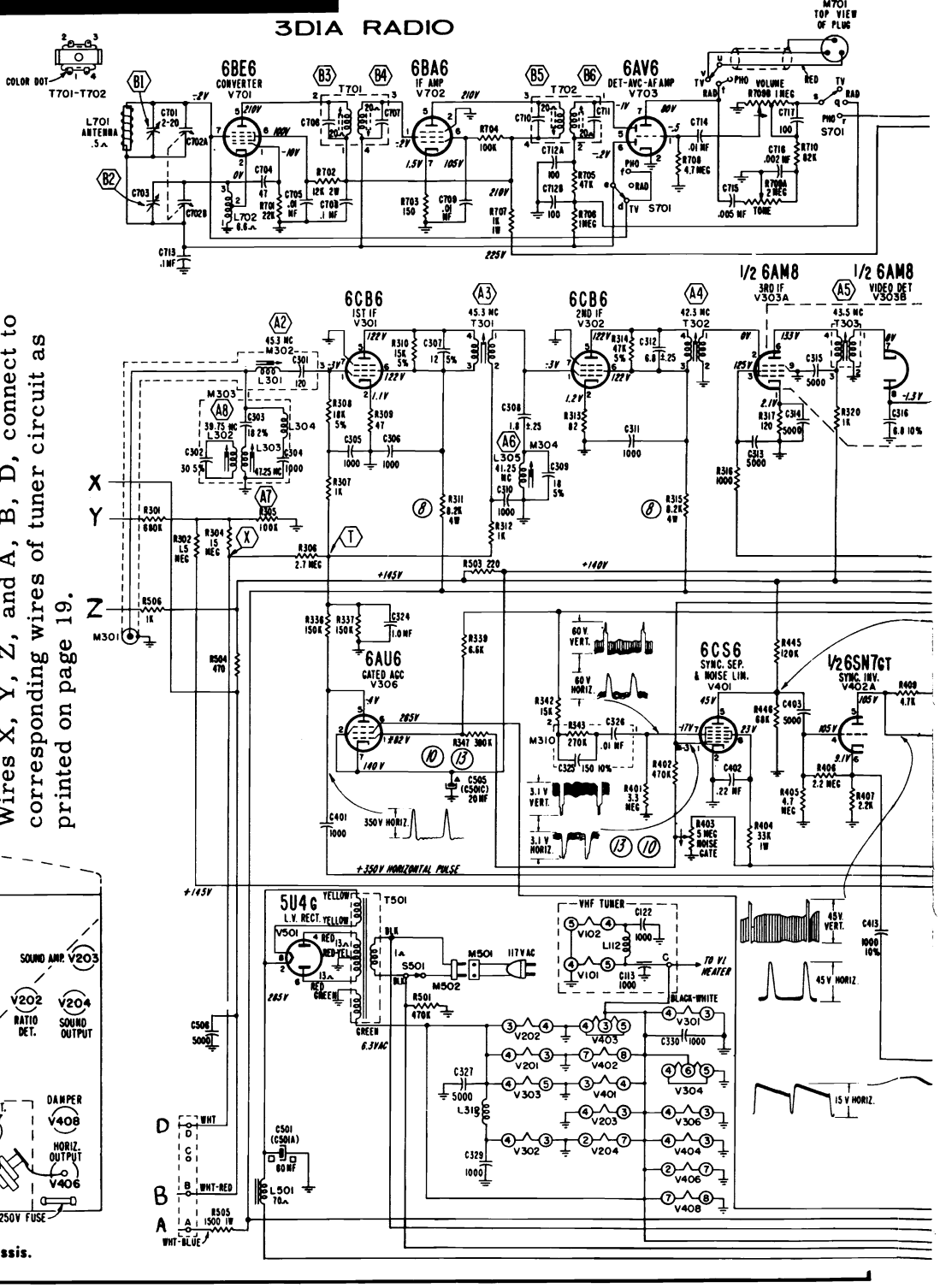
- Set the **TV-Rad-Pho** switch to the "TV" position. Set the **Channel Selector** on an unused channel. **Contrast** control fully clockwise. All other controls fully counterclockwise. **Width and Horiz. Lin.** set fully to the left. Do not disturb **Horiz. Lock** and **Horiz. Drive** settings.
- Antenna disconnected and terminals shorted together.
- Line voltage: 117 volts AC.
- DC voltages measured with a VTVM between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V101 and V102 measured from the top ot the chassis with tubes in socket. Use of an adapter is recommended.
- Voltages at V305 socket measured with socket removed from tube.
- Voltages marked (*) will vary widely with control settings.
- Voltages on 3D1A radio chassis measured with TV-Rad-Pho switch in "Rad" position.

Admiral

for Models Using 41 MC IF Chassis
21B3Z, 21D3Z and 21H3Z

See page 19 for schematic notes and explanation of conditions for measuring voltages and observing waveforms.

3D1A RADIO



Wires X, Y, Z, and A, B, D, connect to corresponding wires of tuner circuit as printed on page 19.

(6) *Outside foil of C212 moved from pin 4 of V204 (6DG6GT) to pin 8 of V204.*

(7) *Outside foil of C424 moved from gnd. to junction of R319 & R327.*

(8) *R329 changed from 270K to 100K. R311 & R312 changed from 8.2K, 2W to 15K, 2W. R345 & R346 added across R311 & R315 respectively.*

(9) *R421 changed 1K to 470.*

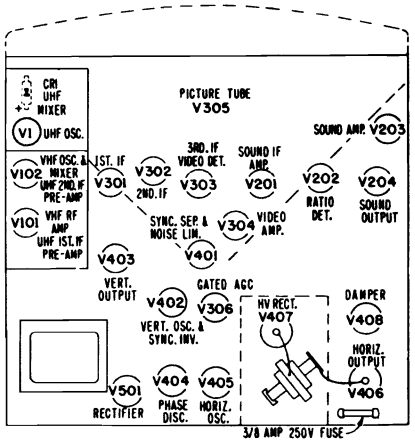
(10) *R338 removed, R347 added. Noise gate wired to function also as an AGC delay control.*

(11) *No changes made under this run number.*

(12) *C429 added, R437 changed to 8.2K.*

(13) *Some change as run 10 except chassis do not have letter "B" or "H" stamped in front of code date.*

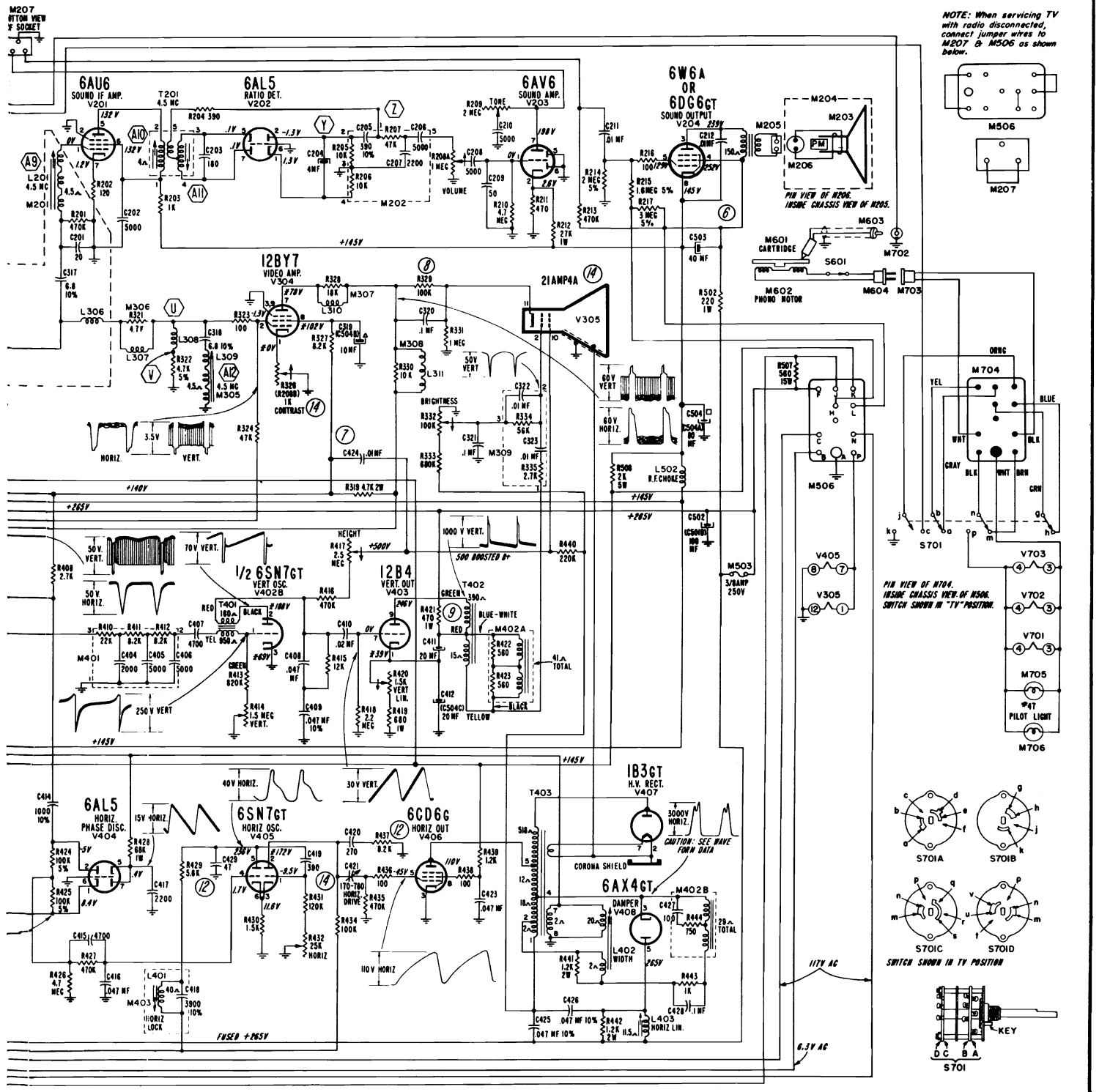
(14) *Horiz. Drive changed from variable resistance type to variable capacitor. Components on chassis shifted back to allow use of different 21AMP4A picture tube with letter "K" molded on its bowl. R325 deleted.*



Top View of 21D3Z Chassis.

Schematic for 21D3Z Chassis Stamped RUN 1 Through RUN 14. ADMIRAL (Continued)

Use this circuit when servicing Chassis 21B3Z, 21D3Z, and 21H3Z. This circuit is exact for 21D3Z. Chassis 21B3Z is a straight television set and does not include 3D1A radio or record changer. Chassis 21H3Z uses a 27RP4 picture tube and has other minor changes.



ADMIRAL (Continued)

VHF (21MC IF) 21A3Z, 21A3AZ, 21C3Z, 21G3Z CHASSIS
VHF-UHF (41MC IF) 21B3Z, 21D3Z, 21H3Z CHASSIS

TELEVISION ALIGNMENT PROCEDURE

The following alignment pages are marked at the top to indicate whether the information applies to both 21 MC and 41 MC sets or applies to only one. BE SURE YOU ARE FOLLOWING THE CORRECT PROCEDURE FOR THE CHASSIS BEING ALIGNED.

ALIGNMENT TOOLS

The following alignment tools are required. They can be obtained from the Admiral distributor under the part numbers listed below:

Metal alignment screwdriver part number 98A30-9.

Non-metallic (fiber) alignment screwdriver (11½" long, ⅛" diameter) part number 98A30-10.

Non-metallic alignment wrench (9" long, for hexagonal core IF slugs) part number 98A30-12.

IMPORTANT ALIGNMENT HINTS

The following suggestions should be performed if difficulty is experienced during the alignment procedure.

1. IF CIRCUIT INSTABILITY: When spot frequency aligning the IF amplifiers, the VTVM pointer may swing when the hand is placed too near the IF transformers. When viewing the IF response curve on an oscilloscope, the curve may change shape with hand capacity, especially when aligning A5 (3rd IF transformer T303). To correct either of these conditions, the following alignment hints should be tried:

(a) Check the generator output leads to be certain that the unshielded portion (especially the grounded lead) is as short as practicable.

(b) Be sure that a decoupling network is used at the video detector output and that the leads on the network are kept as short as possible (See figure 13).

(c) The use of a nine inch hexagonal alignment tool will permit adjustment without encountering "hand capacity" effects. See "Alignment Tools".

2. RECEIVER OVERLOADING WHEN CHECKING THE OVER-ALL RESPONSE CURVE: Due to the inherent high sensitivity of these receivers, it is very easy to cause overloading of the third IF amplifier stage. In some cases, generator leakage alone is enough to produce a response curve on the oscilloscope. To prevent overloading, the following things should be done:

(a) Be certain that the generator output attenuators are set for a minimum output.

(b) Some generators have a built-in pad in the output cable. Be sure that the pad in the cable is properly connected in the circuit. Refer to the generator instruction manual for details.

(c) If a pad is not built in, the 12 db pad shown below in figure 12 can be constructed and connected between the generator and the antenna terminals.

3. ADJACENT CHANNEL TRAP: If difficulty is experienced in aligning A7 and A8 traps using the method outlined in the alignment procedure on page 13 or 17, try the following procedure:

(a) Connect high side of oscilloscope to pin 7 (plate) of video amplifier V304 (12BY7) and common to chassis.

(b) Make all connections and receiver control settings as instructed in steps 5 and 6 of the alignment procedure on page 13 or 17.

(c) Amplitude modulate the signal from the marker generator with an audio frequency. Full generator output may be needed.

(d) Adjust A7 and A8 for minimum amplitude of the audio waveform on the oscilloscope.

4. For injecting 21MC or 41MC IF Signals, use an insulated tube shield over V102 Oscillator-Mixer tube. Insulate bottom of tube shield with masking tape, see figure 11.

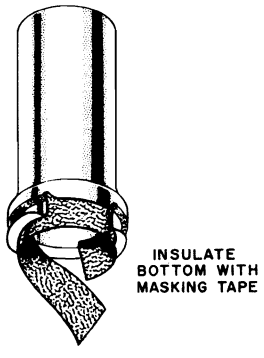


Figure 11. Special Tube Shield for IF Alignment and IF Response Curve Check.

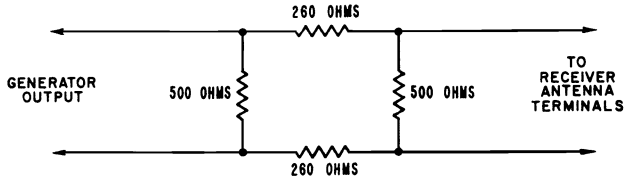


Figure 12. Illustration of 12db Attenuation Pad for Viewing Over-all RF-IF Response Curve.

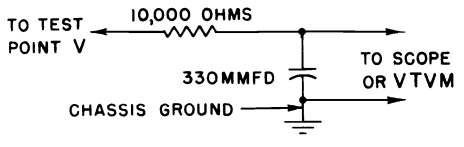


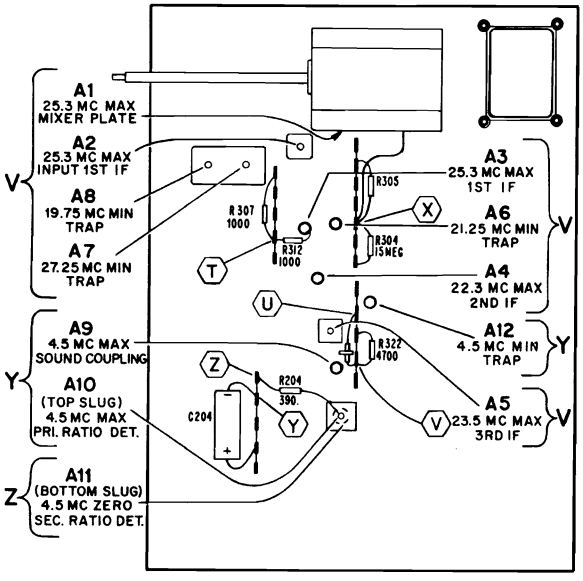
Figure 13. Decoupling Filter.

ADMIRAL (Continued)

VHF (21MC IF) 21A3Z, 21A3AZ, 21C3Z, 21G3Z CHASSIS
VHF-UHF (41MC IF) 21B3Z, 21D3Z, 21H3Z CHASSIS

SIMPLIFIED ALIGNMENT

After becoming familiar with alignment procedure, some servicemen simplify subsequent alignment of sets by merely using the essential alignment data given in figures 14, 15, 19 and 26.



NOTE: In early production, there was an extra lug on the terminal strip containing test point (X) that was not used.

Figure 14. Bottom View of VHF Only Chassis Showing Test Point Connections and IF Alignment Data.

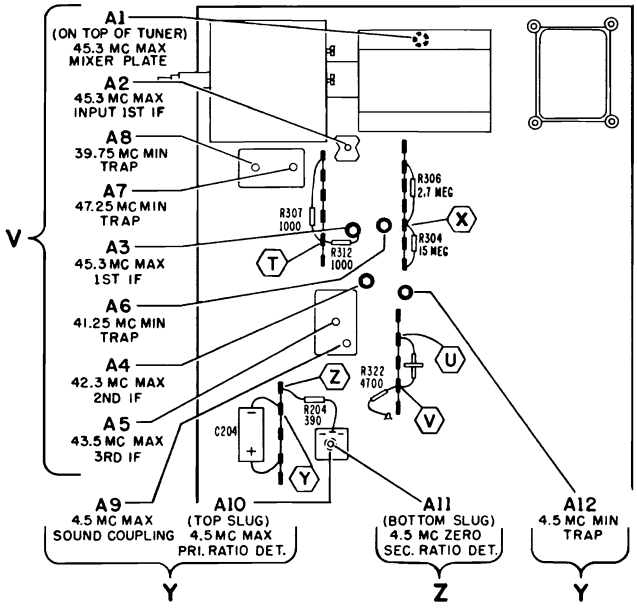


Figure 15. Bottom View of VHF-UHF Chassis Showing Test Connections and IF Alignment Data.

FREQUENCY TABLE FOR CHASSIS WITH 41 MC IF SYSTEM

FOR CHASSIS WITH 21 MC IF SYSTEM, SEE FOOTNOTE †

Channel No.	Freq. Range MC	Picture Carrier MC	Sound Carrier MC	Osc. Freq. MC	Sweep Gen. Center Freq. MC
2	54-60	55.25	59.75	*101	57.5
3	60-66	61.25	65.75	*107	63.5
4	66-72	67.25	71.75	*113	69.5
5	76-82	77.25	81.75	*123	79.5
6	82-88	83.25	87.75	*129	85.5
7	174-180	175.25	179.75	*221	177.5
8	180-186	181.25	185.75	*227	183.5
9	186-192	187.25	191.75	*233	189.5
10	192-198	193.25	197.75	*239	195.5
11	198-204	199.25	203.75	*245	201.5
12	204-210	205.25	209.75	*251	207.5
13	210-216	211.25	215.75	*257	213.5
14	470-476	471.25	475.75	517	473.5
15	476-482	477.25	481.75	523	479.5
16	482-488	483.25	487.75	529	485.5
17	488-494	489.25	493.75	535	491.5
18	494-500	495.25	499.75	541	497.5
19	500-506	501.25	505.75	547	503.5
20	506-512	507.25	511.75	553	509.5
21	512-518	513.25	517.75	559	515.5
22	518-524	519.25	523.75	565	521.5
23	524-530	525.25	529.75	571	527.5
24	530-536	531.25	535.75	577	533.5
25	536-542	537.25	541.75	583	539.5
26	542-548	543.25	547.75	589	545.5
27	548-554	549.25	553.75	595	551.5
28	554-560	555.25	559.75	601	557.5
29	560-566	561.25	565.75	607	563.5
30	566-572	567.25	571.75	613	569.5
31	572-578	573.25	577.75	619	575.5
32	578-584	579.25	583.75	625	581.5
33	584-590	585.25	589.75	631	587.5
34	590-596	591.25	595.75	637	593.5
35	596-602	597.25	601.75	643	599.5
36	602-608	603.25	607.75	649	605.5
37	608-614	609.25	613.75	655	611.5
38	614-620	615.25	619.75	661	617.5
39	620-626	621.25	625.75	667	623.5
40	626-632	627.25	631.75	673	629.5
41	632-638	633.25	637.75	679	635.5
42	638-644	639.25	643.75	685	641.5
43	644-650	645.25	649.75	691	647.5
44	650-656	651.25	655.75	697	653.5
45	656-662	657.25	661.75	703	659.5
46	662-668	663.25	667.75	709	665.5
47	668-674	669.25	673.75	715	671.5
48	674-680	675.25	679.75	721	677.5
49	680-686	681.25	685.75	727	683.5
50	686-692	687.25	691.75	'733	689.5
51	692-698	693.25	697.75	739	695.5
52	698-704	699.25	703.75	745	701.5
53	704-710	705.25	709.75	751	707.5
54	710-716	711.25	715.75	757	713.5
55	716-722	717.25	721.75	763	719.5
56	722-728	723.25	727.75	769	725.5
57	728-734	729.25	733.75	775	731.5
58	734-740	735.25	739.75	781	737.5
59	740-746	741.25	745.75	787	743.5
60	746-752	747.25	751.75	793	749.5
61	752-758	753.25	757.75	799	755.5
62	758-764	759.25	763.75	805	761.5
63	764-770	765.25	769.75	811	767.5
64	770-776	771.25	775.75	817	773.5
65	776-782	777.25	781.75	823	779.5
66	782-788	783.25	787.75	829	785.5
67	788-794	789.25	793.75	835	791.5
68	794-800	795.25	799.75	841	797.5
69	800-806	801.25	805.75	847	803.5
70	806-812	807.25	811.75	853	809.5
71	812-818	813.25	817.75	859	815.5
72	818-824	819.25	823.75	865	821.5
73	824-830	825.25	829.75	871	827.5
74	830-836	831.25	835.75	877	833.5
75	836-842	837.25	841.75	883	839.5
76	842-848	843.25	847.75	889	845.5
77	848-854	849.25	853.75	895	851.5
78	854-860	855.25	859.75	901	857.5
79	860-866	861.25	865.75	907	863.5
80	866-872	867.25	871.75	913	869.5
81	872-878	873.25	877.75	919	875.5
82	878-884	879.25	883.75	925	881.5
83	884-890	885.25	889.75	931	887.5

* For oscillator frequencies from channels 2 to 13, frequency indicated is that of VHF oscillator. For oscillator frequencies higher than channel 13, frequency indicated is that of UHF oscillator with VHF oscillator inoperative.

† For channels 2 through 13, subtract 20 MC from Oscillator Frequency for chassis with a 21 MC IF system.

ADMIRAL (Continued)

VHF (21MC IF) 21A3Z, 21A3AZ, 21C3Z, 21G3Z CHASSIS
VHF-UHF (41MC IF) 21B3Z, 21D3Z, 21H3Z CHASSIS

Information on this page applies ONLY to 21 MC Chassis 21A3Z, 21A3AZ, 21C3Z and 21G3Z.

21 MC IF AMPLIFIER AND TRAP ALIGNMENT

See page 28 for 41 MC IF Amplifier and Trap Alignment.

- Connect bias supply negative to test point "T", see figure 14, positive to chassis. 3 volts is required for steps 1, 2, 3, 4, 7 and 8. 1½ volts is required for steps 5 and 6. 4½ volts is required for step 7.
- Disconnect antenna. Connect a jumper wire across antenna terminals.
- Set **Channel Selector** to channel 12 or other unassigned high channel to prevent interference during alignment.
- Set **Contrast** control fully counterclockwise.
- Allow about 15 minutes for receiver and test equipment to warm up.
- Use lowest DC scale on VTVM.

Step	Signal Gen. Freq.	VTVM and Signal Generator Connections	Instructions	Adjust
1	25.3 MC	VTVM high side to test point "V" through a decoupling filter, common to chassis. See figures 13 and 14. Connect generator high side to top of insulated tube shield for 6J6 (V102); connect low side to chassis near tube shield. See figure 11.	Use 3 volts bias. Use lowest DC scale on VTVM. When peaking, keep reducing generator output for VTVM reading of approx. 1 volt or less. Set **Channel Selector** to channel 12 or other unassigned high channel.	A1, A2 and A3 for maximum.
2	22.3 MC			A4 for maximum.
3	23.5 MC			A5 for maximum.
4	*21.25 MC			A6 for minimum.
5	*27.25 MC*	Connect generator and VTVM same as in step 1.	Use 1½ volts bias. Set **Channel Selector** same as in step 1.	A7 for minimum.
6	*19.75 MC			A8 for minimum.
7	25.3 MC	Connect generator and VTVM same as in step 1.	Use 4½ volts bias. Set **Channel Selector** same as in step 1.	Readjust A1, A2 and A3 for maximum.
8	To insure correct IF alignment, make "IF Response Curve Check" given below.			

IF RESPONSE CURVE CHECK

Receiver Controls and Bias Supply	Sweep Generator	Marker Generator	Oscilloscope	Instructions
Set **Channel Selector** on channel 12 or an unassigned high channel. **Contrast** control fully to the left. Connect negative 4½ volts bias to test poiht "T", positive to chassis.	Connect high side to top of insulated tube shield, low side to chassis, see figure 11. Set sweep frequency to 23MC, and sweep width approximately 7MC.	If an external marker generator is used, loosely couple high side to sweep generator lead on top of tube shield, low side to chassis. Marker frequencies indicated on IF Response Curve.	Connect to test point "V" through a decoupling filter. See figures 13 and 14. Marker pips on scope will be more distinct if a capacitor of 100 mmf to 1000 mmf is connected across the oscilloscope input.	Check curve obtained against ideal response curve in fig. 16. Note tolerances on curve. Keep marker and sweep outputs at a minimum to prevent overloading. A reduction in sweep output should reduce response curve amplitude without altering the shape of the response curve. If the curve is not within tolerance or the markers are not in the proper location on the curve, touch-up IF slugs as instructed below. If curve changes shape with hand capacity, see "IF Instability" on page 22.

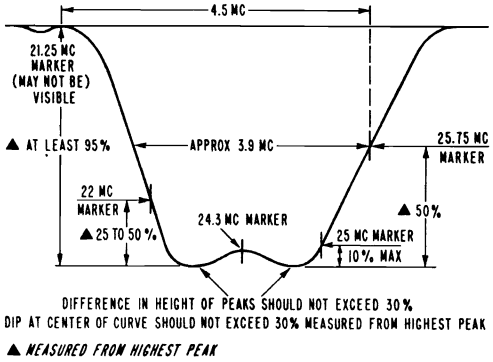


Figure 16. Ideal IF Response Curve.

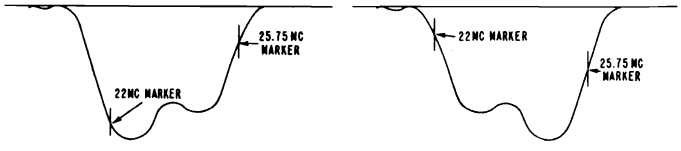


Figure 17. IF Response Curves, Incorrect Shape.

If it is necessary to adjust for approximate equal peaks, carefully adjust slug A5 (23.5 MC). It should not be necessary to turn slug more than one turn in either direction.

If the curve cannot be made to resemble the response curve shown at left, repeat all steps under "IF Amplifier and Trap Alignment" making sure that generator frequencies are accurate and adjustments are carefully made. If a satisfactory curve cannot be obtained after repeating these steps, it may be necessary to change IF amplifier tubes or check for a defective circuit component to be sure that each stage is operating properly.

* Before proceeding, be sure to check the signal generator used in alignment against a crystal calibrator or other frequency standard foi absolute frequency calibration. Also see "Adjacent Channel Trap" on page 22.

ADMIRAL (Continued)

VHF (21MC IF) 21A3Z, 21A3AZ, 21C3Z, 21G3Z CHASSIS
VHF-UHF (41MC IF) 21B3Z, 21D3Z, 21H3Z CHASSIS

Information on this page applies to BOTH 21 MC and 41 MC Chassis.

4.5 MC SOUND IF AND TRAP ALIGNMENT

- Allow about 15 minutes for receiver and test equipment to warm up.
- Set **Contrast** control fully to the right (clockwise).
- Ratio Detector Transformer (T201) must be aligned from the bottom of chassis. Use alignment tool number 98A30-12 obtainable from your Admiral distributor.

It is preferable to use a TV signal instead of a signal generator for this alignment. However, if a TV signal is not available, a signal generator which has been checked against a crystal calibrator or other frequency standard, may be used. Accuracy required is within one kilocycle.

Step	VTVM Connections	Instructions for TV Signal	Instructions for Signal Generator	Adjust
1	High side to test point "Y", common to chassis.	Connect VHF antenna to receiver. Set VHF channel selector to the strongest TV signal available and adjust "Fine Tuning" control on front panel for highest indication on VTVM. Note: Sound bars may be present in picture at this setting.	Disconnect VHF antenna and connect a wire jumper across antenna terminals. Set VHF channel selector to an unused channel. Set signal generator to exactly 4.5 MC and connect high side to test point "U" through a .01 mf. capacitor; connect low side to chassis.	A9 and A10 for maximum (if using signal generator keep reducing output to keep VTVM on lowest scale possible).
2	High side to test point "Z", common to chassis.	Same as in step 1. Use Zero center scale on VTVM, if available.	Same as in step 1. Use Zero center scale on VTVM, if available.	A11 for Zero on VTVM (the correct zero point is located between a positive and a negative maximum). If A11 was far off, repeat step 1.
3	High side to test point "Y", common to chassis.	Follow instructions under step 1 except connect a jumper wire across L307.	Follow instructions under step 1 except connect signal generator high side to test point "U" through a .01 mf. capacitor, connect low side to chassis. Connect a jumper wire across peaking coil L307.	A12 for minimum.

TOUCH-UP OF RATIO DETECTOR SECONDARY USING TELEVISION SIGNAL (A11, BOTTOM SLUG OF T201)

Adjustment need be made on one channel only.

This adjustment is accessible through the hole (just below T201) in bottom of the cabinet or the chassis mounting shelf, located toward the right side facing the rear of the set. Removal of the chassis is therefore not required.

Proceed as follows:

a. Turn set on and allow about 15 minutes for warm up.
b. Tune set for normal picture and sound.
c. Carefully insert a ***non-metallic*** alignment tool through the opening in cabinet bottom below T201. An alignment tool with a hexagonal end is required. The bottom slug adjustment A11 can be made by using alignment tool, part number 98A30-12, (available at Admiral distributor). When the alignment tool engages the bottom tuning slug A11, adjust the slug for best sound with minimum buzz level. Do this carefully as only slight rotation in either direction will genreally be required. Correct adjustment point is located between the two maximum buzz peaks that will be noticed when turning the slug back and forth about ¼ to ½ turn.
d. If necessary, repeat individual channel slug adjustment and retouch the ratio detector secondary. Note: If oscillator adjustment is required for other channels, it will ***not*** be necessary to repeat the ratio detector secondary adjustment after ***once*** correctly adjusting it.

ALIGNMENT OF 4.5 MC TRAP A12, USING A TELEVISION SIGNAL

Beat interference (4.5 MC) appears in picture as very fine vertical or diagonal lines, very close together, having a "gauze-like" appearance. The pattern will vary with speech, forming a very fine herringbone pattern.

The trap can be tuned by watching the picture and adjusting the slug A12 for minimum 4.5 MC interference. If greater accuracy is required, the trap should be adjusted as instructed in step 3 above.

UHF CHANNEL STRIPS

Admiral UHF channel strips convert all VHF turret tuners, for UHF reception. These strips are easily and economically installed and eliminate any necessity for external UHF converters or adapters. Complete information for ordering Admiral UHF channel strips, installation instructions, and other UHF data is included in Form No. S523 which can be obtained from your Admiral distributor.

HIGH VOLTAGE WARNING

High voltages are present throughout the horizontal output, damper and second anode supply circuits. No attempt should be made to make measurements from high voltage points in these circuits with ordinary test equipment.

Caution: Operation of the set outside of the cabinet or with cabinet back removed involves shock hazard. Exercise normal high voltage precautions.

ADMIRAL (Continued)

VHF (21MC IF) 21A3Z, 21A3AZ, 21C3Z, 21G3Z CHASSIS
VHF-UHF (41MC IF) 21B3Z, 21D3Z, 21H3Z CHASSIS

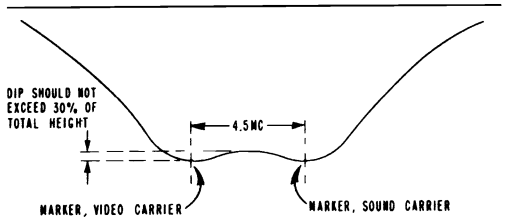
Information on this page applies ONLY to 21 MC Chassis 21A3Z, 21A3AZ, 21C3Z and 21G3Z.

VHF AMPLIFIER AND MIXER ALIGNMENT

See page 29 for VHF Amplifier and Mixer Alignment for 41 MC Chassis.

- Connect negative of 3 volt bias supply to test point "X", positive to chassis.
- Connect sweep generator 300 ohm output to antenna terminals. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the antenna terminals. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible.
- Connect oscilloscope to test point "W" on tuner (figure 19). Keep scope leads away from chassis.
- Allow about 15 minutes for receiver and test equipment to warm up.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instructions
1	193.25 MC (Video Carrier) 197.75 MC (Sound Carrier)	Sweeping Channel 10. See "Frequency Table".	Set Channel Selector to channel 10. Check response obtained with RF response curve shown in figure 18. Alternately adjust A13 and A14 (figure 19) as required to obtain equal peak amplitudes and symmetry consistent with proper bandwidth and correct marker location.
2	83.25 MC (Video Carrier) 87.75 MC (Sound Carrier)	Sweeping Channel 6. See "Frequency Table".	Set Channel Selector to channel 6. Check response obtained with RF response curve shown in figure 11. Adjust A15 as required to obtain curve having maximum amplitude and flat top appearance consistent with proper bandwidth and correct marker location. After completing adjustment, recheck adjustment of step 1.
3	Set the sweep generator to sweep the channel to be checked. Set the marker generator for the corresponding video carrier frequency and sound carrier frequency.		Check each channel operating in the service area for curve shown below. In general, the adjustment performed in steps 1 and 2 are sufficient to give satisfactory response curves on all channels. However, if reasonable alignment is not obtained on a parcticular channel, (a) check to see that coils have not been intermixed, or (b) try replacing the pair of coils for that particular channel, or (c) repeat step 1 for a weak high channel as a compromise adjustment to favor the particular channel. Repeat step 2 for the weak low channel to favor the particular channel. If a compromise adjustment is made, other channels operating in the service area should be checked to make certain that they have not been appreciably affected.



Full skirt of curve will not be visible unless generator sweep width extends beyond 10 MC.

Figure 18. RF Response Curve.

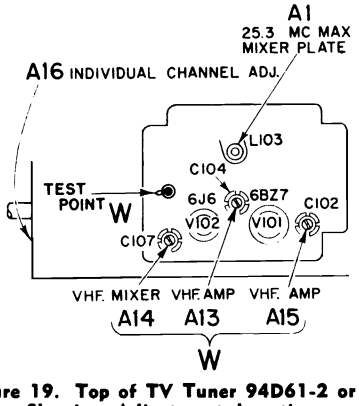


Figure 19. Top of TV Tuner 94D61-2 or -3, Showing Adjustment Locations.

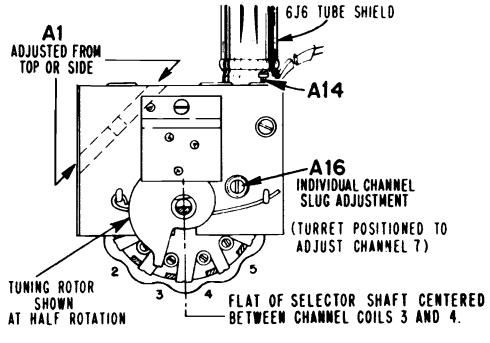


Figure 20. Front View of TV Tuner 94D61-2 or -3. Bottom Cover Removed.

ADMIRAL (Continued)

VHF (21MC IF) 21A3Z, 21A3AZ, 21C3Z, 21G3Z CHASSIS
VHF-UHF (41MC IF) 21B3Z, 21D3Z, 21H3Z CHASSIS

Information on this page applies BOTH to 21 MC and 41 MC Chassis.

OVER-ALL RF AND IF RESPONSE CURVE CHECK

Receiver Controls and Bias Supply	Sweep Generator	Marker Generator	Oscilloscope	Instructions
Contrast control fully to the left. **Channel Selector** on channel 12 or other unassigned high channel. Connect negative of 4½ volt bias supply to test point "T", positive to chassis.	Connect to antenna terminals. Set generator to sweep channel selected. See frequency table on page **23.** Keep generator output as low as possible to prevent overloading.	If an external marker generator is used, loosely couple high side to sweep generator lead. Marker frequencies are shown in frequency table on page **23.**	Connect to point "V" through a decoupling filter. See figures 13, 14 and 15.	Compare response curve obtained against ideal curve shown in figure 21. If the curve is not within tolerance, touch up A5 as instructed below. It should never be necessary to turn A5 more than one turn in either direction. If the curve is satisfactory on the channel checked, all other channels should also be satisfactory. **IMPORTANT:** When sweep output is reduced, response curve amplitude on scope should also decrease, but curve shape should remain the same. If curve shape changes, reduce sweep output and/or the scope gain until the shape does not change.

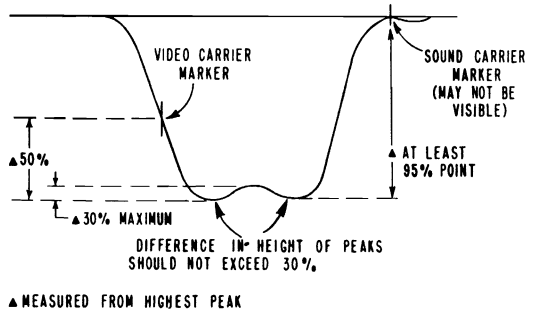


Figure 21. Ideal Over-all RF and IF Response Curve.

Note that video marker on the "Over-all RF-IF Response Curve" in figure 21 will appear on the opposite side of the curve as compared to the "IF Response Curve", figure 16. This is due to action of the mixer tube.

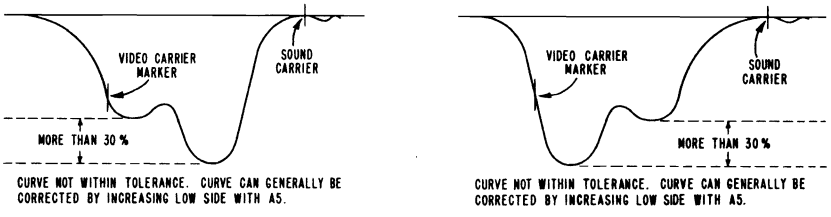


Figure 22. Over-all RF and IF Response Curves, Incorrect Shape.

VHF OSCILLATOR ADJUSTMENT USING SIGNAL GENERATOR

It is always advisable to make VHF oscillator adjustments using a Television Signal as instructed on page 13. If a Television Signal is not available, VHF oscillator adjustment can be made using a crystal calibrated signal generator. Make adjustments as follows:

Receiver Control Settings	Signal Generator	Instructions
Set **Channel Selector** for each channel to be adjusted. Set **Fine Tuning** control at half rotation. Turn **Volume** control fully clockwise.	Connect to antenna terminals. Set generator to exact frequency of VHF oscillator. See frequency table on page **23.** **Set generator for maximum output.**	Connect a wire jumper from test point "W" on the tuner to test point "Z". See figure 14 or 15. Remove the ratio detector tube V202 (6AL5). Carefully adjust the individual oscillator slug (see figures 20 and 27) until a zero beat is heard in the speaker of the receiver.

ADMIRAL (Continued)

VHF (21MC IF) 21A3Z, 21A3AZ, 21C3Z, 21G3Z CHASSIS
VHF-UHF (41MC IF) 21B3Z, 21D3Z, 21H3Z CHASSIS

Information on this page applies ONLY to 41 MC IF Chassis 21B3Z, 21D3Z and 21H3Z.

41 MC IF AMPLIFIER AND TRAP ALIGNMENT

See page 24 for 21 MC IF Amplifier and Trap Alignment

- Connect bias supply negative to test point "T", see figure 14, positive to chassis.
- Disconnect antenna. Connect a jumper wire across antenna terminals.
- Set **Low-Channel Selector** to channel 12 or other unassigned high VHF channel to prevent interference during alignment.
- Set **Contrast** control fully counterclockwise.
- Allow about 15 minutes for receiver and test equipment to warm up.
- Use lowest DC scale on VTVM.

Step	Signal Gen. Freq.	VTVM and Signal Generator Connections	Instructions	Adjust
1	45.3 MC	VTVM high side to test point "V" through a decoupling filter, common to chassis. See figures 13 and 15. Connect generator high side to top of insulated tube shield for 6U8 (V102); connect low side to chassis near tube shield. See figure 11.	Use 3 volt bias supply. Use lowest DC scale on VTVM. When peaking, keep reducing generator output for VTVM reading of approx. 1 volt or less. Set **Low-Channel Selector** to channel 12 or other unassigned high VHF channel.	A1, A2 and A3 for maximum.
2	42.3 MC			A4 for maximum.
3	43.5 MC			A5 for maximum.
4	41.25 MC			A6 for minimum.
5	47.25 MC	Connect generator and VTVM same as in step 1.	Use 1½ volt bias supply	A7 for minimum.
6	39.75 MC			A8 for minimum.
7	45.3 MC	Connect generator and VTVM same as in step 1.	Use 3 volt bias supply.	Readjust A1, A2 and A3 for maximum.
8	43.5 MC	Connect VTVM as above. Disconnect antenna terminals jumper, connect generator high side to antenna terminals; full output may be required.	Use 1½ volt bias supply and set Channel selector to 2 or other low channel.	A18 for minimum.
9	To insure correct IF alignment, make the "IF Response Curve Check" given below.			

IF RESPONSE CURVE CHECK

Receiver Controls and Bias Supply	Sweep Generator	Marker Generator	Oscilloscope	Instructions
Set **Channel Selector** on channel 12 or an unassigned high channel. **Contrast** control fully to the left. Connect negative of 3 volt bias supply to test point "T"; positive to chassis.	Connect high side to top of 6U8 mixer-osc. special tube shield. Connect low side to chassis, see figure 11. Set sweep frequency to 43MC, and sweep width approximately 7MC.	If an external marker generator is used, loosely couple high side to sweep generator lead on top of tube shield, low side to bottom of tube shield. Marker frequencies indicated on IF Response Curve.	Connect to test point "V" through a decoupling filter. See figures 13 and 15. Marker pips on scope will be more distinct if a capacitor from 100 mmf to 1000 mmf is connected across the oscilloscope input.	Check curve obtained against ideal response curve in fig. 23. Note tolerances on curve. Keep marker and sweep outputs at very minimum to prevent overloading. A reduction in sweep output should reduce response curve amplitude without altering the shape of the response curve. If the curve is not within tolerance or the markers are not in the proper location on the curve, touch-up with IF slugs as instructed below. If curve changes shape with hand capacity, see "Alignment Hints" on page 22.

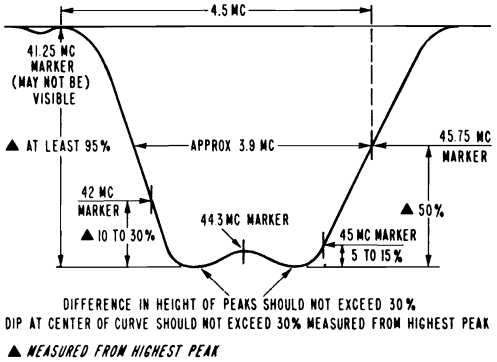


Figure 23. Ideal IF Response Curve.

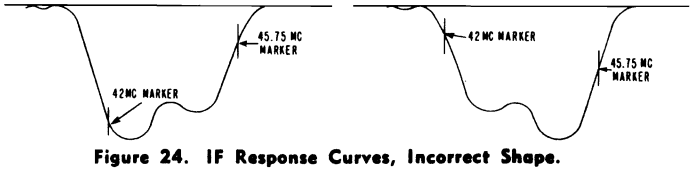


Figure 24. IF Response Curves, Incorrect Shape.

If it is necessary to adjust for approximate equal peaks, carefully adjust slug A5 (43.5 MC). It should not be necessary to turn slug more than one turn in either direction.

If the curve cannot be made to resemble the response curve shown at left, repeat all steps under "IF Amplifier and Trap Alignment" making sure that generator frequencies are accurate and adjustments are carefully made. If a satisfactory curve cannot be obtained after repeating these steps, it may be necessary to change IF amplifier tubes or check for a defective circuit component to be sure that each stage is operating properly.

ADMIRAL (Continued)

VHF (21MC IF) 21A3Z, 21A3AZ, 21C3Z, 21G3Z CHASSIS
VHF-UHF (41MC IF) 21B3Z, 21D3Z, 21H3Z CHASSIS

Information on this page applies ONLY to 41 MC IF Chassis 21B3Z, 21D3Z and 21H3Z.

4.5 MC SOUND IF AND TRAP ALIGNMENT

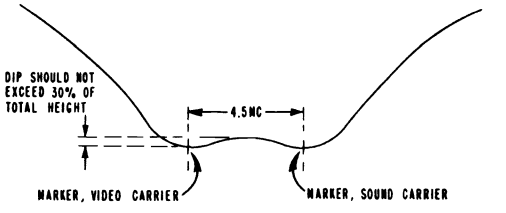
This procedure is identical for 21 MC and 41 MC IF Chassis. *See page 25.*

VHF AMPLIFIER AND MIXER ALIGNMENT

See page 26 for VHF Amplifier and Mixer Alignment for 21 MC Chassis.

- Connect negative of 3 volt bias supply to AGC buss (test point "X"), positive to chassis.
- Connect sweep generator 300 ohm output to VHF antenna terminals. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the antenna terminals. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible.
- Connect oscilloscope to test point "W" on VHF tuner (figure 26). Keep scope leads away from chassis.
- Allow about 15 minutes for receiver and test equipment to warm up.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instructions
1	193.25 MC (Video Carrier) 197.75 MC (Sound Carrier)	Sweeping Channel 10. See "Frequency Table".	Check for RF response curve below. Alternately adjust A13 and A14 (figure 26) as required to obtain equal peak amplitudes and symmetry consistent with proper bandwidth and correct marker location.
2	83.25 MC (Video Carrier) 87.75 MC (Sound Carrier)	Sweeping Channel 6. See "Frequency Table".	Check for RF response curve below. Adjust A15 as required to obtain curve having maximum amplitude and flat top appearance consistent with proper bandwidth and correct marker location. After completing adjustment, recheck adjustment of step 1.
3	Set the sweep generator to sweep the channel to be checked. Set the marker generator for the corresponding video carrier frequency and sound carrier frequency.		Check each channel operating in the service area for curve shown below. In general, the adjustment performed in steps 1 and 2 are sufficient to give satisfactory response curves on all channels. However, if reasonable alignment is not obtained on a particular channel, (a) check to see that coils have not been intermixed, or (b) try replacing the pair of coils for that particular channel, or (c) repeat step 1 for a weak high channel as a compromise adjustment to favor the particular channel. Repeat step 2 for the weak low channel to favor the particular channel. If a compromise adjustment is made, other channels operating in the service area should be checked to make certain that they have not been appreciably affected.



Full skirt of curve will not be visible unless generator sweep width extends beyond 10 MC.

Figure 25. RF Response Curve.

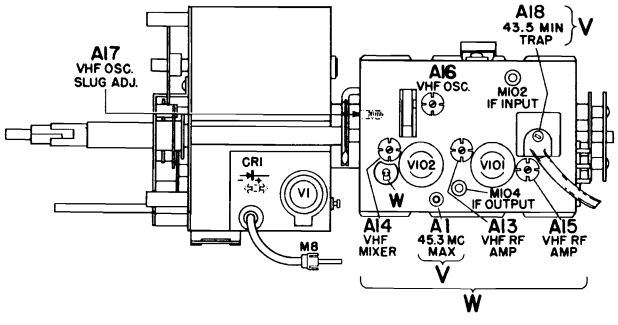


Figure 26. Top of VHF and UHF TV TUNER, Showing Adjustment Locations.

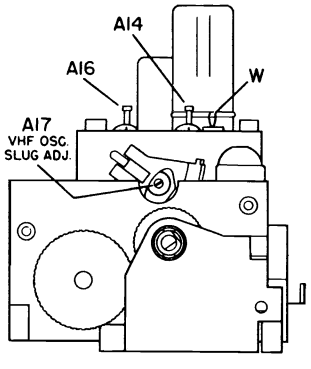


Figure 27. Front View of VHF Tuner.

OVER-ALL RF AND IF RESPONSE CURVE CHECK

This procedure is identical for 21 MC and 41 MC IF Chassis. *See page 27.*

ADMIRAL (Continued)

VHF (21MC IF) 21A3Z, 21A3AZ, 21C3Z, 21G3Z CHASSIS
VHF-UHF (41MC IF) 21B3Z, 21D3Z, 21H3Z CHASSIS

Information on this pages applies ONLY to 41 MC IF Chassis 21B3Z, 21D3Z and 21H3Z.

IF PRE-AMPLIFIER ALIGNMENT AND RESPONSE CURVE CHECK

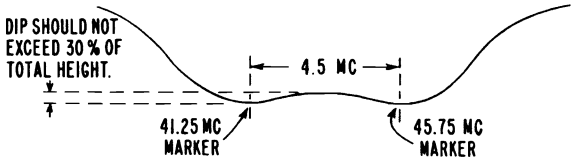
Important: This alignment is seldom required and should be made only if UHF reception is poor and after usual causes of poor reception have been checked.

- Set VHF Channel Selector at detent position midway between channels 5 and 6.
- Connect negative of 3 volt bias supply to AGC buss (test point "X"), positive to chassis.
- Remove CR1 (mixer crystal) from holder. Connect sweep generator high side through 100 ohm resistor to negative clip of mixer crystal socket, see figure 26. If sweep generator does not have a built-in marker generator, loosely couple a marker generator to the high side of sweep generator. To avoid distortion of the response curve, keep sweep generator output at a minimum, marker pips just barely visible.
- Connect oscilloscope to test point "W" on tuner (figure 26). Keep scope leads aways from chassis.
- Allow about 15 minutes for receiver and test equipment to warm up.
- Use a non-metallic alignment tool. If hollow core slugs are used, use alignment tool, part number 98A30-14.

Before proceeding, detune slug A2 exactly 3 turns counterclockwise. After completing this alignment, return slug A2 to its original setting by turning it exactly 3 turns clockwise.

Caution: Use extreme care to avoid damage to coils or slugs.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instructions
1	45.75 MC (Video IF Carrier) 41.25 MC (Sound IF Carrier)	Set sweep at 43.5 MC sweep width 12 MC.	Adjust A19 to obtain maximum amplitude at center of curve. Alternately adjust A20 and A21 (figure 29) as required to obtain equal peak amplitudes and symmetry, consistent with flat top appearance, proper band width and correct marker location; see figure 28.
2	If curve cannot be made to resemble response curve, figure 28, check to be sure all instructions have been followed. Check tubes V101 and V102 and repeat alignment. **Important:** After replacing tubes, it may be necessary to check "VHF Amplifier and Mixer Alignment".		



Full skirt of curve will not be visible unless generator sweep width extends beyond 12 MC.

Figure 28. IF Pre-amplifier and UHF Tuner Response Curve.

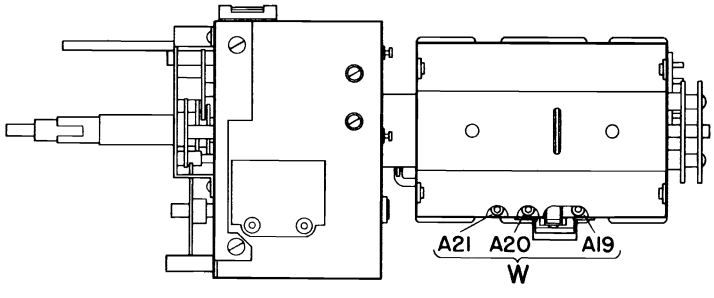


Figure 29. Bottom View of Tuners Showing IF Pre-amplifier Adjustments.

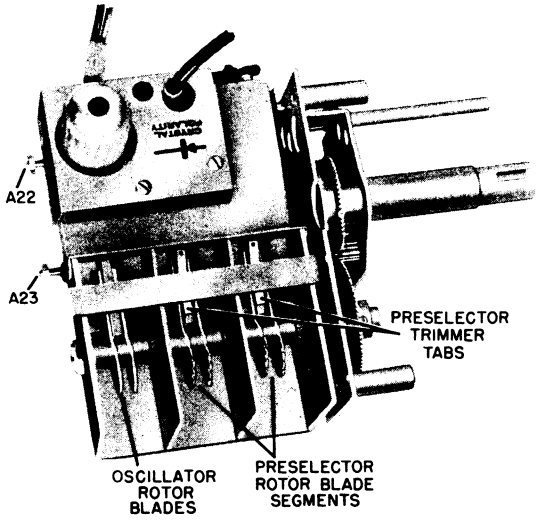


Figure 30. UHF Tuner Showing Alignment Locations.

Admiral

Chassis	Model Numbers
18SX4BZ	TS2301Z, TS2302Z, TS2326Z, TS2327Z, TS2336Z, TS2337Z
18SX4CZ	CS2336Z, CS2337Z, CS2356Z, CS2338Z
18SX4EZ	CS2566FZ, CS2567FZ
18SX4FZ	TS2501Z, TS2502Z, TS2506FZ, TS2507FZ
18SX4GZ	CS2365Z, CS2366FZ, CS2367FZ
18X4CZ	C2336Z, C2337Z, C2338Z, C2356Z
18X4EZ	C2566FZ, C2567FZ
18X4FZ	T2501Z, T2502Z, T2506FZ, T2507FZ
18X4GZ	C2365Z, C2366FZ, C2367FZ
18XP4BZ	T2301Z, T2302Z, T2326Z, T2327Z, T2336Z, T2337Z
18XP4HZ	T2301SZ, T2326SZ, T2327SZ

The principal chassis differences are described here. The 18XP4BZ and 18XP4HZ chassis are vertically mounted, 18-tube VHF receivers having a switch type tuner, type 94D77-1. A type 21ALP4A aluminized picture tube is used. The IF amplifier of the 18XP4HZ chassis is contained in a printed circuit wiring assembly. The IF amplifier of the 18XP4BZ chassis is conventional and is part of the main chassis. Both receivers have a 24 MC IF amplifier and use 6CB6 tubes as IF amplifiers, V301 and V302.

The 18X4CZ, 18X4EZ, 18X4FZ, and 18X4GZ chassis are 18-tube VHF receivers having a turret type cascode tuner. Early production sets use tuner 94D46; later production receivers use tuner 94D92. These chassis have a 24 MC IF amplifier and use 6BZ6 tubes for V301 and V302.

The 18X4EZ, 18X4FZ, and 18X4GZ chassis are mounted vertically with the neck of the picture tube extending through the center of the chassis. The 18X4CZ chassis is mounted at a slight angle from horizontal and has the picture tube mounted separately. A 21" aluminized (type 21ALP4A) picture tube is used in the 18X4CZ and 18X4GZ. A 24" aluminized (type 24DP4A) picture tube is employed in the 18X4EZ and 18X4FZ chassis.

The 18SX4BZ, 18SX4CZ, 18SX4EZ, 18SX4FZ, and 18SX4GZ chassis are 19-tube VHF-UHF receivers. These receivers use a combination VHF-UHF tuner, number 94E75, and have a 43 MC IF system. The 18SX4BZ, 18SX4EZ, 18SX4FZ, and 18SX4GZ chassis are mounted vertically with the neck of the picture tube extending through the center of the chassis. The 18SX4CZ chassis is mounted at a slight angle from the horizontal with the picture tube mounted separately. Chassis 18SX4EZ and 18SX4FZ use type 24DP4A picture tubes. The other chassis in this group use type 21ALP4A.

The circuit on pages 34-35 is exact for 18XP4BZ, and the circuit on pages 36-37 is exact for 18SX4BZ. This material may be used for servicing all the sets listed at the top of this page. The differences described should be kept in mind.

ION TRAP & FOCUS ADJUSTMENT

To prolong picture tube life and insure proper focus, always adjust trap when installing or after centering picture.

The focus of the picture tube is very much affected by the position of the ion trap. The ion trap must be adjusted for maximum brightness consistent with good focus. The ion trap can generally be adjusted over a limited range through which brightness remains the same but focus is affected.

Set **Brightness** control to about ¾ of its clockwise rotation.

Starting with the ion trap close to the picture tube base, very carefully move the ion trap forward or backward and at the same time, rotate it slightly in either direction until maximum brightness is produced.

Reset the **Brightness** control for normal brightness and readjust the ion trap for best focus and maximum brightness.

ADMIRAL Alignment for 18X4CZ, 18X4EZ, 18X4FZ, 18X4GZ, 18XP4BZ, 18XP4HZ Chassis

TOUCH-UP OF RATIO DETECTOR SECONDARY (A8) USING TELEVISION SIGNAL

Adjustment need be made on one channel only.

Proceed as follows:

a. Turn set on and allow about 15 minutes for warm up.

b. Tune set for normal picture and sound.

c. Carefully adjust the secondary slug (A8) of the Ratio Detector Transformer using a non-metallic alignment tool with a hexagonal end (part number 98A30-12). Both slugs (A6 and A8) have hollow cores. Either slug may be adjusted from the top or bottom of the chassis by passing the alignment tool through the core of the first slug encountered. A8 is the slug closest to the chassis.

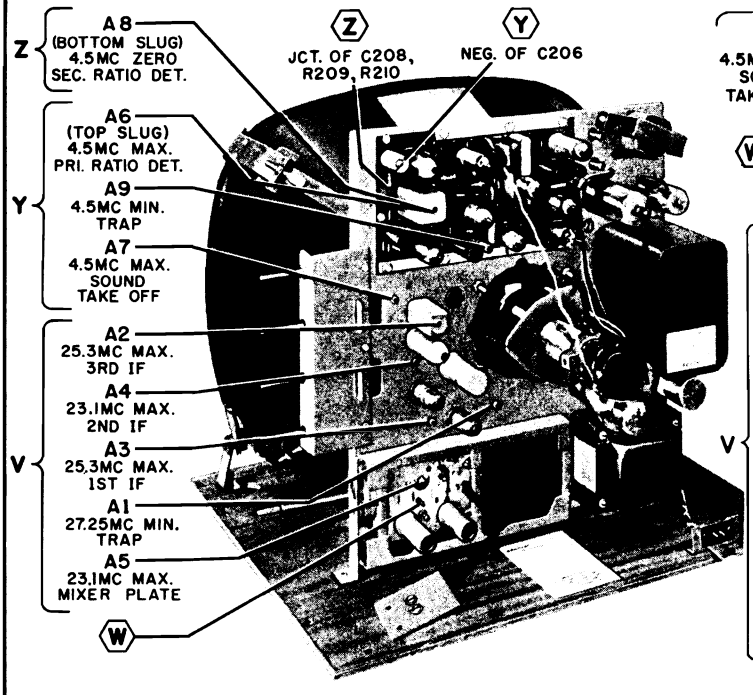
Adjust A8 for best sound with minimum buzz level. Do this carefully as only slight rotation in either direction will generally be required. Correct adjustment point is located between the two maximum buzz peaks that will be noticed when turning the slug back and forth about ¼ to ½ turn.

d. If necessary, repeat individual channel VHF oscillator adjustment and conclude with retouching the ratio detector secondary. Note: If oscillator adjustment is required for other channels, it will ***not*** be necessary to repeat the ratio detector secondary adjustment after ***once*** correctly adjusting it.

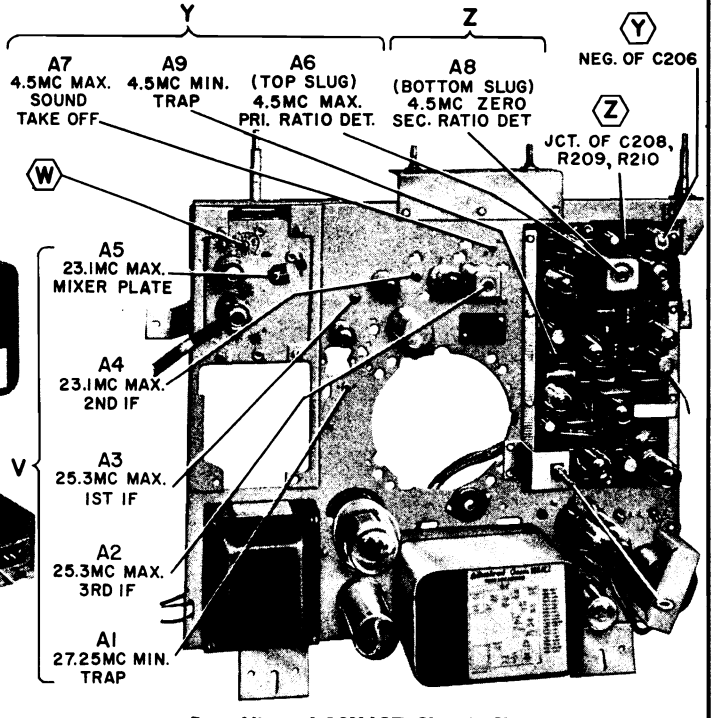
ALIGNMENT OF 4.5 MC TRAP A9, USING A TELEVISION SIGNAL

Beat interference (4.5 MC) appears in picture as very fine vertical or diagonal lines, very close together, having a "gauze-like" appearance, the pattern will vary with speech, forming a very fine herringbone pattern.

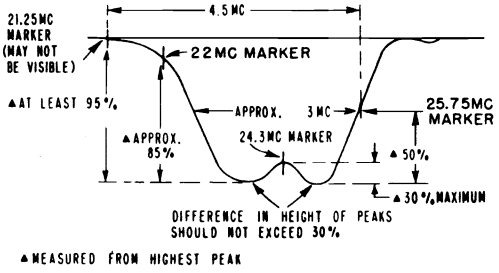
The trap can be tuned by watching the picture and adjusting the slug A9 for minimum 4.5 MC interference.



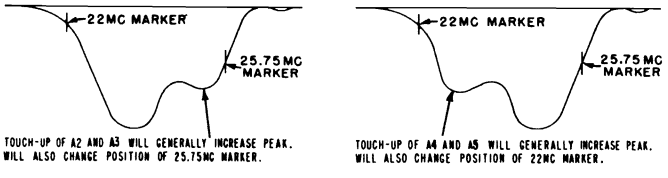
Rear View of 18XP4BZ Chassis Showing Test Point Connections and IF Alignment Data.



Rear View of 18X4CZ Chassis Showing Test Point Connections and IF Alignment Data.



Ideal IF Response Curve.



IF Response Curves, Incorrect Shape.

ADMIRAL Alignment for 18SX4BZ, 18SX4CZ, 18SX4EZ, 18SX4FZ, 18SX4GZ Chassis

TOUCH-UP OF RATIO DETECTOR SECONDARY (A10) USING TELEVISION SIGNAL

Adjustment need be made on one channel only. Proceed as follows:

a. Turn set on and allow about 15 minutes for warm up.

b. Tune set for normal picture and sound.

c. Carefully adjust the secondary slug (A10) of the Ratio Detector Transformer using a non-metallic alignment tool with a hexagonal end (part number 98A30-12). Both slugs (A8 and A10) have hollow cores. Either slug may be adjusted from the top or bottom of the chassis by passing the alignment tool through the core of the first slug encountered. A10 is the slug closest to the chassis.

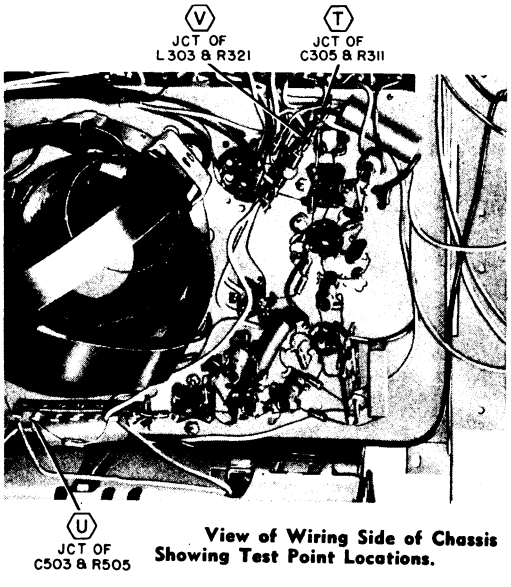
Adjust A10 for best sound with minimum buzz level. Do this carefully as only slight rotation in either direction will generally be required. Correct adjustment point is located between the two maximum buzz peaks that will be noticed when turning the slug back and forth about ¼ to ½ turn.

d. If necessary, repeat individual channel slug adjustment and conclude with retouching the ratio detector secondary. Note: If oscillator adjustment is required for other channels, it will ***not*** be necessary to repeat the ratio detector secondary adjustment after ***once*** correctly adjusting it.

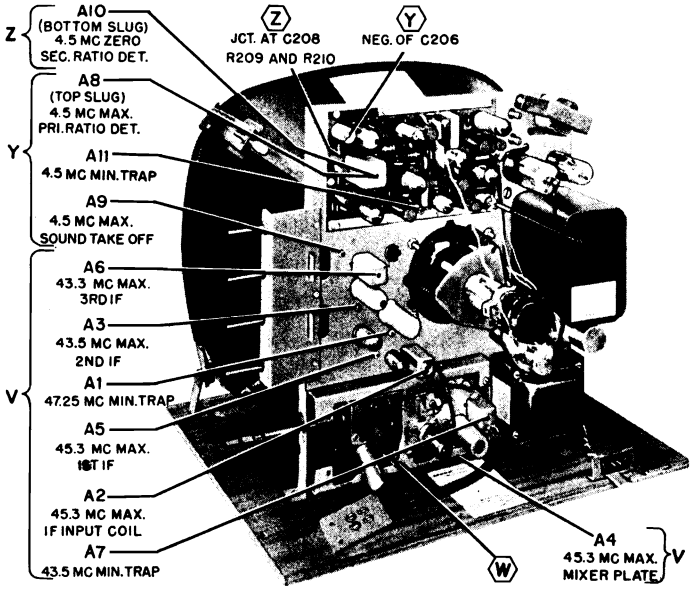
ALIGNMENT OF 4.5 MC TRAP A11, USING A TELEVISION SIGNAL

Beat interference (4.5 MC) appears in picture as very fine vertical or diagonal lines, very close together, having a "gauze-like" appearance, the pattern will vary with speech, forming a very fine herringbone pattern.

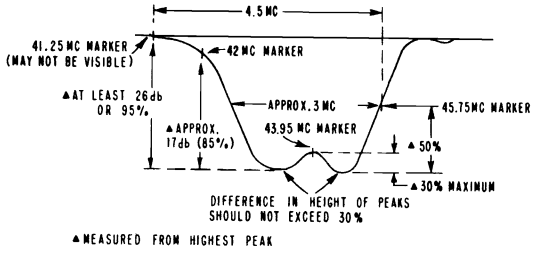
The trap can be tuned by watching the picture and adjusting the slug A11 for minimum 4.5 MC interference.



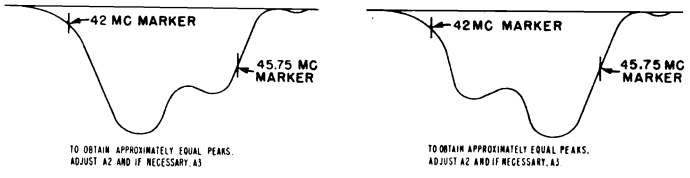
View of Wiring Side of Chassis Showing Test Point Locations.



Rear View of 18SX4BZ (vertical) Chassis Showing Test Point Connections and IF Alignment Data.
Note: In 18SX4CZ (horizontal) chassis, All Test Point Connections and Alignment Points are In the Same Relative Locations.



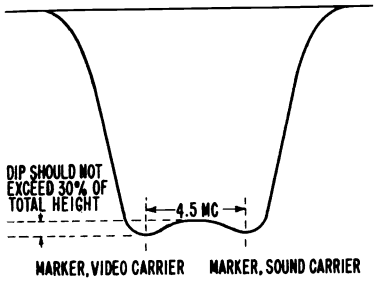
Ideal IF Response Curve.



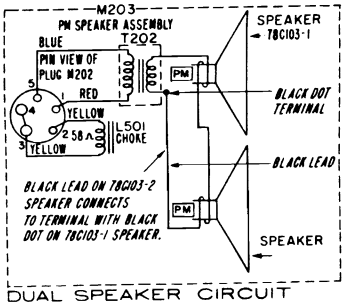
IF Response Curves, Incorrect Shape.

If it is necessary to adjust for approximate equal peaks and marker location, carefully adjust alignment slugs as instructed under the above figures. It should not be necessary to turn the slugs more than one turn in either direction.

ADMIRAL Schematic Diagram for 18XP4BZ Chassis, Stamped Run 1 through Run 5

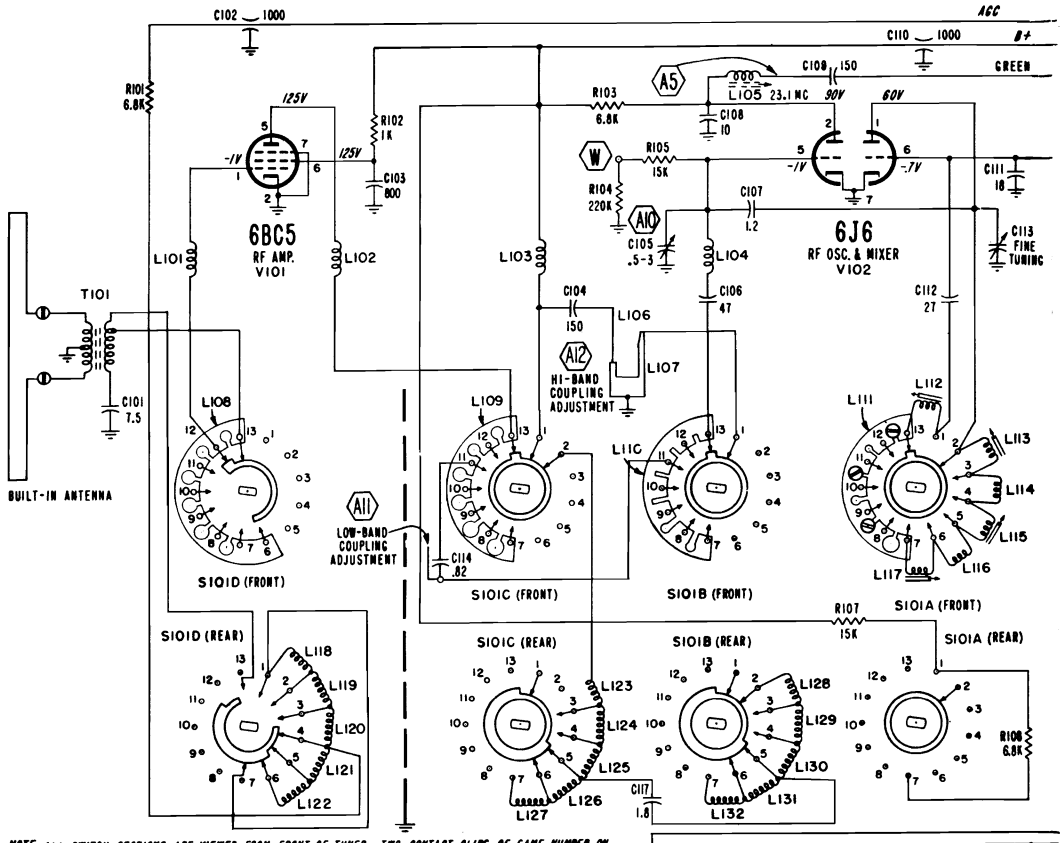


Ideal VHF Response Curve.



DUAL SPEAKER CIRCUIT

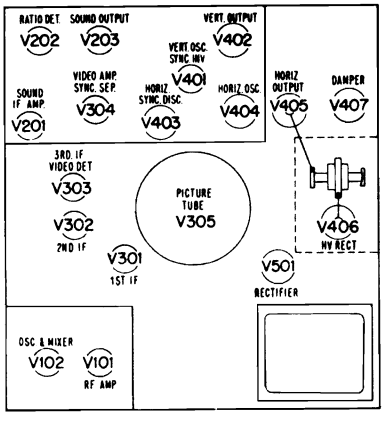
VHF TUNER 94D77-1



NOTE: ALL SWITCH SECTIONS ARE VIEWED FROM FRONT OF TUNER. TWO CONTACT CLIPS OF SAME NUMBER ON FRONT AND REAR SIDES OF A WAFER ARE CONNECTED TO EACH OTHER (NOT SHOWN).

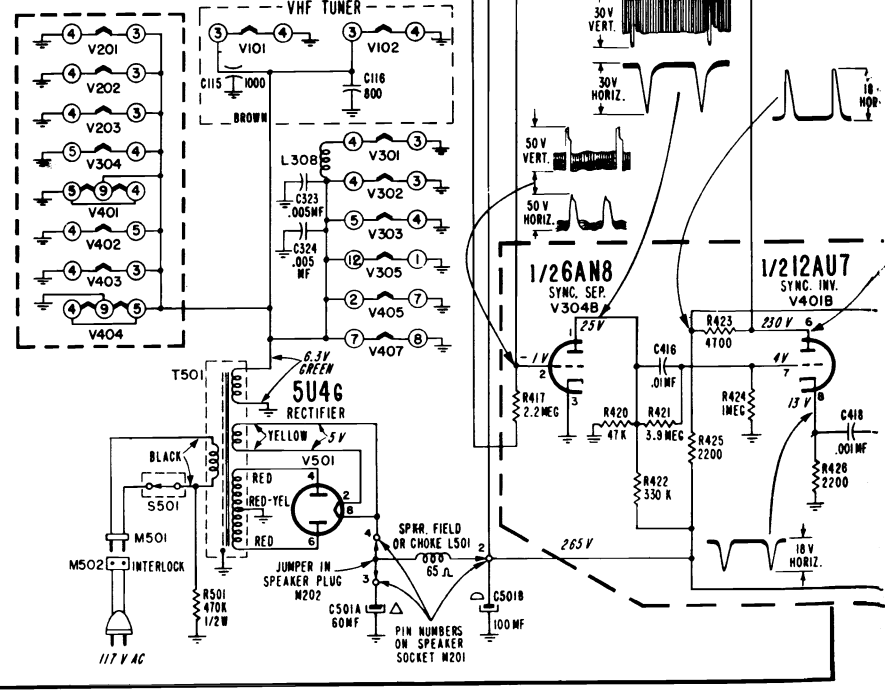
PRODUCTION CHANGES

1. Start of production
2. Change to prevent capacitor breakdown, C407 and C409 changed from upright to conventional paper type.
3. Change to prevent capacitor breakdown, C416 and C420 changed from molded to conventional paper type; C212 changed from molded to ceramic type.
4. Change to increase range of R324, R325 changed from 470 to 1000 ohms.
5. Circuitry simplified. R305 (1000 ohms) and C302 (.005 mf.) were deleted. R305 was connected between white lead (AGC) of tuner to junction of C303 and R306. C302 was connected from junction of tuner AGC lead and R305 to chassis ground.



V101—6BC5
V102—6J6
V201—6AU6
V202—6AL5
V203—6AS5
V301—6CB6
V302—6CB6
V303—6AM8
V304—6AN8
V305—21ALP4A
V401—12AU7
V402—6S4
V403—6AL5
V404—12AU7
V405—6CU6
V406—1X2B
V407—6AX4GT
V501—5U4G or 5U4GA

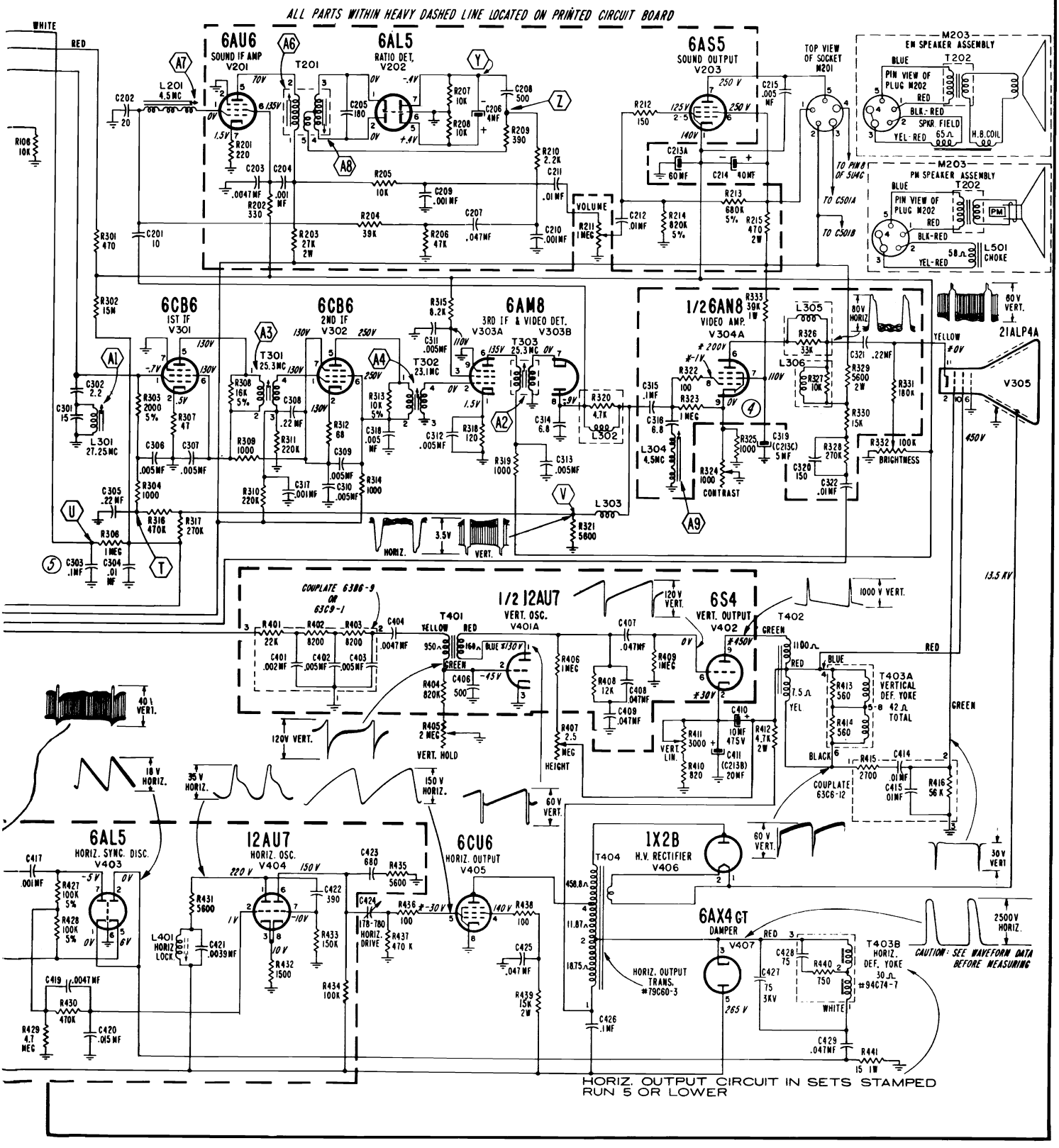
View of 18XP4BZ Chassis.



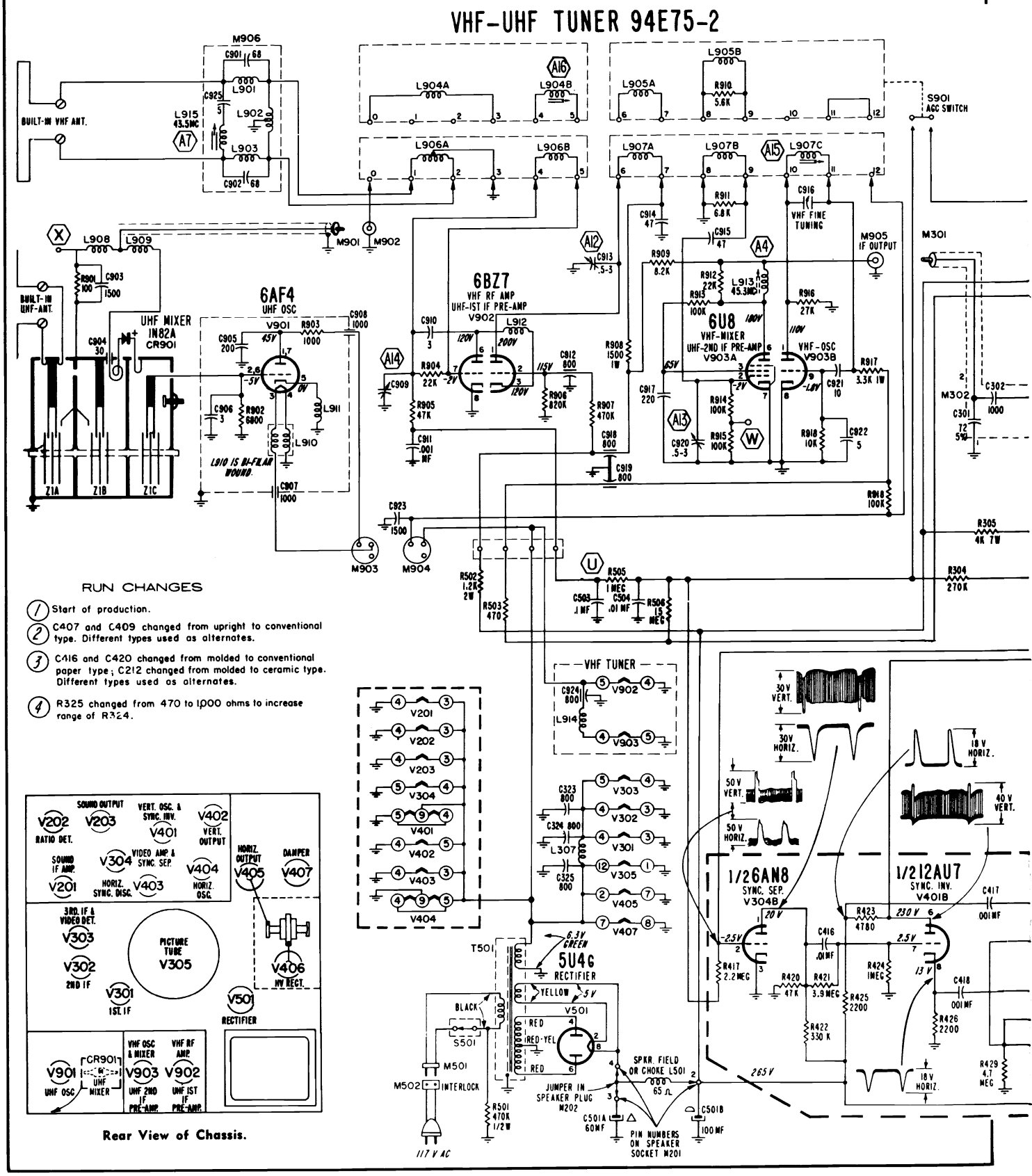
ADMIRAL

Schematic for 18XP4BZ Television Chassis Stamped Run 1 through Run 5.

See page 38 for Schematic Notes.



ADMIRAL Schematic Diagramfor 18SX4BZ Chassis, Stamped Run 1 through Run 5



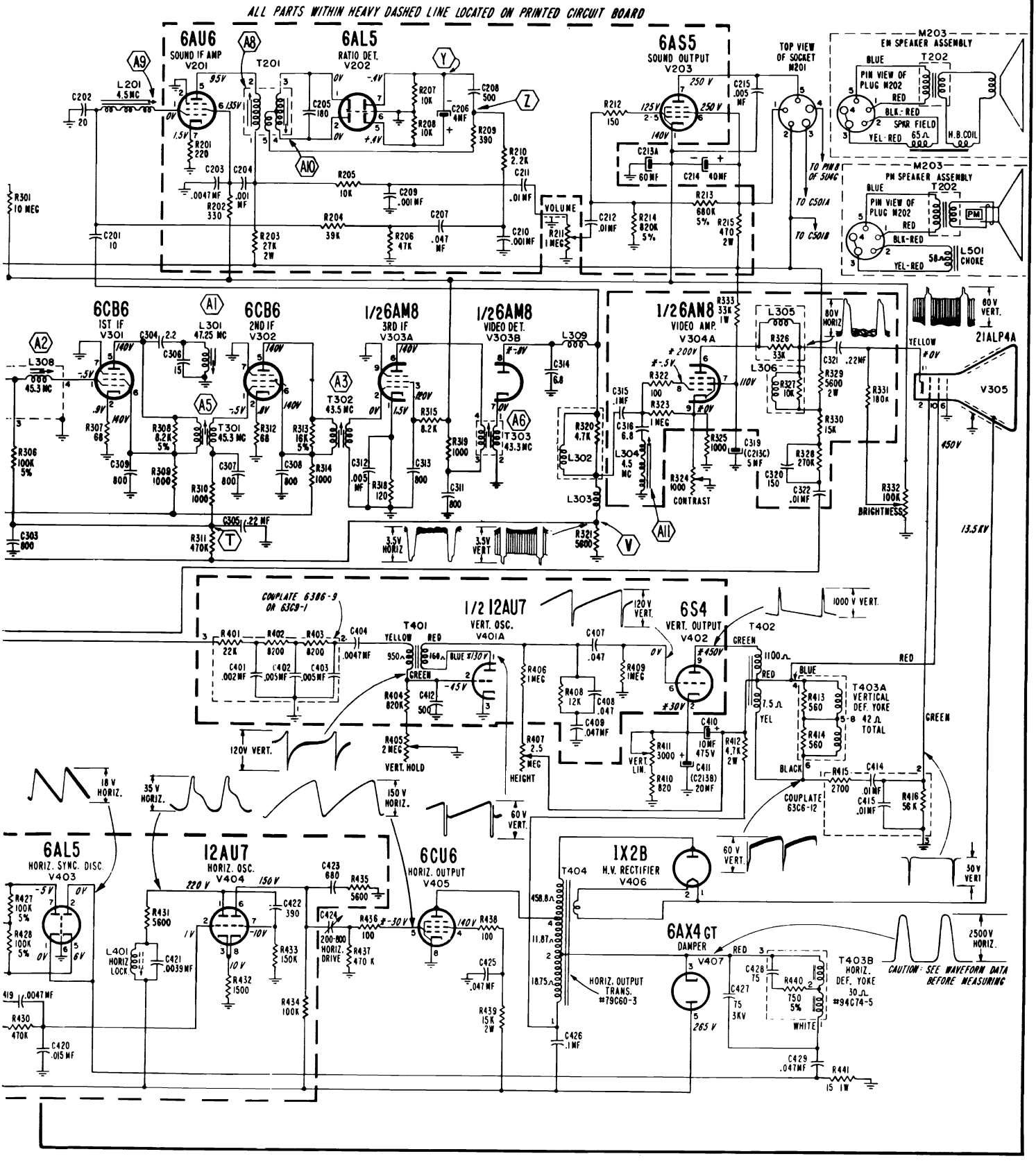
RUN CHANGES

1. Start of production.
2. C407 and C409 changed from upright to conventional type. Different types used as alternates.
3. C416 and C420 changed from molded to conventional paper type; C212 changed from molded to ceramic type. Different types used as alternates.
4. R325 changed from 470 to 1000 ohms to increase range of R324.

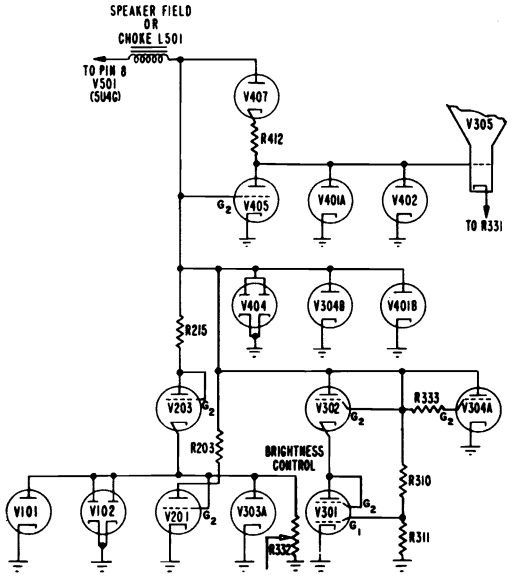
Rear View of Chassis.

ADMIRAL **Schematic for 18SX4BZ Television Chassis Stamped Run 1 through Run 4.**

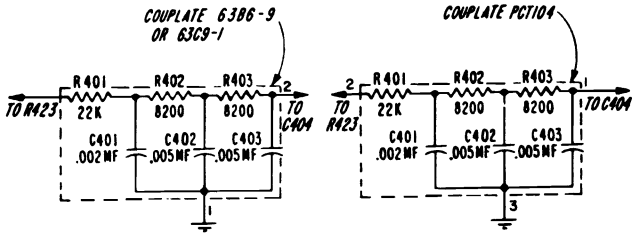
See page 38 for Schematic Notes.



ADMIRAL Chassis 18XP4BZ, 18SX4BZ, etc. (Continued)



Simplified B+ Distribution Diagram for 18XP4BZ Chassis.



Different Integrator Couplates Used.

SCHEMATIC NOTES

(A1), (A2),.....(Y), (Z), etc. indicate alignment points and alignment connections.

(2), (3), . . . etc. indicate changes covered by a Run number. Run numbers are stamped at the rear of the chassis.

Fixed resistor values shown in ohms ± 10% tolerance, ½ watt; capacitor values shown in micromicrofarads ± 20% tolerance unless otherwise specified.

NOTE: K=x 1000, MEG=x 1,000,000 MF=microfarad.

CONDITIONS FOR OBSERVING WAVEFORMS

Warning: Pulsed high voltages are present on the caps of V405 and V406, and at pin 3 of V407. **Do not** attempt to observe waveforms at these points unless suitable test equipment is used. Waveforms at these points may be taken with a capacitive voltage divider probe.

- Waveforms should closely resemble those shown on the schematic.
- Waveforms are taken with a transmitted signal input to the television chassis.
- Set all controls for a normal picture. After the receiver is set for a normal picture, turn the **Contrast** control fully clockwise.
- Oscilloscope sweep is set at 30 cycles for vertical waveforms and at 7,875 cycles for horizontal waveforms to permit 2 complete cycles to be observed.
- Peak-to-peak voltages will vary slightly from those shown on the schematic, depending on the test equipment employed and chassis parts tolerance.

CONDITIONS FOR MEASURING VOLTAGES

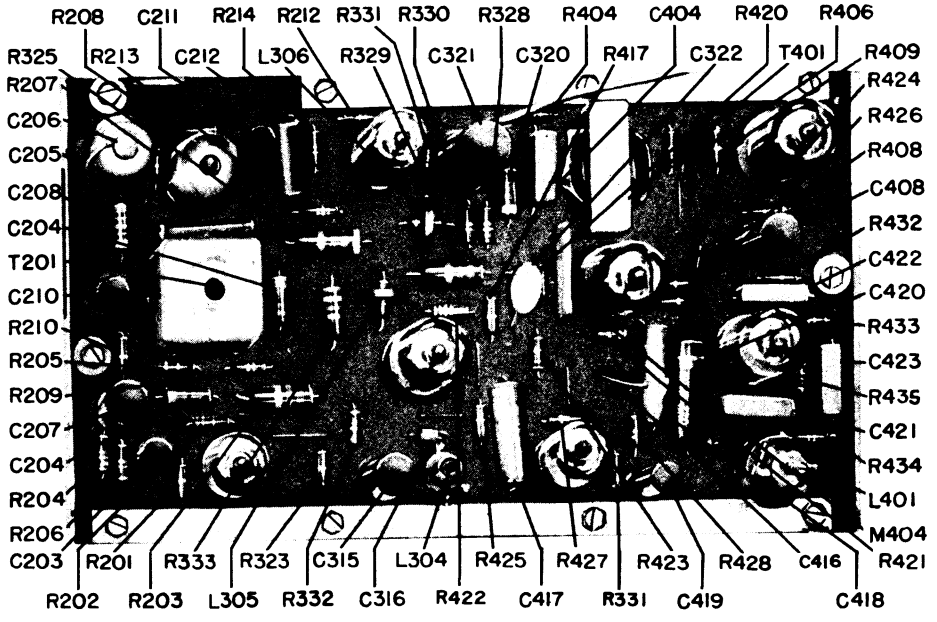
Warning: Pulsed high voltages are present on the caps of V405 and V406, and at pin 3 of V407. **Do not** attempt to measure voltages at these points without suitable test equipment. A VTVM with a high voltage probe may be used when measuring picture tube 2nd anode voltage.

- Set the **Channel Selector** on an unused channel. **Contrast** control fully clockwise. All other controls counterclockwise. Do not disturb Horizontal or Horiz. Drive adjustments.
- Antenna disconnected and terminals shorted together.
- Line voltage: 117 volt AC.
- DC voltages measured with a VTVM between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V305 socket measured with socket removed from tube.
- Voltages marked (*) will vary widely with control settings.

SERVICING PRINTED CIRCUITS

A major portion of the circuit wiring of these receivers is contained in a printed circuit assembly. The printed circuit assembly includes the sound IF amplifier, V201; ratio detector, V202; sound output, V203; video amplifier and sync separator, V304; vertical oscillator and sync inverter, V401; vertical output, V402; horizontal sync discriminator, V403 and horizontal oscillator, V404.

Trouble shooting of printed circuits is similar to that of conventionally wired circuits.



View of Component Side of Printed Circuit Assembly Showing Location of Components.

Admiral

20AX5, 20AX5A, 20AX5B, 20AX5D, 20AX5EZ, 20AX5F and 20AX5GZ TELEVISION CHASSIS

Chassis	Models
20AX5	TA1831, TA1832, TA1842
20AX5A	CA2256
20AX5B	KA2256, KA2257
20AX5D	TA2212B
20AX5EZ	CA2306BZ, CA2306Z, CA2307BZ, CA2307Z
20AX5F	TA1812B
20AX5GZ	KA2366Z, KA2367Z

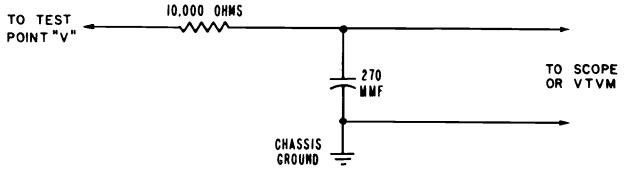


Figure 10. Decoupling Filter.

DIFFERENCES BETWEEN CHASSIS

The 20AX5 chassis is used in "TV-only" models and is the basic chassis of this series. It uses a 17HP4 picture tube, has a 41 MC IF system, uses a 94D64-2 VHF tuner and a 94D66-1 UHF tuner.

The 20AX5F chassis is similar to the 20AX5 chassis except for locations of auxiliary controls on the front panel of the cabinet.

The 20AX5A and 20AX5D use a 21XP4 picture tube. In other respects, they are similar to the 20AX5 chassis.

The 20AX5EZ chassis is similar to the 20AX5A chassis, except that it uses a 21AUP4A picture tube.

The 20AX5B chassis is used in combination models and is similar to the 20AX5A chassis, except that it has a 2B1A built-in AM radio.

The 20AX5GZ chassis is similar to the 20AX5B chassis, except that it uses a 21AUP4A picture tube.

IF AMPLIFIER AND TRAP ALIGNMENT

- Connect bias supply; negative to test point "T", see figure 11, positive to chassis. A 3 volt bias supply is required for all steps below.
- Disconnect antenna. Connect a jumper wire across the antenna terminals.
- Set Channel Selector to channel 12 or other unassigned high channel, to prevent interference during alignment.
- Set the Contrast control fully to the left (counterclockwise).
- Allow about 15 minutes for receiver and test equipment to warm up.
- Use lowest DC scale on VTVM.

Note: Since A2 and A3 are adjustments of an overcoupled double tuned circuit, adjustment of A3 is first made at 43.3 MC (step 3) and then at 45.3 MC (step 5), to obtain proper peak.

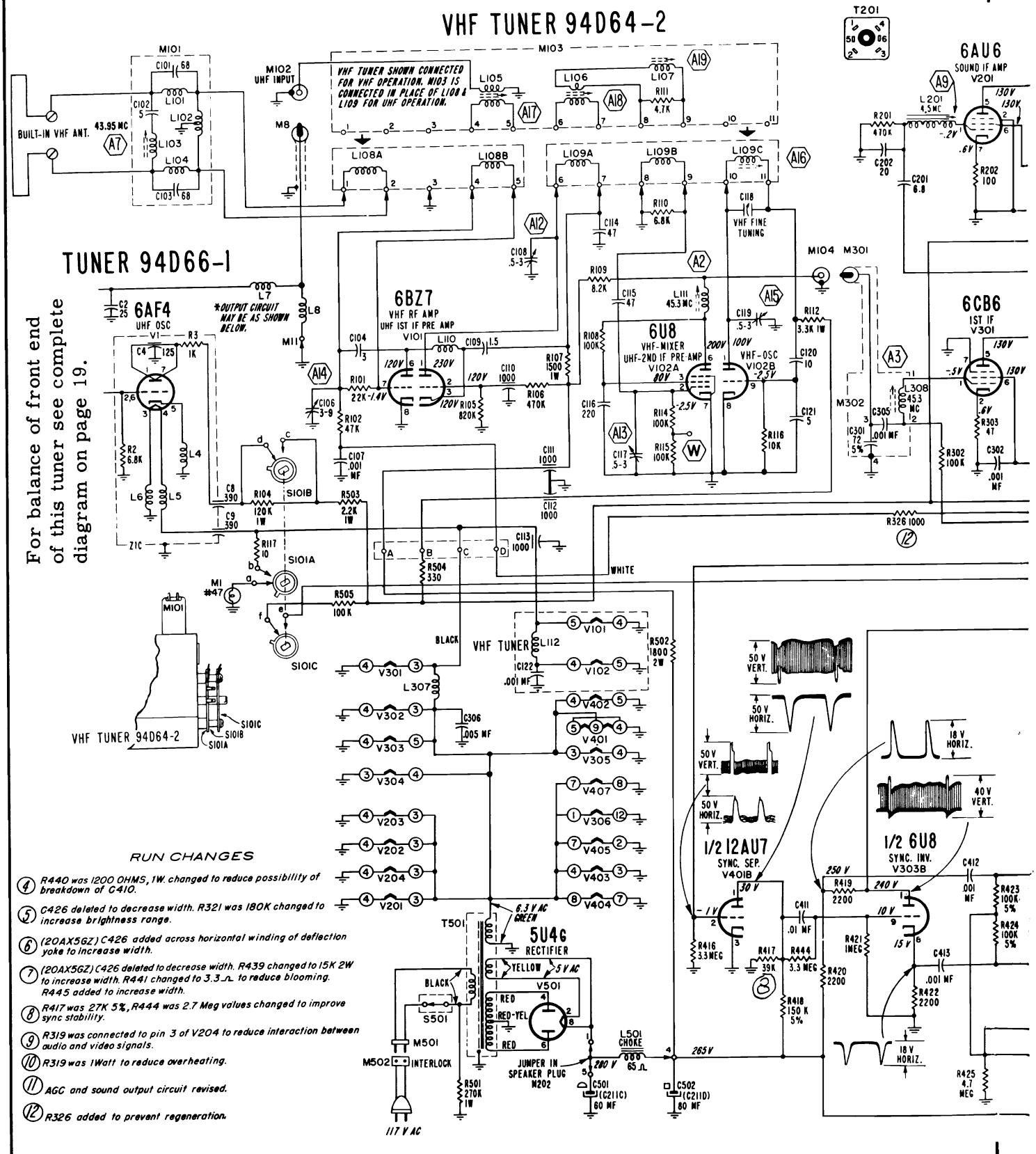
Step	Signal Gen. Freq.	VTVM and Signal Generator Connections	Instructions	Adjust
*1	*47.25 MC	VTVM high side to test point "V" through a decoupling filter; see figs. 10 and 11, common to chassis. Generator high side to 6U8 (V102) special tube shield. Connect low side to chassis near the tube shield.	Connect a 3 volt bias supply to test point "T". Use lowest DC scale on VTVM. When peaking, keep reducing generator output for VTVM reading of approx. 1 volt or less.	A1 for minimum.
2	45.3 MC			A2 for maximum.
3	43.3 MC			A3 for maximum.
4	45.3 MC			Repeat step 2.
5	45.3 MC			Readjust A3 for maximum.
6	45.3 MC			A4 for maximum
7	43.3 MC			A5 for maximum.
8	43.95 MC			A6 for maximum.
9	43.95 MC	Connect VTVM as above. Remove Jumper from antenna terminals. Connect generator high side to antenna terminals; full output may be required.	Follow above instructions. Set Channel selector to 2 or other low channel	A7 for minimum.
10	To insure correct alignment, repeat step 1 and 6, then make the "IF Response Curve Check" given below.			

* Before proceeding with alignment, turn slugs A2 and A3 out fully (counterclockwise). Check the signal generator used in alignment against a crystal calibrator or other frequency standard for absolute frequency calibration required for this operation.

(Alignment Information continued on page 42)

ADMIRAL **20AX5, 20AX5A, 20AX5B, 20AX5D, 20AX5EZ, 20AX5F, 20AX5GZ Chassis**

(For Schematic Notes refer to material on page 38, also applicable to these sets.)



RUN CHANGES

(4) *R440 was 1200 OHMS, 1W. changed to reduce possibility of breakdown of C410.*

(5) *C426 deleted to decrease width. R321 was 180K changed to increase brightness range.*

(6) *(20AX5GZ) C426 added across horizontal winding of deflection yoke to increase width.*

(7) *(20AX5GZ) C426 deleted to decrease width. R439 changed to 15K 2W to increase width. R441 changed to 3.3 Ω to reduce blooming. R445 added to increase width.*

(8) *R417 was 27K 5%, R444 was 2.7 Meg values changed to improve sync stability.*

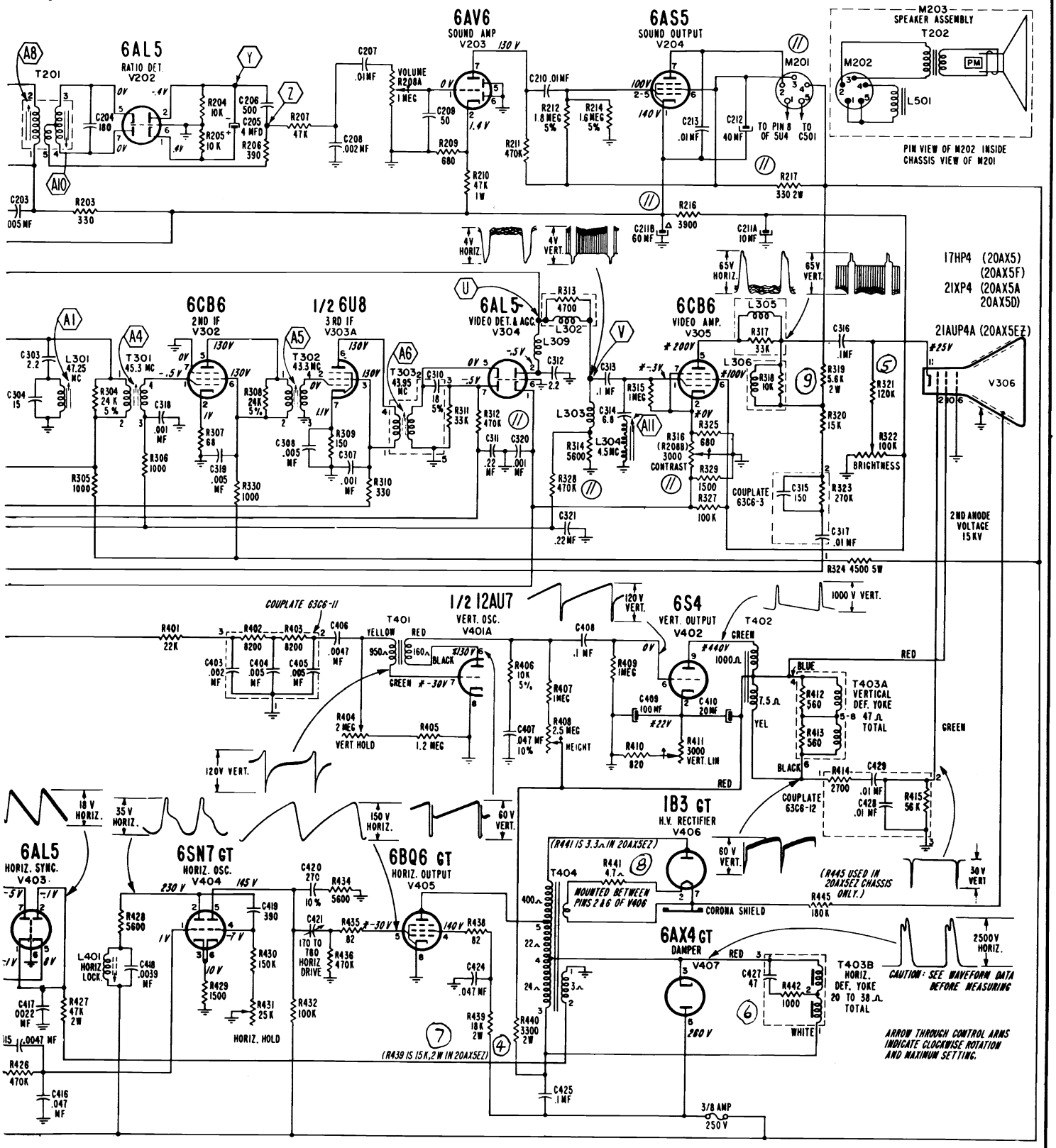
(9) *R319 was connected to pin 3 of V204 to reduce interaction between audio and video signals.*

(10) *R319 was 1Watt to reduce overheating.*

(11) *AGC and sound output circuit revised.*

(12) *R326 added to prevent regeneration.*

ADMIRAL **Schematic for 20AX5, 20AX5A, 20AX5D, 20AX5EZ and 20AX5F Television Chassis Stamped Run 11 and Run 12.**



ADMIRAL (Continued) **20AX5, 20AX5A, 20AX5B, 20AX5D, 20AX5EZ, 20AX5F, 20AX5GZ Chassis**

IF RESPONSE CURVE CHECK

Receiver Controls and Bias Supply	Sweep Generator	Marker Generator	Oscilloscope	Instructions
Set **Channel Selector** on channel 12 or an unassigned high channel. **Contrast** control fully to the left. Connect negative of 3 volt bias supply to test point "T"; positive to chassis.	Connect high side to top of 6U8 mixer-osc. special tube shield. Connect low side to chassis, near tube shield. Set sweep frequency to 44MC, and sweep width approximately 7 MC.	If an external marker generator is used, loosely couple high side to sweep generator lead on tube shield, low side to chassis. Marker frequencies indicated on IF Response Curve.	Connect to test point "V" through a decoupling filter. See figures 10 and 11.	Check curve obtained against ideal response curve in fig. 13. Note tolerances on curve. Keep marker and sweep outputs at very minimum to prevent overloading. A reduction in sweep output should reduce response curve amplitude without altering the shape of the response curve. If the curve is not within tolerance or the markers are not in the proper location on the curve, touch-up with IF slugs as instructed below.

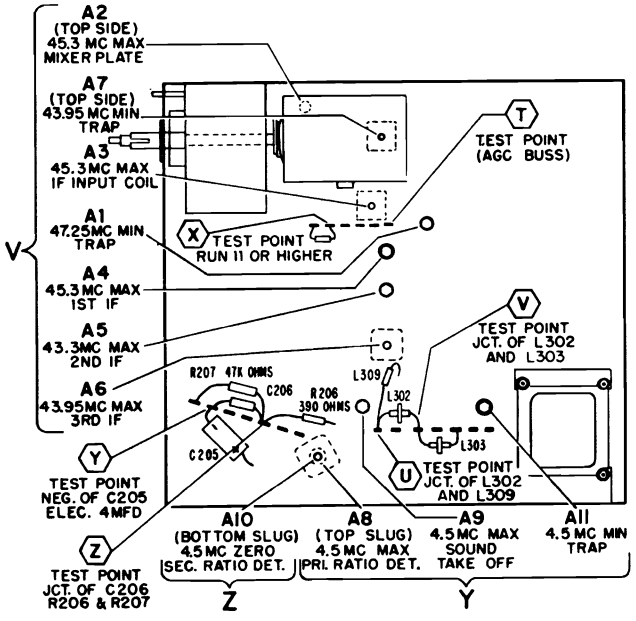


Figure 11. Bottom View of Chassis Showing Test Point Connections and IF Alignment Data.

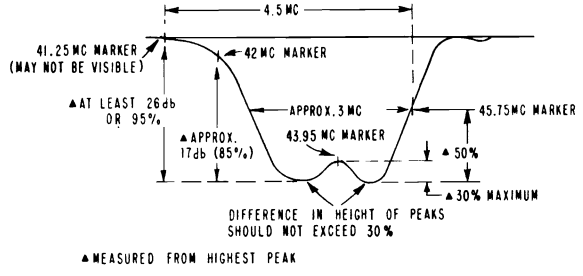


Figure 13. Ideal IF Response Curve.

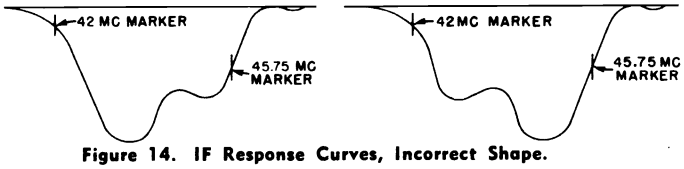


Figure 14. IF Response Curves, Incorrect Shape.

If it is necessary to adjust for approximate equal peaks, carefully adjust slug A2 and if necessary, adjust slug A3. It should not be necessary to turn the slug more than one turn in either direction.

If the curve cannot be made to resemble the response curve shown at left, repeat all steps under "IF Amplifier and Trap Alignment" making sure that generator frequencies are accurate and adjustments are carefully made.

4.5 MC SOUND IF AND TRAP ALIGNMENT

- If a television signal is to be used, connect antenna, set Channel Selector to the strongest TV signal available and tune in a picture.
- If a signal generator is to be used, disconnect antenna and short terminals together. Set Channel Selector to an unassigned high channel.
- Use a non-metallic alignment tool. Ratio detector transformer (T201) has hollow core slugs; adjustments A8 and A10 can be made from the top of the chassis if you use alignment tool, part number 98A30-12 obtainable from your Admiral distributor.

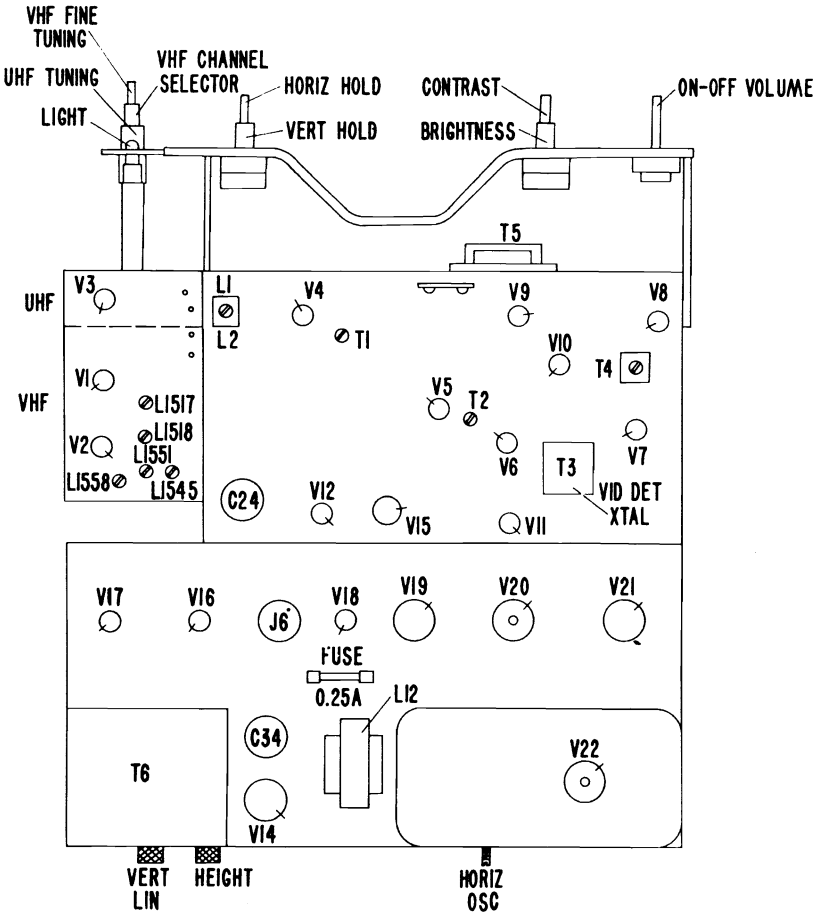
Step	Signal Generator	VTVM Connection	Instructions	Adjust
1	Tune in TV Signal or Set Signal Generator to exactly 4.5 MC.	High side to test point "Y", common to chassis.	Use lowest DC scale possible on VTVM.	A9 and A8 for maximum (if using signal generator keep reducing output to keep VTVM indication at approx. 1 volt).
2		High side to test point "Z", common to chassis.	Use zero center scale on VTVM, if available.	A10 for zero on VTVM (the correct zero point is located between a positive and a negative maximum). If A8 was far off, repeat step 1.
3		High side to test point "Y", common to chassis.	Connect a wire jumper across L302. Use lowest DC scale possible on VTVM.	A11 for minimum.

BENDIX TELEVISION

CHASSIS T18-1, T18-2

Models KS21E, KS21EU, KST21E, KST21EU, TS21E, TS21EU, TSF21E, TSF21EU

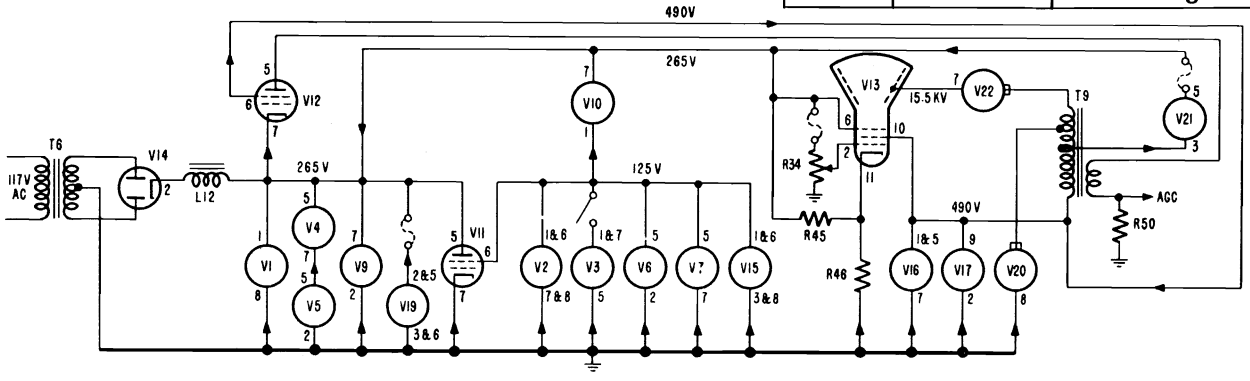
(Circuit diagram on pages 32-33, alignment on page 34).



Top View T18-2 Chassis, UHF Tuner Not Included On T18-1

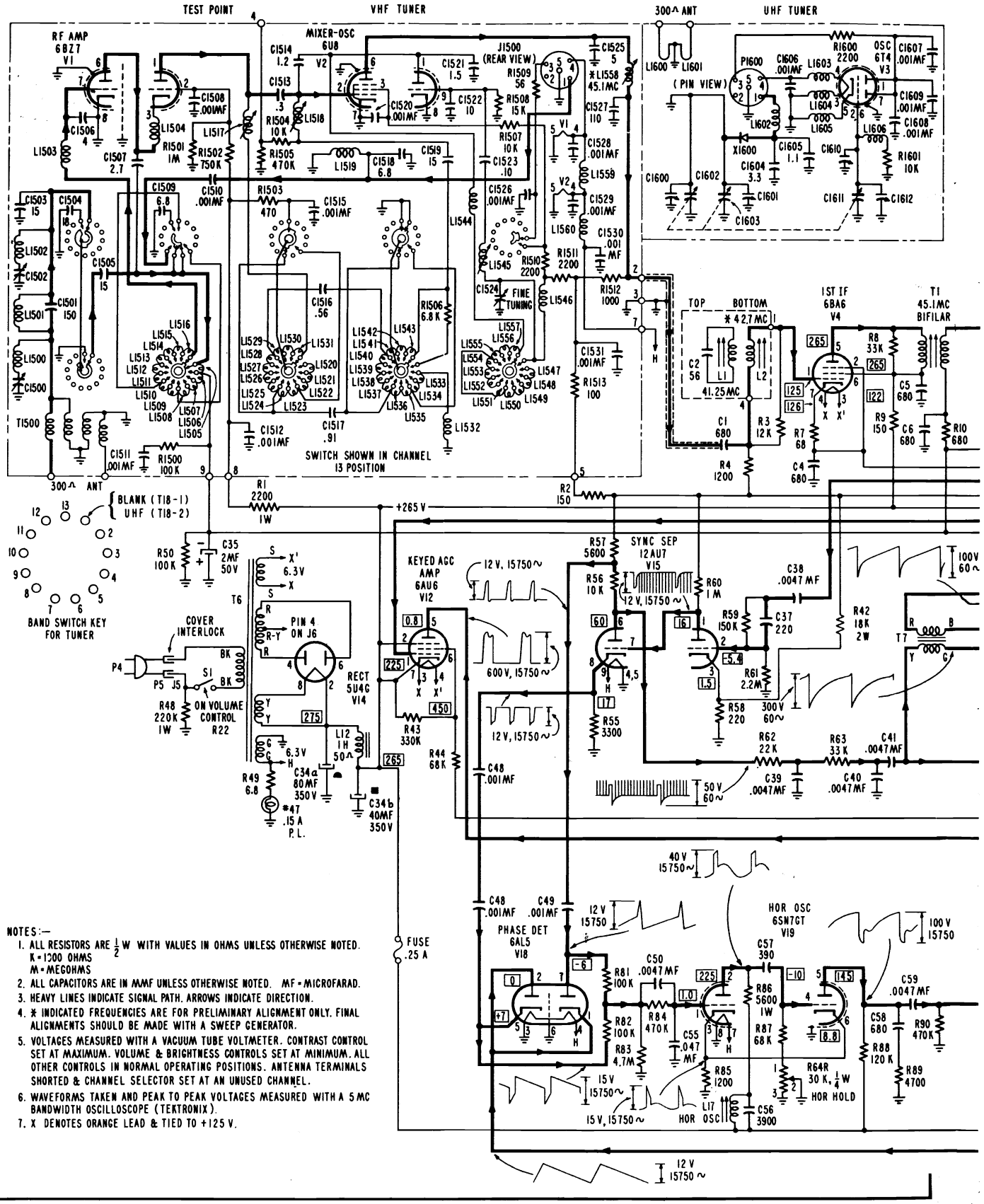
TUBE COMPLEMENT

V1	6BZ7	Cascode RF Amplifier
V2	6U8	Mixer and Oscillator
V3	6T4	UHF Oscillator
V4	6BA6	1st IF Amplifier
V5	6CB6	2nd IF Amplifier
V6	6CB6	3rd IF Amplifier
V7	6AU6	Ratio Detector Driver
V8	6AL5	Ratio Detector
V9	6AV6	Audio Amplifier
V10	6AS5	Audio Output
V11	6AH6	Video Amplifier
V12	6AU6	Keyed AGC Amplifier
V13	21XP4 or 21XP4A	Picture Tube
V14	5U4G	Low Voltage Rectifier
V15	12AU7	Sync Separator
V16	6C4	Vertical Oscillator
V17	6S4	Vertical Output
V18	6AL5	Phase Detector
V19	6SN7GT	Horizontal Oscillator
V20	6CU6	Horizontal Output
V21	6AX4GT	Horizontal Damper
V22	1B3GT	Hi-voltage Rectifier



Current Distribution Diagram

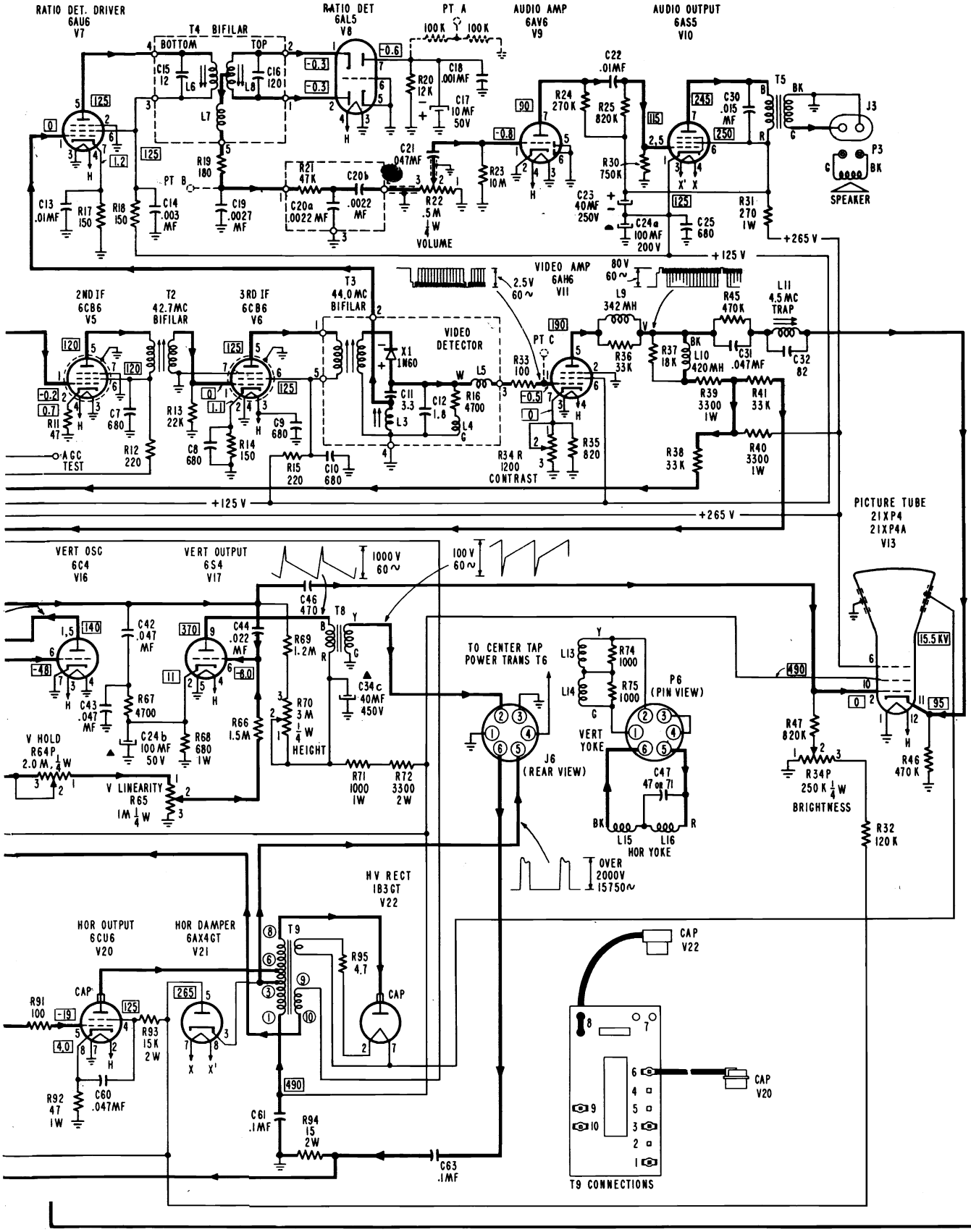
BENDIX TV CHASSIS T18-1, T18-2, Schematic Diagram



NOTES:—

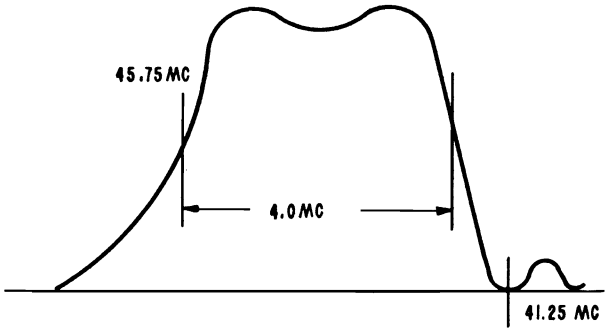
1. ALL RESISTORS ARE $\frac{1}{2}$ W WITH VALUES IN OHMS UNLESS OTHERWISE NOTED. K = 1000 OHMS M = MEGOHMS
2. ALL CAPACITORS ARE IN MMF UNLESS OTHERWISE NOTED. MF = MICROFARAD.
3. HEAVY LINES INDICATE SIGNAL PATH. ARROWS INDICATE DIRECTION.
4. * INDICATED FREQUENCIES ARE FOR PRELIMINARY ALIGNMENT ONLY. FINAL ALIGNMENTS SHOULD BE MADE WITH A SWEEP GENERATOR.
5. VOLTAGES MEASURED WITH A VACUUM TUBE VOLTMETER. CONTRAST CONTROL SET AT MAXIMUM. VOLUME & BRIGHTNESS CONTROLS SET AT MINIMUM. ALL OTHER CONTROLS IN NORMAL OPERATING POSITIONS. ANTENNA TERMINALS SHORTED & CHANNEL SELECTOR SET AT AN UNUSED CHANNEL.
6. WAVEFORMS TAKEN AND PEAK TO PEAK VOLTAGES MEASURED WITH A 5 MC BANDWIDTH OSCILLOSCOPE (TEKTRONIX).
7. X DENOTES ORANGE LEAD & TIED TO +125 V.

SCHEMATIC DIAGRAM FOR BENDIX TV CHASSIS T18-1, T18-2

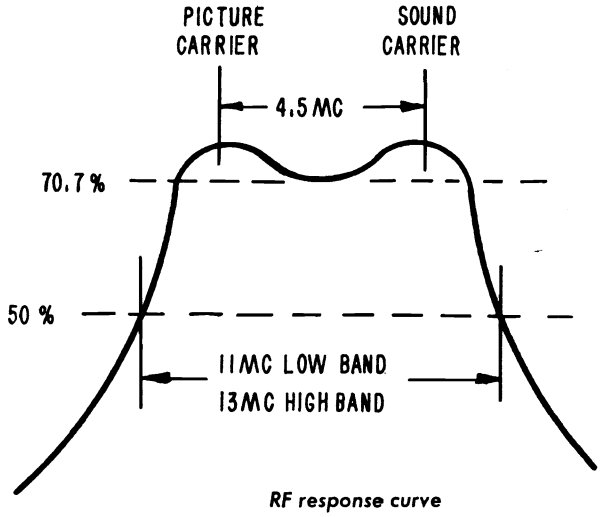


BENDIX TV CHASSIS T18-1, T18-2 ALIGNMENT PROCEDURE

(See page 31 for top view diagram showing trimmer locations).



IF Response Curve



RF response curve

SIMPLIFIED IF ALIGNMENT.

1. Connect the negative terminal of a 3-volt dry cell bias supply to the AGC test point and the positive terminal to chassis ground.

2. Raise the tube shield of V2 until it is not grounded.

3. Connect the output of the signal generator to the ungrounded shield.

Generator Frequency	*VTVM Connections*	*Adjust*	*Remarks*
44 mc	V11—pin 1 and ground	T3	Adjust for maximum
42.7 mc	V11—pin 1 and ground	T2 and L2*	Adjust for maximum
45.1 mc	V11—pin 1 and ground	T1 and L1558*	Adjust for maximum
41.25 mc	V11—pin 1 and ground	L1	Adjust for minimum with output of Gen at Max.

* The designated frequencies for L1558 and L2 are to be used for preliminary alignment only. Since these two coils comprise a bandpass circuit, final alignment should be made with a sweep generator.

SOUND ALIGNMENT.

Connect the negative terminal of a 9-volt dry cell bias supply to the AGC test point and the positive terminal to chassis ground. See schematic diagram for test points A and B.

Signal Generator Connections	*Frequency*	*Connect*	*Adjust*	*Remarks*
High side to pin 1 of V11. Low side to chassis ground.	4.5 mc	Parallel R20 with two 100k resistors which are within 1% of each other. DC probe of VTVM to Pt. A. Common lead to chassis.	L3 L6	Adjust for max.
High side to pin 1 of V11. Low side to chassis ground.	4.5 mc	DC probe of VTVM to Pt. B. Common lead to Pt. A.	L8	Adjust for zero reading at crossover.

CAPEHART-FARNSWORTH COMPANY

"CX-38C"

CX-38 and CX-38C Series use Chassis Type CT-109, CT-125, CT-139, CT-140, CT-157, CT-158, CT-171, CT-172, which are used in Models 1T175, 2T215, 3T215, 7C215, 8C215, 9C215, 12F215, 14F215, 18C215, 21T215, 22C215, 23T215, 24T215, each with several suffix letters indicating cabinet types.

Circuit diagram is on pages 48-49; trouble-shooting hints on pages 50 and 51, and alignment instructions are on pages 52 through 54.

General Description

The CX-38C chassis is a revised version of the basic CX-38 chassis. A number of improvements have been made in this chassis without changing the circuitry to any great extent. Listed below are the major changes which were made in the chassis and the improvements which were brought about by these changes.

1. Type 6BZ6 Remote Cut-Off Tubes now used in the 1st and 2nd Video I.F. Stages.
   The use of remote cut-off pentodes provides greater uniformity of operation throughout the I-F stages without the necessity for selecting tubes.
2. Type 6AM8 Tube now used as 3rd Video I-F and Video Detector.
   The pentode section of this tube is essentially the same as a 6CB6 and will perform equally as well as an I-F Amplifier. The Diode section of this tube is used as a Video Detector in place of the previously used 1N64 Germanium Diode. The use of a vacuum tube here will provide more uniform operation.
3. New Horizontal Deflection System.
   A new high efficiency Auto-Transformer in the Horizontal Output circuit provides a greater deflection angle and increased high voltage (17.5 KV average) while operating from a lower voltage supply (260 V instead of 300 V). An improved deflection yoke design also provides for better linearity.
4. New Horizontal Size (Width) Transformer.
   This new transformer utilizes heavier wire for longer life and through better energy transfer is able to provide a sufficient AGC Keying Pulse regardless of Width setting.
5. Heavy Duty 5U4GA, 6SN7GTA, 6CU6 and 6AX4 Tubes.
   Improved reliability and increased tube life will be realized as a result of the increased current ratings of these tubes.

Chassis Coding

The rear panel of the CX-38C chassis, in addition to being coded as per chassis type, will also have the suffix "—4", "—5", or "—6" appearing after the "CX-38C". The "—4" suffix indicates that the SWITCH TYPE VHF TUNER only is used, the "—5" indicates that the UHF/VHF TUNER is used and the "—6" indicates that the 13 position TURRET TYPE VHF TUNER is used. These suffix numbers will also appear after the model on the model number label that appears on the cabinet back.

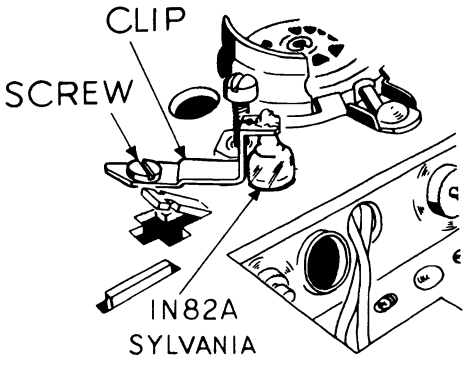


Figure 1

Production Coding

Also on the rear near the chassis coding (which may be as an example "CX-38C-4") the production run coding will appear. This coding will only apply to major production changes. The first chassis will be stamped with the production coding "R-1". All future changes will be coded "R2", "R3", etc., depending on the number of production changes incorporated. All changes are listed below the schematic diagram.

UHF Adaptation

The CX-38C-4 and the CX-38C-6 chassis incorporate VHF TUNERS only which can readily be adapted to UHF reception. The "—4" chassis, incorporating the SWITCH TYPE VHF TUNER, is adapted for UHF reception in the same manner as the previous CX-38 chassis. The TK-1 Kit contains the UHF tuner, necessary hardware and complete installation instructions and may be obtained from your Capehart Distributor.

The "—6" chassis, incorporating the TURRET TYPE VHF TUNER, can be readily adapted to UHF reception with individual UHF strips. This tuner is a 13-position tuner with 12 positions for VHF and a 13th position provided for one UHF strip. If more than one strip is needed, then any unused VHF strip may be removed and the UHF strip inserted in its place. This tuner uses a new "D" type strip which contains both the oscillator section and the antenna section on a single board. A single mixer diode (1N82A) must be installed upon the initial installation of any UHF strip. Any future installation of strips require only the strip itself. Each UHF strip is supplied in a package which contains the necessary hardware for installation of the mixer diode. The mixer diode is **not** included. The 1N82A mixer diode can be obtained from any parts jobber; however, it should be one that has been selected for minimum noise level. It may be necessary to try a number of these diodes before obtaining one which will provide optimum performance. The UHF strips may be obtained from either the Capehart Distributor or any Standard Coil Parts Jobber in your area. When ordering these strips, it is only necessary to order by channel number and type. (For example: 43D).

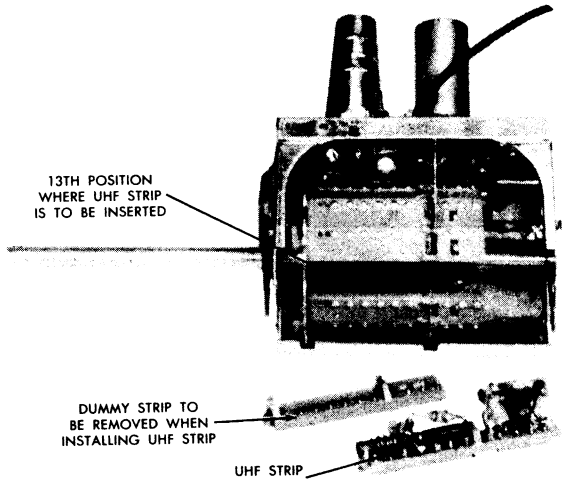
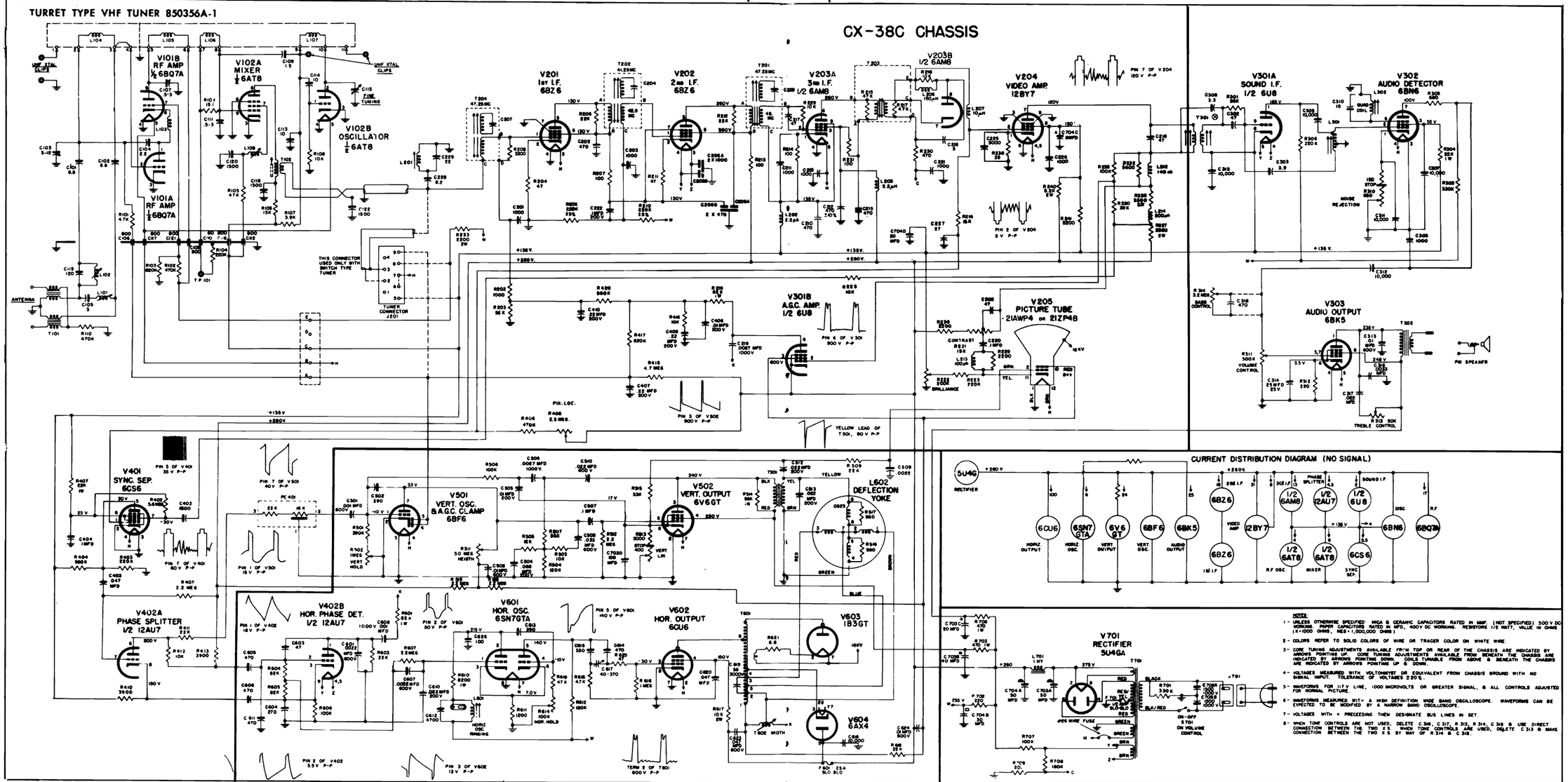


Figure 2

CAPEHART "CX-38C" SERIES TV CHASSIS

VOLUME TV-10, ADDITIONAL 1955 TELEVISION SERVICING INFORMATION

CAPEHART CX-38C SERIES CIRCUIT DIAGRAM



PRODUCTION CHANGES

The schematic shown here is correct for chassis coded R-2. These chassis differ from those coded R-1 in the following manner:

1. **R509** (22K ½W 10%) has been added in place of a bus wire from junction of C512 and R515 and the grid (Pin 2) of the CRT.
2. **C509** (.0022-600V) has been added from the grid (Pin 2) of the CRT to ground.

Chassis coded R3 will contain the R2 changes plus the following production changes:

1. The parallel combination of C217 and R229 is removed from the grid of V203 (Pin 2) and Terminal B of T201 and connected in series with Terminal C of T201 and L202. The grid of V203 is connected directly to Terminal B of T201.
2. C211 (1000 mmfd) is changed to C231 (470 mmfd).
3. When the Turret Tuner is used, a 33K—2W resistor (R234) is connected from plus 135V to ground.

Picture Size and Linearity

Adjust the Horizontal Drive control for maximum width. Decrease drive slightly if a vertical white line (or lines) appear in the picture. Then adjust the width control for proper picture width.

Adjust the Height and Vertical Linearity controls to obtain the proper height and vertical linearity. It may be necessary to adjust the Vertical Hold control while making these adjustments, if the picture should roll. (On sets employing Beam Corrector Magnets, refer to the instructions under that heading for additional linearity checks.)

Adjustment of the Quadrature Coil

Adjustment of the Quadrature Coil (L302) and Noise Rejection control (R301) should be made at the time of installation to insure the best sound reproduction. These two items are located on the rear panel for easy adjustment.

With a station properly tuned in, adjust the Quadrature coil for the strongest and clearest sound. Then attenuate the signal until background noise is apparent in the sound. With the signal attenuated, adjust the Noise Rejection Control for a minimum background hiss and noise.

CAPEHART CX-38 CHASSIS TUBE SOCKET RESISTANCE CHART

REFERENCE TUBE NO.	PIN NO. 1	PIN NO. 2	PIN NO. 3	PIN NO. 4	PIN NO. 5	PIN NO. 6	PIN NO. 7	PIN NO. 8	PIN NO. 9
V1	90K	10K	0	0	0	10K	90K		
V101	90K	50K	INF.	0	0	INF.	90K	0	0
V102	INF.	50K	90K	0	0	90K	0	0	15K
V201	75K	50 OHMS	.5	0	INF.	INF.	0		
V202	120K	INF.	80K	80K	80K	80K	INF.		
V203	45K	45K	80K	80K	80K	80K	45K		
V204	45 OHMS	500 OHMS	0	.5	.5	0	100K	124K	0
V205	0	33K	NC	(PIN 10) INF.	(PIN 11) 330K	0	(Pin 12) .5	NC	NC
V301	120K	100K	INF.	100K	100K	90K	68K	90K	140
V302	150 OHMS	4.2 OHMS	0	.5	90K	7 OHMS	470K		
V303	90K	6 OHMS	30 OHMS	0	.5	220 OHMS	4 OHMS	90K	90
V401	20K	0	0	.5	180K	90K	6.8 MEG.		
V402	220K	270K	100K	100K	100K	90K	0	100K	120K
V501	170K*	0	0	.5	80K	80K	2.2 MEG.		
V502	NC	.5	80K	80K	2.2 MEG.	NC	.5	33K*	
V601	2.2 MEG.	100K	1.2K	150K*	150K	1.2K	.5	0	
V602	NC	.5	150K	100K	1.2 MEG.	NC	0	0	
V603	NC	INF.	NC	NC	100K	NC	100K	NC	
V604	40K	NC	INF.	NC	18K	NC	75K	75	
V701	NC	100K	NC	22 OHMS	NC	22 OHMS	NC	100K	

* VARIES WITH CONTROL ADJUSTMENT

ALL CONTROLS SET AT MAXIMUM RESISTANCE

TROUBLE-SHOOTING NOTES ON THE CX-38 SERIES TV CHASSIS

Picture Circuits

1. No Picture, No Sound, Raster Present.
   Use Oscilloscope to trace video signal. If video is not present at output of video detector, check:
   (A) R-F tubes V101 and V102 or I-F tubes V201, V202, V203.
   (B) Video detector crystal 1N64 and associated components.
   (C) Voltage readings on all R-F and I-F tube pins.
   (D) Plate and screen load-resistors and by-pass capacitors in the R-F and I-F stages.
   If video signal at Video Detector is normal, check:
   (A) Video Amplifier tube V204.
   (B) Voltage readings on the video amp. (12BY7) V204.
   (C) Resistors R217, R219, R226, R227, and R238. Peaking Coil L207 and L214 for open.

2. No Picture, Sound O.K., Raster Present.
   Use oscilloscope to trace video signal from video detector to isolate defective component. If video checks normal at the plate of the video amp., but is not present at cathode of picture tube, check:
   (A) Contrast control R221 for open.
   (B) Coupling capacitor C220 for open.

3. A Single Wide Black Bar (60 cycle hum) in Picture.
   Use oscilloscope to observe video signal at output of video detector. If video shows hum modulation, check:
   (A) Tubes in R-F and I-F stages for heater-to-cathode leakage.

   If no hum is present at the detector output, check:
   (A) Video amp. (12BY7 V204) and the picture tube for heater-to-cathode leakage.

4. Smear in Picture, Check:
   (A) Video amp. tube (12BY7) V204.
   (B) Peaking coils L212 and L213 for open.
   (C) Capacitor C220 for leak.
   (D) Alignment of I-F Stages—Check response curve with sweep generator and oscilloscope.

5. Trailing Whites (Ringing in Picture)
   If condition is not present on all channels, check:
   (A) Fine tuning adjustment for proper tuning. If not obtainable, check adjustment of local oscillator on the channels involved.

   If conditions are present on all channels, check:
   (A) Value of Detector load-resistor, R217.
   (B) Alignment of I-F Stages.

Sound Circuit

1. No Sound or Weak Sound—Picture O.K. Check:
   (A) Audio Output tube 6BK5 (V303) by substitution.
   (B) Audio Detector tube 6BN6 (V302) by substitution.
   (C) Sound I-F tube ½6U8 (V301A) by substitution.
   (D) Voltage readings on 6BK5 (V303), 6BN6 (V203) and 6U8 (V301A).
   (E) Volume Control (R311) and R312.
   (F) Resistors R307, R302, R305, R304.
   (G) Coupling Capacitors C305 and C306 for open.
   (H) Noise rejection control, R307 for open.
   (I) Output Transformer, T301 and speaker.
   (J) Alignment of 4.5 MC sound I-F and sound detector.

2. "Buzz" In Sound—Picture Okay
   In some instances "buzz" in the sound may be the result of a transmitter difficulty. If the buzz is not a transmission difficulty, check:
   (A) Adjustment of Noise Rejection Control (R310) and/or Quadrature Coil (L302). Follow procedure outlined in Service Manual.
   If satisfactory adjustment cannot be made, check:
   (A) Quadrature Coil (L302) for short or open.
   (B) Noise Rejection Control (R310).
   (C) By-Pass capacitor — (C-311) for short.

3. Distorted Sound
   Check Audio Output stage by feeding audio signal into grid of 6BK5 tube and observe signal at plate of this tube with a scope. Also check tone through speaker. If signal is distorted, check:
   (A) Capacitor 704B.
   (B) Output transformer and speaker.
   If audio section shows no evidence of distortion, check:
   (A) Coupling capacitor C312 for leak.
   (B) By-Pass capacitor C307 for open.
   (C) Alignment of Sound I-F and Detector circuits.

TROUBLE-SHOOTING NOTES ON THE CX-38 SERIES TV CHASSIS—*(Continued)*

Horizontal Sync—AFC and Sweep Circuits

1. Loss of horizontal sync:
   If vertical sync is also critical, check:
   (A) Sync Separator 6CS6 (V401) and Phase Splitter 12AU7 (V402) tubes.
   (B) Sync Coupling Capacitors C402 and C403.
   (C) Resistors R225, R404, R410, R412 and R413 for open.
   If Vertical Sync is normal, check:
   (A) Capacitors C605 and C602 for open.
   (B) Resistors R606 and R601 for open.
2. "Jittery" Horizontal Sync:
   Check:
   (A) Horizontal Phase Detector, 12AU7 (V402B) tube.
   (B) Value of resistors R604, R605 and R607.
   (C) Capacitor C607 for open.
3. Extreme Horizontal Sweep Distortion (Picture Distorted—Horizontal Sync Critical) Check:
   (A) Horizontal Phase Detector 12AU7 (V402B) and Horizontal Oscillator 6SN7 (V601) tubes for heater-to-cathode leakage.
4. Three Overlapping Pictures (Horizontal Osc. frequency too high). If adjustment of horizontal osc. cannot correct condition, check:
   (A) Horizontal Osc., 6SN7 (V601) tube by substitution.
   (B) Capacitor C615 for open.
   (C) Resistor R615 for open.
5. Tearing at Top of Picture:
   If adjustments of Horizontal Osc., AGC and Pix Lock Control do not correct condition, check:
   (A) Capacitor C612 for open.
6. No Raster—No High Voltage:
   Use Oscilloscope to check waveform at grid (pin 5) of Horizontal Output 6BQ6GA or 6CU6 (V602). If waveform is normal, check:
   (A) Horizontal Output 6BQ6GA or 6CU6 (V602,) H.V. rectifier 1B3GT (V603) and Damper 6W4GT (V604) tubes.
   (B) H.V. Circuit fuse (0.2 Amp. Sol-Blo) for open.
   (C) Horizontal Winding of Deflection Yoke and Horizontal Output Trans. (T601) for open.
   (D) Parallel resistor R622 and Capacitor C622 for open.
   If waveform at grid (pin 5) of 6BQ6GA or 6CU6 (V602) is **not** normal, check:
   (A) Horizontal Osc. 6SN7 (V601) tube.
   (B) Coupling capacitor C614 and resistor R625 for open.
   (C) Horizontal Osc. plate-load resistors R610 and R612 for open.
   (D) Horizontal ringing coil L601 for open. Also check valves of other components in horizontal osc. circuit.
7. Insufficient Horizontal Sweep:
   If condition cannot be corrected by adjustment of Horizontal Drive and Width, check:
   (A) Horizontal Osc. 6SN7 (V601), Horizontal Output 6BQ6GA or 6CU6 (V602), and Damper 6W4GT (V604) tubes.
   (B) Voltage readings on Horizontal Osc. 6SN7 and Horizontal Output 6BQ6GA or 6CU6.
   (C) Valve of capacitor C623 in damper circuit, also capacitors C614, C615 and other components in Horizontal Osc. circuit.
   (D) Capacitor C620 for open.
8. Insufficient Horizontal Sweep with Foldover on Right Side:
   (A) Capacitor C614 for leakage.
9. Horizontal Foldover in Center of Picture:
   Check:
   (A) Capacitor C620 for leakage.
10. Trapazoidal Raster—Horizontal sweep decrease:
    Check:
    (A) Horizontal winding of deflection yoke for partial short.
    (B) Capacitor C625 (across half of yoke winding) for short.

Vertical Sync and Sweep Circuits

1. Loss of Vertical Sync or Critical Hold:
   Use oscilloscope to check sync signal at grid (pin 1) of Vertical Osc., 6BF6 (V501). If sync signal is normal, check:
   (A) Valves of capacitors C504, C506, C505 and C510 resistors R501, R502 and other components in Vertical Osc. circuit.
   If sync signal is **not** normal, check:
   (A) Sync Seprator 6CS6 (V402) and Phase Splitter ½12AU7 (V402A) tubes by substitution.
   (B) Voltage readings and waveforms in Sync Separator and Phase Splitter circuits.
   (C) Integrating network (PC401.)
   (D) Resistor R411 for open.
2. Loss of Vertical Sweep:
   Check:
   (A) Vertical Osc. 6BF6 (V501) and Vertical Output 6V6 (V502) tubes by substitution. Use oscilloscope to check waveform at plate (Pin 3) of vertical output, 6V6 (V502).
   If waveform is normal, check:
   (A) Vertical winding of deflection yoke.
   (B) Vertical Output transformer (T501).
   (C) Capacitor C513 for short.
   If waveform is **not** normal, check:
   (A) Voltage readings in vertical osc. (V501) and vertical output (V502) circuits.
   (B) Vertical Output transformer (T501) for open primary.
   (C) Resistors R513, R510 and R511, Capacitors C502, C506 and C507 for open. Also check other components in Vertical Osc. circuit.
3. Insufficient vertical scan:
   Use oscilloscope to check waveform at plate (pin 3) of vertical output, 6V6 (V502). If waveform is normal, check:
   (A) Vertical winding of deflection yoke for partial short.
   (B) Vertical Output transformer (T501) for partial short.
   (C) Capacitor C513 for leak.
   If waveform is **not** normal, check:
   (A) Vertical Osc. 6BF6 (V501) and Vertical Output 6V6 (V502) tubes by substitution.
   (B) Voltage readings on V501 and V502.
   (C) Capacitor C704C for open.
   (D) Capacitors C506, C507 and C510; Resistors R513, R510 and R511 and other components associated with V501 and V502.
4. Extreme compression of scan lines at bottom with stretching at top:
   Check:
   (A) Adjustment of Vertical Hold, Vertical Linearity and Height.
   (B) Capacitor C504 for open.
5. Vertical Foldover at Top—Poor Vertical Linearity:
   Check:
   (A) Value of Resistor R503 and Capacitor C503.
6. Two Pictures Vertically—Linearity Distorted:
   Adjust vertical hold to stop roll, check:
   (A) Capacitor C510 for leakage.
7. Vertical Scan Reduced with Stretching at Top:
   Check:
   (A) Adjustment of Vertical Hold, Vertical Linearity and Height.
   (B) Capacitors C504 and C503 for change in value.

CAPEHART CX-38, CX-38C, ALIGNMENT INSTRUCTIONS

Video I.F. Alignment

Note:

1. Disconnect the tuner lead from Terminal "D" of the first I.F. transformer (T204) and connect the sweep (40MC) generator to the grid (Pin 1) of the first I.F. Amplifier (V201 - 6CB6), through a .001 mfd. isolating capacitor. If a separate marker generator is used, it should be coupled to the same point through a 10K isolation resistor.
2. Remove the AGC Amplifier tube (V301-6U8) and connect a bias source from the junction of R202 and R203, with a jumper to Pin 5 or 6 of the AGC Clamp (V501-6BF6), and ground. A bias source may be obtained from a 4.5 volt battery with a 1K pot connected across its terminals. Connect the positive end of the battery to chassis ground and connect the arm of the pot to the junction point above. Connect a VTVM to the arm of the pot and adjust the pot for a minus 3 volt reading on the VTVM.
3. Connect the oscilloscope "Vertical Input" cable through a 10K isolation resistor, to the grid (Pin 2) of the video amplifier (V204-12BY7). Connect the ground side of the input cable to chassis ground.
4. Adjust the marker generator to provide a marker at 41.25 MC and adjust the top slug of T202 (CO-channel Sound I.F. Trap) for minimum response at the marker frequency. This adjustment may be made easier by running the sweep generator output high so that the trap "dips" are easily visible.
5. Adjust the marker generator to 47.25 MC and adjust the top slug of T201 (Adjacent Channel Sound I.F. Trap) for minimum response at the marker frequency.
6. Reduce the sweep generator output so that a normal curve is seen. Adjust the marker generator to 44.1 MC and adjust the bottom of T203 for maximum amplitude of the 44.1 MC marker with minimum tilt.
7. Adjust the marker generator to 42.5 MC and adjust the bottom of T202 to position the 42.5 marker within 40% to 60% of maximum amplitude of the curve on one side.
8. Adjust the marker generator to 45.75 MC and adjust the bottom of T201 to position the 45.75 MC marker within 40% to 60% of maximum amplitude of the curve on the other side.
9. After repeating the above steps, reconnect the tuner lead to terminal "D" of T204 and connect the Sweep and Marker Generator to Pin 4 (test point) of J201 on the back of the VHF tuner.
10. Adjust the marker generator to 47.25 MC and adjust the top of T204 for minimum response at the marker frequency. Then adjust the marker generator to 39.75 MC and adjust the trap (L201) for minimum response at that marker frequency.
11. Now connect the Sweep Generator to the VHF Antenna terminals and the oscilloscope to the tuner test point (Pin 4 of J201) and select a channel with a flat response. After selecting the proper channel, connect a marker generator to the VHF antenna terminals and apply a sound carrier marker signal.
12. With the oscilloscope again connected as in Note 3 above, adjust the Fine Tuning setting until the Sound Carrier marker falls directly into the sound trap.
13. After adjustment of the fine tuning setting, connect the scope, through the detector circuit shown in Figure 3 to the first I.F. Amplifier. Now short Pin 5 to Pin 6 (plate to screen) on V202 the second I.F. Amplifier tube.
14. Adjust the marker generator to the picture carrier frequency and then adjust T102 (on top of tuner) and T204 (bottom) for maximum amplitude without tilt, positioning the picture carrier marker at the high frequency corner of the response curve shown in figure 4.

VIDEO I-F ALIGNMENT CHART

Step No.	Set Sweep Generator To:	Set Marker Generator To:	Connect Sweep Generator To:	Connect Oscilloscope To:	Adjust	Refer to Note/s
1.	44MC (10MC Sweep)	41.25MC	Pin #1 of V201-Grid of First I. F. Amplifier Test Point on R.F. Unit (Pin #4)	Thru a 10K Isolation Resistor To Pin #2 of V204 Grid of Video Amplifier	T202 (Top)	1-2-3-4
2.	44MC (10MC Sweep)	47.25MC			T201 (Top)	1-2-3-5
3.	44MC (10MC Sweep)	44.1MC			T203 (Bottom)	1-2-3-6
4.	44MC (10MC Sweep)	42.5MC			T202 (Bottom)	1-2-3-7
5.	44MC (10MC Sweep)	45.75MC			T201 (Bottom)	1-2-3-8
6.	44MC (10MC Sweep)	47.25MC			T204 (Top)	9-10
7.	44MC (10MC Sweep)	39.75MC			L201 (Bottom)	9-10
8.	Channel #9 (10MC Sweep)	Channel #9 Picture Carrier	VHF Antenna Terminals	Thru the Detector Network to First I. F. Amplifier	T102 (on tuner) T204 (Bottom)	11-12 13-14

CAPEHART

ALIGNMENT INSTRUCTIONS (Cont.)

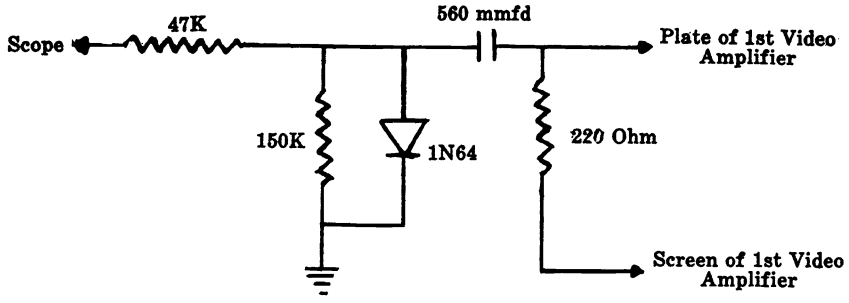


Figure 3

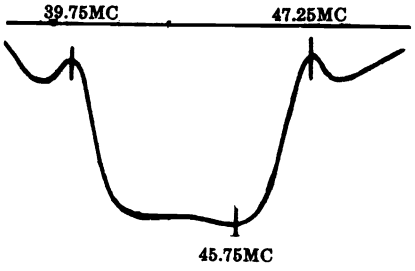


Figure 4

4.5 MC Sound I.F. Alignment

Note:

1. Connect Generator output cables to Pin 2 of V204 (12BY7). Short out secondary of T202, terminals "B" and "C."
2. Connect vertical input leads of oscilloscope to detector network shown in Figure 5. Connect the detector input to Pin #11 (CRT Cathode) of V205.
3. Inject 4.5 MC signal with 50% AM Modulation and adjust both primary and secondary of T301 for minimum output.
4. Remove detector network and connect scope directly to junction of C312 and R311.
5. Turn off AM modulation and inject 4.5 MC signal with 25KC deviation. Using maximum output of generator to insure limiting in the 6BN6, adjust L302 (quadrature coil) for maximum output. In tuning this coil, two peaks will be noticed, adjust for peak having greater amplitude.
6. Keeping output from generator low enough to prevent limiting, adjust L301 (Limiter Grid Coil) for maximum output.
7. Remove short from T202 secondary and connect receiver to antenna through a signal attenuator. Adjust set for reception of a local TV signal. By attenuating the incoming signal so that background noise is just noticeable at all times a more exact setting can be obtained. Adjust Noise Rejection Control (R307) for minimum background noise and hiss.
8. Remove attenuator and with full signal adjust L302 for clearest sound.

4.5 MC SOUND ALIGNMENT CHART

Step No.	Set Generator To	Connect Scope Vertical Input Gable To	Connect Generator To	Adjust	To Obtain	Refer To Notes
1.	4.5MC 50% AM Modulation	Detector Network As in Figure 5	Pin 2 of V204 (12BY7)	T301 (top & bottom)	Minimum	1, 2, 3
2.	25KC Dev. Max. Output 4.5MC	Direct to Junction C312 & R311		L302	Maximum	4, 5
3.	25KC Dev. Max. Output 4.5MC	Direct to Junction C312 & R311		L301	Maximum Min. Noise	6
4.	Remove Short From T202 and Connect Set to Antenna. Turn on Station and Attenuate Signal until Noise & Hiss is Apparnet			R307	and Hiss.	7
5.	Set Connected to Antenna with Full Signal			L302	Maximum	8

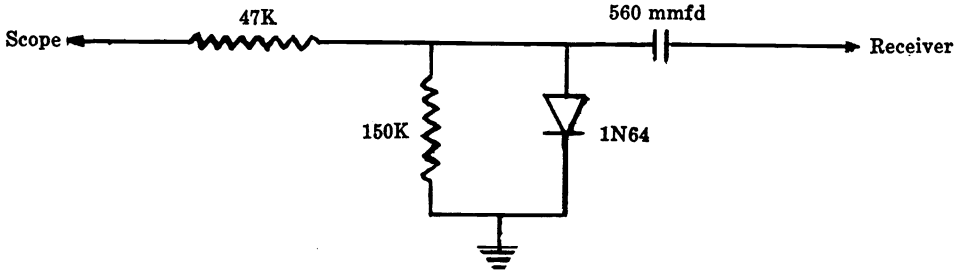
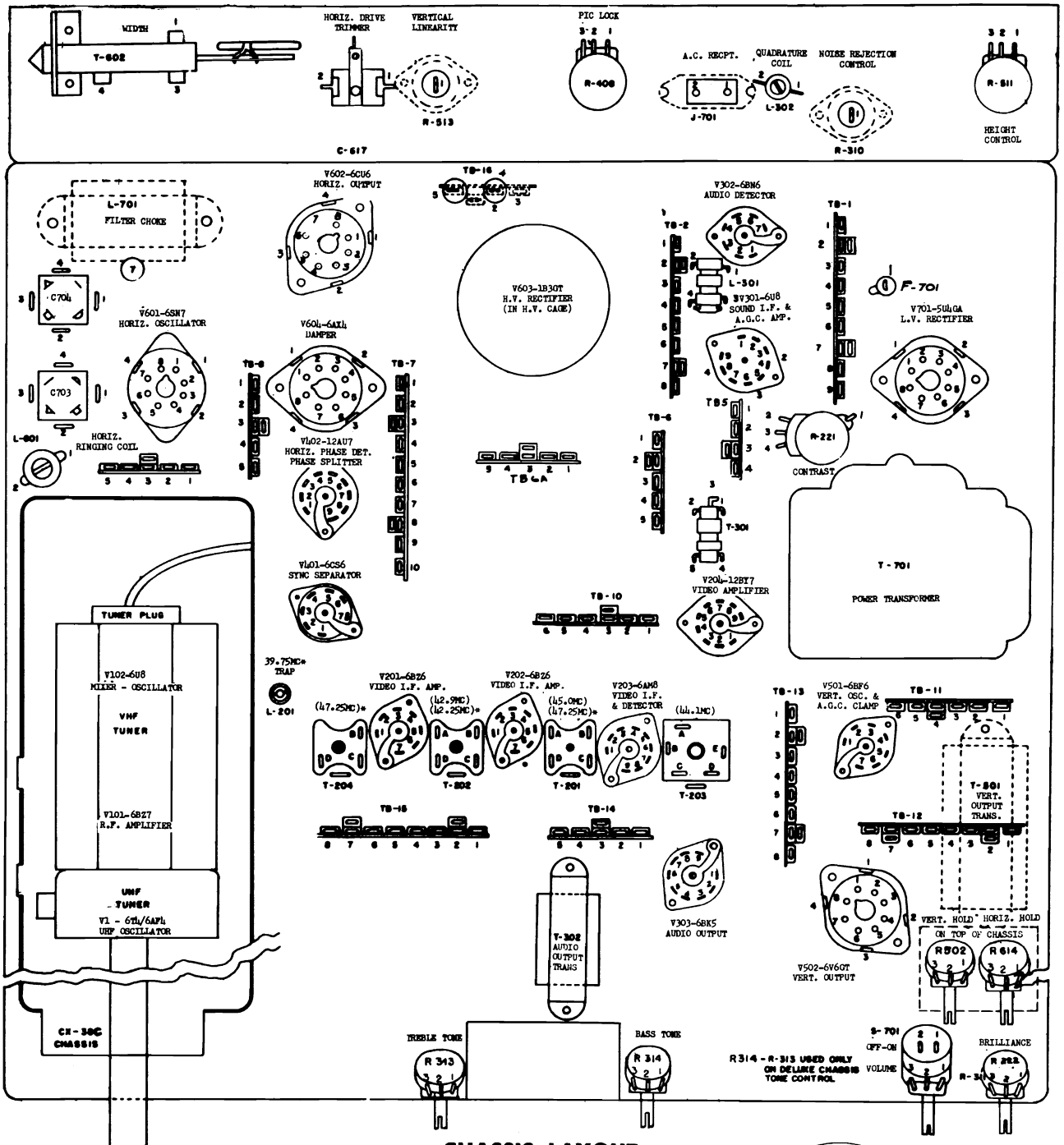
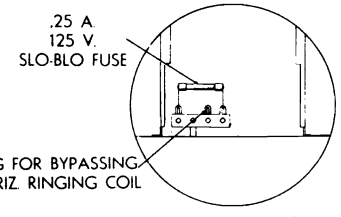


Figure 5

CAPEHART CX-38C CHASSIS LAYOUT AND ALIGNMENT POINTS



CHASSIS LAYOUT



Adjustment of the Horizontal Oscillator

By-pass the ringing coil (L-601) to ground with a .1 MFD-600V capacitor (a lug for making the connection to the ringing coil is located just inside the H.V. cage) and adjust the Horizontal Hold control to provide sync and set it so that there is ¼" between the right edge of the picture and the right edge of the raster (turn the contrast control down and de-center the picture slightly so that this condition can be seen).

Leave the Hold control in this position, remove the capacitor, and adjust the "slug" of L-601 to again provide ¼" between picture and raster on the right edge. Check this adjustment by switching off-channel and back

CBS-COLUMBIA

Chassis 1603, Models 23TS005, 23TS006, 23TS007, 23TS008, 23CS013, 23CS014,
Chassis 1605, Models 22TK301, 22TK321, 22CK009, 22CK010,
Chassis 1607, Models 23TK001, 23TK002, 23TK003, 23TK004, 23CK011, 23CK012,

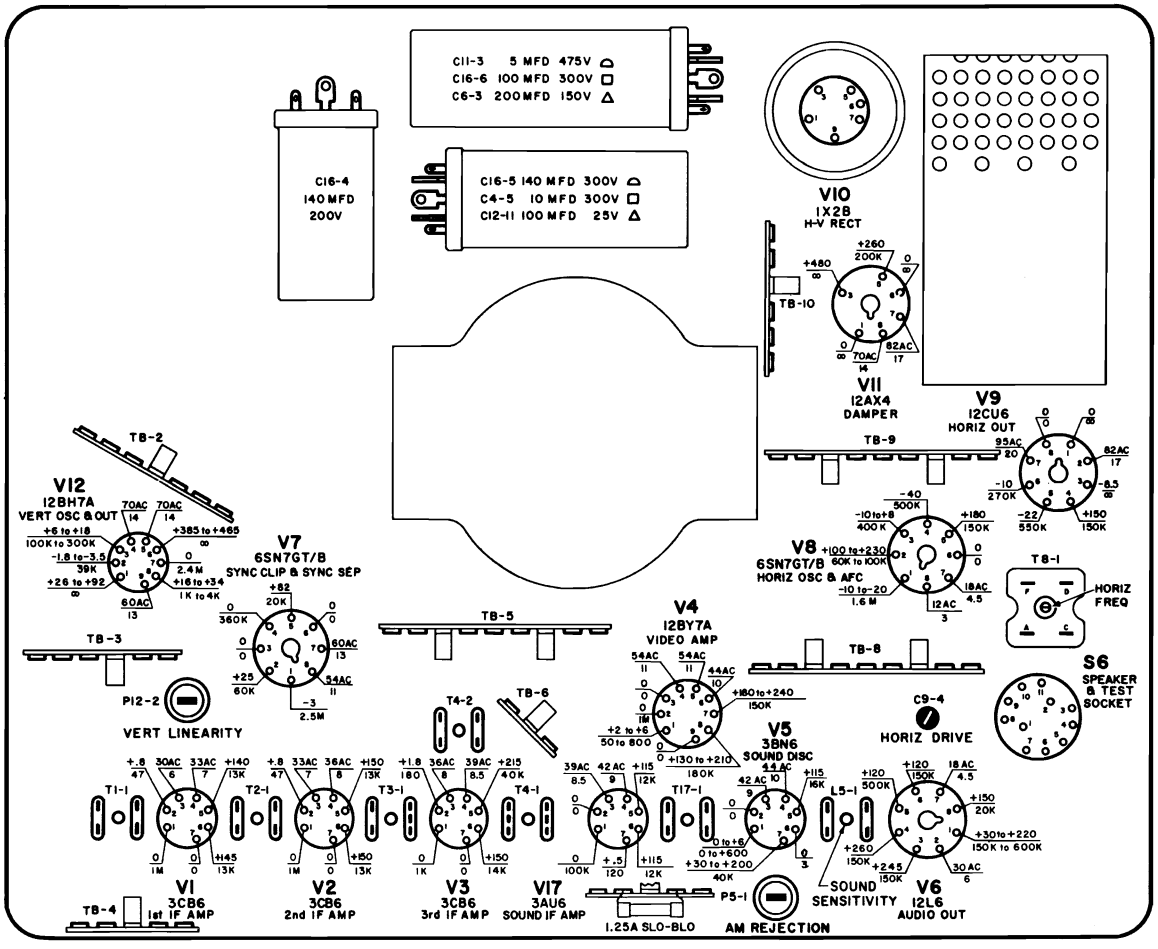
The material for servicing the above listed sets is printed on pages 55 through 60.

The list of sets listed below are practically identical except for types of tuners:

Chassis 1604, Models U23TS005, U23TS006, U23TS007, U23TS008, U23CS013,
Chassis 1606, Models U22TK301, U22TK321, // and U23CS014,
Chassis 1608, Models U23TK001, U23TK002, U23TK003, U23TK004.

Additional sets which have very similar circuits are listed below. These sets have terminals 6 and 10 of the picture tube tied together and connect to 430 volts, sound amplifier tube is omitted, filaments are connected somewhat differently, and there are other minor differences.

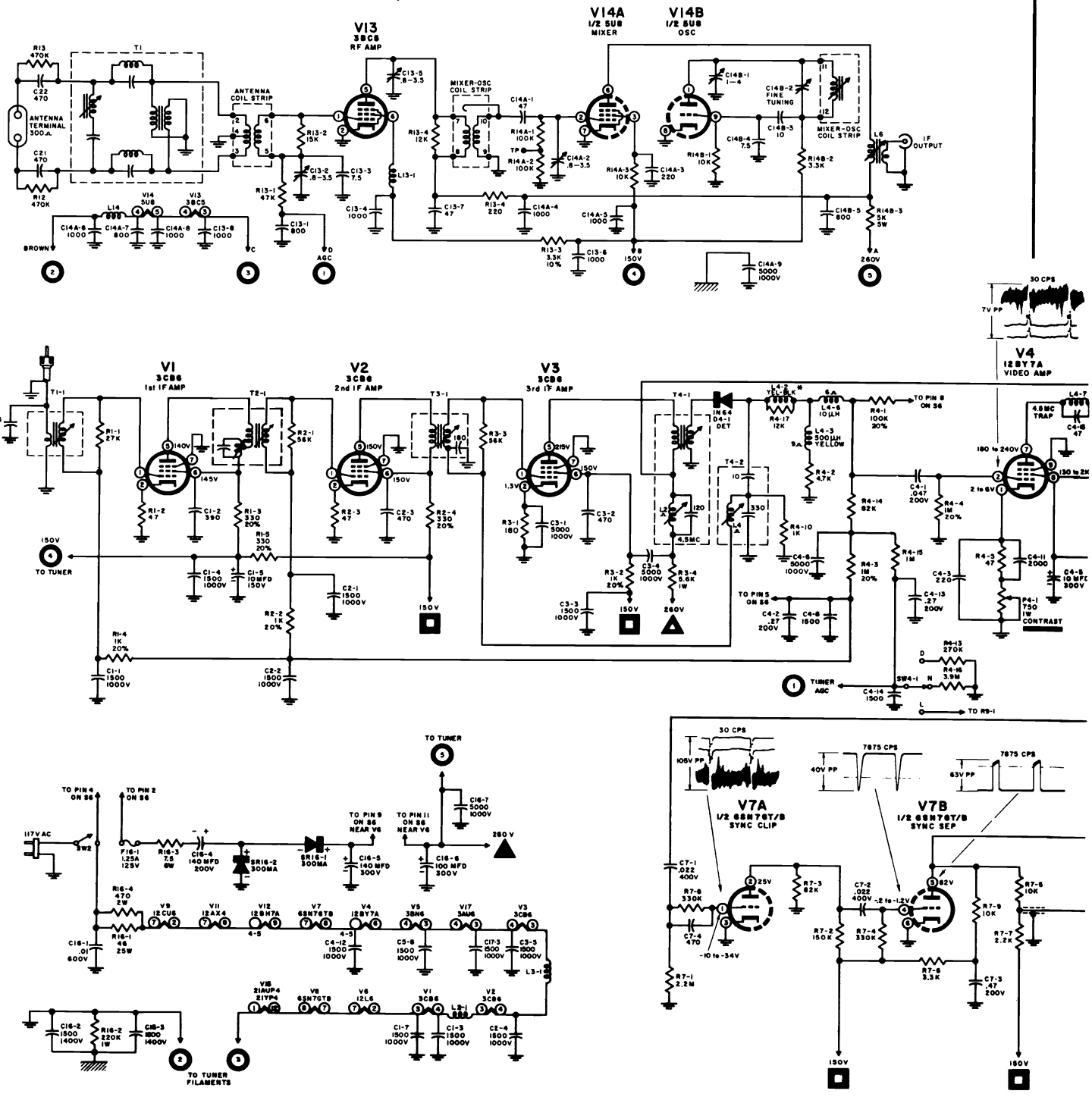
Chassis 1601/1602, Models 22CX1, 22CX2, 22CX3, 22CX4, 22TX1, 22TX2.



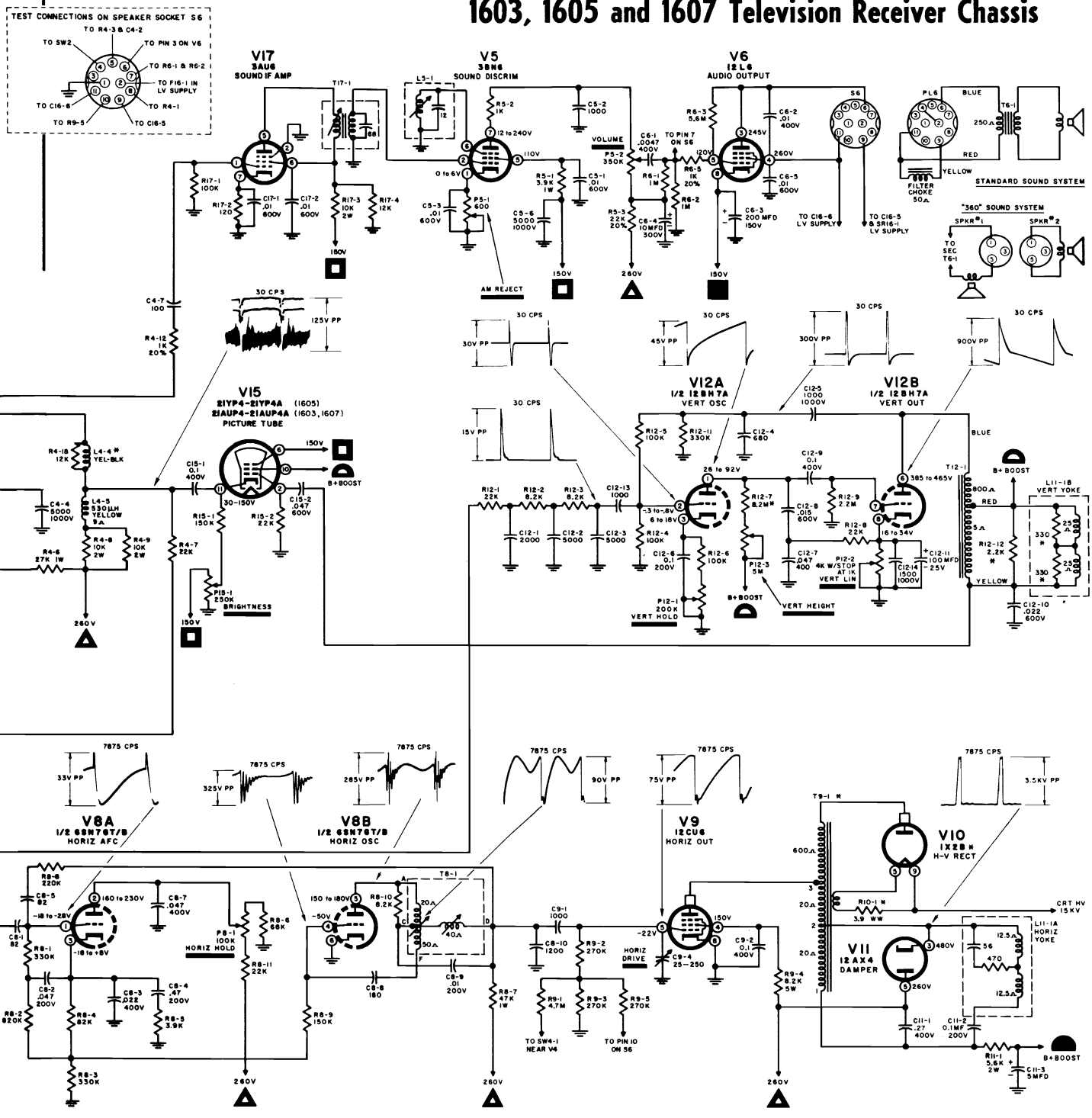
REAR VIEW OF CHASSIS

Voltages are shown above and resistances below the lines drawn from the socket terminals.

CBS-COLUMBIA Chassis 1603, 1605, 1607



1603, 1605 and 1607 Television Receiver Chassis



SCHEMATIC NOTES

1. Solid geometric symbols indicate B+ voltage sources—open symbols indicate points of application.
2. Numbered circles indicate tuner lead connections.
3. Component symbols are coded to indicate tube near which component is located on schematic. Ex. C9-2; capacitor, located near V9.
4. All d-c voltages measured with a VTVM connected between the chassis and tube socket terminals, with channel selector set between channels and the a-g-c switch (SW4-1) in the normal position. Where readings are effected by control settings, voltages are shown for the clockwise and counterclockwise positions of the controls.
5. All resistors are ½W, ±10% unless otherwise indicated. K=X1,000; M=X1,000,000.
6. All capacitors are 500 WV unless otherwise indicated. Values less than one are microfarads and values more than one are micro-microfarads, unless otherwise indicated.
7. All coil and winding resistances were taken with the components disconnected from the circuit.

*Indicates more than one value used, as listed below.

In 1605 chassis
R12-7 is 10 megohm, ½W, 10%.
R12-12 is 680 ohm, ½W, 10%.
Vertical yoke resistors are 470 (part of yoke assy.).

In some chassis
V10 is a 1B3GT, R10-1 is 2.7 ohm, ½W, 10%, and T9-1 is part number 12 001 091.
L4-2 and L4-4 are part number 16 001 362 shunted by 18K ohm, ½W, 10%.
R4-9 is omitted and R4-8 is 5K ohm, 5W. Wirewound.

CBS-COLUMBIA (Continued) Adjustment Information

POSITIONING ADJUSTMENTS

1—Remove the cabinet back. If the receiver is a console model apply power to the set through a spare power cord.

2—Turn the set on and adjust all controls for a normal picture.

3—Move the centering adjustment (figure 1) clockwise and counter-clockwise around the neck of the tube until the picture is properly centered.

If the picture is tilted, so that the scanning lines in the raster are not horizontal, loosen the Yoke Positioning Screw (figure 1) and move it to the right or left until the picture is properly aligned with the edges of the mask.

ION-TRAP MAGNET

1—Remove the cabinet back and position the magnet as shown in figure 1. If the receiver is a console apply power through a spare power cord.

2—Turn the set on, set the Contrast control in the middle of its range and turn down the Brightness to provide a very dim raster.
CAUTION: Do not operate the receiver with the ion-trap improperly positioned for more than the few minutes needed to make this adjustment.

3—Slide the magnet back and forth along the neck of the tube, at the same time rotating it clockwise and counter-clockwise, until the position which gives maximum brightness and best focus is found. Turn down the brightness to maintain a very dim raster while making the adjustment.

4—Turn up the brightness until the raster just begins to increase in size, and readjust the ion-trap for maximum brightness and best focus. Best focus is obtained when the *white* scanning lines in the raster are as thin and sharp as possible.

LOCAL-DISTANT SWITCH

1—Turn the receiver on and tune to the strongest signal available.

2—Place the switch in the Distant position. If overloading (indicated by excessive contrast, unstable sync and/or buzz) occurs, set the switch in the Normal position. In very strong signal areas it may be necessary to place the switch in the Local position.

Check reception on all channels and reset the switch if required. In areas where both very weak and very strong signals are received, best results may be obtained by changing the switch position when tuning from one channel to another.

HEIGHT AND VERTICAL LINEARITY

The Height and Vertical Linearity controls should be adjusted to provide a properly proportioned picture which fills the mask vertically. The Vertical Linearity control is accessible through the hole in the back cover marked VL. It should be adjusted with an insulated screwdriver.

Adjust the controls so that the picture extends approximately ½-inch above and below the mask opening, to allow for the slight loss in size which occurs when the line voltage drops during peak power-demand periods.

HORIZONTAL DRIVE

If a bright vertical drive line appears in the picture, or if the picture is not wide enough to fill the mask, check the setting of the Drive control. The control is accessible through the hole in the back cover marked HD.

To adjust the control tune the receiver to a station and adjust the front controls for best picture and sound. Using an insulated screwdriver, turn the Drive control counter-clockwise until a bright vertical line appears in the picture, then turn the control clockwise until the line just disappears.

TUNER OSCILLATOR ADJUSTMENT

An individual oscillator adjustment is provided for each channel. Table Models—The oscillator adjustments are accessible through a hole in the receiver bottom pan. In models equipped with sweep tuning the adjustment is directly above the access hole (A in figure 2).

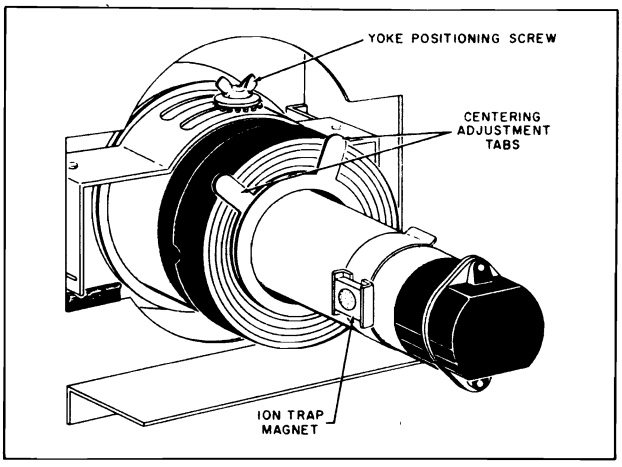


Figure 1

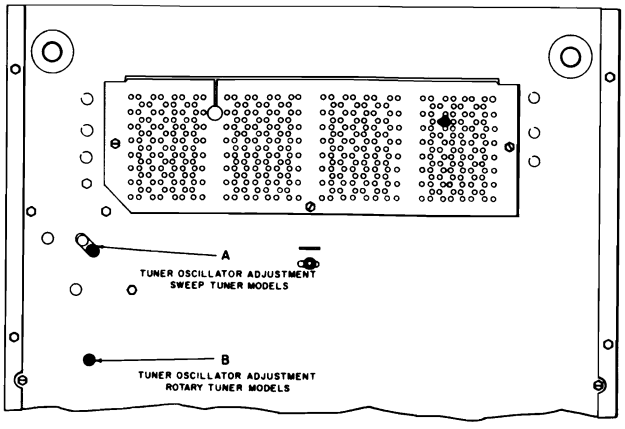


Figure 2

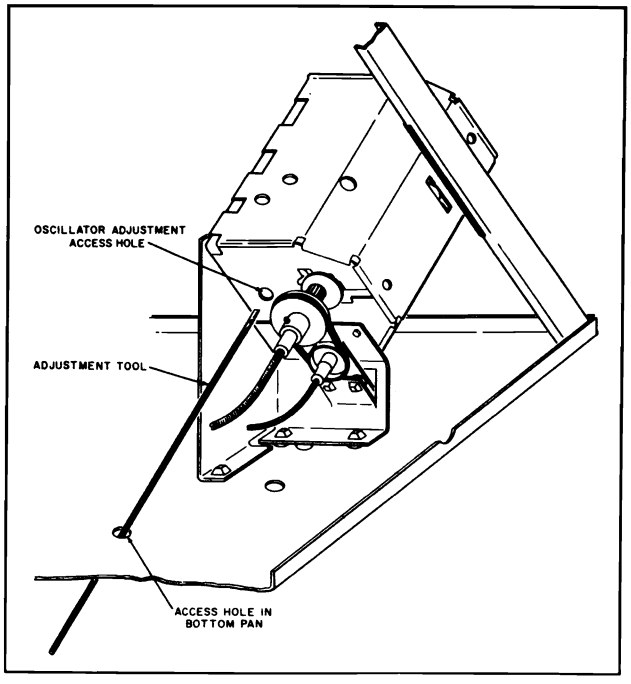


Figure 3

CBS-COLUMBIA (Continued) Adjustment Information

In models with rotary tuning the adjustment tool should be inserted through hole B in figure 2. To engage the adjustment slug in the tuner, the tool must be inserted at a 45 degree angle, as shown in figure 3.

Console Models—Remove the screws fastening the top and sides of the rear cover, and the four bolts fastening the chassis bottom pan to the cabinet shelf. Grasp the lower edge of the rear cover and pull the chassis back until it stops.

The access hole in the bottom pan may now be reached through a hole in the cabinet shelf.

To adjust the tuner oscillator set the Channel Selector on the channel requiring adjustment, insert a fibre screwdriver through the access hole into the tuner, and adjust the slug for best picture and sound.

ALTERNATE SOUND ALIGNMENT USING TV SIGNAL

1—Tune receiver to a strong TV signal, adjust controls for best picture, and set AM Rejection control at center of its rotation.

2—Attenuate signal at receiver antenna terminals (remove antenna and/or place Local-Distant switch in Local position) until a hiss is heard in the sound and adjust front slug of T4-1, T4-2, and T17-1 for maximum sound.

3—Increase signal level at receiver input to normal and adjust L5-1 (quadrature coil) for maximum sound and minimum buzz.

4—Attenuate signal at receiver antenna terminals, as in step 2, and adjust P5-1 (AM Rejection control) for minimum noise (hiss).

5—Increase signal level at receiver input to normal and rotate fine tuning control. If buzz is present in sound readjust L5-1 (quadrature coil) slightly, to provide clearest sound with minimum buzz.

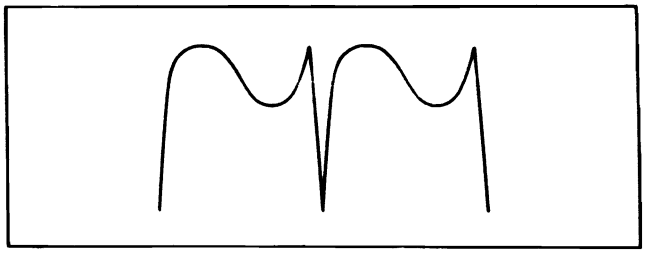


Figure 4

HORIZONTAL OSCILLATOR ALIGNMENT

1—Tune to a TV station, adjust controls for normal picture and sound and set the Horizontal Hold control in the center of its range.

2—Short terminals C & D of the horizontal oscillator coil (T8-1) and adjust the rear slug of T8-1 until the picture is in sync. Set slug in center of range over which picture remains locked in sync.

3—Remove the short from terminals C & D of T8-1 and connect an oscillograph to terminal C of T8-1, through a 10 mmfd capacitor.

4—Adjust the front slug (on tube side of chassis) of T8-1 until the waveform shown in figure 4 is obtained. The rounded peak and the sharp peak of the waveform must be exactly the same height.

5—Adjust the Horizontal Frequency adjustment (rear slug T8-1) so that picture is out of sync and shows approximately 9 slanting bars with Horizontal Hold control fully counter-clockwise.

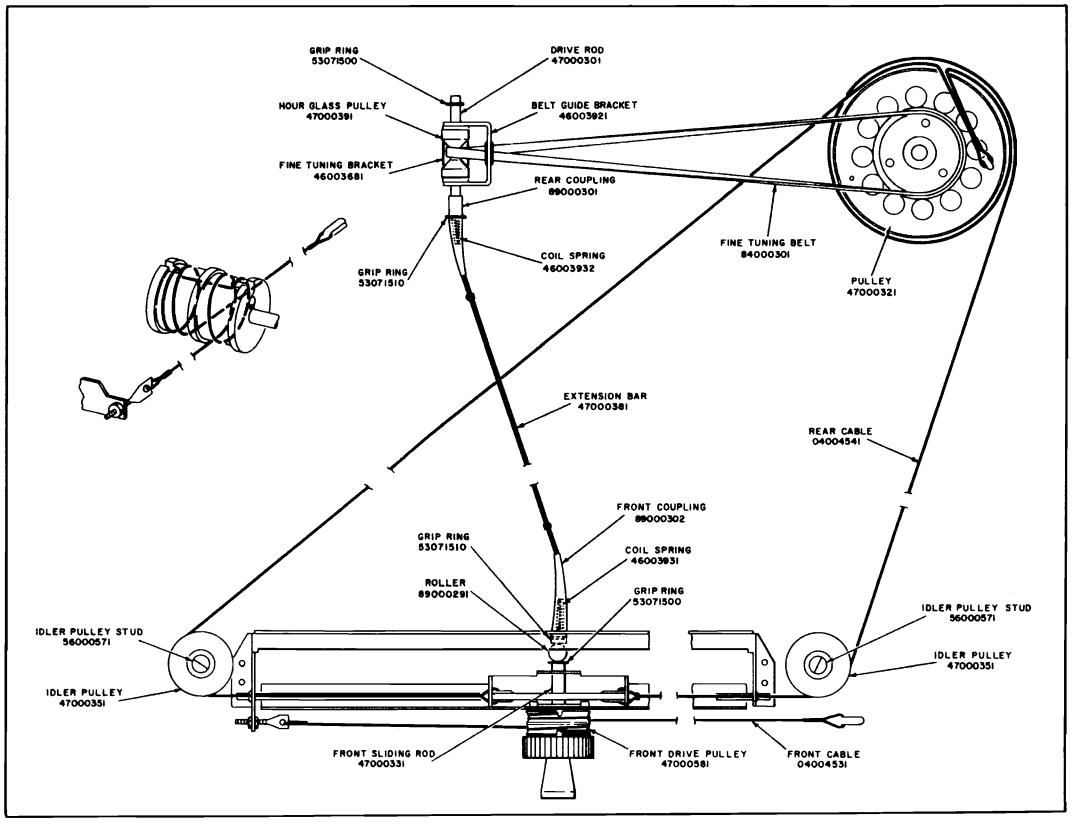
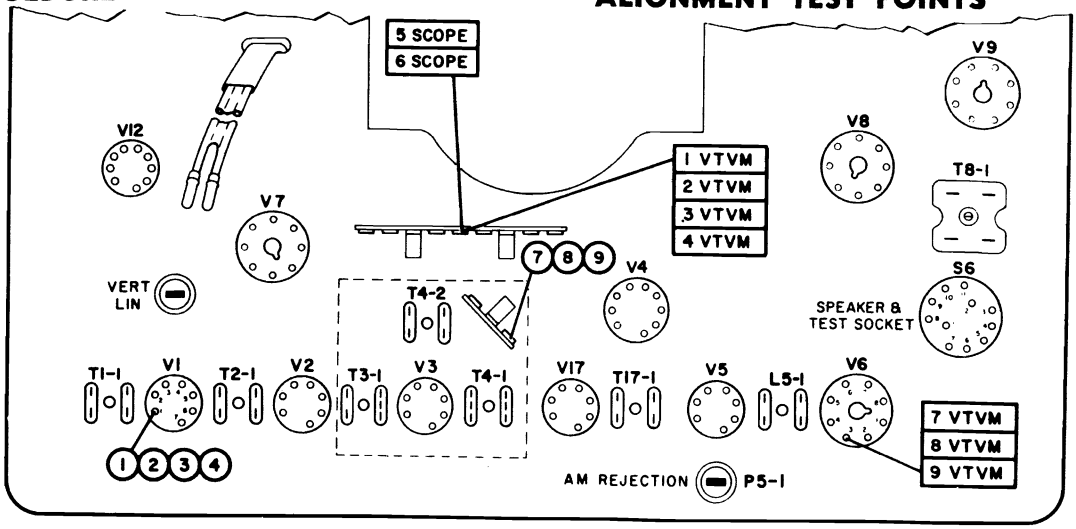


Figure 5. Sweep tuner stringing diagram and part numbers.

ALIGNMENT PROCEDURE

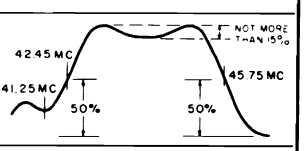
CBS-COLUMBIA
(Continued)

ALIGNMENT TEST POINTS



VIDEO I-F

Place channel selector between channels (to disable oscillator) and set Local-Distant switch in NORMAL position. Disconnect ground lead from the cathode (pin 8) of V9, the 12CU6 horizontal-deflection amplifier. Apply -3V bias to AGC line. Use lowest possible VTVM range for all steps.

Step	Signal Generator		Output Indicator	Connect to	Adjust
	Freq.	Connect to			
1	42.7 mc No sweep	Pin #1 of V1, thru 1000 mmf. (1)	VTVM	Open end of R4-1 1 VTVM	Front slug T2-1 for maximum reading. Set sig. gen. for VTVM reading of —2.5 to —3V with T2-1 properly adjusted.
2	41.25 mc No sweep	As above (2)	VTVM	As above 2 VTVM	Rear slug T2-1 for minimum reading. Set sig. gen. for reading of —2.5 to —3V with T2-1 properly adjusted.
3	45.5 mc No sweep	As above (3)	VTVM	As above 3 VTVM	T3-1 for maximum reading. Set sig. gen. for VTVM reading of —2.5 to —3V with T3-1 properly adjusted.
4	44.2 mc No sweep	As above (4)	VTVM	As above 4 VTVM	Read slug T-4-1 for maximum reading. Set signal generator for reading of —2.5 to —3V with T4-1 properly adjusted.
5	43 mc Center freq. 10 mc deviation 42.45 mc and 45.75 mc	Mixer shield See Note 1 (5)	SCOPE	As above 5 SCOPE	T1-1 and tuner i-f coil (L-6) to place 45.75 & 42.45 markers at 50% point (see curve). 
6	43 mc Center freq. 10 mc deviation	As above (6)	SCOPE	As above 6 SCOPE	If necessary retouch T2-1 & T3-1 to correct positions of 45.75 & 42.45 mc markers and rear slug of T4-1 for symmetrical curve.

SOUND I-F ALIGNMENT

Step	Signal Generator		Output Indicator	Connect to	Adjust
	Freq.	Connect to			
7	4.5 mc AM 30% mod.	Junction L4-2 & L4-3 (7)	VTVM (AC)	Pin #3 V6 thru 0.01 mfd 7 VTVM	Front slug of T4-1, T4-2 and T17-1 for maximum output indication. Use lowest signal generator output that gives satisfactory indication. Increase bias to —6V and set Local-Distant switch to Local before performing this step.
8	4.5 mc FM 25 kc dev.	As above (8)	VTVM (AC)	As above 8 VTVM	Volume control to approximate center and adjust L5-1 (quadrature coil) for maximum output indication.
9	4.5 mc AM 30% mod.	As above (9)	VTVM (AC)	As above 9 VTVM	P5-1 (A-M Rejection) for minimum output indication and repeat step 8.

NOTES: 1. Connect signal generator output lead to mixer-oscillator shield. Slip shield partially off tube and hold in place with tape. Do not ground shield.

CROSLEY

CHASSIS 432-1
Models: H-17TOMHa, H-17TOBHa, H-17TOWHa, H-17TOMNHa

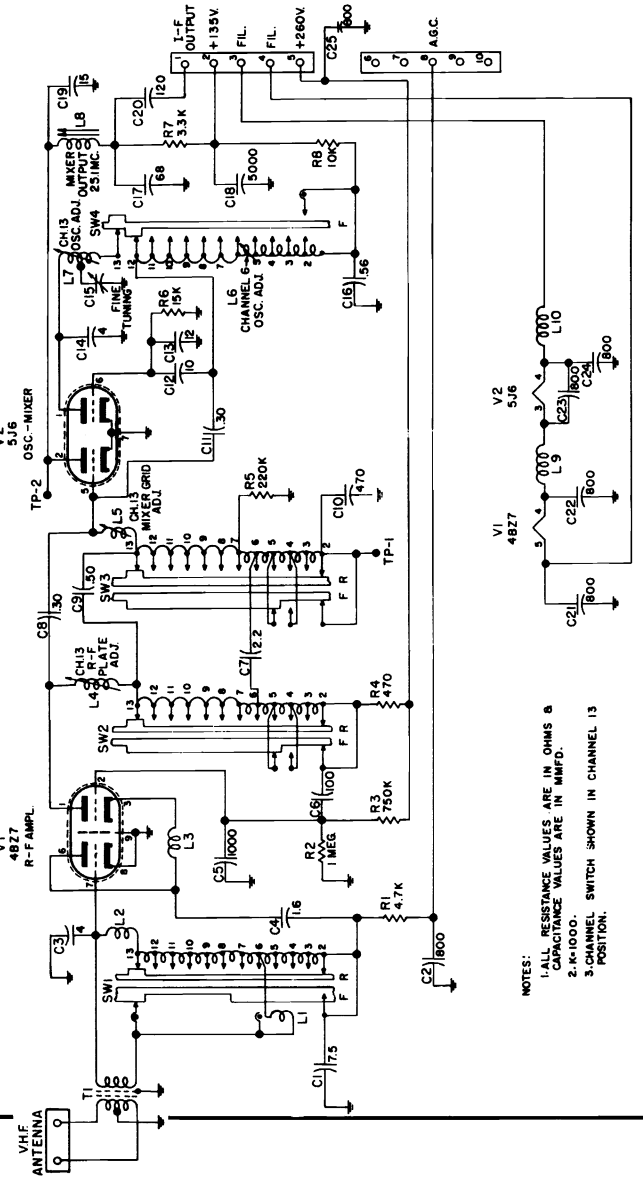
CHASSIS 431-1
Models: H-21TOMHa, H-21TOBHa, H-21TOWHa, H-21HCMHa, H-21HCBHa, H-21HCWHa, H-21COMHa, H-21COBHa, H-21COWHa, H-21COSHa, H-21COSBHa

CHASSIS 432-3
Models: H-17TOMHd, H-17TOBHd, H-17TOWHd

CHASSIS 431-3
Models: H-21TOMHd, H-21TOBHd, H-21TOWHd, H-21HCMHd, H-21HCBHd, H-21HCWHd, H-21COMHd, H-21COBHd, H-21COWHd, H-21COSHd, H-21COSBHd

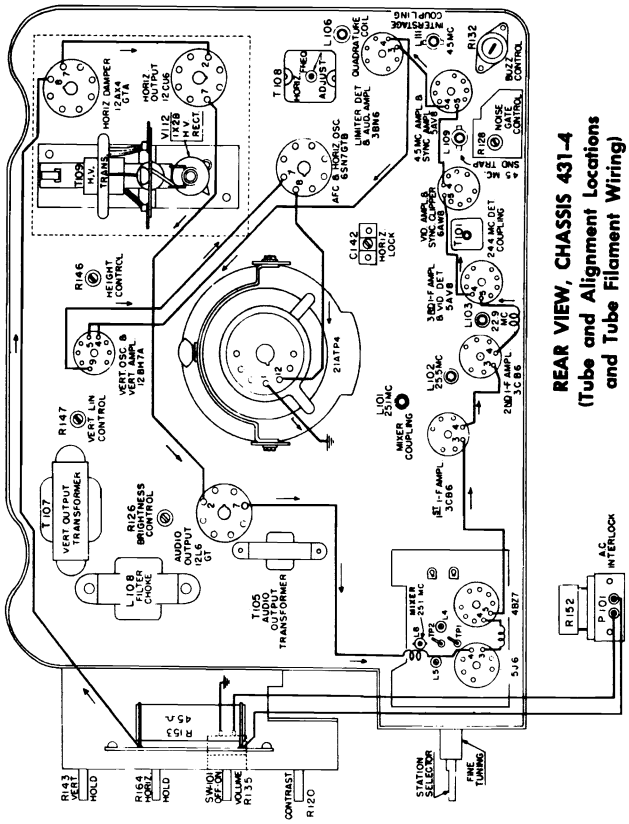
CHASSIS 431-4
Models: H-21TCOMH, H-21TCOBH, H-21TCOWH, H-21CCOMH, H-21CCOBH, H-21CCOWH

CHASSIS 431-1 with UHF Converter, Part No. 159952-1
Models: H-21TOMUf, H-21TOBUf, H-21TOWUf



NOTES:
1. ALL RESISTANCE VALUES ARE IN OHMS & CAPACITANCE VALUES ARE IN MMFD.
2. K=1000.
3. CHANNEL SWITCH SHOWN IN CHANNEL 13 POSITION.

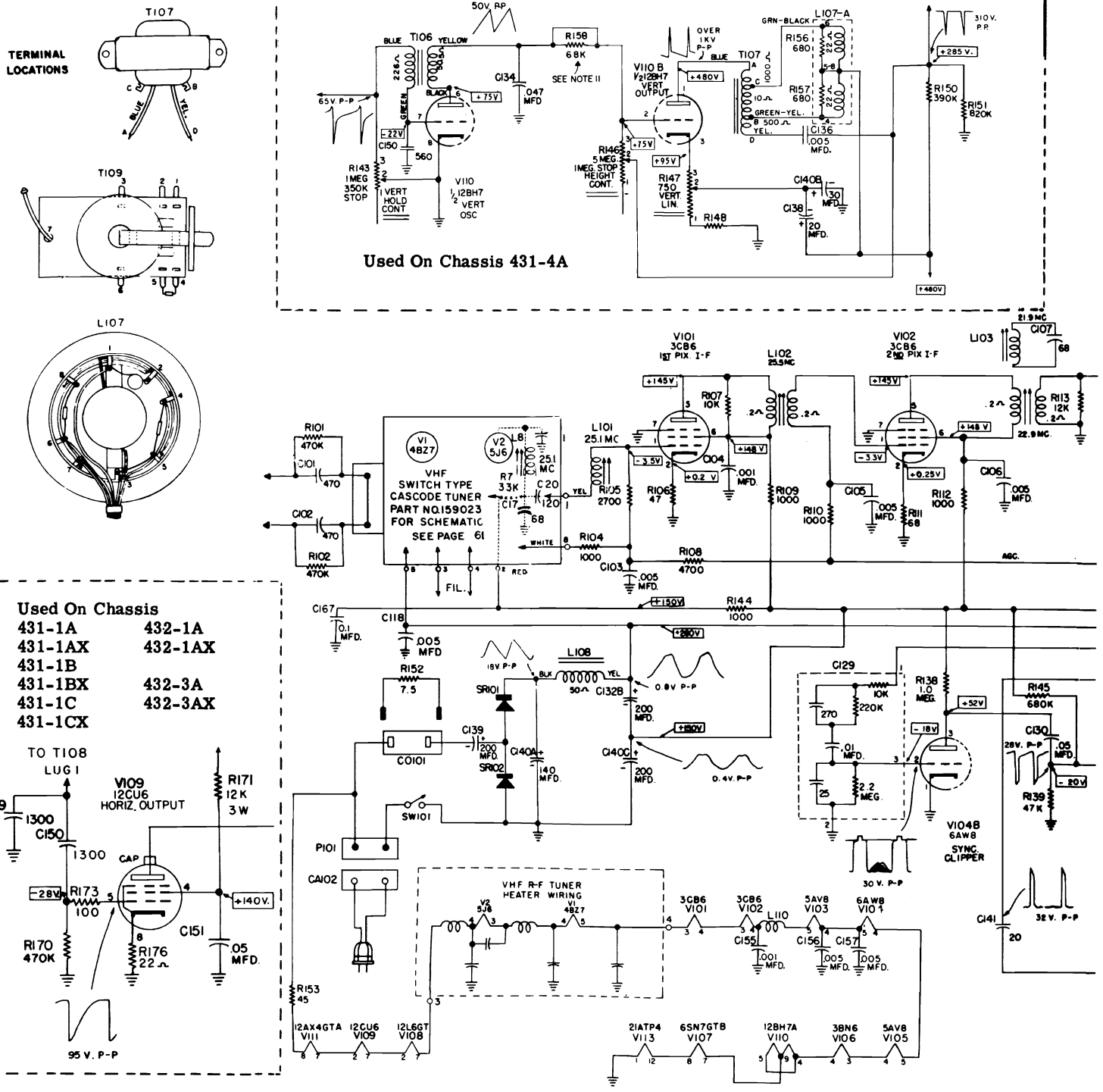
VHF SWITCH TYPE CASCODE TUNER
(Part No. 159023-1, used on chassis 431-4 only)



REAR VIEW, CHASSIS 431-4
(Tube and Alignment Locations and Tube Filament Wiring)

(Circuit diagram on pages 62-63, I. F. alignment data on page 64.)

CROSLEY Chassis 431 and 432, Circuit Diagrams

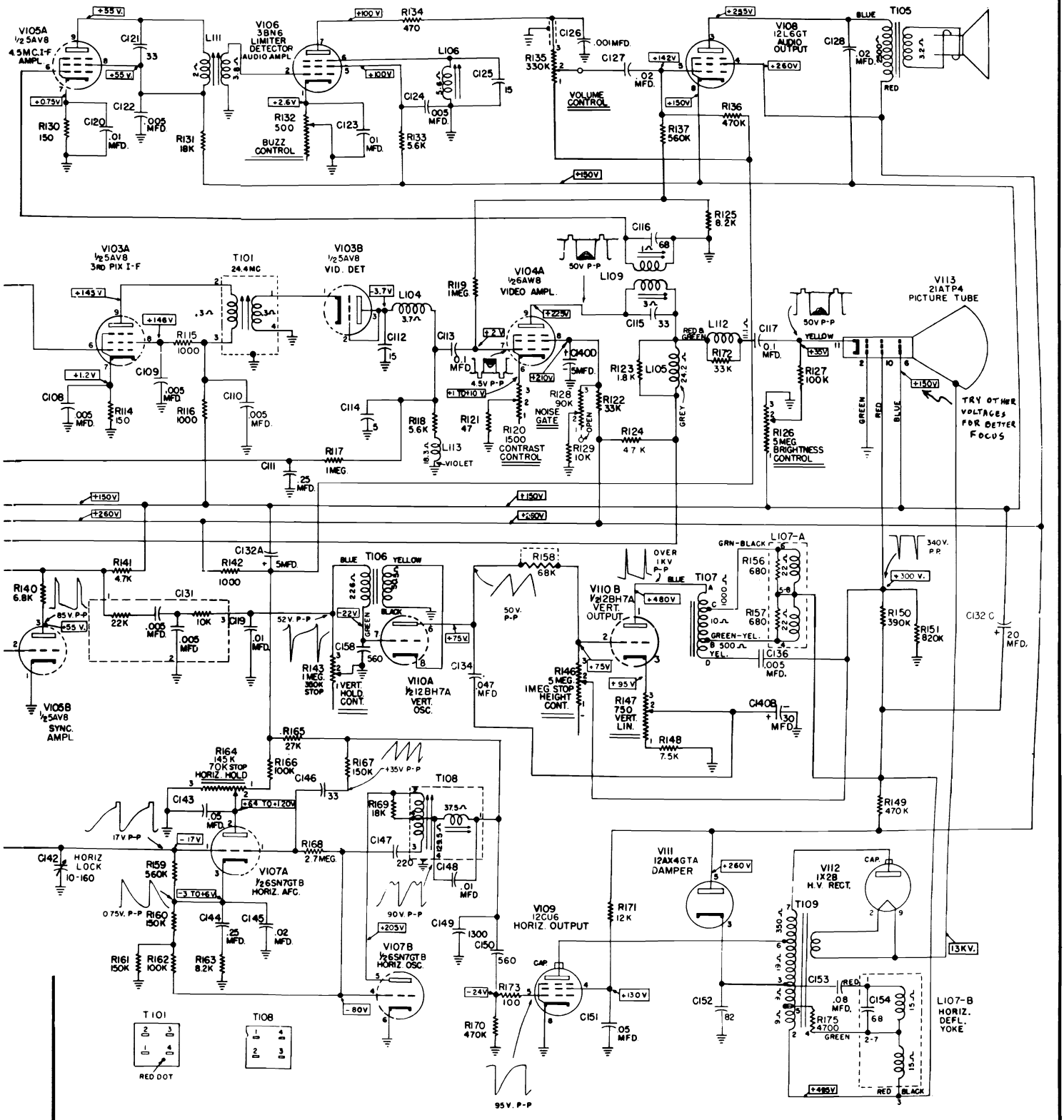


1. All D.C. voltages measured with an electronic voltmeter connected from socket lug to chassis. Some voltages are variable depending upon signal input and settings of other controls. Voltages shown were measured with a signal voltage of approximately 3000 microvolts and with a normal picture on the picture tube and the contrast and brightness controls set for 50 volts peak to peak on the cathode (pin 11) of the picture tube, and the noise gate open (maximum counter-clockwise rotation).
2. Supply voltage, 117 volts, 60 cycle AC.
3. K = 1000.
4. All capacitance values in mmf. and all resistance values in ohms unless otherwise noted.

CROSLEY

SCHEMATIC WIRING DIAGRAM

CHASSIS 431-4 (Code CX)



CROSLEY (Continued)

I. F. ALIGNMENT

Chassis 431-3, 432-3, & 431-4 Only

All lead connections from the signal marker generator and sweep generator must be shielded. Keep exposed ends and ground leads as short as possible (about one inch). Always locate the ground lead connections as close as possible to their respective "hot" leads in the television receiver chassis. The sweep generator output, signal generator output, and contrast control must be kept low enough to prevent overloading the television receiver circuits.

CAUTION: One side of the chassis is connected to the power line. Therefore, test equipment should not be connected to the receiver unless an isolation transformer is used between the power line and the receiver. DO NOT GROUND THE RECEIVER CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED.

The front side of the chassis as referred to below means the side opposite the tubes.
The rear side of the chassis means the side on which the tubes are mounted.

VIDEO I. F. ALIGNMENT (with VTVM)

In the I. F. Alignment, limit input of signal generator so that reading on VTVM does not exceed -1 volt.

Step No.	Connect Signal Generator Through a .01 Capacitor	Signal Gen. Freq. MC	Connect VTVM	Miscellaneous Connections and Instructions	Adjust
1.	Test Point No. 2 on Tuner (See Note 2).	24.4 mc.	Junction of R118 and C113 and chassis.	Connect 3 volt bias battery negative lead to white lead from tuner, positive lead to chassis.	T101 for maximum indication on meter, limit input to make peak less than -1 volt D. C. on VTVM.
2.	"	22.9 mc.	"	"	L103 (rear slug) for maximum. Use first peak from tinnerman clip end of coil.
3.	"	21.9 mc.	"	"	L103 (front slug) for minimum. Input level should be high enough to produce at least .5 volts at null on VTVM. Use first null obtained from end of coil form opposite tinnerman clip.
4.	Repeat steps 2 and 3.				
5.	"	25.5 mc.	"	"	L 102 for maximum.
6.	"	25.1 mc.	"	"	L101 (front slug) for maximum. Use first peak from tinnerman clip end of coil.
7.	"	27.9 mc.	"	"	See Note 1. L101 (rear slug) for minimum defelction on VTVM. Use first null obtained from end of coil form opposite tinnerman clip.
8.	Repeat step 6 (and 7, is adjacent channel trap is used).				
9.	Test Point No. 1 on Tuner (See Note 2).	25.1 mc.	"	Connect a 100 ohm resistor in series with a 1000 mmf. cap. across L101.	L 9 for maximum (431-3, 432-3) L 8 for maximum (431-4)

NOTE 1. This adjustment can be made only on receivers where the Adjacent Trap has been added. For installation of this trap in areas where adjacent channel interference is prevalent, see page 6 of Bulletin No. 483.

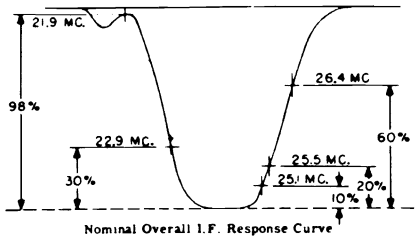
NOTE 2. For test point and alignment locations see photo of either VHF turret tuner (chassis 431-3 or 432-3) or VHF switch type tuner (chassis 431-4).

TO CHECK I. F. ALIGNMENT (with scope)

Excessive sweep input will overload the circuit and cause distortion in the wave form. Check for possible overload by temporarily increasing and decreasing the signal input level and noting any change in the wave form.

Excessive signal from the marker generator will also distort the wave form. Be sure to keep the marker at the minimum usable amplitude.

NOTE: Be sure, when checking the I. F. alignment, to set the channel selector switch to a channel (other than UHF) where moving the fine tuning control does not affect the shape or position of the I. F. response curve.

Sweep Gen. Connected to	Scope Connected to	Bias	Sweep Gen. Set to	Remarks
Ungrounded shield of V2 and chassis.	High side of contrast control R120 and chassis. Contrast control at minimum contrast.	Connect 3 volt bias battery negative lead to white lead from tuner, positive lead to chassis.	Sweep from 20 to 30 megacycles.	Provide markers as shown on curve.  Nominal Overall I.F. Response Curve A slight deviation in response curve is tolerable, but if any great deviation is noted, the I. F. stages will have to be realigned.

CROSLEY

CHASSIS 441
Models: H-17TOMUc
H-17TOBUc
H-17TOWUc

CHASSIS 442
Models: H-21TOMUc H-21HCMUc H-21COMUc H-21COSUc
H-21TOBUc H-21HCBUc H-21COBUc H-21COSBUc
H-21TOWUc H-21HCWUc H-21COWUc

The circuit diagram on pages 66-67 is exact for Chassis 441 and 442. The electrical circuit for Chassis 434, used in models listed below, is very similar to Chassis 442. Service material and alignment information on pages 65 through 70 may be used as an aid when repairing any of these sets.

CHASSIS 434

H-21TOMHb H-21HCMHb H-21COSHb H-21COMHb
H-21TOBHb H-21HCBHb H-21COSBHb H-21COBHb
H-21TOWHb H-21HCWHb H-21COWHb

DISASSEMBLY

Removing the Chassis and Base (or Shelf) From the Cabinet.

Table Models:

1. Remove the control knobs, the cover plate adjacent to the tuner shaft opening (used only on early production sets), the cabinet back, the antenna terminal plate, and the wires from the speaker (or the speaker from the cabinet).
2. Remove the two wood screws on the inside rear corner braces that hold the cabinet to the cabinet base.
3. On 21" models, remove the two wood screws that hold the chassis to the wood strip on the inside of the cabinet above the chassis.
4. Remove the hex head screws and lockwashers on the underside of the base (along the sides of the cabinet). There are two at each side of 17" models, and three at each side of 21" models. Also remove the one wood screw that is through the base at the center front on the bottom.
5. Lift the cabinet up and off the base. Where there is no cover plate, it will be necessary to spread the sides of the cabinet slightly in order to clear the shaft on the tuner.
6. To replace the chassis and base in the cabinet, reverse the removal procedure.

Vertical Console Models:

1. Remove the control knobs, cabinet back, and antenna terminal plate and the wires from the speaker (or the speaker from the cabinet). On early production models, remove also the cover plate adjacent to the tuner shaft opening by releasing the retaining spring from the hole in the cover plate.
2. Remove the wood screws that hold the chassis to the wood strip on the inside of the cabinet above the chassis.
3. Remove the wood screw on the top side of the chassis shelf at the rear.
4. From the underside of the cabinet side rails, remove the hex head machine screws that hold the shelf to the rails.
5. To clear the tuner shaft from its hole in the cabinet, turn the shelf so that the diagonal cut at the rear of the shelf is parallel to the side of the cabinet. Where the cabinet is not slotted, spring the control panel side of the cabinet to clear the tuner shaft. Then slide the shelf and chassis the rest of the way out of the cabinet.
6. To replace the chassis and shelf, reverse the above procedure.

Horizontal Console Models:

1. Remove the control knobs, cabinet back, antenna terminal plate, and the wires from the speaker (or the speaker from the cabinet).
2. Remove the two wood screws that hold the chassis to the wood strip on the inside of the cabinet above the chassis.
3. Remove the two wood screws on the inside rear corner braces that hold the cabinet to the cabinet base.
4. Remove the seven hex head screws and lockwashers on the underside of the base (three on each side, one at the front).
5. Lift the cabinet up and off the assembled chassis, base, and legs. It may be necessary to spread the sides of the cabinet slightly to clear the tuner shaft.
6. To remove the legs, rest the chassis end of the base on a block of wood approximately one inch thick. This allows the legs nearest to the floor to be unscrewed from their mounting plates without damaging the control shafts of the chassis. Then remove the upper two legs. For easier handling of the chassis and base, remove the four wood screws that hold the chassis mounting base to the base extension.
7. To replace the chassis and base, reverse the above procedure.

Removing the Picture Tube

HANDLING PRECAUTIONS - Do not remove or handle the picture tube in any manner unless heavy gloves and protective goggles are worn. KEEP TUBE AWAY FROM THE BODY WHILE HANDLING.

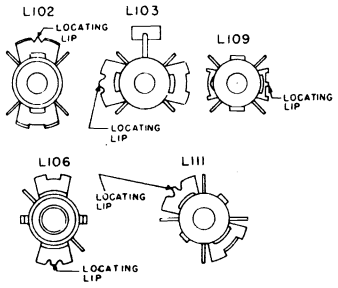
1. Remove the chassis and cabinet base as outlined above.
2. Disconnect the tube socket and remove the ion trap magnet from the neck of the tube. Loosen the wing screw on the deflection yoke bracket.
3. Disconnect the second anode lead from the bell of the tube.
4. Remove the nuts on both tie rods that extend from the tube support bracket to the tube rests. Unhook the tie rods.
5. Remove the two nuts that are on the screws that hold the top of the tube support bracket to the chassis.
6. Remove both hex head machine screws that hold the tube strap to base, and lift off the strap.
7. Raise tube slightly at the front so that it will clear the stops on the tube rests, and pull the tube forward to remove. DO NOT ALLOW PRESSURE TO BE EXERTED ON THE NECK OF THE TUBE.

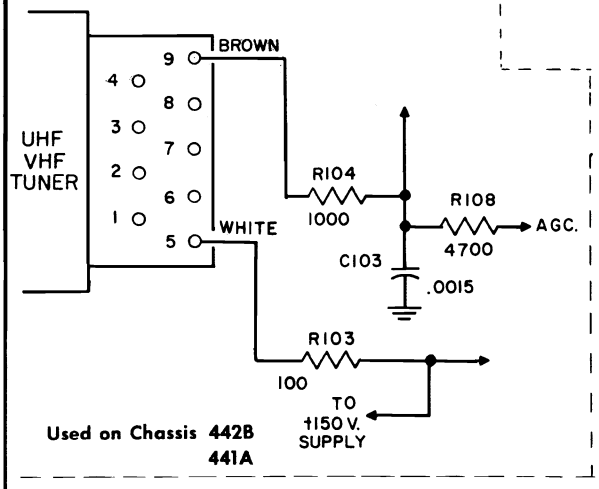
Replacing the Picture Tube

1. Guide neck of tube through opening in the tube support bracket and deflection yoke, and place bottom of face plate against stops on tube rests. Be sure the pads are in position between the tube and tube strap.
2. Place pad and strap over tube and insert the two hex head screws through the strap and into the two tube rests (do not tighten screws).
3. Replace and tighten the two nuts on the screws that hold the tube support to the chassis.
4. Replace the tie rods, apply the nuts and tighten. Bell of tube should rest against insulating ring of the tube support bracket.
5. Tighten the two screws that hold the strap to the base.
6. Connect second anode to the tube.
7. Push deflection yoke forward against flare of tube, and tighten wing screw.
8. Replace ion trap on neck of tube and connect tube socket.
9. Make necessary adjustments on the ion trap and deflection yoke.
10. Replace the cabinet over the chassis and base, then follow instructions for "Removing The Chassis From The Cabinet", steps 1 to 4 in reverse order.

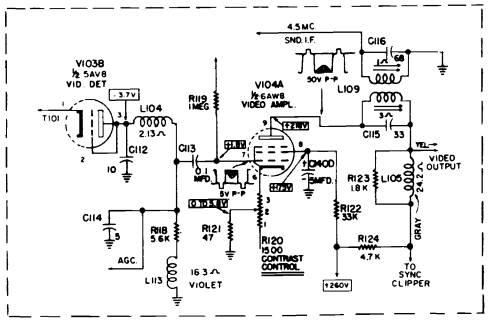
CROSLEY **SCHEMATIC WIRING DIAGRAM**

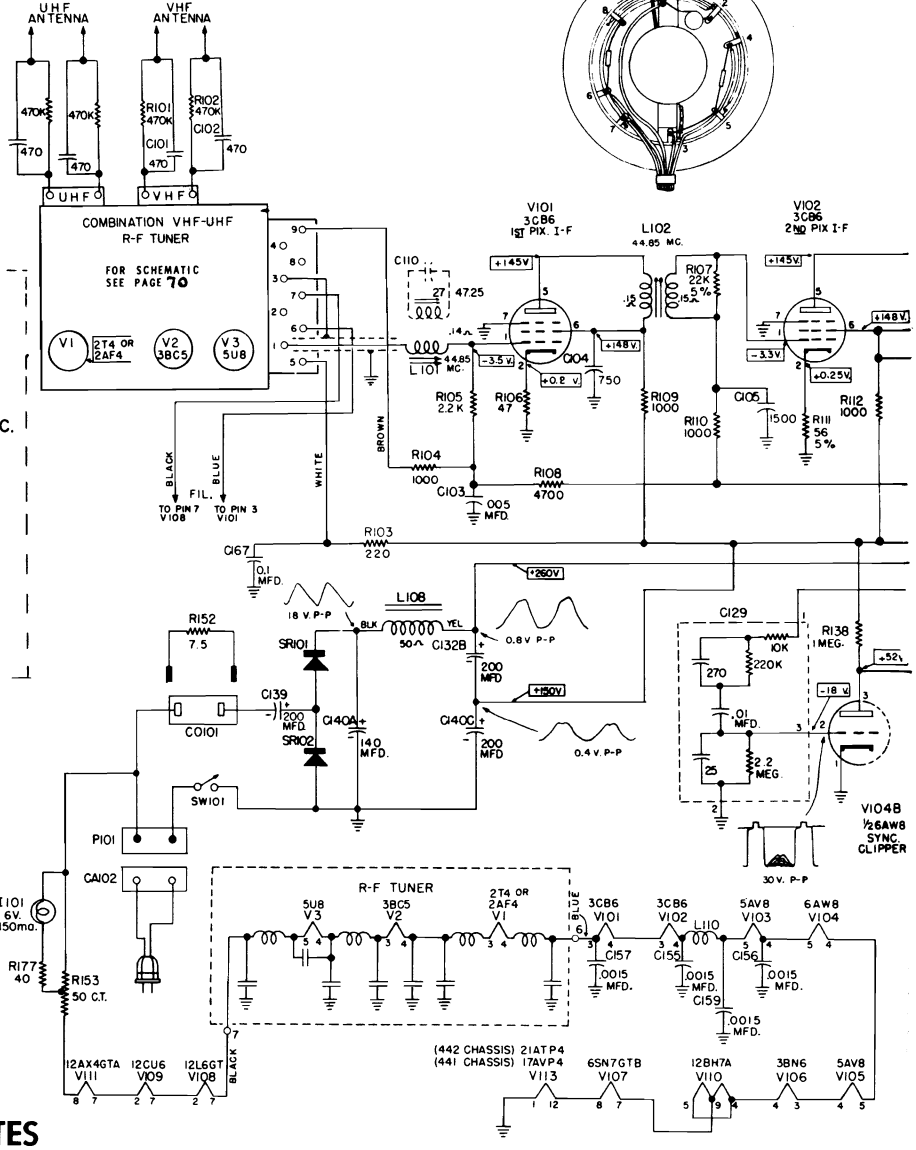
CHASSIS 441 CODE C, 442 CODE D





Used on Chassis 442C1 441BX
442C1X 441B
442AX 441BX

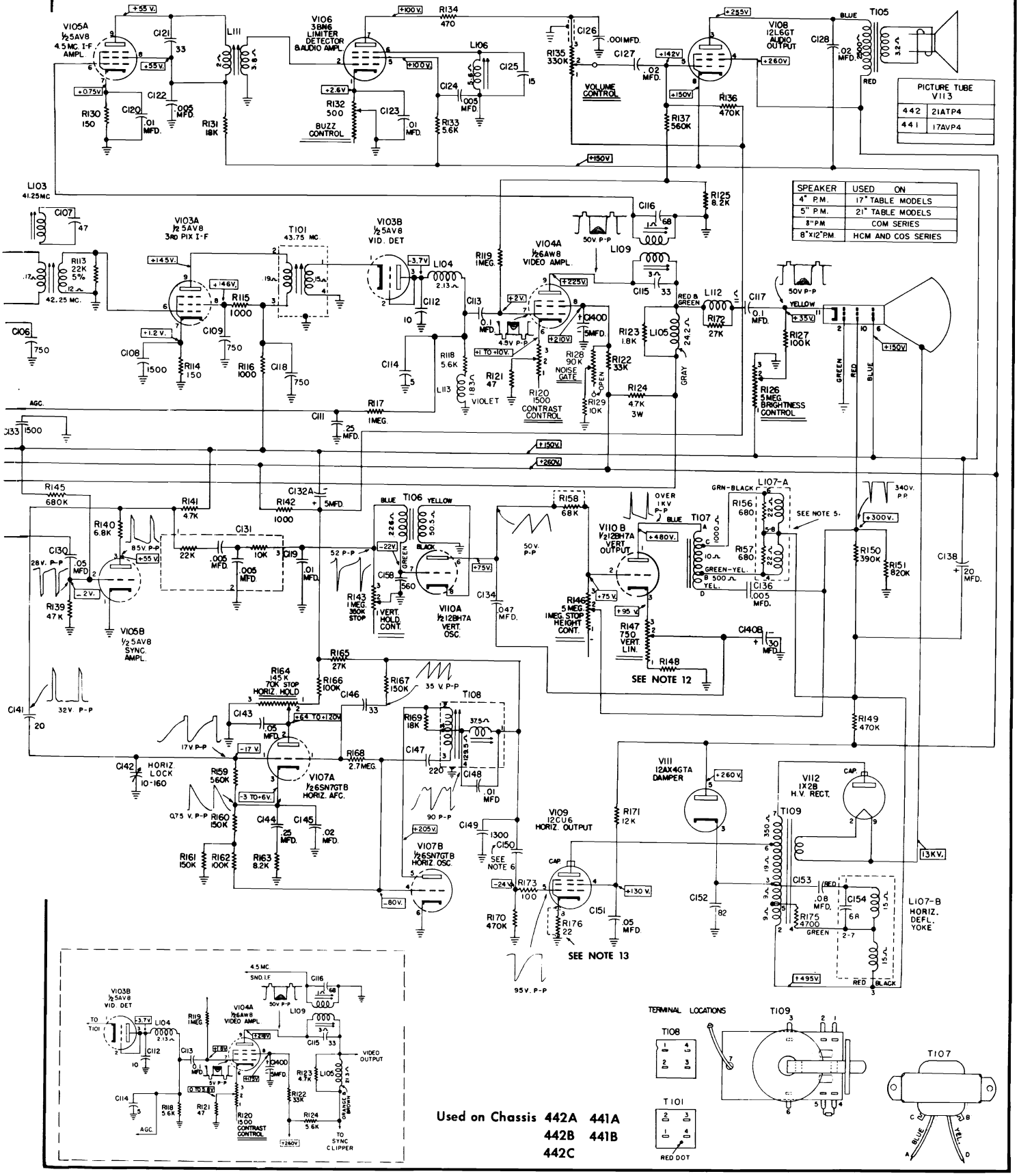




NOTES

1. All D.C. voltages measured with an electronic voltmeter connected from socket lug to chassis. Some voltages are variable depending upon signal input and settings of other controls. Voltages shown were measured with a signal voltage of approximately 3000 microvolts and with a normal picture on the picture tube and the contrast and brightness controls set for 50 volts peak to peak on the cathode (pin 11) of the picture tube, and the noise gate open (maximum counter-clockwise rotation). Socket voltage tolerance 10%.
2. Supply voltage, 117 volts, 60 cycle AC.
3. K = 1000.
4. All capacitance values in mmf. and all resistance values in ohms unless otherwise noted.
5. Lug 3 connected to boost voltage and Lug 3, 8 and 5 connected internally.
6. Better focus may be obtained with replacement picture tubes if the electronic focus anode is connected to a point other than + 150 volts. Suggested points to try are: chassis ground, +260 volts, +300 volts (picture tube, pin 10) and +480 volts.
12. The value of R148 is 7500 ohms for chassis 442, and 6800 ohms for chassis 441.
13. On chassis 442, C150 is a 560 mmf. capacitor, and the cathode of V109 is connected directly to chassis ground. On chassis 441, C150 is a 1300 mmf. capacitor, and R176 is connected between the cathode of V109 and ground.

CROSLEY CIRCUIT DIAGRAM **CHASSIS 441 & 442**



CROSLEY Chassis 434, 441, and 442 (Continued)

I. F. ALIGNMENT

All lead connections from the signal marker generator and sweep generator must be shielded. Keep exposed ends and ground leads as short as possible (about one inch). Always locate the ground lead connections as close as possible to their respective "hot" leads in the television receiver chassis. The sweep generator output, signal generator output, and contrast control must be kept low enough to prevent overloading the television receiver circuits.

CAUTION: One side of the chassis is connected to the power line. Therefore, test equipment should not be connected to the receiver unless an isolation transformer is used between the power line and the receiver. DO NOT GROUND THE RECEIVER CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED.

The front side of the chassis as referred to below means the side opposite the tubes.
The rear side of the chassis means the side on which the tubes are mounted.

VIDEO I.F. ALIGNMENT (with VTVM)

In the I. F. Alignment, limit input of signal generator so that reading on VTVM does not exceed -1.5 volts.

Step No.	Connect Signal Generator Through a .01 Capacitor	Signal Gen. Freq. MC.	Connect VTVM	Miscellaneous Connections and Instructions	Adjust
1.	Test Point No. 2 Wire protruding from Tuner next to 5U8 (V3)	43.75 mc.	Junction of R118 and C113 and chassis.	Connect a 3 volt bias battery, negative lead to junction of R117 and C111, positive lead to chassis.	T101 for maximum indication on meter, limit input to make peak less than -1.5 volt D.C. on VTVM.
2.	"	42.25 mc.	"	"	L103 (rear slug) for maximum. Use first peak from tinnerman clip end of coil.
3.	"	41.25 mc.	"	"	L103 (front slug) for minimum. Input level should be high enough to produce at least .5 volts at null on VTVM. Use first null obtained from end of coil form opposite tinnerman clip.
4.	Repeat steps 2 and 3.				
5.	"	44.85 mc.	"	"	L102 for maximum.
6.	"	44.85 mc.	"	"	L101 (front slug) for maximum. Use first peak from tinnerman clip end of coil.
		47.25 mc.	Adjacent Sound Channel Trap (L101 rear slug) see Note 1.		
7.	Test Point No. 1.	44.85 mc.	"	Connect a 100 ohm resistor in series with a 1000 mmf. cap. from V101 grid, pin #1, to chassis.	L12 on the Tuner for maximum.

Note 1. To insure proper peak aligning of the I. F. strip, the rear slug of L101 should be adjusted out to the end of the coil form. In areas where a trap is needed, turn core in only so far as is necessary to eliminate adjacent sound interference. Turning core in too far may result in deterioration of the picture signal.

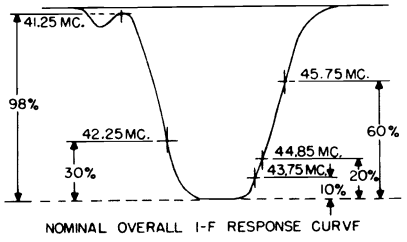
In later production sets the trap winding is omitted, in which case the shield has an opening to facilitate the installation of adjacent channel trap. For installation and adjustment instructions see page 5.

TO CHECK I.F. ALIGNMENT (with scope)

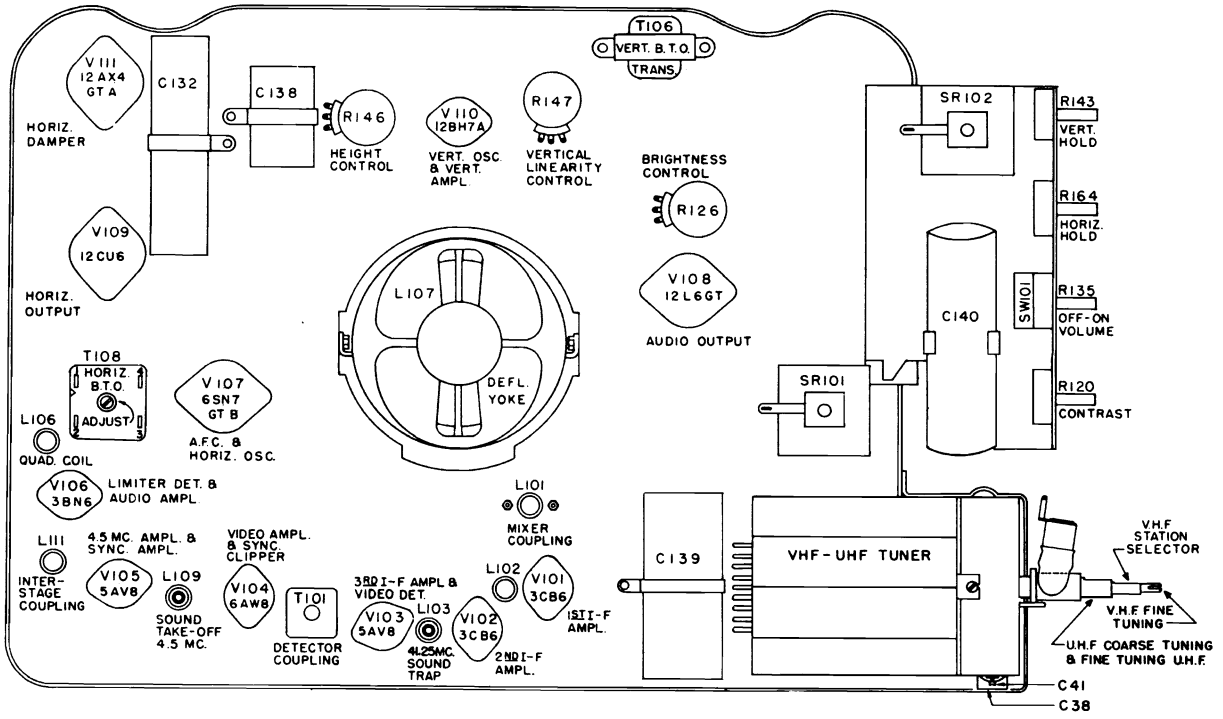
Excessive sweep input will overload the circuit and cause distortion in the wave form. Check for possible overload by temporarily increasing and decreasing the signal input level and noting any change in the wave form.

Excessive signal from the marker generator will also distort the wave form. Be sure to keep the marker at the minimum usable amplitude.

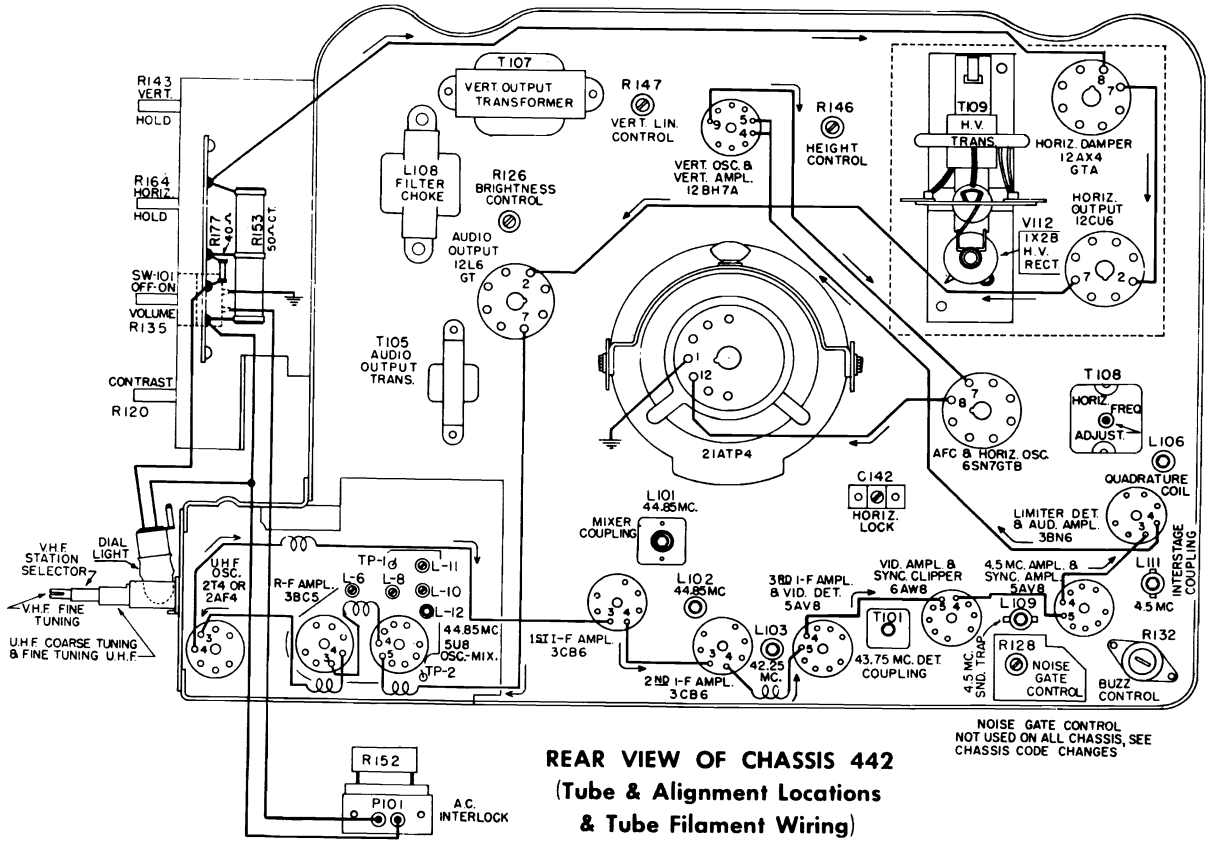
NOTE: Be sure, when checking the I. F. alignment, to set the channel selector switch to a channel (other than UHF) where moving the fine tuning control does not affect the shape or position of the I. F. response curve.

Sweep Gen. Connected to	Scope Connected to	Bias	Sweep Gen. Set to	Remarks
Ungrounded shield of 5U8 (V3) and chassis.	High side of contrast control R120 and chassis. Contrast control at minimum contrast.	Connect a 3 volt bias battery negative lead to junction of R117 and C111, positive lead to chassis.	Sweep from 40 to 50 megacycles.	Provide markers as shown on curve.  NOMINAL OVERALL I-F RESPONSE CURVE A slight deviation in response curve is tolerable, but if any great deviation is noted, the I. F. stages will have to be realigned.

CROSLEY Chassis 434, 441, and 442 (Continued)



FRONT VIEW OF CHASSIS 442
(Tube & Alignment Locations)



REAR VIEW OF CHASSIS 442
(Tube & Alignment Locations & Tube Filament Wiring)

CROSLEY Chassis 434, 441, and 442 (continued)

SOUND ALIGNMENT

Step No.	Channel Set To	Adjust	Remarks
1.	Any unused channel	Connect a crystal controlled 4.5 Mc., 400 cycle amplitude modulated signal (30% or greater) between pin 7 of V104 and chassis. Connect high side of scope through a detector probe to cathode of picture tube, low side to chassis. Adjust L109 (rear slug) for minimum 400 cycle indication on scope.	Remove signal generator and scope from the receiver.
2.	Strong signal	L106 for maximum sound output.	Set Buzz Control (R132) approximately 90° from clockwise stop.
3.	Weak signal	L111 and L109 (front slug) for maximum sound output.	If the signal in the area is too strong to obtain these peaks, remove the antenna from the receiver.
4.	Weak signal	Buzz Control (R132) for minimum noise (hash).	This signal should be weak enough to allow noise (hash) to come through along with the sound.
5.	Strong signal	L106 again for maximum sound output.	Limit the volume control setting so that this peak can be heard.

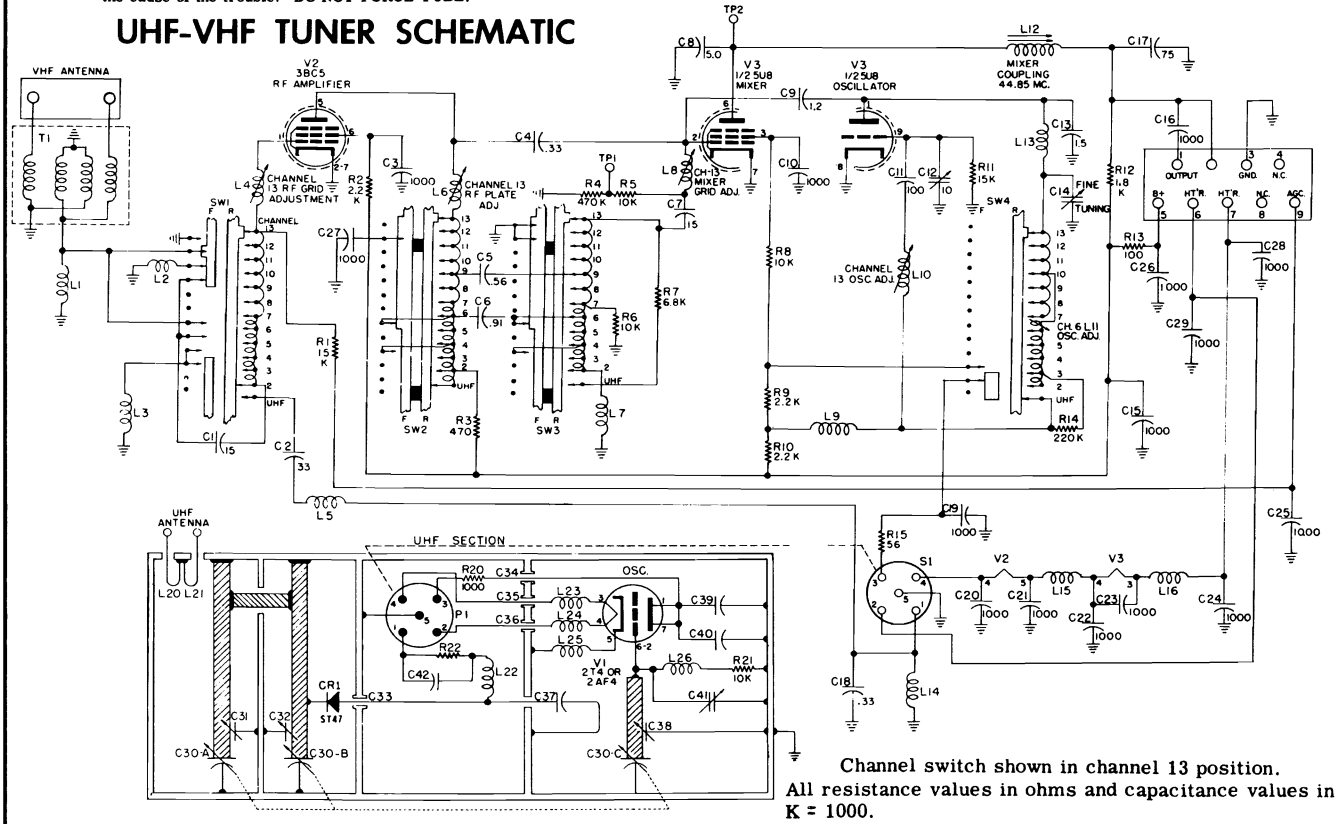
CAUTION

HIGH VOLTAGE -- The receiver chassis is connected to one side of the 117 volt, 60 cycle power line. For your protection, there is an interlock switch which automatically disconnects the receiver from the power line when the cabinet back is open. Because operation of the receiver with the back open or with barriers removed involves a shock hazard, always replace fishpaper barriers which have been removed while servicing the receiver, and exercise all precautions for working near high voltage and on a line-connected chassis. **DO NOT CONNECT TEST EQUIPMENT TO ANY PART OF THE RECEIVER OR DO NOT GROUND THE CHASSIS** unless an isolation transformer is used between the power line and the receiver. After replacing tubes in the high-voltage cage, attach cover on rear of cage before turning on receiver.

HIGH TEMPERATURE OF TUBES -- Some tubes in the receiver operate at extremely high temperatures. To avoid serious burns, do not touch these tubes while the receiver is in operation, or until the tubes have cooled after the receiver is shut off.

HANDLING OF PICTURE TUBES -- Breakage of the picture tube, which contains a high vacuum, may result in injury from flying glass. Do not scratch tube face or subject to more than moderate pressure. **DO NOT REMOVE OR HANDLE THE PICTURE TUBE IN ANY MANNER UNLESS HEAVY GLOVES AND PROTECTIVE GOGGLES ARE WORN.** Persons not so equipped should be kept away while handling the tube. **NEVER GRASP THE TUBE BY THE NECK OR ALLOW PRESSURE TO BE EXERTED ON THE NECK.** In installation, if the tube sticks or fails to slip smoothly through the deflection yoke, investigate and remove the cause of the trouble. **DO NOT FORCE TUBE.**

UHF-VHF TUNER SCHEMATIC



Channel switch shown in channel 13 position.
All resistance values in ohms and capacitance values in mmf.
K = 1000.
P1 and S1 viewed from wiring side.
Front and rear rotors of SW2 and SW3 connected electrically.

CROSLEY

CHASSIS 466
Models: H-21TKMF H-21CKBF H-21TKBF H-21HKMF H-21CKMF H-21HKBF

CHASSIS 467
Models: H-21TKMU H-21CKBU H-21TKBU H-21HKMU H-21CKMU H-21HKBU

Service material on pages 71 through 78 is exact for the above listed models. Phono-TV combination sets listed below are practically identical electrically to these sets and this material will apply to them as well. A switching arrangement is, of course, incorporated in these combination models. Chassis 468 corresponds to 466, and Chassis 469 corresponds to 467.

CHASSIS 468
Models: H-21LPKMF H-21LPKBF

CHASSIS 469
Models: H-21LPKMU H-21LPKBU

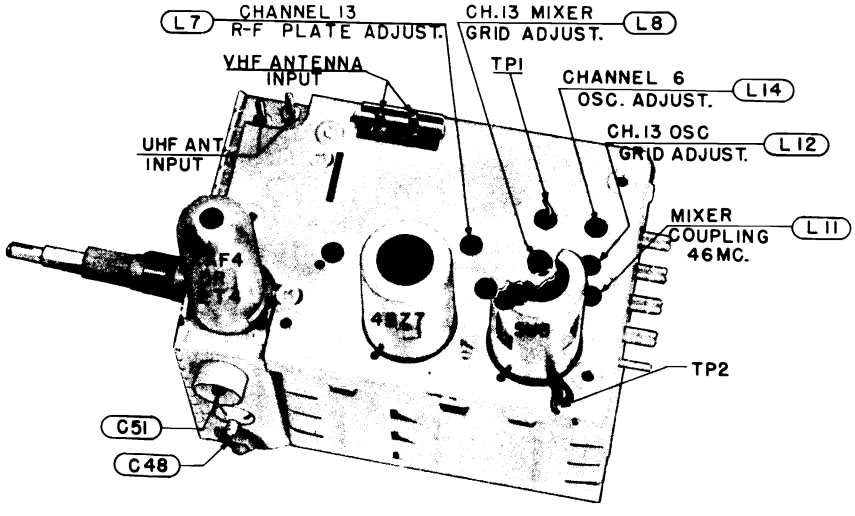
VHF OSCILLATOR ADJUSTMENTS
(Chassis 467 469 only)

If tne proper tuning point for certain channels is out of the range of the VHF fine tuning control to adjust, it will then be necessary to readjust L12 and L14, the locations of which are shown in the top view of the tuner. Use the following procedure (steps 1, 2 and 5 may be omitted if there are no stations operating in the area on channels 7 through 13):

1. Set the channel selector switch to the highest VHF channel operating in the area between channels 7 and 13. Then set the VHF fine tuning control shaft to the center of its range -- that is, until the slot in the shaft is parallel to the top side (tube side) of the tuner.
2. With a non-metallic screw driver, adjust the slug of L12 for best sound and picture.

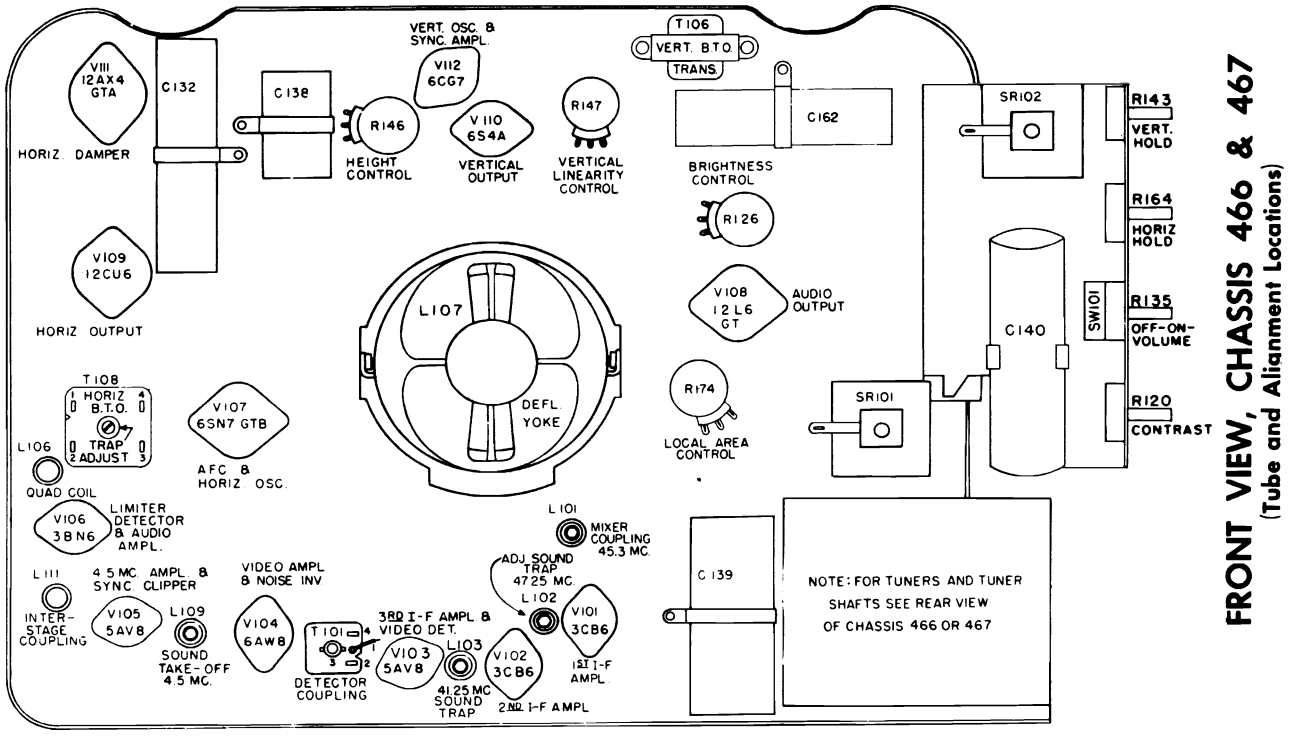
NOTE: If other stations are operating in the channel range that is being adjusted (13 to 7 or 6 to 2), it may be necessary to compromise slightly on the oscillator adjustments so as to permit the Fine Tuning to be equally effective on all stations.

3. Set the channel selector switch to the highest VHF channel operating in the area between channels 2 and 6. Be sure that the VHF fine tuning control is still set to the middle of its range.
4. With a non-metallic screw driver, adjust the slug of L14 for best sound and picture.
5. Recheck the previous adjustment and if tuning is changed, repeat steps 1 through 4.

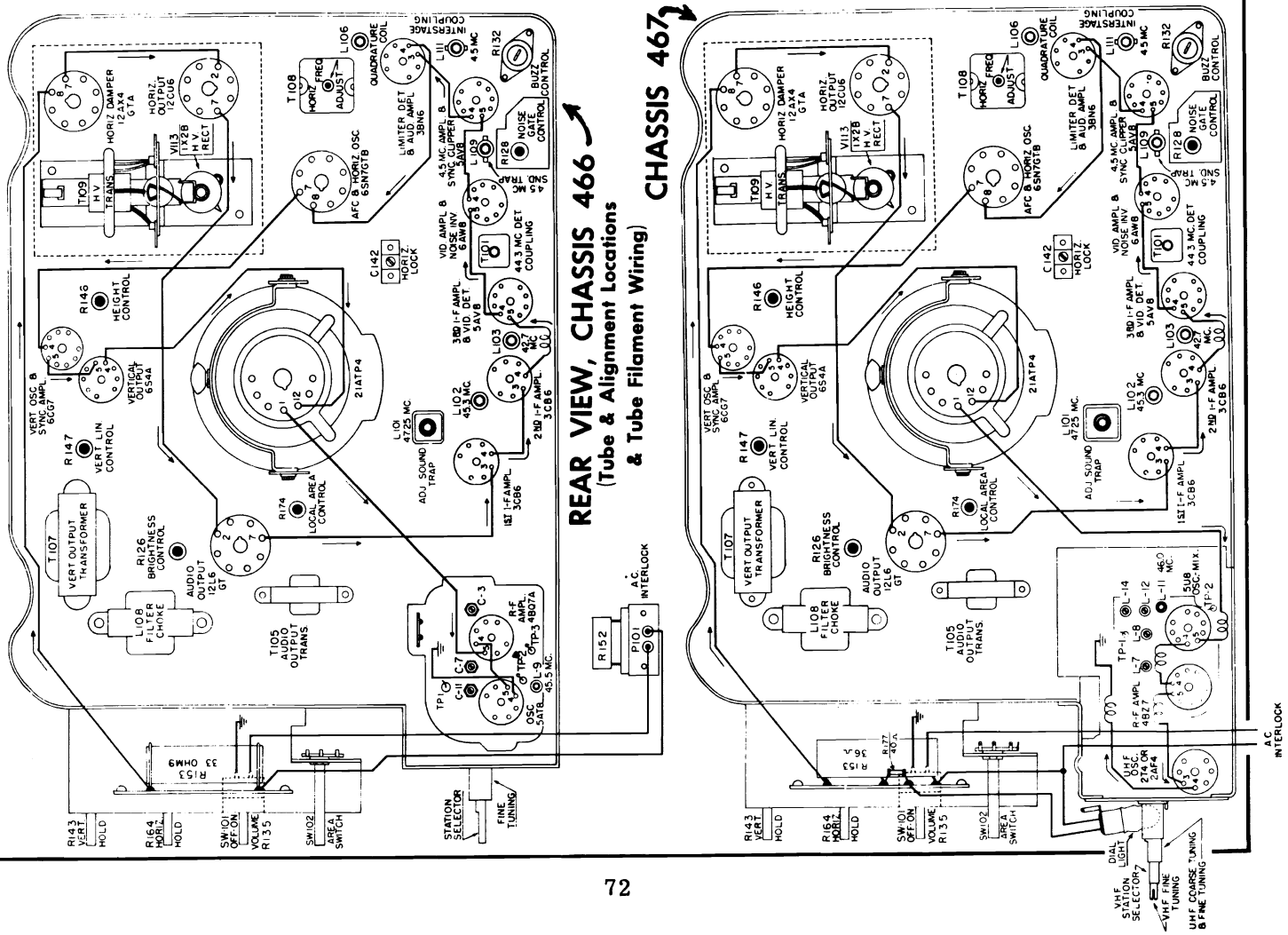


UHF-VHF TUNER
(Tube and Alignment Locations)

CROSLEY Chassis 466 and 467 (Continued)



FRONT VIEW, CHASSIS 466 & 467
(Tube and Alignment Locations)



CROSLEY Chassis 466 and 467 (Continued)

I. F. ALIGNMENT

All lead connections from the signal marker generator and sweep generator must be shielded. Keep exposed ends and ground leads as short as possible (about one inch). Always locate the ground lead connections as close as possible to their respective "hot" leads in the television receiver chassis. The sweep generator output, signal generator output, and contrast control must be kept low enough to prevent overloading the television receiver circuits.

CAUTION: One side of the chassis is connected to the power line. Therefore, test equipment should not be connected to the receiver unless an isolation transformer is used between the power line and the receiver. DO NOT GROUND THE RECEIVER CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED.

The front side of the chassis as referred to below means the side opposite the tubes.
The rear side of the chassis means the side on which the tubes are mounted.

VIDEO I.F. ALIGNMENT (with VTVM)

Step No.	Connect Signal Generator Through a .01 Capacitor	Signal Generator Freq. M.C.	Connect VTVM	Miscellaneous Connections and Instructions	Adjust
1.	Test Point No. 2, wire protruding from Tuner next to 5AT8(V2). (Chassis 466 only). Wire protruding from Tuner next to 5U8 (V3). (Chassis 467 only.)	44.3 mc.	Junction of C113 and L115 and chassis.	Connect a 3 volt bias battery, negative lead to junction of R117 and C174 (I. F. AGC) and 4.5 volt bias battery, negative lead to junction of R183 and brown lead going to Tuner (R-F AGC), positive leads to chassis.	T101 for maximum indication on meter, limit input to make peak -2 volts D.C. on VTVM. Use first peak from tinnerman clip end of coil.
2.	"	42.7 mc.	"	"	L103 (rear slug) for maximum. Use first peak from tinnerman clip end of coil.
3.	"	41.25 mc.	"	"	L103 (front slug) for minimum. First null when running slug into winding from open end is correct tuning point.
4.	Repeat steps 2 and 3.				
5.	Test Point No. 2.	45.3 mc.	"	"	L102 (rear slug) for maximum. Use first peak from tinnerman clip end of coil. Do not use more input than required for -2 volt D.C. indication on VTVM.
6.	"	47.25 mc.	"	"	L102 (front slug) for minimum. First null when running slug into winding from open end is correct tuning point.
7.	Repeat steps 5 and 6.				
8.	Test Point No. 2.	45.3 mc.	"	"	L101 (front slug) for maximum. Use first peak from tinnerman clip end of coil.
9.	"	47.25 mc.	"	"	L101 (rear slug) for minimum. First null when running slug into winding from open end is correct tuning point. Short L102 trap while adjusting L101 trap. Do Not Forget To Remove Short.
10.	Repeat Steps 8 and 9.				
11.	Test Point No. 1, wire protruding from Tuner next to 4BQ7A (V1). (466 Chassis only).	45.5 mc. (466 Chassis only)	"	Connect dummy load (consisting of 100 ohm resistor and 100 mmf capacitor in series) from grid of V101, pin #1, to chassis.	L9 on the Tuner for maximum. (466 Chassis only)
12.	Test Point No. 1. Wire protruding from Tuner above 5U8 (V3). (467 Chassis only).	46 mc. (467 Chassis only)	"	"	L11 on the Tuner for maximum. (467 Chassis only)

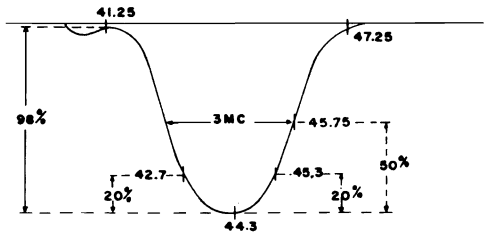
CROSLEY Chassis 466 and 467 (Continued)

I. F. ALIGNMENT

TO CHECK I.F. ALIGNMENT (with scope)

Excessive sweep input will overload the circuit and cause distortion in the wave form. Check for possible overload by temporarily increasing and decreasing the signal input level and noting any change in the wave form. Excessive signal from the marker generator will also distort the wave form. Be sure to keep the marker at the minimum usable amplitude.

NOTE: Be sure, when checking the I. F. alignment, to set the channel selector switch to a channel where moving the fine tuning control does not affect the shape or position of the I. F. response curve.

Sweep Gen. Connected to	Scope Connected to	Bias	Sweep Gen. Set To	Remarks
High side to ungrounded Aluminum Foil around 5U8(V3) or 5AT8(V2). Low side to grounded tube shield. (See Note 1 and Figs. below)	Junction of C113 and L115	Connect a 3 volt bias battery, negative lead to junction of R117 and C174 (I. F. AGC) and a 4.5 volt bias battery, negative lead to junction of R183 and brown lead going to Tuner (R-F AGC). Connect positive leads to chassis.	Sweep from 40 to 50 megacycles	Provide markers as shown on curve.  NOMINAL OVERALL I-F RESPONSE CURVE A slight deviation in response curve is tolerable, but if any great deviation is noted, the I. F. stages will have to be realigned.

NOTE 1.
Cut aluminum foil to dimensions shown in Fig. 8. Wrap foil around the tube and take scotch tape and wrap around the foil to hold the foil in place and to insulate it from the tube shield as shown in Fig. 9. Replace the tube and tube shield. Connect the high side of sweep generator to the (ungrounded) foil extending from the top of the tube shield and the ground lead from sweep generator to tube shield.

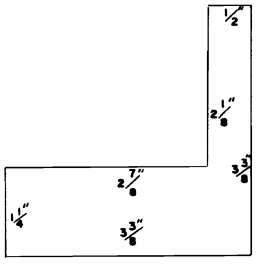


FIG. 8

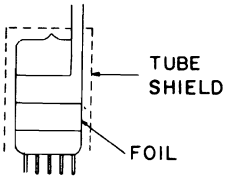


FIG. 9

SOUND ALIGNMENT

The 4.5 mc. trap (front of L109) must be aligned first, regardless of which procedure is used for the remainder of the alignment (Procedure A or B).

Step No.	Channel Set To	Adjust	Remarks
1.	Any unused channel	Connect a crystal controlled 4.5 MC., 400 cycle amplitude modulated signal (30% or greater) between pin 7 of V104 and chassis. Connect high side of scope through a detector probe to cathode of picture tube, low side to chassis. Adjust L109 (rear slug) for minimum 400 cycle indication on scope.	Remove signal generator and scope from the receiver.

Proceed with the remainder of the Sound Alignment, using either a signal from a TV station as in Procedure A, or alignment equipment as in Procedure B.

PROCEDURE A (with signal from station)

Step No.	Channel Set To	Adjust	Remarks
1.	Strong signal	L106 for maximum sound output.	Set Buzz Control (R132) approximately 90° from clockwise stop.
2.	Weak signal	L111 and L109 (front slug) for maximum sound output.	If the signal in the area is too strong to obtain these peaks, remove the antenna from the receiver.
3.	Weak signal	Buzz Control (R132) for minimum noise (hash).	This signal should be weak enough to allow noise (hash) to come through along with the sound.
4.	Strong signal	L106 again for maximum sound output.	Limit the volume control setting so that this peak can be heard.

CROSLEY Chassis 466 and 467 (Continued)

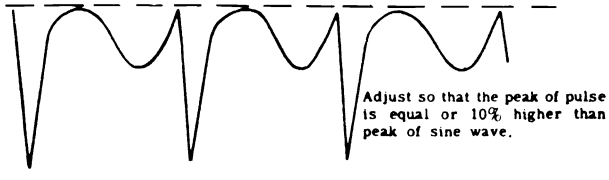
SOUND ALIGNMENT - Continued

PROCEDURE B (with alignment equipment)

Step No.	Connect Signal Gen.	Signal Gen. Freq. MC.	Connect Scope	Miscellaneous Instructions	Adjust
1.	Pin 7 of V104.	4.5 mc. FM modulated 400 c.p.s., 25 kc. deviation	Across secondary of output trans. T105.	Set Buzz Control (R132) to approximately 90° from clockwise stop. Set the Volume Control (R135) at a low level.	L106 for maximum 400 cycle indication on scope, keeping input signal high enough to assure limiting.
2.	"	"	"	"	L111 for maximum response keeping input signal at a low level (below limiting).
3.	"	"	"	"	L109 (front slug) for maximum response keeping input signal at a low level.
4.	"	4.5 mc. AM modulated 400 c.p.s.	"	Use a high input level on signal generator.	Buzz Control (R132) for null (minimum 400 c.p.s. amplitude on scope).
5.	"	4.5 mc. FM modulated 400 c.p.s., 25 kc. deviation.	"	Set the Volume Control (R135) at a low level.	Re-peak L106 for maximum 400 cycle indication on scope.

HORIZONTAL BLOCKING OSCILLATOR ALIGNMENT

Tune Receiver to TV signal, adjust contrast control for normal picture below limiting in the Video Amplifier, and proceed as follows:

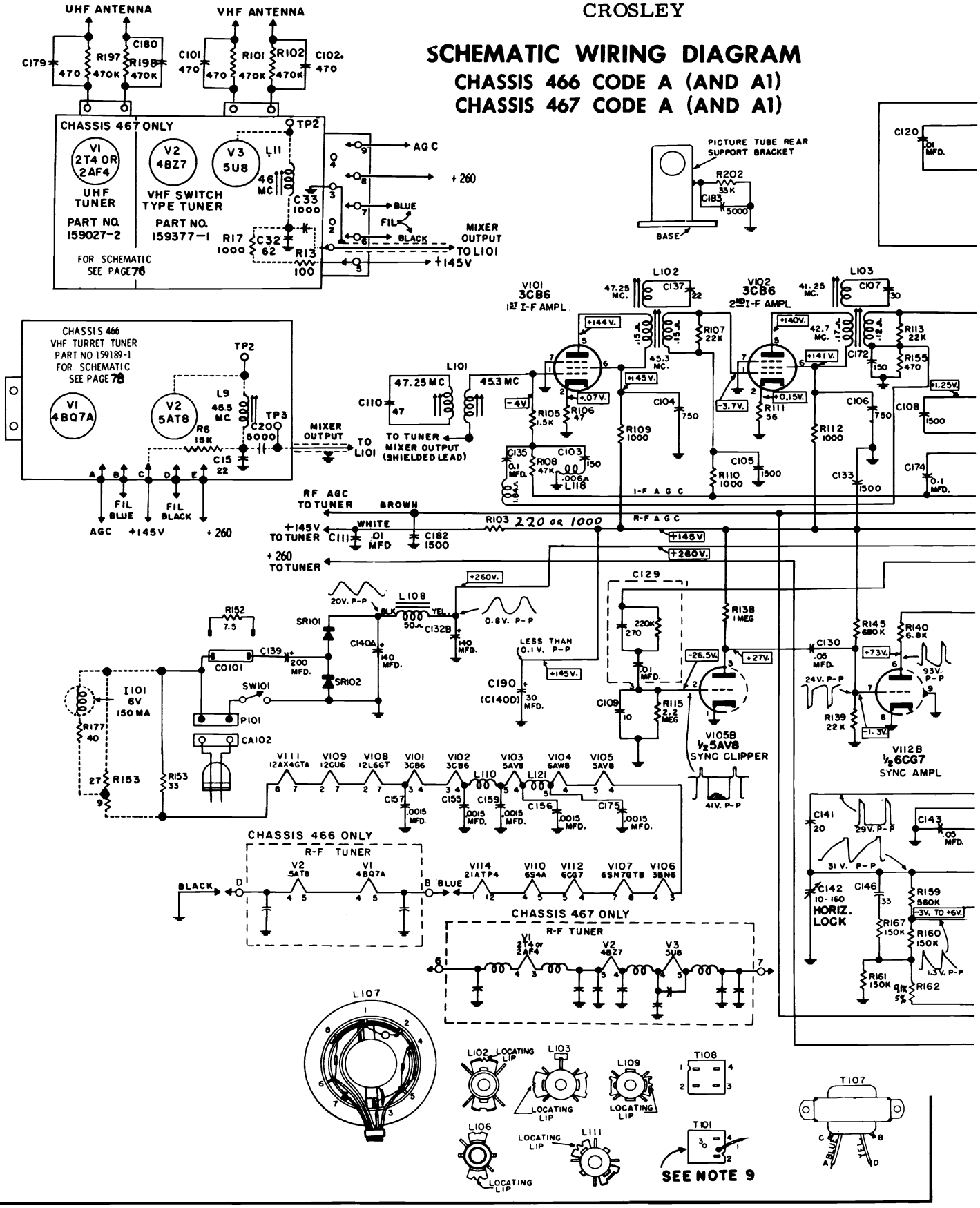
Step No.	Contrast Control Set For	Miscellaneous	Adjust
1.	Normal Picture	Pre-set Horizontal lock trimmer 1/2 turn from full tight.	Horizontal Hold Control (R164) and Horizontal Frequency Adjustment (rear slug of T108) until picture is in sync.
2.	"	Connect scope in series with 10 mmf. to lug 4 of T108 (junction of .01 mfd. capacitor and 18K resistor.)	Adjust Horizontal BTO Trap (front slug of T108) to obtain the waveform shown below. Keep the picture in sync at all times by readjusting the Horizontal Hold and Horizontal Frequency Adjustment. 
3.	"	Horizontal Hold set fully counter-clockwise.	Adjust Horizontal Frequency (rear slug of T108) by turning out until the picture is just out of sync. Then turn the control slowly in until the picture is just ready to fall into sync (indicated by a wide black vertical or diagonal horizontal blanking bar).
4.	"	----------	Turn Horizontal Hold Control clockwise until picture falls out of sync. (If picture does not fall out of sync, turn tuner off station and then back to a station again.) Then turn Horizontal Hold Control counter-clockwise until the picture just falls into sync, noting number of bars just before it syncs in. If more than three bars are present just before syncing in, adjust C-142 Horizontal Lock Trimmer slightly clockwise. If less than two bars are present, adjust Trimmer slightly counter-clockwise. Recheck number of bars and repeat until two or three bars are present. Recheck step 3 and check pull-in range, which should be normally 60° to 120°.
5.	Weak Picture	----------	Set the Horizontal Hold Control so that when the receiver is tuned off and then re-tuned to the station, the picture returns completely in sync.

CROSLEY

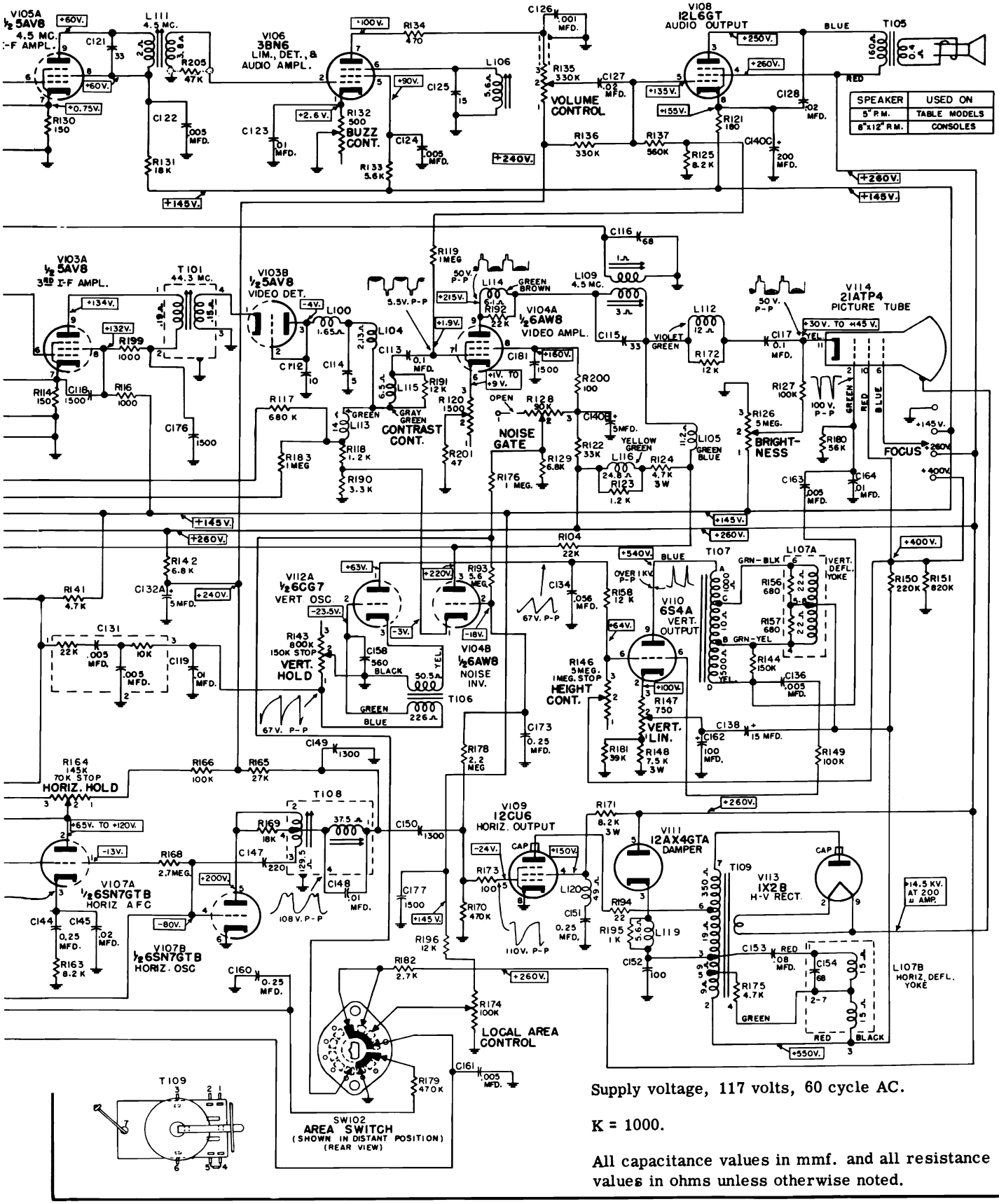
SCHEMATIC WIRING DIAGRAM

CHASSIS 466 CODE A (AND A1)

CHASSIS 467 CODE A (AND A1)



CROSLEY Circuit Diagram Chassis 466 and 467



Supply voltage, 117 volts, 60 cycle AC.

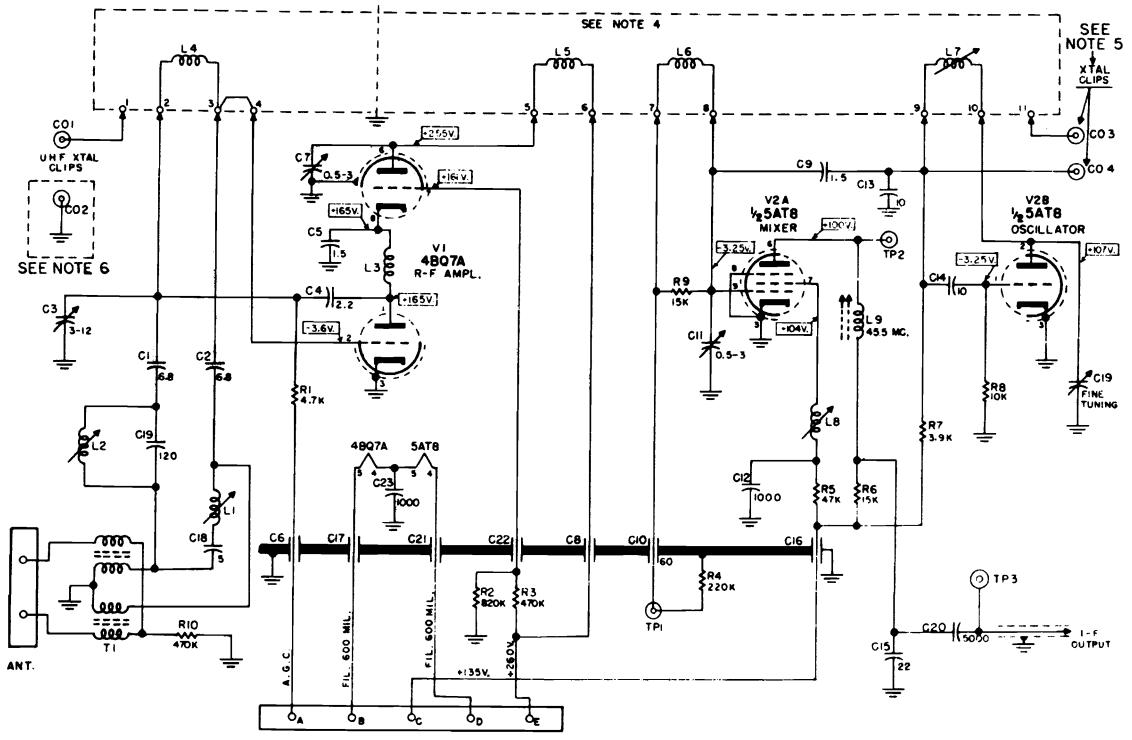
K = 1000.

All capacitance values in mmf. and all resistance values in ohms unless otherwise noted.

CROSLEY (Continued)

VHF TURRET TUNER SCHEMATIC

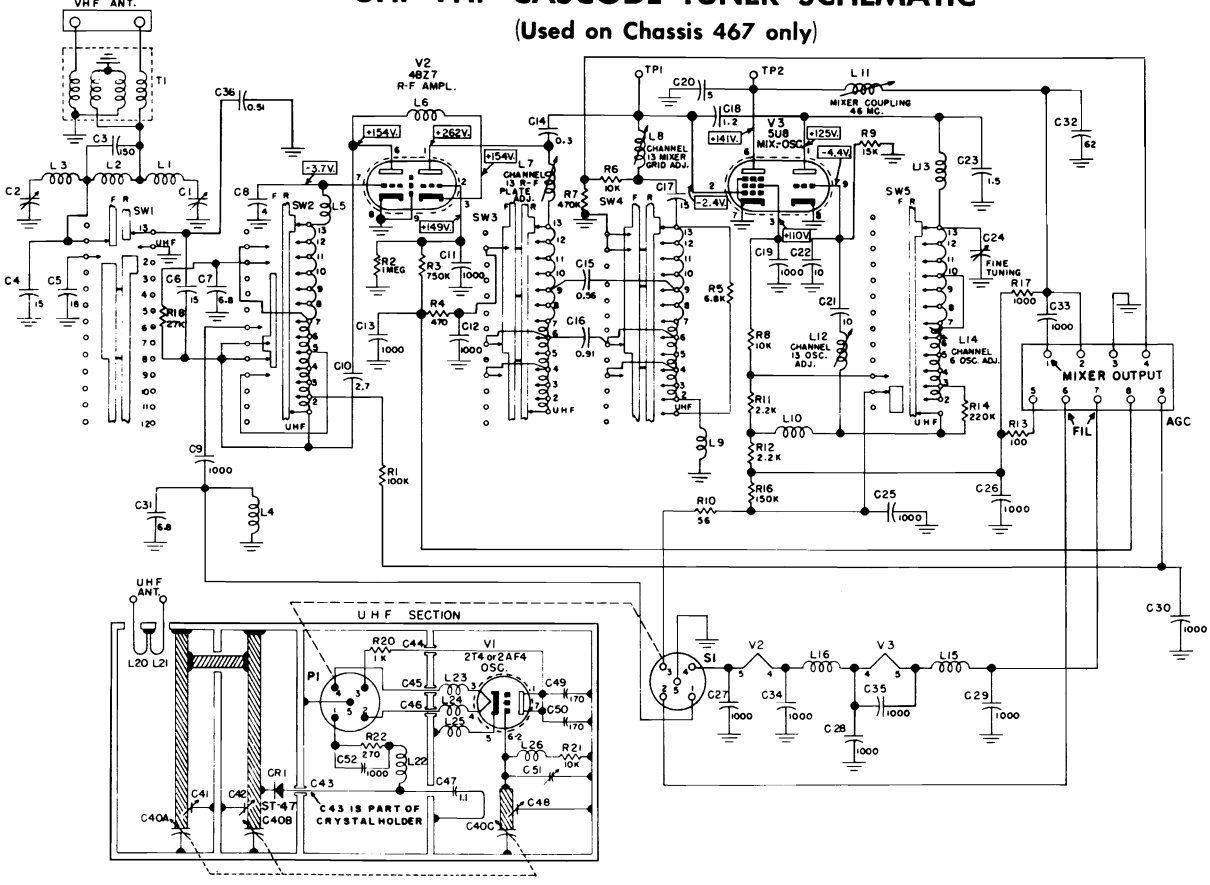
(Part No. 159189-1, used on Chassis 466 only)



NOTES:
1. ALL CAPACITANCE VALUES ARE IN MMF. AND ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
2. K = 1000.
3. FEED THRU CAPACITORS ARE 800 MMF. UNLESS OTHERWISE NOTED.
4. ONE OF TWELVE V. H. F. CHANNEL STRIPS MOUNTED IN DRUM.
5. DISREGARD C03 AND C04. THE CRYSTAL FOR WHICH THESE CLIPS WERE INTENDED IS MOUNTED ON THE UHF CHANNEL STRIPS.
6. C02 IS INSTALLED WITH FIRST UHF CHANNEL STRIP. FOR INSTALLATION,

UHF-VHF CASCODE TUNER SCHEMATIC

(Used on Chassis 467 only)



NOTES:
1. ALL CAPACITANCE VALUES ARE IN MMF. AND ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
2. K = 1000.
3. FEED THRU CAPACITORS ARE 1000 MMF. UNLESS OTHERWISE NOTED.
4. FRONT AND REAR ROTORS OF SW1, SW3 & SW4 CONNECTED ELECTRICALLY.
5. CHANNEL SWITCH SHOWN IN CHANNEL 13 POSITION.
6. P1 AND S1 VIEWED FROM WIRING SIDE.
7. SOCKET VOLTAGE MEASUREMENTS TAKEN IN CHANNEL 3 POSITION.

Emerson Television

Chassis	Models	Tube	Tuner
120245D	1102D, 1130D	17LP4	470786
120245N	1102F	17LP4	470818
120255D	1106H, 1106J	21AUP4A	470803
120255F	1106L, 1106N	21AUP4A	470798
120256D	1104F	21YP4	470803
120256F	1104J	21YP4	470798
120256N	1104L	21YP4	470817
120259D	1114D	21AUP4	470803
120259F	1114F	21AUP4	470798
120259N	1114H	21AUP4	470817
120269L	1107D, 1107F	21AUP4A	470810
120273F	1128F*	21AUP4A	470798

*This is a combination with radio 120272B

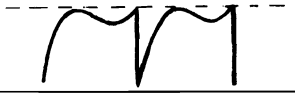
ALIGNMENT OF MIRACLE PICTURE LOCK (Horizontal Oscillator and A.F.C.)

This can be accomplished without removing chassis from cabinet as follows:

1- Turn picture stabilizer (R-40) fully clockwise (minimum resistance) and tune set to a known good channel.
2- Short phasing coil (L-14 by using a clip lead across phasing coil terminal strip located on top of chassis.
3- Rotate horizontal hold control (R-54) fully clockwise.
4- Starting with horizontal frequency slug (T-7) all the way "out" (towards you looking at top of chassis), rotate "in" until picture just locks into sync.
5- Remove short from phase coil and starting with slug all the way "out", adjust "in" until picture almost locks into sync (2 - 3 diagonal bars).

ALTERNATE METHOD

The phase coil can also be adjusted using a scope through a low capacity probe connected to junction of T-7, L-14 (yellow dot). Adjust phase coil for even peaks after the picture is in sync.



6- Turn horizontal hold (R-54) to counterclockwise position to lock picture "in", then turn horizontal hold to full clockwise position. If picture falls out of sync, continue to adjust frequency coil slug (T-7) "in" until picture just locks in.
7- Check for horizontal hold while switching channels. If this is not obtained at extreme clockwise position of horizontal hold control (R-54), turn frequency slug (T-7) "in" slightly until desired results are obtained. If excessive squedging (Christmas Tree effect) is experienced while switching channels, adjust phase coil "in" about 1/2 turn more.

ADJUSTMENT OF PICTURE STABILIZER (R-40)

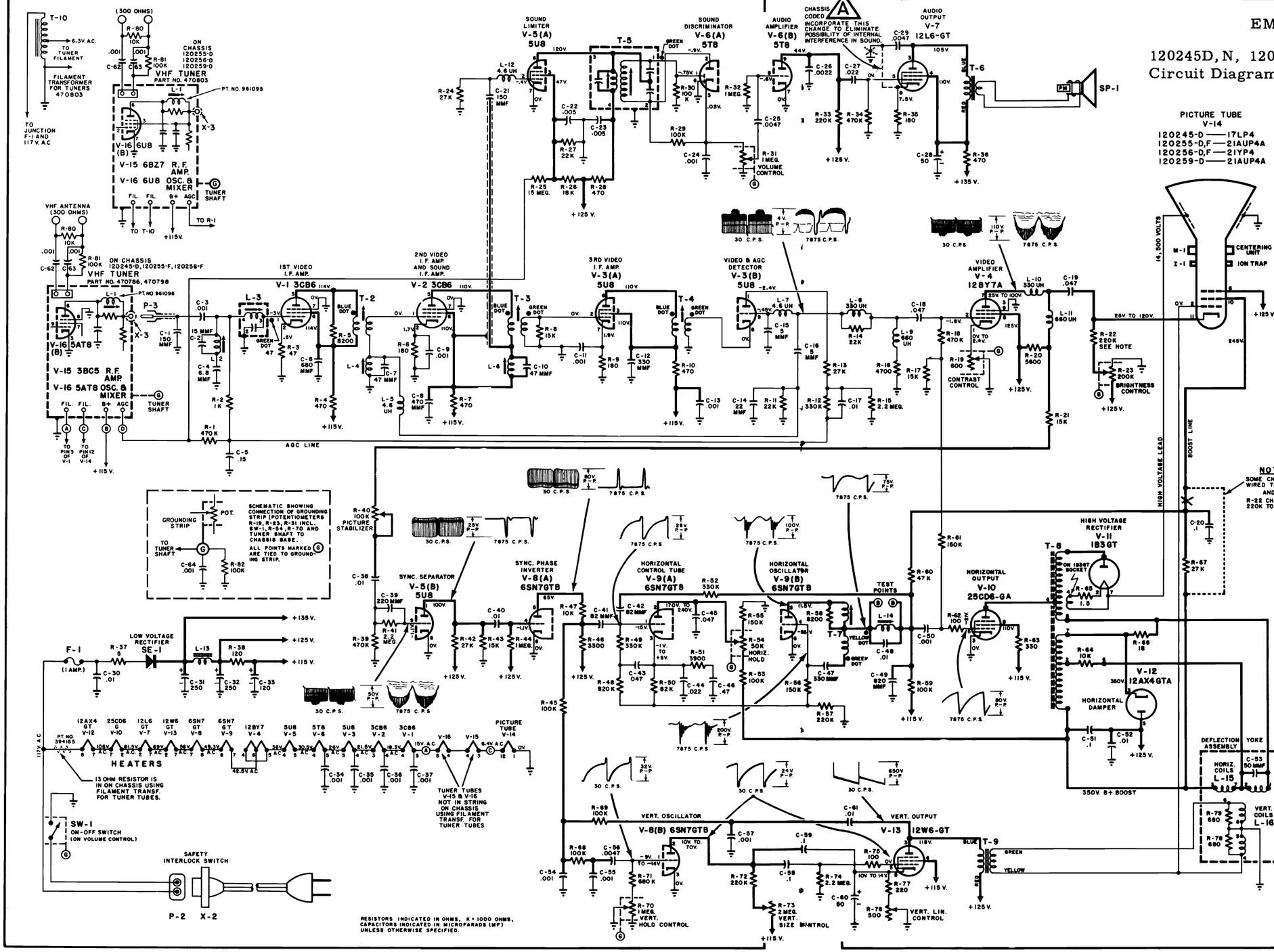
Before adjusting, make sure the Miracle Picture Lock (horizontal oscillator and AFC) has been properly adjusted (see above). This control should normally be set at its extreme clockwise position (minimum resistance). If sync improvement is required in electrically noisy fringe areas, rotate this control (R-40) counterclockwise for best picture stability. NOTE: For local signals this control (R-40) should be set to its extreme clockwise position (minimum resistance). When adjusting, always start from the extreme clockwise position and stop at the point where maximum sync stability is achieved.

Circuit diagram on pages 80-81.

VOLUME TV-10, ADDITIONAL 1955 TELEVISION SERVICING INFORMATION

EMERSON Television Chassis

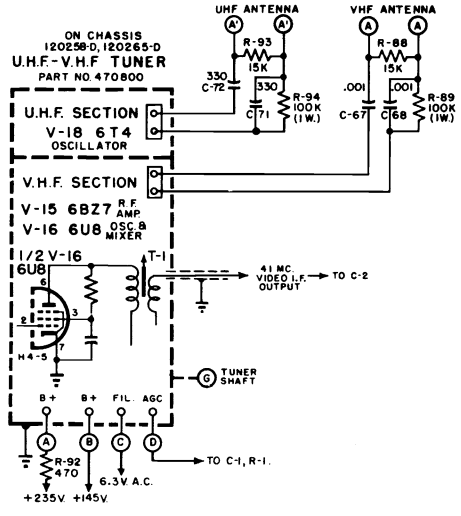
120245D, N, 120255D, F, 120256D, F, N, 120259D, F, N
Circuit Diagram

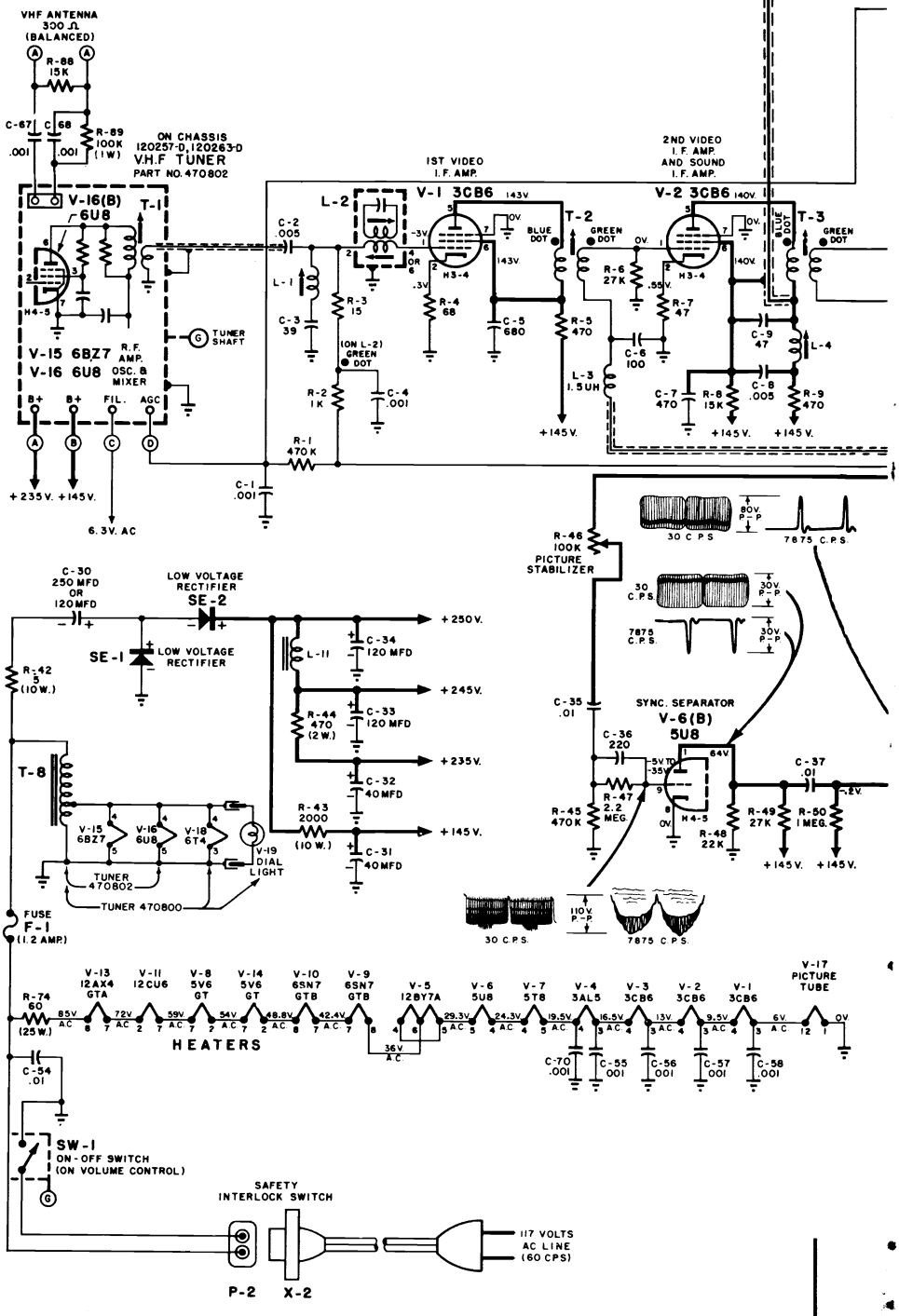


TYPE	MODEL NUMBERS	TV CHASSIS	TUBE SIZE	TV TUNER
VHF RECEIVERS	1108D, 1110D, 1112D, 1116D, 1120D, 1126D	120257-D	21ALP4A	470802
	1122D, 1124D	120263-D	24DP4A	
UHF-VHF RECEIVERS	1109D, 1111D, 1113D, 1117D, 1121D, 1127D	120258-D	21ALP4A	470800
	1123D, 1125D	120265-D	24DP4A	

Emerson

(Additional service material on page 84)





H 2-7 INDICATES TUBE FILAMENT IS PINS 2 AND 7.

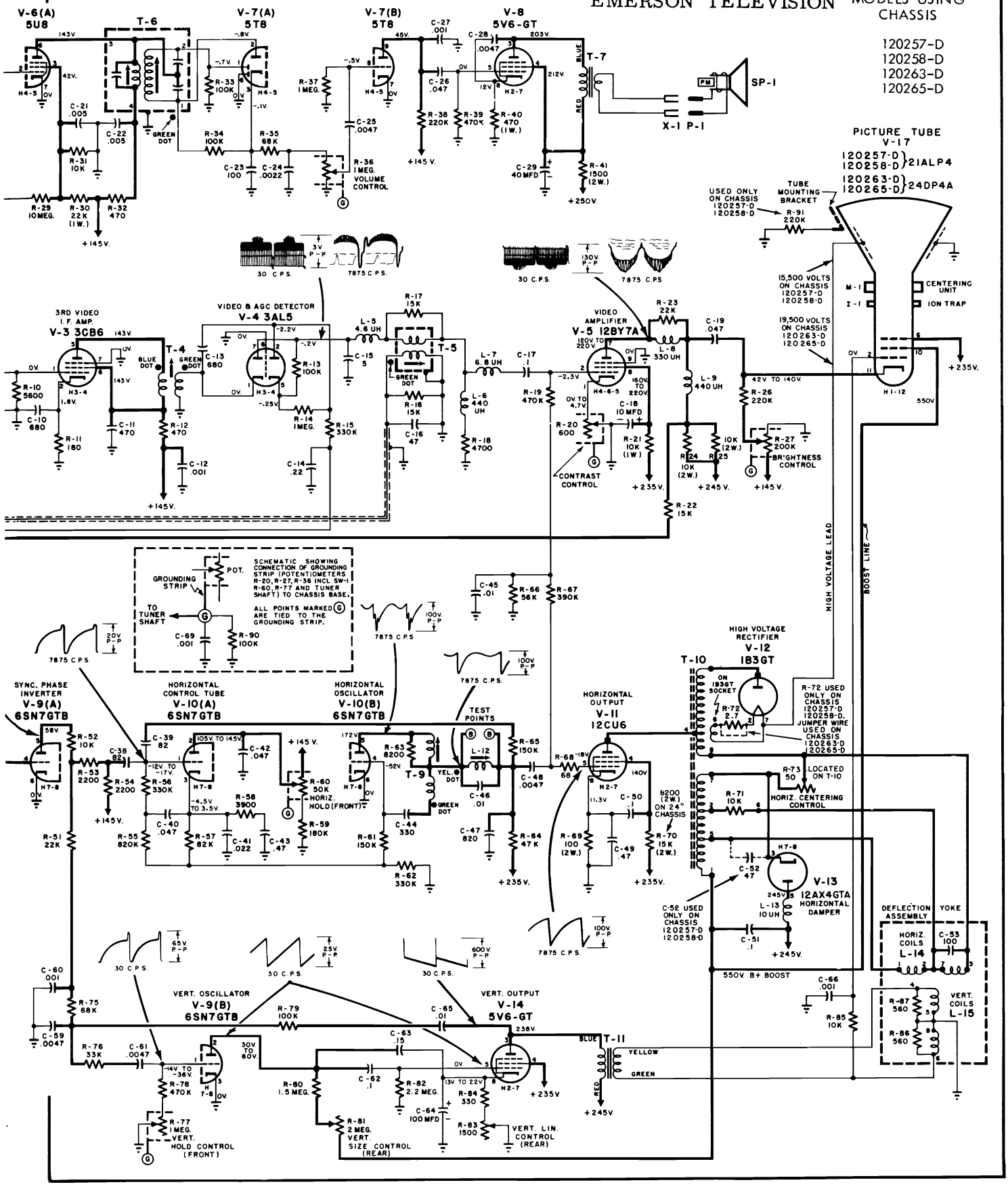
RESISTORS ARE IN OHMS (K=1000 OHMS) AND 1/2 WATT UNLESS OTHERWISE NOTED.

CAPACITORS LESS THAN ONE ARE IN MFD, CAPACITORS MORE THAN ONE ARE IN MMFD'S UNLESS OTHERWISE SPECIFIED.

EMERSON TELEVISION

MODELS USING CHASSIS

120257-D
120258-D
120263-D
120265-D



Emerson Television

Chassis 120257D, 120258D, 120263D, and 120265D

(For list of models and circuit diagram see pages 82-83)

GENERAL DESCRIPTION

All of the chassis covered in this note are electrically the same except for the size of the picture tube, type of tuner used (VHF or UHF-VHF) and the horizontal output transformer. The weight of these chassis has been kept to a minimum by the use of a selenium rectifier doubler power supply and a series filament string. A separate 6.3 volt transformer provides filament power for the two tuner tubes.

ADAPTING VHF SETS TO UHF

VHF receivers can, if desired, be easily adapted to UHF by means of interchangeable channel strips or by use of an external converter. The 470802 VHF tuner requires a "U" coded UHF strip. These strips can be purchased from your Emerson distributor.

ALIGNMENT OF MIRACLE PICTURE LOCK (Horizontal Oscillator and A.F.C.).

This can be accomplished without removing chassis from cabinet as follows:

1 - Turn picture stabilizer (R-46) fully clockwise (minimum resistance) and tune set to a known good channel.
2 - Short phasing coil (L-12 by using a clip lead across phasing coil terminal strip located on top of chassis.
3 - Rotate horizontal hold control (R-60) fully clockwise.
4 - Starting with horizontal frequency slug (T-9) all the way "out" (towards you looking at back of chassis), rotate "in" until picture just locks into sync.
5 - Remove short from phase coil and starting with slug all the way "out", adjust "in" until picture almost locks into sync (2 - 3 diagonal bars).
6 - Turn horizontal hold (R-60) in counterclockwise direction to lock picture "in", then turn horizontal hold to full clockwise position. If picture falls out of sync, or the top is unstable horizontally, continue to adjust phase coil slug (L-12) "in" until picture just becomes stable.
7 - Check for horizontal hold while switching channels. If this is not obtained at extreme clockwise position of horizontal hold control (R-60), turn frequency slug (T-9) "in" slightly until desired results are obtained. If excessive squedging (Christmas Tree effect) is experienced while switching channels, readjust phase coil slightly. Check to make sure no horizontal bending is introduced at top of picture.

ADJUSTMENT OF PICTURE STABILIZER (R-46)

Before adjusting, make sure the Miracle Picture Lock has been properly adjusted. This control should normally be set at its extreme clockwise position (minimum resistance). If sync improvement is required in electrically noisy fringe areas, rotate the control R-46 in a counterclockwise direction until best picture stability is achieved.

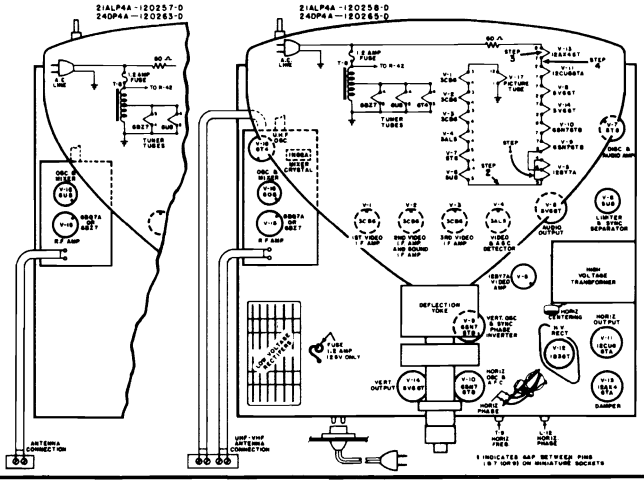
NOTE: For local signals, this control (R-46) should be set to its extreme clockwise position (minimum resistance). When adjusting, always start from the extreme clockwise position and stop at the point where maximum sync stability is achieved.

LOCATING AN OPEN TUBE FILAMENT (from top of chassis)

This can be done quite rapidly by using an ohmmeter or any other method of checking continuity such as a 3 volt battery in series with a #40 pilot light bulb. The procedure as shown below is to first isolate the open filament to one of seven tubes rather than one of 14. When this is done, it is then localized further to one of 3 or 4 tubes and then to the exact tube. Note: Pull A.C. line cord plug out of wall receptacle during this test.

1 - Remove V-5, (12BY7A tube) and check its continuity from pins #4 to #5. If okay, then -
2 - Connect continuity checker from chassis to hole #5 of 12BY7A tube socket (tube removed). If okay replace 12BY7 tube. NOTE: When looking at top of socket count pin #'s counterclockwise from reference (key or wide pin spacing).
3 - Remove 12AX4 tube and check continuity from pin #8 to #7 of 12AX4 if okay.
4 - Test for continuity between chassis and hole #5 of 12AX4 tube socket (tube removed) if okay then trouble is due to open R-74 or bad connection from AC line to resistor or from resistor to pin #8 of 12AX7 tube socket.

If an open was found during step #2, the open filament is in either V-6, V-7, V-4, V-3, V-2, V-1 or V-17. If found during step #4 then in either V-11, V-8, V-14, V-10 or V-9. Trouble can be further isolated by using a similar method on the 6 or 7 tubes in question.



MODELS
21T26
21T27
21C240
21C241
21C242
21C243
21C244
21C245

GENERAL ELECTRIC

"H" LINE

TELEVISION RECEIVERS

UHF Model Numbers Bear Suffix "UHF"

HEIGHT AND VERTICAL LINEARITY: These controls (R207 and R211), see Fig. 1, should be adjusted simultaneously to provide proper picture height consistent with good vertical linearity. The final adjustment should extend the picture approximately ⅛ inch beyond the mask limits.

HORIZONTAL SIZE (WIDTH) & HORIZONTAL LINEARITY: These controls (L252 and L253), should be adjusted simultaneously to provide proper picture width, consistent with good horizontal linearity. The adjustments, when completed, should extend the picture approximately ¼ inch beyond the mask limits.

HORIZONTAL STABILIZER COIL: The stabilizer coil, L251, should be adjusted so that the horizontal sync will remain locked over the entire range of the Horizontal Hold control, R264. Also, the "pull-in" range of the sync should be evenly distributed on each end of the horizontal hold-control range. This may be checked by switching off and on a station and observing the "pull-in" ability at different settings of the control.

In order to adjust the coil properly, adhere to the following procedure:

1. Replace the 12AU7 phase detector–phase splitter tube, V110, temporarily with a tube whose pins 6, 7, and 8 have been clipped off. If such a tube is not readily available, connect a jumper wire from the arm of the Horizontal Hold Control, R264, to junction of R260 and C255 in order to render the automatic frequency control (AFC) inoperative.

2. Set the Horizontal Hold Control, R264, to approximate center of its range and adjust the Horizontal Stabilizer coil, L251, for best sync. Instead of being steady, the picture will slowly drift in either direction.

3. Check sync at clockwise and counterclockwise position of the Horizontal Hold Control, R264. The number of bars should be approximately the same at each end of the Horizontal Hold Control range.

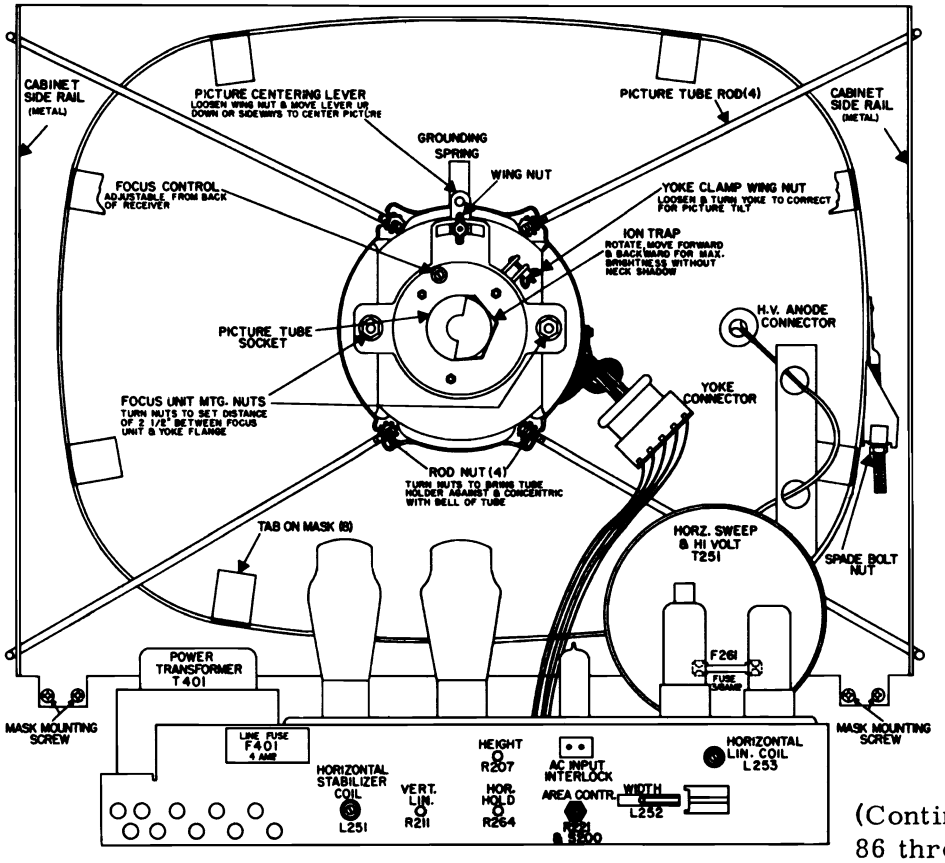
4. Repeat the Horizontal Stabilizer coil (L251) adjustment, if necessary, at slightly different settings of the Horizontal Hold control R264, until the number of bars in the picture pattern are the same at each end of the Horizontal Hold control range.

5. Reset the Horizontal Hold Control for best sync, remove jumper wire or clipped tube and replace original 12AU7 tube to restore AFC.

FOCUS CONTROL ADJUSTMENT: This is an extended shaft and knurled metal knob which also has a screw driver adjustment slot that can be reached through the cabinet back. The knob provides fine control of focus as the final adjustment after focus unit is properly positioned.

POSITION: A position of 2½ inches between focus unit and deflection yoke provides optimum over-all picture focus for average receivers. The focus unit should be concentric with and perpendicular to the neck of the picture tube. To reposition focus unit, loosen the focus unit mounting nuts; the large holes allow considerable vertical and lateral movement for concentric positioning with the tube neck, while the position of the nuts determine the distance to deflection yoke for best over-all picture focus.

PICTURE CENTERING:—Loosen the wing nut and move picture centering lever up, down, and to each side, following a circular pattern, until picture is centered.



(Continued on pages 86 through 90.)

Fig. 1. Chassis and Picture Tube Assembly (Rear View)

GENERAL ELECTRIC "H" LINE (Continued)

REMOVAL OF PICTURE TUBE AND YOKE ASSEMBLY

1. Remove the chassis and lay cabinet, face downward, on padded non-scratching surface.

2. Remove ion trap.

3. Remove the two focus unit mounting nuts and slide focus unit off the tube neck.

4. Loosen yoke clamp ring wing nut and slide deflection yoke off tube neck.

5. Loosen the four picture tube rod nuts. Remove rods, and picture tube holder.

6. Remove Phillips screws at lower corners of picture mask. Move tube and mask slightly toward bottom of cabinet to free mask from cabinet top rail. Remove and place tube, face downward, on bench.

7. Loosen spade bolt nut and lift tube from harness strap assembly.

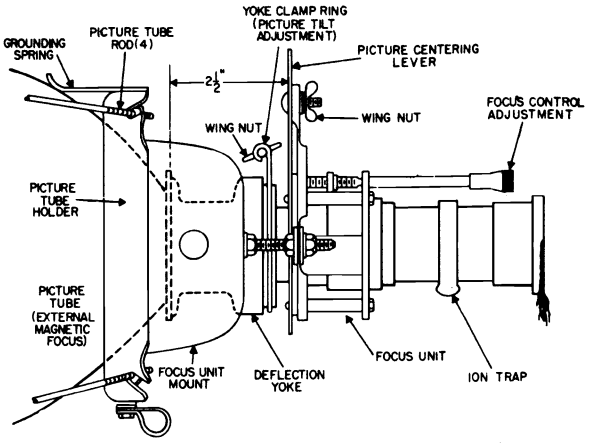


Fig. 3. Side View of Picture Tube Mount Assembly

ALIGNMENT OF L100 I-F TRAP

The trap, L100, Fig. 20, is for the purpose of removing any frequency in the i-f range which may cause interference.

It may be aligned by tuning for minimum i-f channel interference pattern on the screen.

If the interference frequency is known, L100 may also be aligned for minimum interference as outlined below.

1. Connect 3 volts bias from the i-f tuner AGC line to chassis. Connect the positive of bias battery to chassis.

2. Use an accurate marker generator to furnish marker of the same frequency as the interfering frequency. Connect the scope to view the response curve at output of the video detector. Use a sweep generator with its center frequency set approximately at the interference frequency.

3. Do not tune L100 so it will attenuate Channel No. 2.

4. Use the G-E ST-8A balanced adapter and a three-foot piece of 300-ohm transmission line to couple the r-f sweep to the antenna terminals of the receiver to properly match the input impedance of this receiver.

If the shape of the response curve changes when you grasp the 300-ohm transmission line, a resistor pad, as shown in Fig. 18A, should be inserted at the r-f tuner antenna terminals. In most cases, as you grasp the 300-ohm transmission line, the amplitude of the response curve will decrease, the shape will not change.

L100 ALIGNMENT CHART

STEP	MARKER FREQUENCY	SWEEP FREQUENCIES & INPUT POINTS	CONNECT OSCILLOSCOPE BETWEEN CHASSIS AND	CHANNEL SWITCH SETTING	ADJUST	SEE NOTE
28	Interference Frequency	40 to 50 MC to antenna terminals	Test Point III	2	Core of L100 for minimum amplitude of curve at marker.	1, 2, 3, 4

VIDEO I-F SYSTEM

The following alignment data is divided into two separate procedures. Because of the large trap attenuation, the conventional method of sweep observation of these traps becomes difficult. Hence all traps shall be pre-tuned by applying an amplitude-modulated signal and adjusting for minimum signal output.

The second portion of this procedure involves the shaping of the i-f response curve in the conventional manner by the application of a sweep generator signal. During this procedure, observe the usual precautions regarding warm-up time, equipment cable lead dress and generator output cable termination.

GENERAL NOTES:

1. Allow receiver and alignment equipment to warm up for 20 minutes before proceeding.

2. Set channel selector switch to Channel #11, #12, or #13. Check for oscillator influence by turning the fine tuning control. If the shape of the response curve changes, switch to another high-frequency channel where oscillator influence is not noted.

3. Turn the volume control and the area control fully counterclockwise. Turn the picture contrast control fully clockwise.

4. Remove V109 and V113 during alignment.

TRAP ALIGNMENT

GENERAL:

As noted above, an AM signal is required for trap alignment. In many cases, the technician will have a suitable AM signal generator available. It should cover the range of 40.0 to 48 megacycles at fundamental frequency, with available internal 400-cycle modulation. When this type of signal is used, the traps should be adjusted for minimum 400-cycle signal as observed on the oscilloscope.

Users of General Electric sweep alignment equipment may obtain the required amplitude-modulated carrier frequencies by a simple manipulation of the equipment controls

Apply this AM signal according to the instructions in the following chart.

The signal observed on the oscilloscope appears as two parallel lines. When the traps are properly tuned, the distance between these lines will be at a minimum. NOTE: It may be necessary to use full output of the sweep generator and near maximum oscilloscope gain to observe proper trap tuning.

Those technicians who do not have either of the above equipment available are advised to omit the trap alignment procedure. With the exception of the video amplifier 4.5 mc trap L156, the traps will not become seriously misaligned due to tube changes. The above-mentioned 4.5 mc trap may be sweep-aligned, if desired, in which case, a 4.5 mc sweep signal should be used in step 2 of Trap Alignment Chart. The trap may then be tuned to minimum response at 4.5 mc which should be crystal marker calibrated.

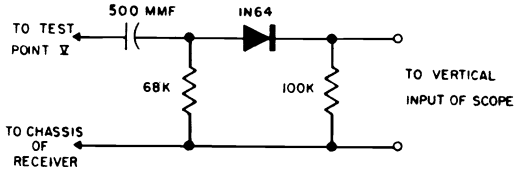


Fig. 25. Detector Network

GENERAL ELECTRIC "H" LINE, Models 21T26, 21T27, 21C240, etc. (Continued)

TRAP ALIGNMENT CHART

STEP	AM—GENERATOR INPUT POINT	AM—GENERATOR FREQUENCY	ADJUST FOR MINIMUM OUTPUT	REMARKS
1	Test Point I (R-F tuner unit)	47.25 mc 41.25 mc	L151 L153	Connect scope to Test Point V; maximum vertical gain may be required.
2	Test Point IV (Diode Load)	4.5 mc	L156	Connect detector network, between oscilloscope input & receiver Test Point V as shown in Fig. 25.

I-F SYSTEM SWEEP ALIGNMENT

Now that the traps have been set at their proper frequencies, the i-f curve may be shaped.

PRE-PEAKING

Should it be difficult to obtain the proper video i-f response as may be experienced when the set is far out of alignment, the tuning of the individual coils may be checked.

If each coil is peaked at the respective frequency specified below with an AM signal as prescribed for setting traps, an over-all i-f response curve which closely approximates the proper curve will be achieved. After this is done, the sweep method may be used to thus permit proper final curve shaping. This peaking may be done by using an AM signal as prescribed for setting the traps, or the sweep method may be used by adjusting the coils for maximum amplitude at the desired marker points.

Since it may be possible to obtain two peaks through the coil adjustment range, make certain the coil is aligned for the first peak (slug starting from "out" position). Begin alignment, starting with T153.

PEAKING FREQUENCIES

*T153—44.15 mc
L152—44.0 mc
L135—43.5 mc
T151—45.25 mc
T152—42.9 mc

*Should be peaked first.

NOTES:

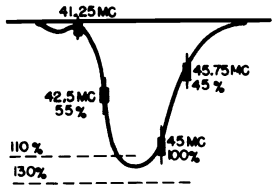
1. Turn picture contrast control to minimum.

2. Observe sweep wave form at Test Point III through a 10,000-ohm resistor. Oscilloscope should be calibrated so that ¾-volt signal will provide 2-inch vertical deflection.

3. Apply a negative 4½-volt battery bias voltage to Test Point VI. Connect positive lead of battery to chassis.

4. Note that the following procedure uses 45.0 mc as the 100% reference point. Maintain the sweep generator output level so that the baseline-to-45 mc marker amplitude equals two inches.

VIDEO I-F ALIGNMENT CHART

CONNECT SWEEP GENERATOR	ADJUST	DESIRED RESPONSE	REMARKS
Into Test Point I (on R-F tuner) thru .001 mfd. capacitor. Center sweep frequency approx. 44 mc. Sweep width approx. 10 mc.	T153 for max. at 44.15 mc T152 to set 42.5 mc marker at 55% T151 to set 45.75 mc marker at 45% L135) See Remarks L152) Column		L135 & L152 should be adjusted to shape peak region of curve for symmetrical response consistent with proper 45.75 mc marker placement. Peak of curve may fall between the limits of 110% and 130% of 45 mc 100% reference point.

AUDIO I-F ALIGNMENT

NOTES:

1. Tune in a television signal. This will provide a 4.5 mc signal source for audio i-f alignment. Keep the volume control turned down unless the speaker is connected.

2. Step 3 below requires a meter connection to the electrical midpoint of the ratio detector load circuit. To do this, connect two 100,000-ohm resistors in series between V117 (6T8), pin 2 and chassis, see Fig. 26. These two 100,000-ohm resistors should be chosen as accurately as possible, for equal resistance.

AUDIO I-F ALIGNMENT CHART

STEP	CONNECT VTVM OR 20,000 OHMS/VOLT METER	ADJUST	METER INDICATION	REMARKS
1	Through 10K-ohm resistor to Test Point IX and chassis	T301	Adjust for maximum deflection	Voltage to be read is negative with respect to chassis.
2	V117, pin 2 and chassis	T302, primary (bottom core)		
3	Between Test Point X and center of two 100,000-ohm resistors, see Fig. 26.	T302, secondary (top core)	Adjust for zero volts d-c output	Repeat steps 1, 2, and 3 to assure proper final adjustment.

GENERAL ELECTRIC "H" LINE Schematic Diagram of Main Chassis

Models 21T26, 21T27, 21C240,
21C241, 21C242, 21C243,
21C244, and 21C245.

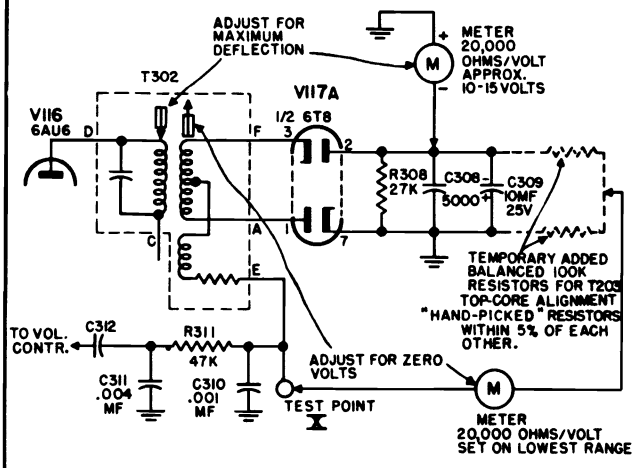
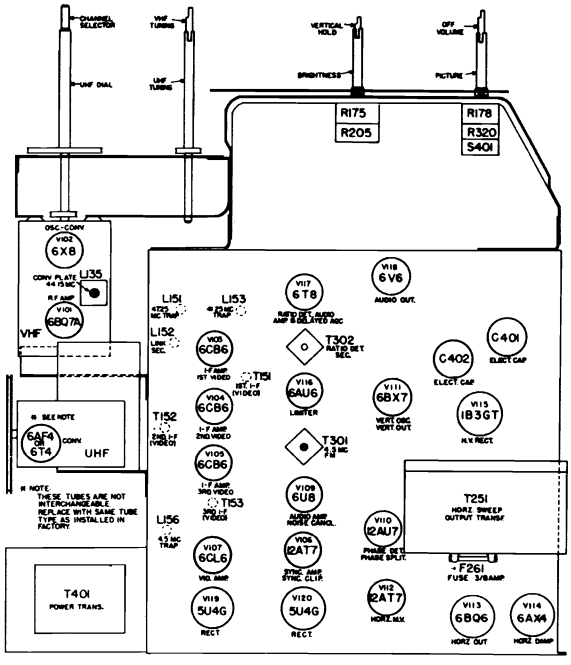
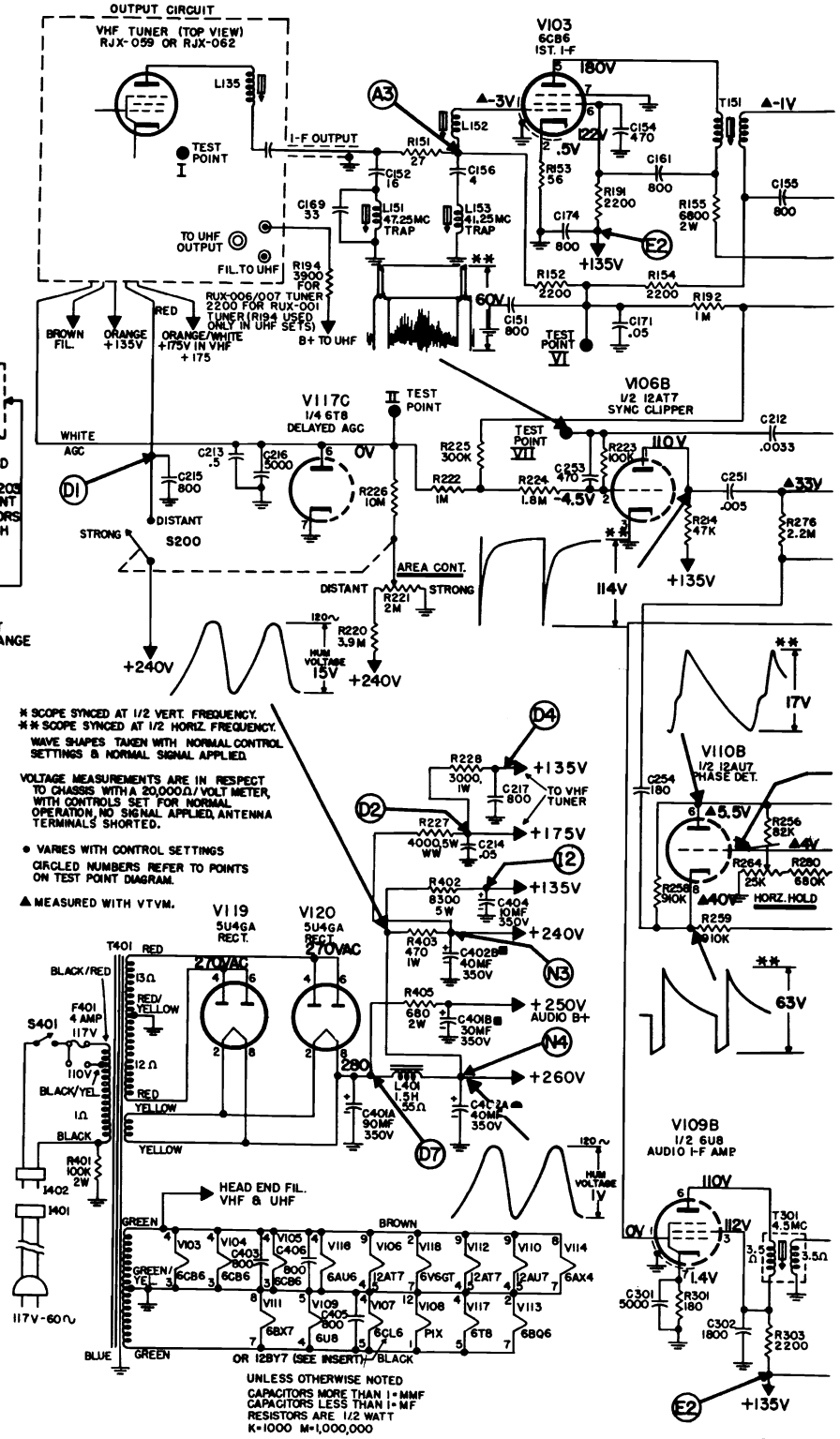


Fig. 26. Audio I-F Meter Connections



Top View

Fig. 27. Location of Tubes and Adjustments



† Late production 220K ohms

GENERAL ELECTRIC "H" LINE
(Continued)

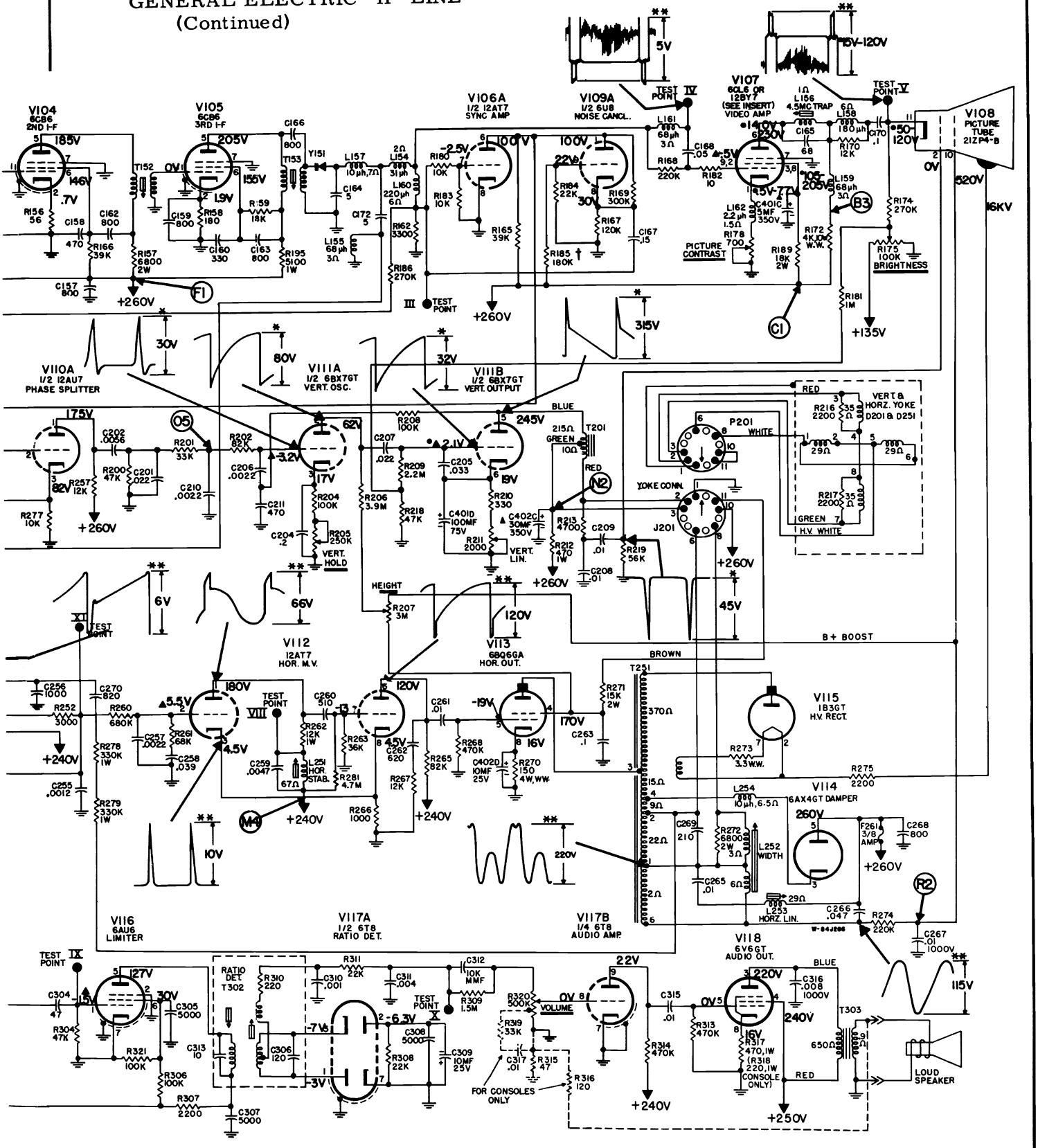
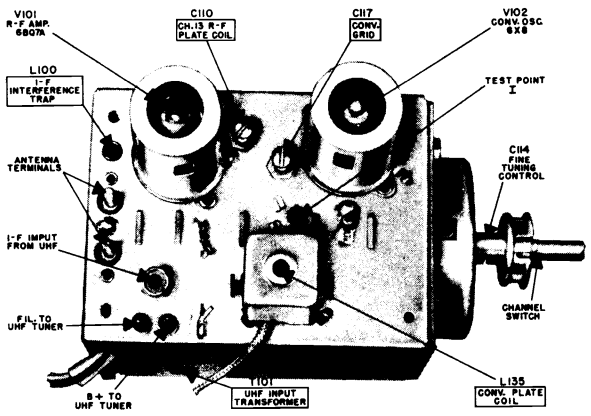
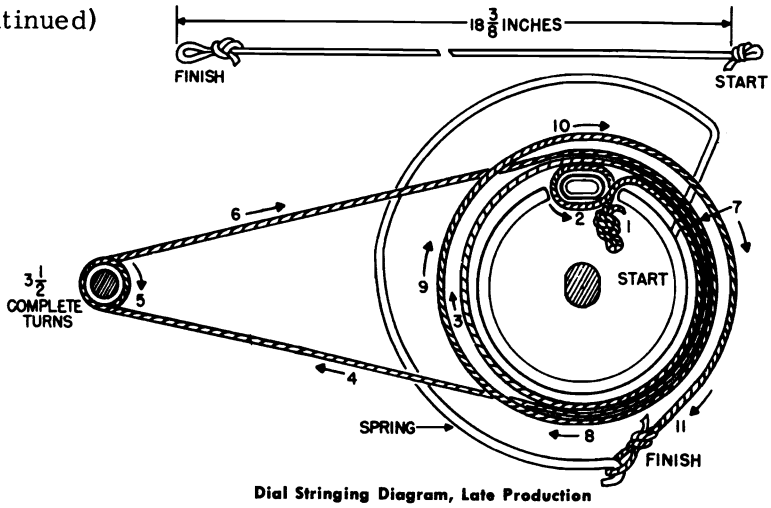


Fig. 35. Schematic Diagram, Main Chassis

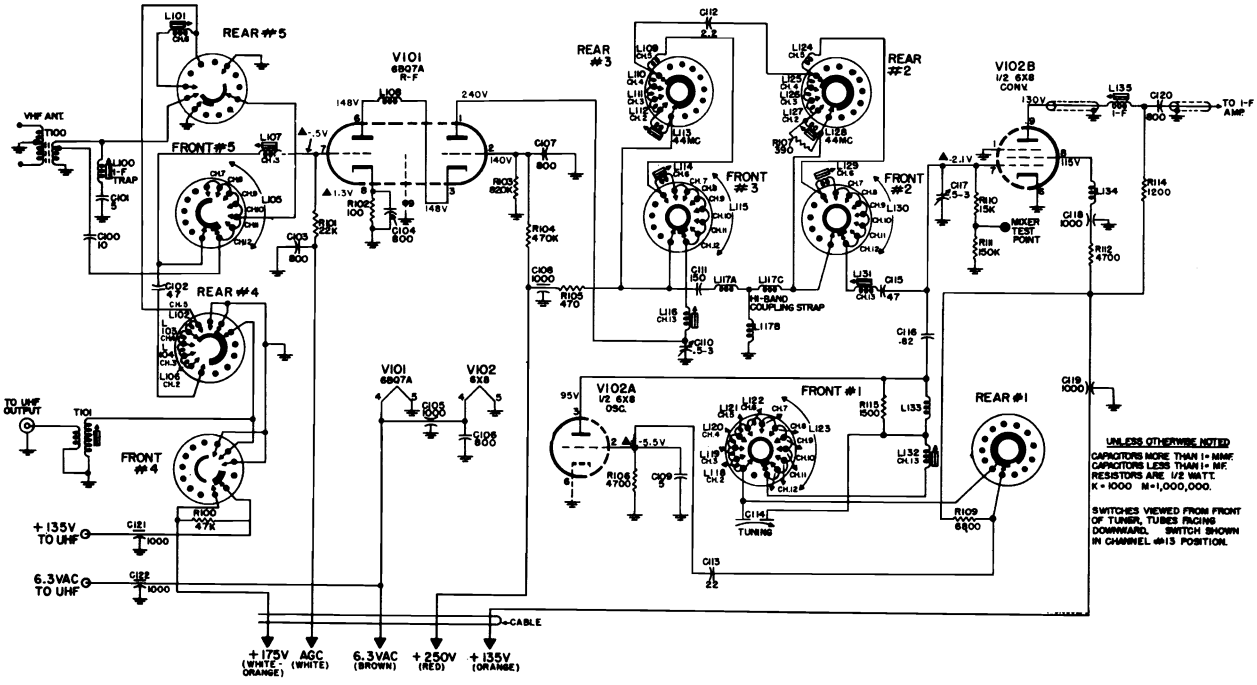
GENERAL ELECTRIC "H" LINE (Continued)



Top View of R-F Tuner



Dial Stringing Diagram, Late Production



Schematic Diagram for R-F Tuner (VHF), Late Production

PRODUCTION CHANGES

1. HORIZONTAL OSCILLATOR

Due to differences in 12AT7 tubes, used as a horizontal oscillator, it was found advisable to add a resistor (R281) 4.7 megohms in the grid circuit of V112B, to insure proper starting of the horizontal sweep.

2. HORIZONTAL OUTPUT

During late production the resistor R269 in the grid circuit of the horizontal output tube was removed.

3. VERTICAL SWEEP CIRCUIT

The vertical hold control R205 (150K ohms) was changed to 100K ohms. At the same time, R204 was changed from 120K ohms to 250K ohms.

4. B+ FOR UHF TUNERS

In order to accommodate for different UHF tuners, a resistor R194 was inserted in series with the B+ line to the UHF. This resistor is 3900 ohms for the RUX-006/007 and is 2200 ohms for the RUX-001 tuner.

5. VIDEO I-F AMPLIFIER

To decrease the power dissipation in the 2nd video i-f stage resistor R166 has been increased to 47K ohms and R157 to 10K ohms.

6. HORIZONTAL HOLD RANGE

To improve the horizontal sync, R280 was changed to 680K ohms and R252 was increased to 3000 ohms.

7. VIDEO AMPLIFIER

Late production receivers employ a 12BY7 tube as a video amplifier; included in this change is a new video peaking choke L160 (part number RLI-315), and a new 4.5 mc trap assembly (RLI-316) which includes choke L158 (part number RLI-304). For circuit diagram, see insert Fig. 35B.

8. NOISE CANCELLER CIRCUIT

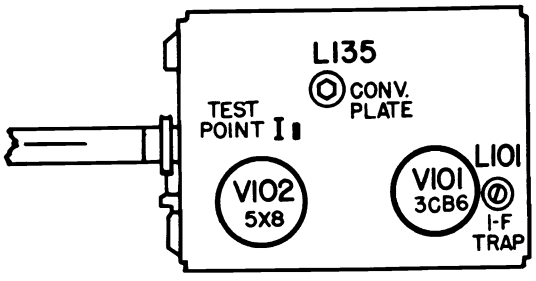
Late production receivers have the grid resistor of the noise canceller, R185, changed from 180K to 220K ohms, 5% (URD-1105) in order to avoid an overload condition which may cause top curl in the picture.

GENERAL ELECTRIC

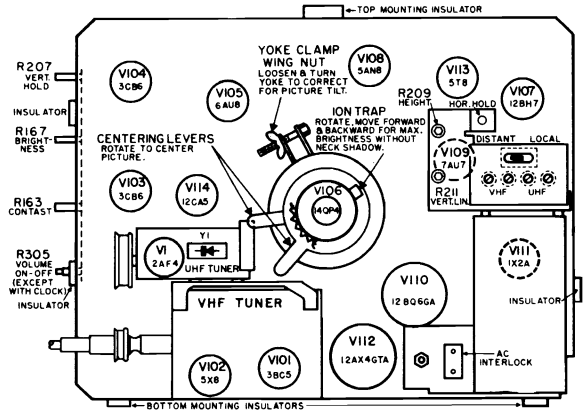
Models 14T007, 14T008, 14T009, 14T010, "M" Line Sets

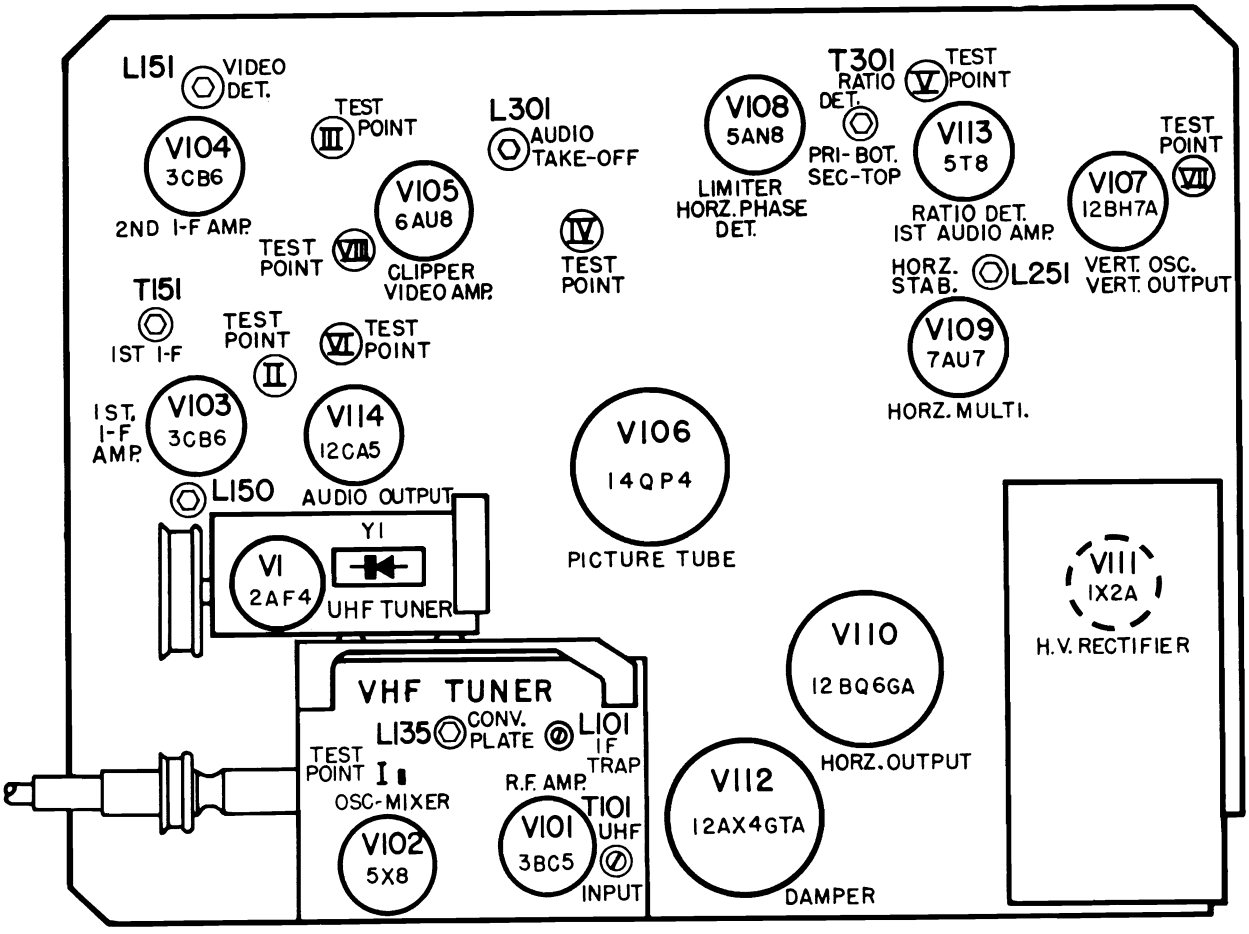
(Circuit diagram on pages 92-93; additional data on page 94)

The "M" series of receivers covered by this manual all incorporate the same basic chassis. Slight differences are necessary for the models having clock operation as the on-off switch is incorporated into the clock.



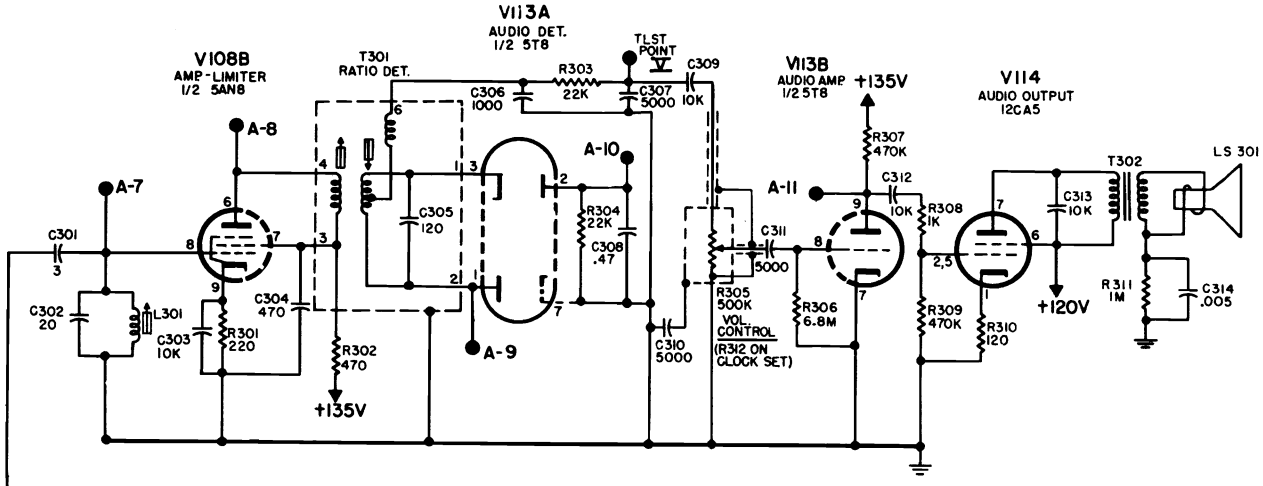
12 POSITION VHF TUNER (RJX-078)

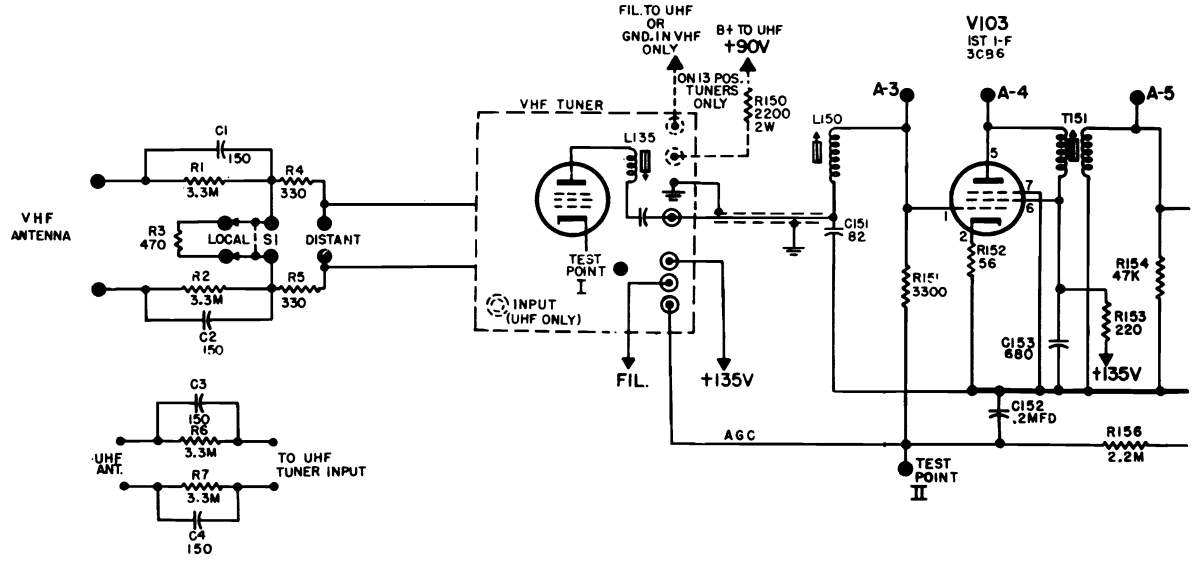


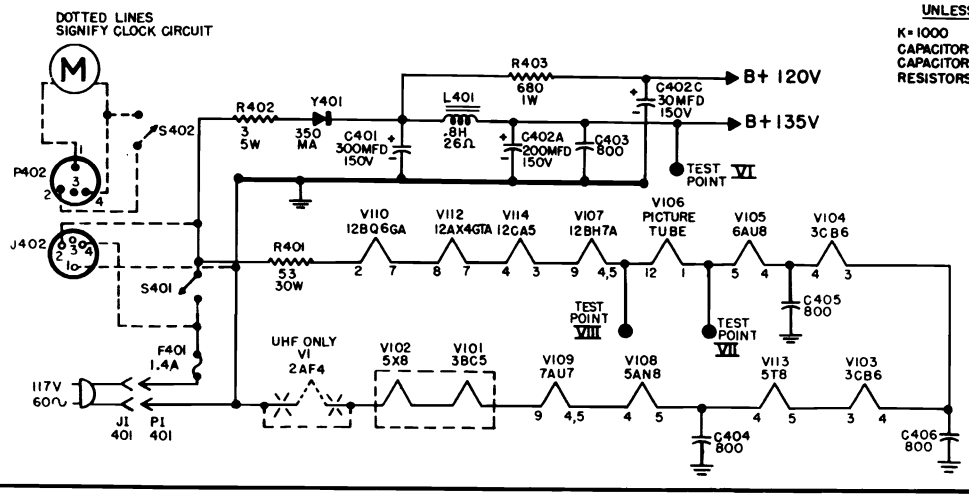


TUBE AND TRIMMER LOCATIONS WITH 13 POSITION VHF TUNER (RJX-077) AND UHF TUNER (RUX-013)

GENERAL ELECTRIC "M" LINE, Models 14T007, 14T008, 14T009, 14T010

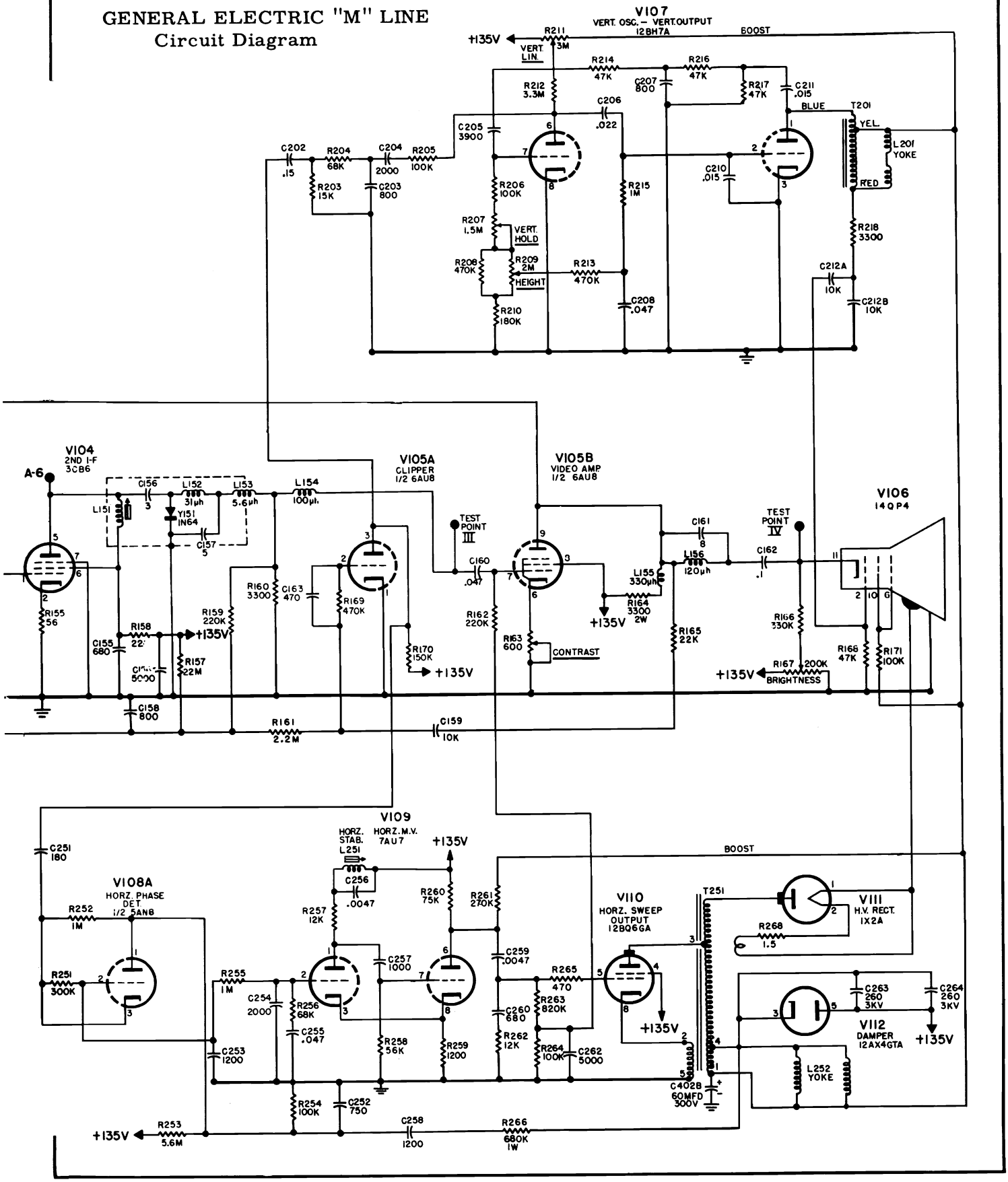






UNLESS OTHERWISE NOTED
K = 1000 M = 1,000,000
CAPACITORS MORE THAN 1 = MMF
CAPACITORS LESS THAN 1 = MF
RESISTORS ARE 1/2 WATT

GENERAL ELECTRIC "M" LINE
Circuit Diagram



GENERAL ELECTRIC "M" LINE, Models 14T007 to 14T010, Continued

SPECIFICATIONS

POWER INPUT RATING:	Frequency . . . . . 60 cycles Voltage . . . . . 110-125 volts Wattage at 117 volts (UHF-VHF)- 112W VHF only - 105W
R-F FREQUENCY RANGE:	Channels . . . . . No. 2 thru No. 13 Frequencies. . . 54-88 mc,174-216 mc For receivers with UHF Tuners - UHF Channels 14 thru 83: Frequencies . . . . . 470-890 mc
OPERATIONAL FREQUENCIES:	Picture I-F Carrier . . . 45.75 mc Sound I-F Carrier . . . . 41.25 mc Intercarrier sound take-off 4.5 mc
AUDIO POWER OUTPUT:	Undistorted . . . . . .7 watts Maximum . . . . . 1.5 watts
LOUDSPEAKER:	Type . . . . . Alnico PM Cone Diameter . . . . . 4 inches Voice Coil Impedance @ 400 cycles . . . . . 3.2 ohms
ANTENNA INPUT:	Built-in antenna provided External antenna terminals Impedance -300 ohms balanced to gnd. UHF antenna loop on receivers with UHF tuners

Suggested service practice includes the use of a 6SN7 with all but pins 7 and 8 removed asa substitute of the picture tube filament. Service may better be aided by the use of a 5AXP4 picture tube for bench operation as the yoke cable has no plugs and lead length does not easily adapt itself for out of the cabinet testing.

Service of the plated circuit sections may be made without removal of the sectional component boards from the main chassis. Leads should be clipped from the defective parts and new partssoldered to the existing leads. Where lead length is short the part may be cut in half and then the remaining ends broken away from the leads to give extra length. The use of a small soldering iron (not exceeding 50 watts) is recommended as the plating may be effected by the use of excess heat.

PICTURE TUBE ADJUSTMENTS

Yoke Position -Loosen the yoke clamp wing nut. Seat the yoke firmly against the bell of the picture tube and rotate the assembly to correct for any tilt of the picture,squaring the picture within the mask. Tighten the wing nut after adjustment is made.

Picture Centering -The levers and ring assembly for picture centering are located on the neck of the tube mounted directly on the rear of the yoke. Rotate the levers towards and away from each other to center the picture on the face.

Focus - On the back of the picture tube is a focus jumper connector. This is so designed as to connect pins 2 and 6 or 10 and 6 together. Best focus is usually found with pins 2 and 6 connected together (focus potential near ground). A check of focus quality may be made by changing this jumper.

Ion Trap -Power should not be applied to the receiver for extended periods of time without proper adjustment of the ion trap. Rotate and slide the ion trap on the neck of the picture tube to obtain maximum picture brightness without neck shadow and consistent with good focus. Brightness should be kept moderate during the ion trap adjustment.

TO REMOVE THE CHASSIS FROM THE CABINET

Remove any antenna connected to the antenna terminal board. Remove the screws securing the back to the cabinet and the nut holding the back to the chassis. Remove the back assembly.

Since there are no plugs on the speaker, if desired remove the nuts securing the speaker and remove the speaker or unsolder the lead connections to the speaker terminals.

Remove the knobs from the shafts on the side of the cabinet. Remove the picture tube socket, the ion trap, the centering lever assembly and the yoke clamp.

Remove the screw in the top center of the cabinet, on portable models this is the rear handle mounting screw - on the clock model this screw is located at the rear of the clock case. Remove the two bottom chassis screws. Tilt the chassis out from the right side, as viewed from the rear, at the same time pull the yoke back over the neck of the tube. Slide the chassis out over the neck of the tube. The anode should be discharged with a jumper, connected first to the chassis, and then disconnect the anode lead by squeezing the anode clip.

To install the chassis reverse the above procedure remembering the speaker leads go under the tuner shaft, the picture tube socket is dressed through the center hole so that all leads should be at the rear of the chassis. Tilt the left edge in and slide the chassis into the cabinet to where the control shafts line up with the respective holes. Connect the H.V. anode lead. Slide the yoke over the neck of the tube and then move both the yoke and the chassis forward to position.

REMOVAL OF THE SAFETY GLASS AND/OR PICTURE TUBE

Remove the two bottom screws securing the cabinet front and safety glass. On models with the portable handle it will be necessary to remove the handle by removing the handle front mounting screw nut. Remove the cabinet front by tilting the front out at the bottom.

The inside of the face glass and the picture tube face may now be cleaned. A solution of pure soap and water and a soft cloth is recommended for cleaning. Most other cleaning agents, sprays, detergents, or solvents are harmful to the safety glass and should not be applied.

It is necessary to first remove the chassis from the cabinet as outlined, in order to disconnect the H.V. anode lead.

The picture tube is secured by the clamping action of the cabinet projectors against the rim of the picture tube. Remove the two clamping screws from the top of the cabinet projection clamps while supporting the rear of the picture tube with one hand - slide the tube out through the front of the cabinet.

To replace the tube, reverse the above procedure remembering the following. The anode button should be positioned on the left side of the cabinet as you face the front.

GENERAL ELECTRIC

Models 17T21, 17T22, 21C106, 21C107, 21C108, 21C109, 21T32, 21T33, 21T36, and 21T37, "N" Line Sets.

All these sets use the same basic chassis. The essential difference between the 17" and 21" models are the picture tube type, the mounting position of the volume-contrast control, and slightly higher B+ needed in the 21" sets.

REMOVAL OF PICTURE TUBE

The picture tube may be removed without the necessity of removing the chassis. Remove the cabinet back and disconnect all cables and leads going to the picture tube. Remove the ION TRAP, CENTERING ASSEMBLY and DEFLECTION YOKE from the tube neck. Next, remove the knobs and the safety glass and overlay assembly on the front of the cabinet. This requires removal of three screws which secure the bottom of the glass assembly to the cabinet front rail just above and in front of the speaker grille. The picture tube and its mounting assembly may then be removed from the cabinet after removal of the four mounting bolts. When changing the picture tube, remember to transfer the pin #6 jumper and the overlay ground spring to the new tube.

Metal table cabinets require removal of the entire cabinet front. First, remove the front knobs and the two screws near the top front of each side of the cabinet. Tip receiver over on its side and remove the two front feet and the two adjacent securing screws. Insert screwdriver through hole in bottom of safety glass overlay and pry against cabinet projection to force overlay forward. Remove overlay. The picture tube strap engages the cabinet projections and must first be loosened before removal of the tube.

REPLACEMENT OF PICTURE TUBE

CONSOLE & WOODEN TABLE MODELS:

Picture tube replacement should be done in reverse of the above noted removal procedure. The anode button should be on the left side of the tube as viewed from the front of cabinet. Before tightening the four corner retaining bolts, the picture tube and strap assembly should be jigged properly to assure proper mechanical alignment of the tube within the overlay opening. In most cases the bottom side of the strap may rest on the loudspeaker textolite mounting board. In some cases, the assembly should be raised approximately 1/16 inch above the board. Replace safety glass assembly, knobs, yoke, centering unit and connect all leads and cables and adjust picture.

METAL TABLE MODELS:

When replacing the picture tube it should be inserted into the cabinet, using due care to prevent slippage of the tube with consequent neck breakage. The strap assembly should next be placed over the tube and cabinet projections, with the clamp bolt located at the bottom of the tube. Tighten the strap assembly nut and replace the safety glass and overlay, knobs, yoke, etc. Connect all leads and cables and adjust picture.

ALIGNMENT PROCEDURE

VIDEO I-F SYSTEM

The alignment of the I-F system involves the adjustment of 1 trap and 5 passband tank circuits. Allow at least 15 minutes warm-up for the receiver and test equipment before proceeding. Follow the usual precautions regarding equipment termination and cable dress. Some tuning cores will apparantly go through two peaks. In all cases, the cores should be tuned to the first peak starting from the "out" position. Adjustment locations are indicated in figure 7.

NOTES:

1. Set channel selector and volume control to channel 11. Turn fine tuning control fully counter-clockwise. Set contract control fully clockwise.
2. Connect sweep generator to capacity type jig shown in figure 5. If General Electric sweep equipment is used, the indicated resistors should be 470,000 ohms each or may be omitted.
3. Connect a 3 volt battery from Test Point II to chassis (positive battery lead to chassis).
4. Remove cap of horizontal sweep output, V110.
5. Connect scope through 10,000 ohms to Test Point III. Calibrate vertical gain of scope for 3 volts peak to peak for 2 inch deflection. When aligning, base-line to 45 mc marker should be kept at 2 inches. Refer to pre-peaking chart if alignment difficulty is experienced. Align as follows:

A-M PRE-PEAKING FREQUENCIES

L126 or L135	45.0 MC
L150 TRAP	47.25 MC
L151	43.3 MC
T151	45.25 MC
T152	42.9 MC
T153	44.15 MC

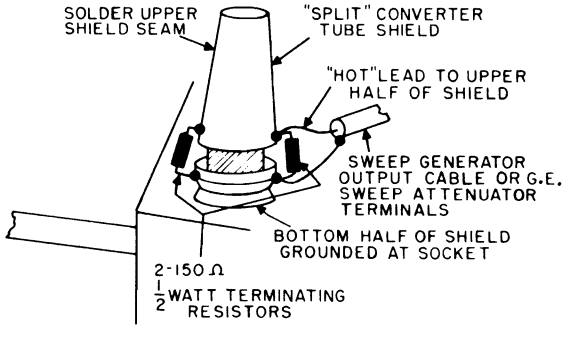


FIGURE 5. I-F SWEEP JIG

(Alignment continued on page 98)

GENERAL ELECTRIC "N" LINE, Circuit Diagram

HORIZONTAL AFC BALANCE ADJUSTMENT: This adjustment is of primary importance when the receiver is installed in an area of low signal strength and high impulse noise interference. The detector balance should be readjusted whenever the horizontal phase detector tube, V107, is changed, since optimum noise immunity in the horizontal AFC system is achieved when the phase detector is properly balanced. Set the channel selector to an an unoccupied channel and short circuit the antenna terminals at the tuner. With a VTVM, adjust for equal d-c voltage at Test Points VI and VIII measured to chassis. This voltage usually measures approximately 4.5 volts.

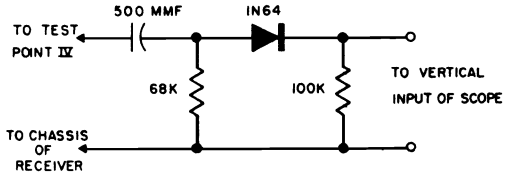


FIGURE 6. DETECTOR NETWORK

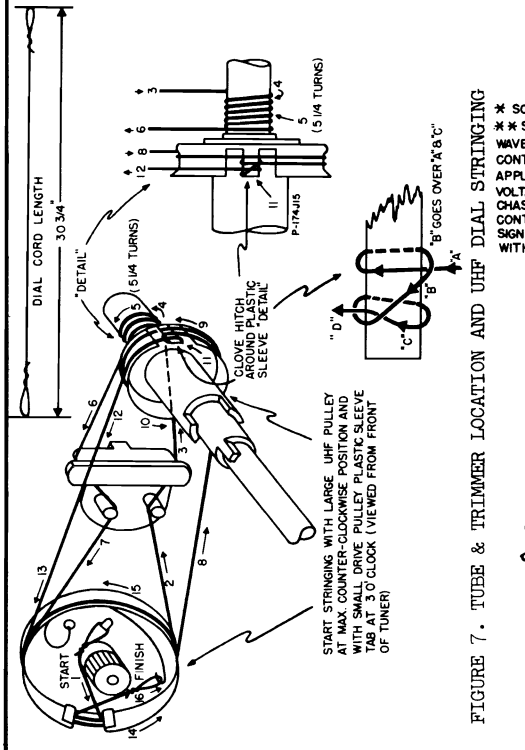
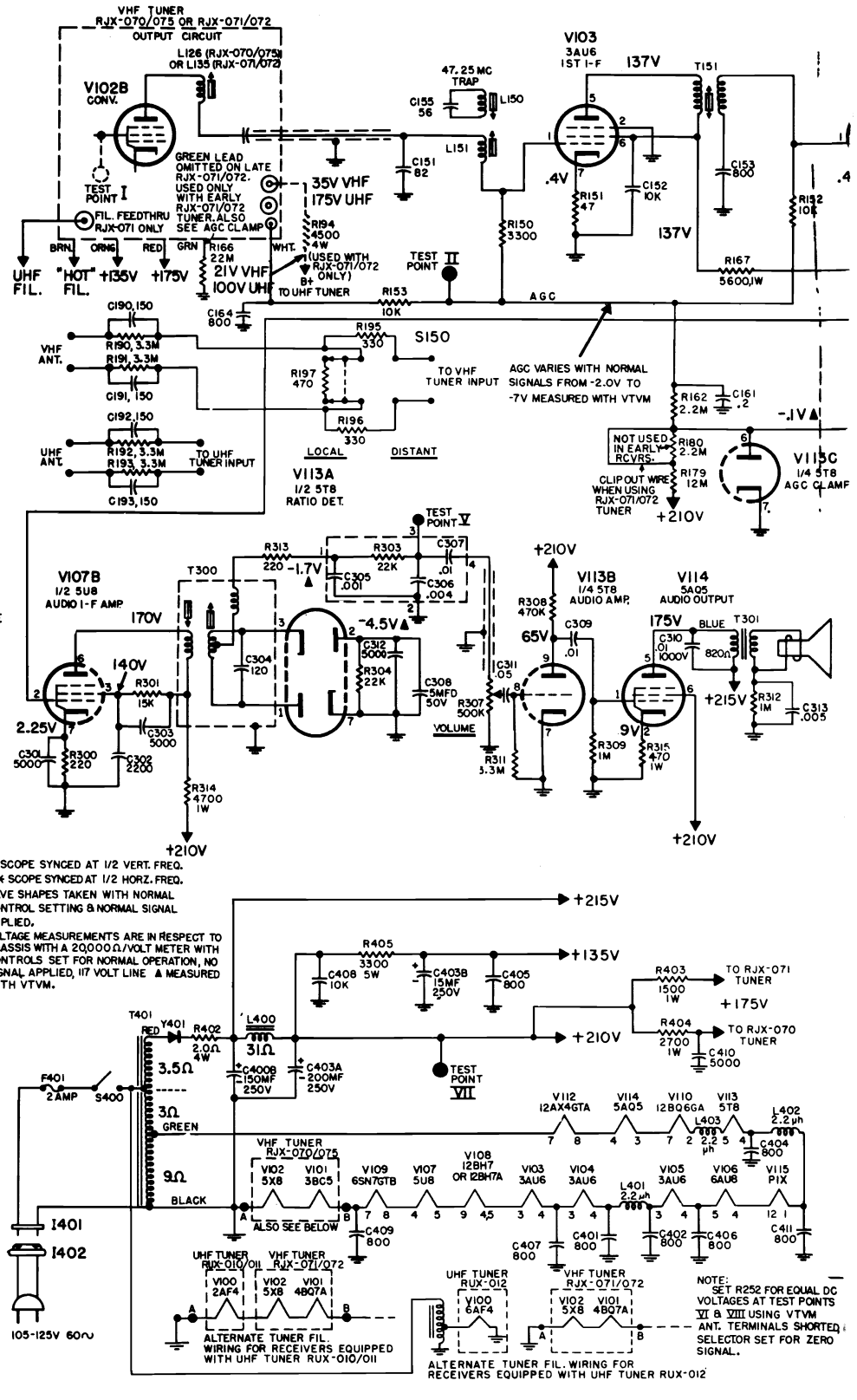


FIGURE 7. TUBE & TRIMMER LOCATION AND UHF DIAL STRINGING



GENERAL ELECTRIC "N" LINE, Circuit Diagram

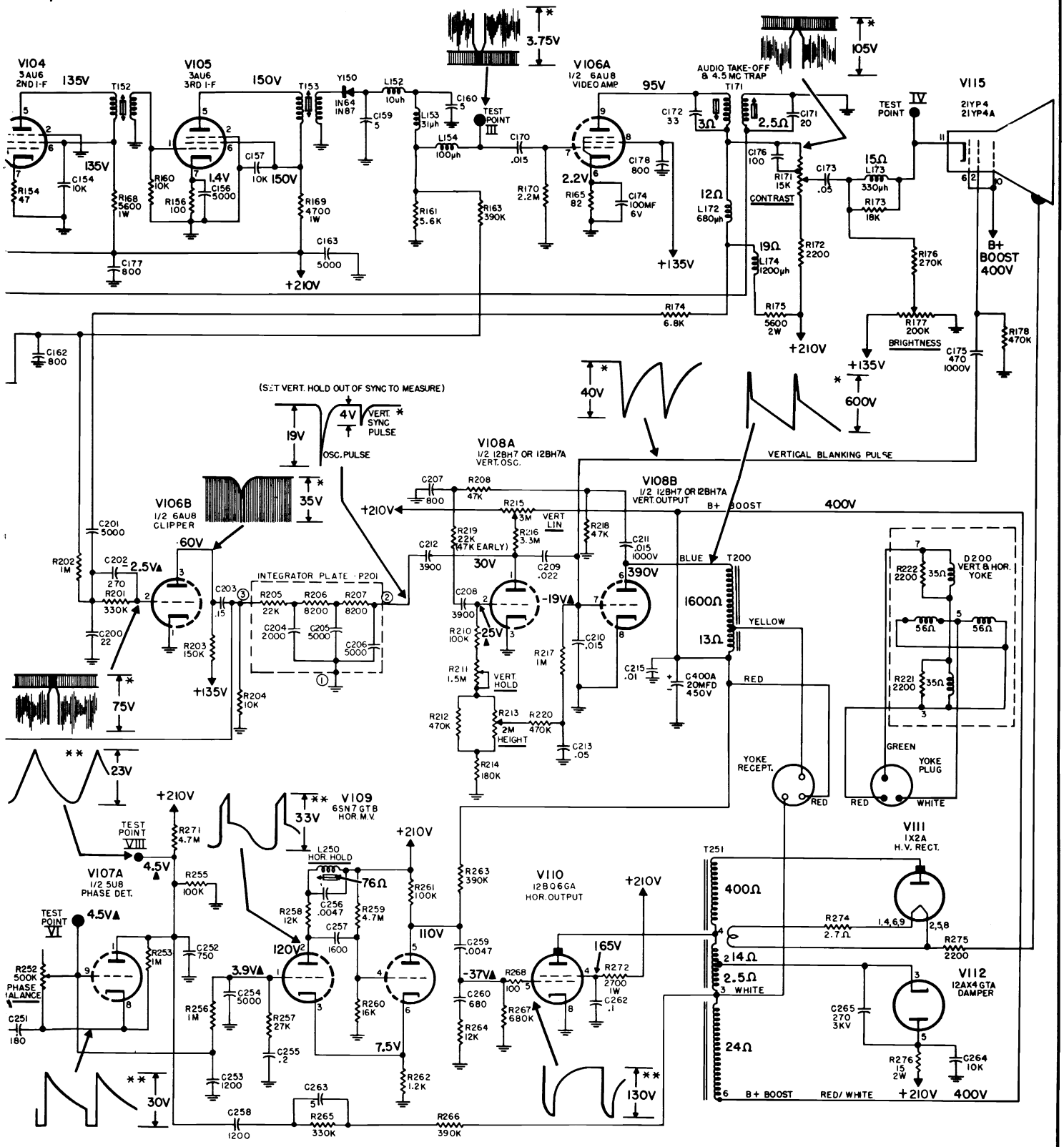
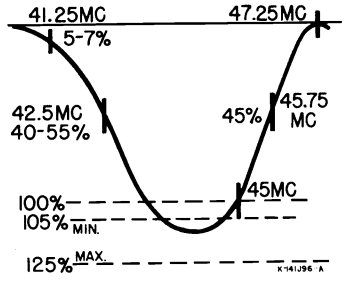


FIG. 12. 21 INCH "N" CHASSIS - SCHEMATIC DIAGRAM (WITH WAVESHAPES AND VOLTAGES)

GENERAL ELECTRIC "N" LINE, Alignment Information, Continued

VIDEO I-F ALIGNMENT CHART

STEP	ADJUST	DESIRED RESPONSE	REMARKS
1	L150 for minimum at 47.25 mc.		Adjust L126 or L135 simultaneously with L151. 41.25 mc marker is very critical and should be kept between limits of 5 to 7%. Peak of curve may fall between limits of 105% and 125% using 45 mc as the 100% reference.
2	T152 to set 42.5 mc marker at 40-55%.		
3	T151 to set 45.75 mc marker at 45%.		
4	L126 or L135 to set width of peak region of curve.		
5	L151 & T153 for peak region symetry.		

AUDIO I-F ALIGNMENT

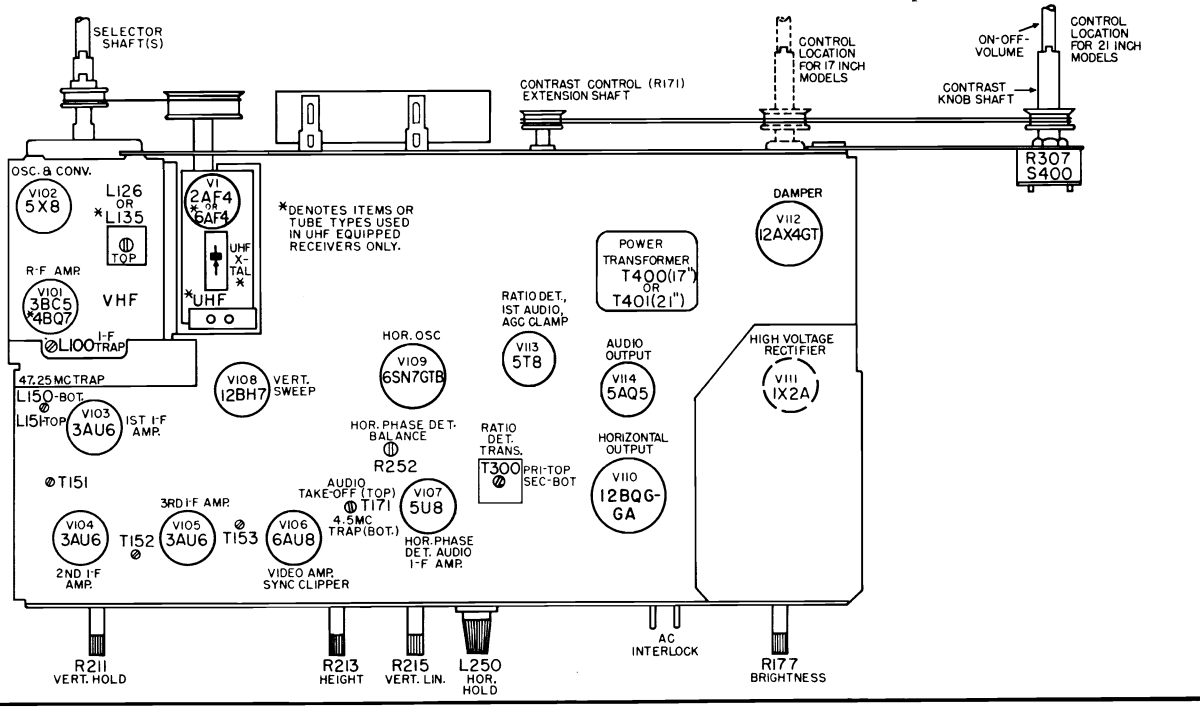
NOTES:
1. Tune in a television signal. This will provide a 4.5 mc signal source for audio i-f alignment. Keep the volume control turned down unless the speaker is connected.
2. Connect two 100,000 ohm resistors (in series) between pin #2 of V113 (5T8) and chassis.

AUDIO ALIGNMENT CHART

STEP	CONNECT VTVM OR 20,000 OHMS/VOLT METER	ADJUST	METER INDICATION	REMARKS
1	Between Pin #2 of V113A & chassis.	T171 secondary (top)	Adjust for maximum deflection.	Repeat steps 1, 2 and 3 to assure proper adjustments.
2		T300 primary (bottom)	Adjust for maximum deflection.	
3	Between Test Point V and the center of the two 100,000 ohm resistors.	T300 secondary (top)	Adjust for zero volts d-c output.	

4.5 MC TRAP ALIGNMENT:

1. Turn contrast control fully clockwise.
2. Connect detector network (Figure 6) to Test Point IV and set contrast to maximum. Connect oscilloscope to network.
3. Apply a 4.5 mc AM signal through .001 MF to Test Point III.
4. Tune the bottom core of T171 for minimum signal observed on oscilloscope.



GENERAL ELECTRIC

Models 21C40, 21C130, 21C131, 21C151, 21C152, 21C156, and 21C157, "O" Line of Sets (Service material on pages 99 through 103)

ELECTRICAL INSTALLATION ADJUSTMENTS

It is recommended that the receiver be permitted to operate for at least 15 minutes before the final raster adjustments are made.

Height & Vertical Linearity: These controls (R207 and R211), See Fig. 1, should be adjusted simultaneously to provide proper picture height consistent with good vertical linearity. The final adjustment should extend the picture approximately 1/8 inch beyond the mask limits.

Horizontal Size (Width) & Horizontal Linearity: These controls (L252 and L253) should be adjusted to provide proper picture width simultaneously with good horizontal linearity. The adjustments, when completed should extend the picture approximately 1/4 inch beyond the mask limits.

HORIZONTAL STABILIZER COIL:

This control is factory pre-set and should only require adjustment if the horizontal oscillator tube has been changed,or if horizontal instability becomes apparent in noisy signal areas.

1. With a signal turned in, adjust the horizontal hold control, R256, until the picture locks in place.
2. Connect a VTVM between Test Point XI and ground.
3. Re-adjust the stabilizer coil, L251, so that +5 volts appears at Test Point XI.

NOTE: If horizontal instability persists in noisy areas, observe picture and tune coil for best horizontal stability.

CAUTION NOTE:

A. DO NOT REMOVE THE 12AT7 HORIZONTAL OSCILLATOR WHILE POWER IS ON AS DAMAGE TO THE HORIZONTAL SWEEP OUTPUT TUBE (6BQ6-GA) WILL RESULT.

B. BEFORE INSTALLING A NEW 6BQ6-GA HORIZONTAL SWEEP OUTPUT - BE SURE TO CHECK THE HORIZONTAL OSCILLATOR (12AT7), OTHERWISE THE NEW 6BQ6-GA MAY BE DAMAGED.

A slide switch has been provided on the rear of the set just above the antenna connections to provide for reduction of signal in areas where extremely strong signals cause cross modulation interference.

PICTURE TUBE ADJUSTMENTS

ION TRAP -Power should not be applied to the receiver for any great length of time without the ion trap being properly adjusted. Rotate and slide the ion trap on the tube neck for position of maximum picture brightness consistent with best focus and without tube neck shadow. As maximum brightness with trap is approached, readjust the rear apron brightness control as required to keep picture brightness moderate during trap adjustment.

YOKE POSITION: (Picture Tilt) -Loosen yoke clamp wing nut and push deflection yoke to seat firmly against bell of picture tube. Rotate yoke and clamp to correct picture tilt (squaring of picture within picture mask). Tighten wing nut after adjustment.

PICTURE CENTERING: A lever and ring assembly used for picture centering clamps over the deflection yoke. Move the levers toward or away from each other until picture is centered within picture mask.

FOCUS: On the base of the picture tube is located a focus jumper. This jumper is so designed that it may be placed either between pin six and two, (focus effectively at ground potential) or pin six and pin ten (focus at B+ boost potential).

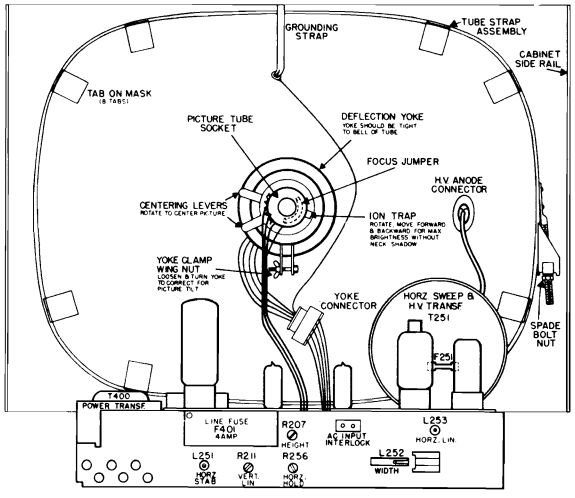


FIG. 1. PICTURE TUBE ADJUSTMENTS

REMOVAL OF THE PICTURE TUBE FROM THE CABINET

If it becomes necessary to remove the picture tube and/or mask, the following procedure should be observed.

1. Disconnect all electrical connections between the picture tube andyoke and the main chassis.
2. Remove the ion trap, centering rings and yoke from the neck of the tube.
3. Remove the four (4) small screws from the top glass retainer at the front of the cabinet,tilt the glass forward at the top and remove safety glass.
4. Remove the six screws (three on each side),-fastening the mask to the cabinet side rails.
5. Remove the mask and picture tube assembly from the front of the cabinet.
6. Loosen the spade bolt nut and remove the tube strap assembly. The picture tube may now be lifted from the mask.

PICTURE TUBE INSTALLATION

To reinstall a picture tube, the removal-instruction procedure may be applied in reverse. Additional items of note are, however, given as follows:

1. When replacing the tube in the mask be sure the anode connection is at the right of the mask as viewed from the rear.
2. Replace the strap assembly as to position the spade bolt and clamp at the side.
3. Slide deflection yoke over the neck of the tube and be sure it rests firmly against the bell of the tube. Tighten yoke clamp wing nut.
4. Replace remaining items on neck of tube,centering ring first and then ion trap.
5. Be sure ground wire eyelet is clipped to ground strap at the top of the tube.

GENERAL ELECTRIC "O" LINE, Alignment Information

VIDEO I-F SYSTEM

The following alignment data is divided into two separate procedures. Because of the large trap attenuation, the conventional method of sweep observation of these traps becomes difficult. Hence all traps shall be pre-tuned by applying an amplitude-modulated signal and adjusted for minimum signal output.

The second portion of this procedure involves the shaping of the i-f response curve in the conventional manner by the application of a sweep generator signal. During this procedure, observe the usual precautions regarding warm-up time,equipment cable lead dress and generator output cable termination.

GENERAL NOTES:

1. Allow receiver and alignment equipment to warm up for 20 minutes before proceeding.
2. Set channel selector switch to channel #11, 12 or 13. Check for oscillator influence by turning the fine tuning control. If the shape of the response curve changes, switch to another high-frequency channel where oscillator influence is not noted. Set tuning control maximum clockwise.
3. Turn the volume control fully counter-clockwise. Turn the picture contrast control fully clockwise.
4. Remove V114 during alignment.
5. In order that the action of the noise inverter (V107A)does not cause false information during alignment,it is advisable to connect a 100,000 ohm resistor between pin #8 (V107) and B+ 275V. Be sure to remove the resistor after alignment.

TRAP ALIGNMENT

GENERAL:

As noted above, an AM signal is required for trap alignment. In many cases, the technician will have a suitable AM signal generator available. It should cover the range of 35 to 48 megacycles at fundamental frequency, with available internal 400 cycle modulation. When this type of signal is used, the traps should be adjusted for minimum 400-cycle signal as observed on the oscilloscope.

Those technicians who do not have equipment available to produce suitable signals should not attempt the trap alignment procedure. With the exception of the 4.5 mc audio trap L156, the traps should not become seriously misaligned due to tube change. The 4.5 mc audio trap L156, may be sweep aligned, if necessary, by substituting a 4.5 mc sweep signal in Step 3 below. The trap may then be tuned for minimum response at 4.5 mc as marked by a calibrated signal.

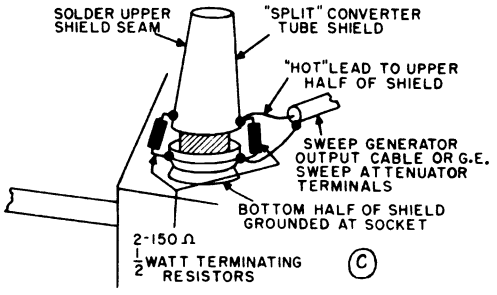


FIG. 2 TEST EQUIPMENT TERMINATION

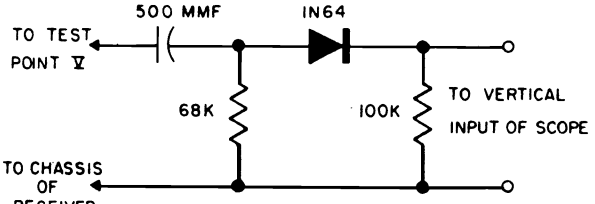


FIG. 4. DETECTOR NETWORK

STEP	AM-GENERATOR INPUT POINT	AM-GENERATOR FREQUENCY	ADJUST	REMARKS
1	Plate of conv. tube thru .001cap. to unGnd. tube shield **	47.25 mc	L151)	Connect scope to Test Point V; maximum vertical gain may be required. Connect detector network between oscilloscope input & receiver Test Point V as shown in Figures 8 & 11.
		41.25 mc	L152) for minimum	
2		39.25 mc	L153 for maximum	
3	Test Point IV (Diode Load).	4.5 mc	L156	

**See Fig. 2C

I-F SYSTEM, SWEEP ALIGNMENT

Now that the traps have been set at their proper frequencies, the i-f curve may be shaped.

PRE-PEAKING:

Should difficulty be experienced in obtaining the proper video i-f response as may be experienced when the set is far out of alignment, the tuning of the individual coils may be checked.

If each coil is peaked at the respentive frequency specified below with an AM signal as prescribed for setting traps, an overall i-f response curve which closely approximates the proper curve will be achieved. After this is done, the sweep method may be used to thus permit proper final curve shaping. This peaking may be done by using an AM signal as prescribed for setting the traps, or the sweep method may be used by adjusting the coils for maximum amplitude at the desired marker points.

Since it may be possible to obtain two peaks through the coil adjustment range, make certain the coil is aligned for the first peak (slug starting from out position).

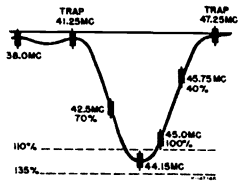
Begin alignment of Peaking Frequencies with T153.
T153 -44.15 mc T151 -44.8 mc
L150 -44.15 mc T152 -42.9 mc
L153 -43.0 mc

NOTES:

1. Turn picture contrast control to minimum.
2. Observe sweep waveform at Test Point III through a 10,000-ohm resistor. Oscilloscope should be calibrated so that 5 volt signal will provide 2-inch vertical deflection.
3. Apply a negative 4 1/2 volt battery bias voltage to Test Point VI. Connect positive lead of battery to chassis.
4. Note that the following procedure uses 45.0 mc as the 100% reference point. Maintain the sweep generator output level so that the baseline-to-45 mc marker amplitude equals two inches.

GENERAL ELECTRIC "O" LINE, Alignment Information, Continued

VIDEO I-F ALIGNMENT CHART

CONNECT SWEEP GENERATOR	ADJUST	DESIRED RESPONSE	REMARKS
To ungrounded tube shield, Fig. 2C through .001 capacitor center sweep frequency approximately 44 mc Sweep width approximately 10 mc.	T153 for max. at 44.15 mc. T152 to set 42.5 mc marker at 70% T151 to set 45.75 mc marker at 40% L135)See Remarks L150)Column		L135 & L150 should be adjusted to shape peak region of curve for symmetrical response consistent with proper 45.75 mc marker placement. Peak of curve may fall between the limits of 110% and 135% of 45 mc 100% reference point.

AUDIO I-F ALIGNMENT

NOTES:

1. Tune in a television signal. This will provide a 4.5 mc signal source for audio i-f alignment. Keep the volume control turned down unless the speaker is connected.
2. Step 3 below requires a meter connection to the electrical midpoint of the ratio detector load circuit. To do this, connect two 100,000-ohm resistors in series between V117 (6T8) pin 2 and chassis. These two 100,000-ohm resistors should be chosen as accurately as possible, for equal resistance.

AUDIO I-F ALIGNMENT CHART

STEP	CONNECT VTVM OR 20,000 OHMS/VOLT METER	ADJUST	METER INDICATION	REMARKS
1	To Test Point IX and chassis	T301	Adjust for maximum deflection.	Voltage to be read is negative with respect to chassis
2	V117 pin 2 and chassis	T302 primary (bottom core)		
3	Between Test Point X and center of two 100,000 ohm resistors.	T302 secondary (top core)	Adjust for zero volts d-c output.	Repeat steps 1, 2 and 3 to assure proper final adjustment.

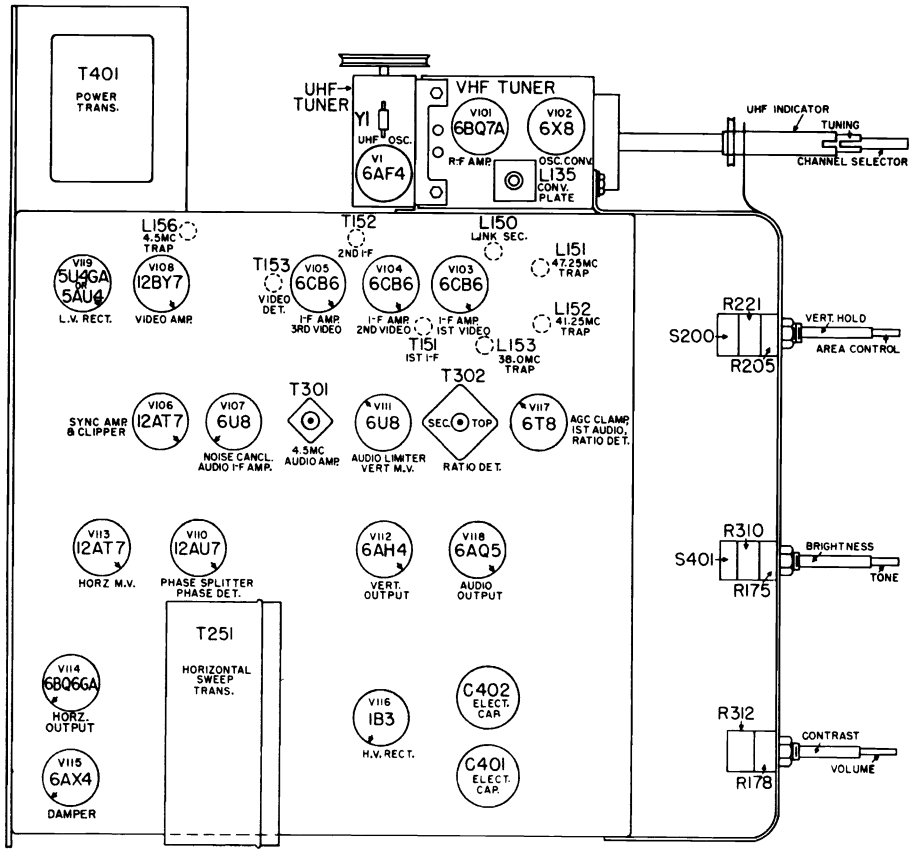


FIG. 5 LOCATION OF TUBES & ADJUSTMENTS

GENERAL ELECTRIC "O" LINE Main Chassis Schematic with Waveforms

Models 21C40, 21C130, 21C131,
21C151, 21C152, 21C156, 21C157.

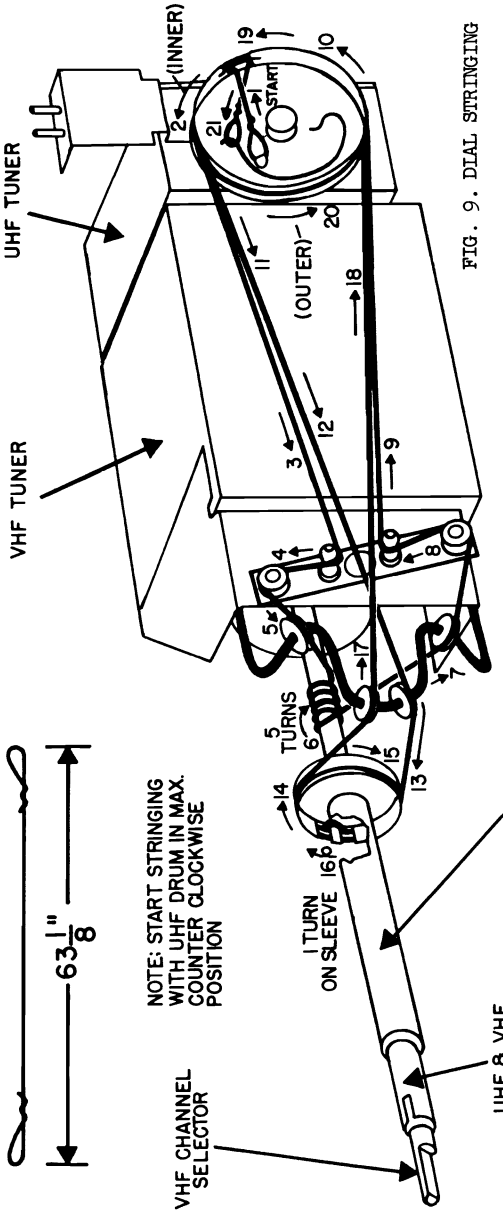


FIG. 9. DIAL STRINGING

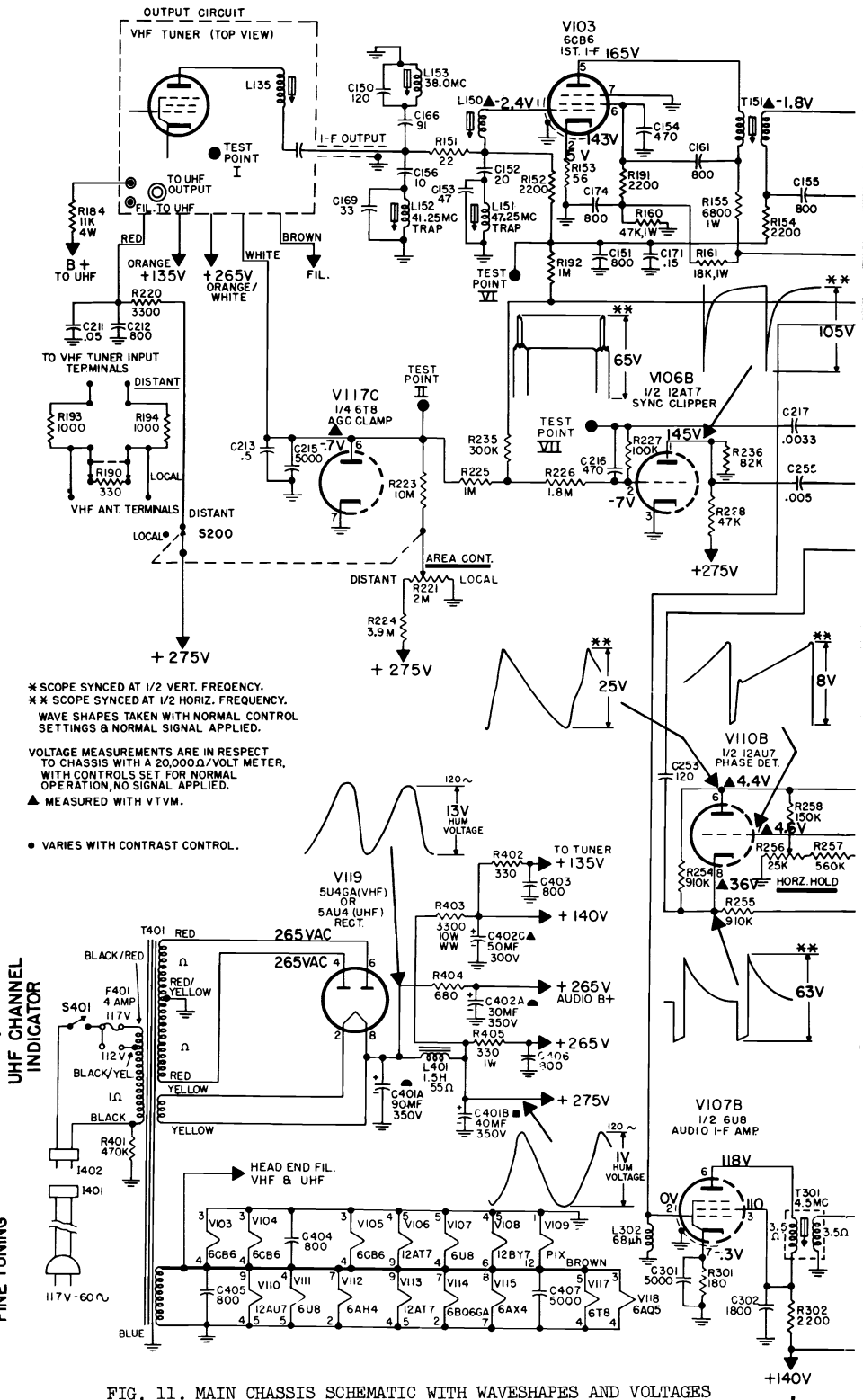
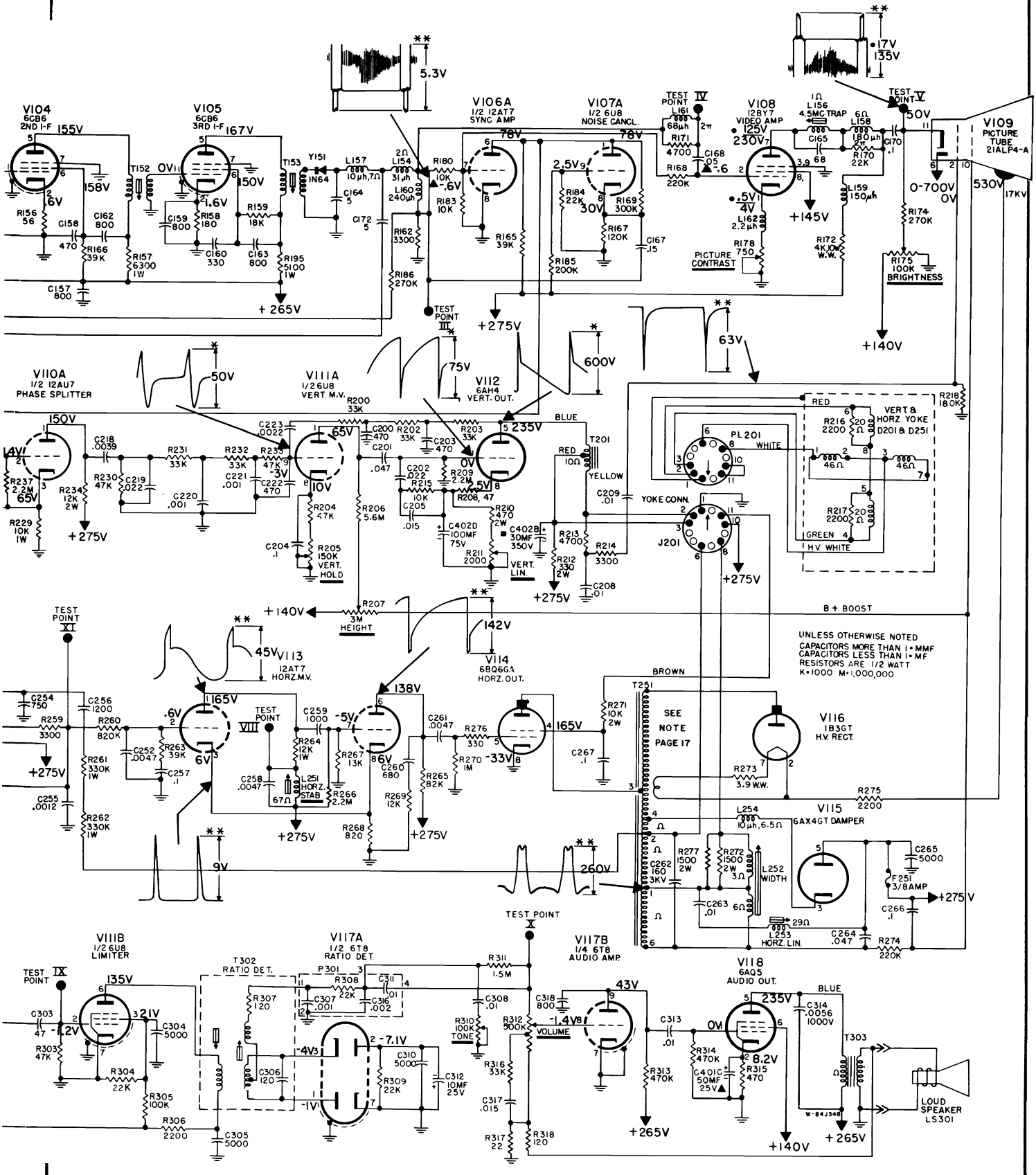


FIG. 11. MAIN CHASSIS SCHEMATIC WITH WAVESHAPES AND VOLTAGES

GENERAL ELECTRIC "O" LINE Circuit Diagram



hallicrafters

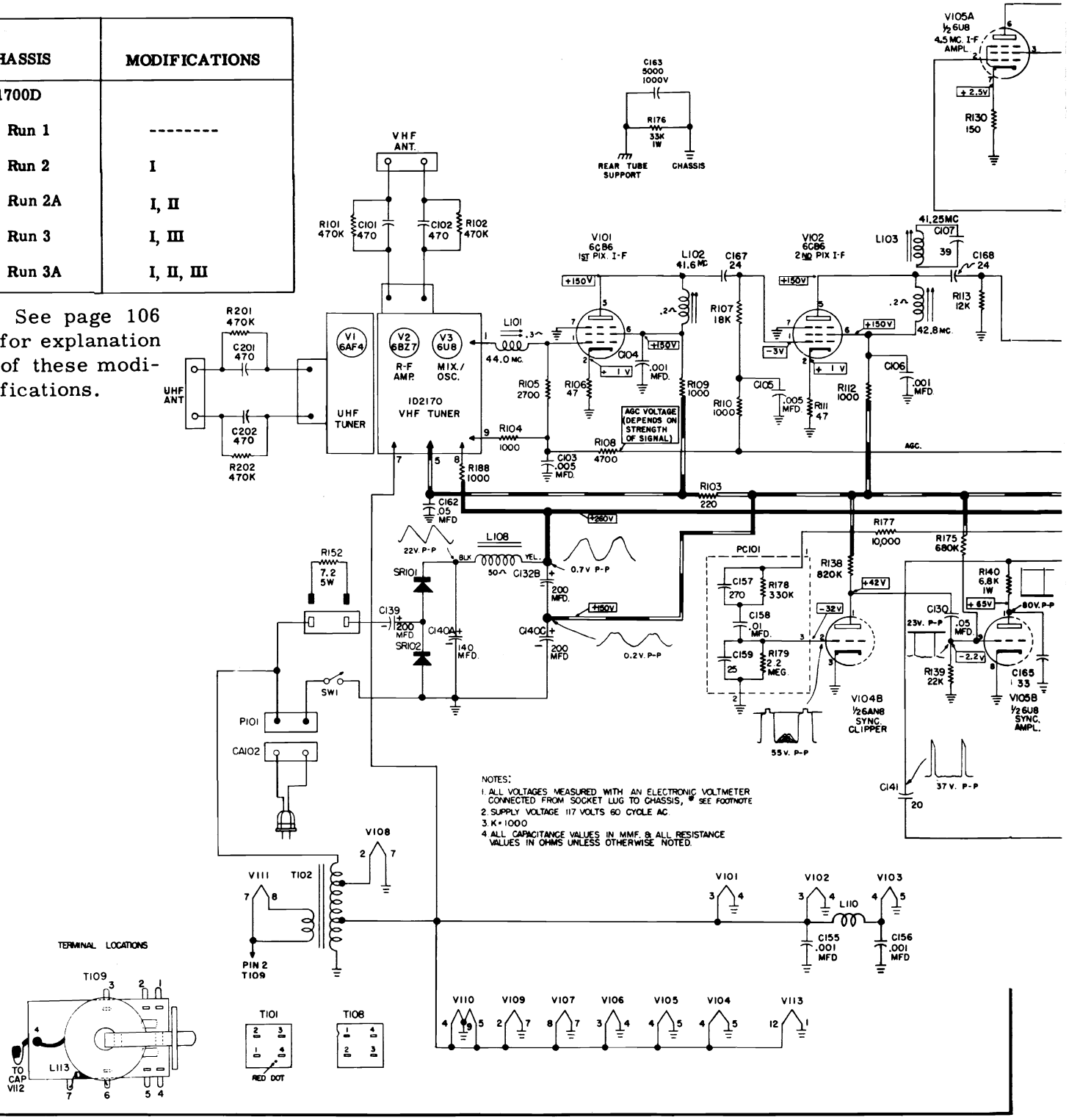
VHF-UHF 21" CHASSIS A1700D

MODELS CHASSIS MAY BE USED IN
21T321W, 21T321M, 21T321B 21K331M, 21K331B 21K341M, 21K341B

COMPARISON CHART

CHASSIS	MODIFICATIONS
A1700D	
Run 1	--------
Run 2	I
Run 2A	I, II
Run 3	I, III
Run 3A	I, II, III

See page 106 for explanation of these modifications.



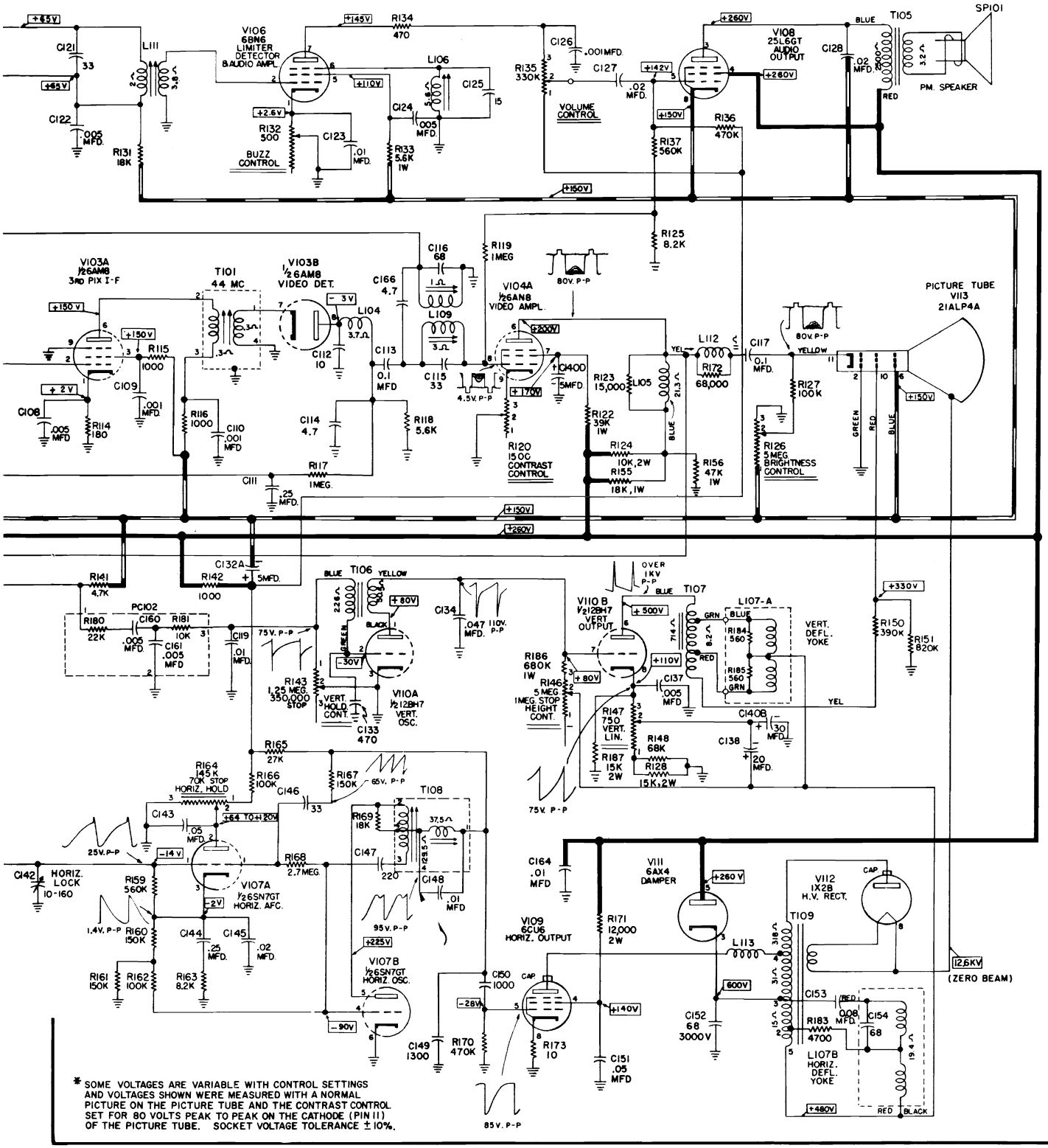
HALLICRAFTERS Chassis A1700D Circuit Diagram

(See list of models on page 104)

21" CHASSIS

A1700D

RUN 1



* SOME VOLTAGES ARE VARIABLE WITH CONTROL SETTINGS AND VOLTAGES SHOWN WERE MEASURED WITH A NORMAL PICTURE ON THE PICTURE TUBE AND THE CONTRAST CONTROL SET FOR 80 VOLTS PEAK TO PEAK ON THE CATHODE (PIN 11) OF THE PICTURE TUBE. SOCKET VOLTAGE TOLERANCE ±10%.

HALLICRAFTERS Chassis A1700D Service Material, Continued

LIST OF MODIFICATIONS

MODIFICATION I

A. R-170 (470,000 ohms ½ watt, carbon) is replaced by R-170-1 (390,000 ohms ½ watt, carbon).

B. R-173 is deleted from cathode circuit of V-109.

C. C-150 (1000 mmf. 500 V., ceramic disc) part number 47A503 is replaced by C-150-1 (0.02 mfd. 500 V., ceramic disc) part number 47A242.

D. C-152 (68 mmf. 3000 V., ceramic disc) part number 47B473 is replaced by C-152-1 (56 mmf. 3000 V., ceramic disc) part number 47A555.

E. T-109 (55B253) including parasitic suppressor L-113 is replaced by T-109-1 (55B266) Flyback Transformer.

F. L-114 (53A307) is added between cathode pin 3 of V-111 and the junction of terminal 1 of new flyback transformer and C-152-1.

G. The ungrounded side of C-149 is removed and connected to Grid Pin 5 of V-109.

MODIFICATION II

A. T-102 (52C322) is replaced by T-102-1 (52C341) which is identical except that the tap for V-108 is a 12 volt lead.

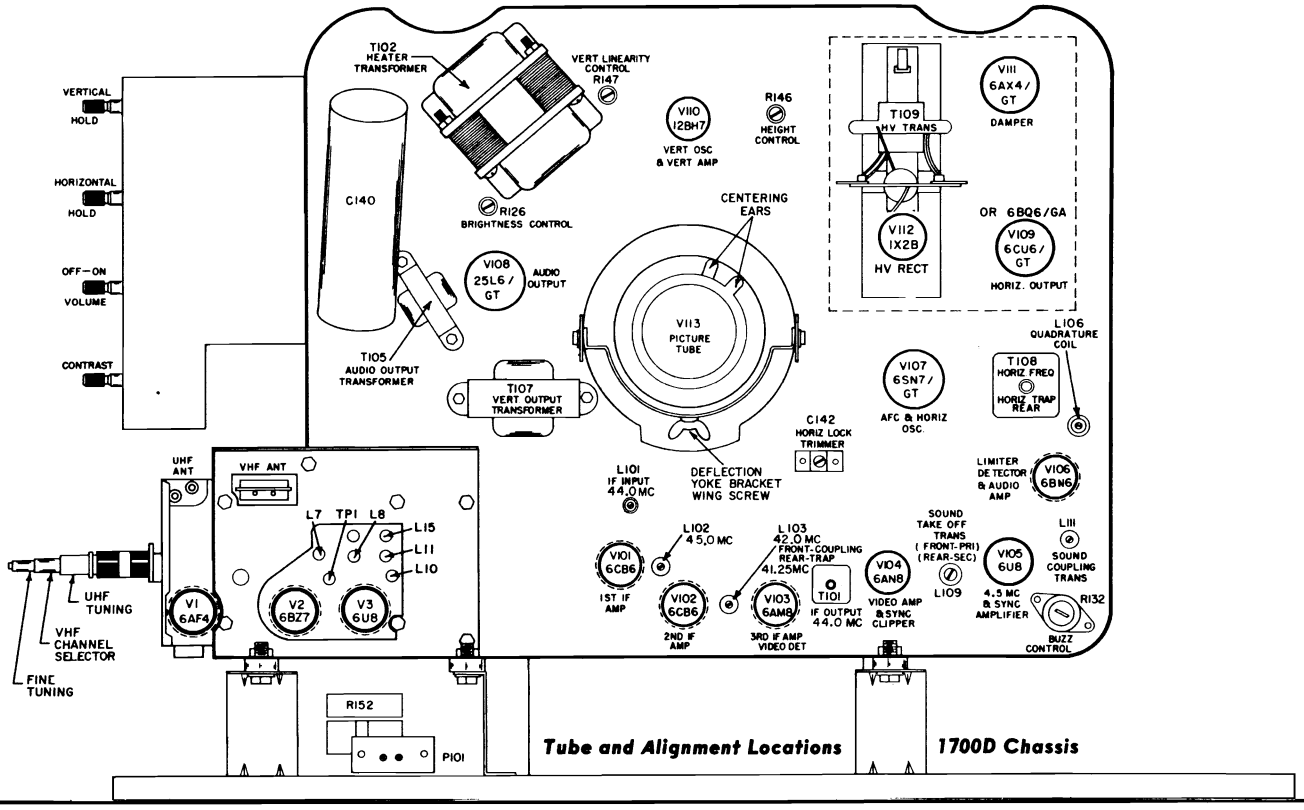
B. V-108 (25L6-GT) is replaced by V-108-1 (12L6-GT).

MODIFICATION III

A. T-109-1 (55B266) as listed in Modification I is replaced by T-109-2 (55D270) Horizontal Flyback Transformer.

B. C-152-1 is deleted.

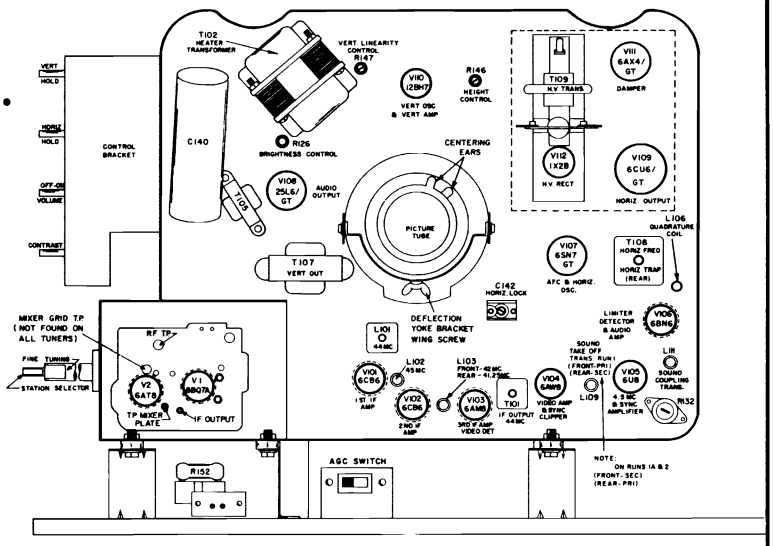
C. C-172 and C-173 (100 mmf. 3000 V., ceramic disc) are added across horizontal deflection winding.



the hallicrafters co.

CHASSIS IDENTIFICATION

Chassis Type	Models Chassis May Be Used In
A1850 D	21K330MA, 21K330BA, 21K340MA 21K340BA, 21T420M, 21T420B
B1850 D	21T421M, 21T421B
C1850 D	24T430M, 24T430B
D1850 D	24T431M, 24T431B



Tube and Alignment Locations for A1850D C1850D

The circuit on pages 108-109 is exact for Chassis A1850D, Run 1, and C1850D, Run 1. The circuits of Run 1 of Chassis B1850D and D1850D are practically the same as these other chassis, but have an additional UHF tuner. All these chassis of Run 1A have modification I, and all of Run 2 have modifications I and II.

LIST OF MODIFICATIONS

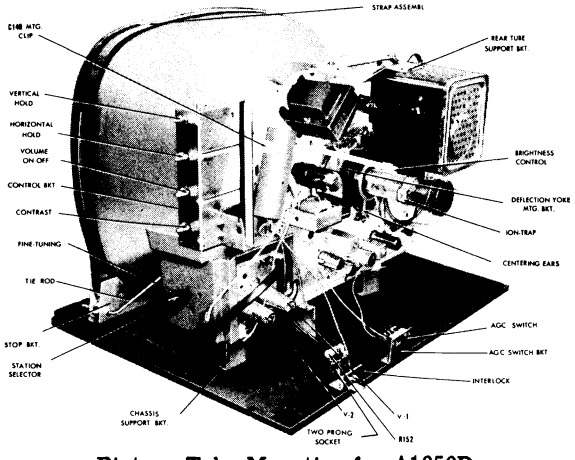
MODIFICATION I.

To improve audio and video characteristics, the following changes were made:

a. L109(51A1858) has been replaced by L109-1 (51A1996) Runs 1A and 2.

b. L104 is coupled direct to L109.

c. L115 is placed between L109-1 and Grid (Pin 7) of Video Amplifier tube V104A.



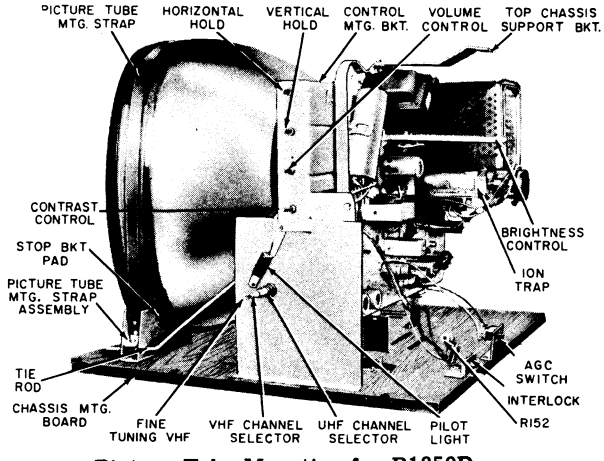
Picture Tube Mounting for A1850D

MODIFICATION II.

a. Center tap between points 5 and 6 has been brought out of T109-1 (Run 2) Flyback Transformer and run direct to R183. This center tap becomes point 2 and resistances now read 9.6 ohms between point 6 and 2 and 10 ohms between point 2 and 5.

b. C174 added across points 5 and 6 on T109-1.

c. C172 and C173 eliminated.



Picture Tube Mounting for B1850D

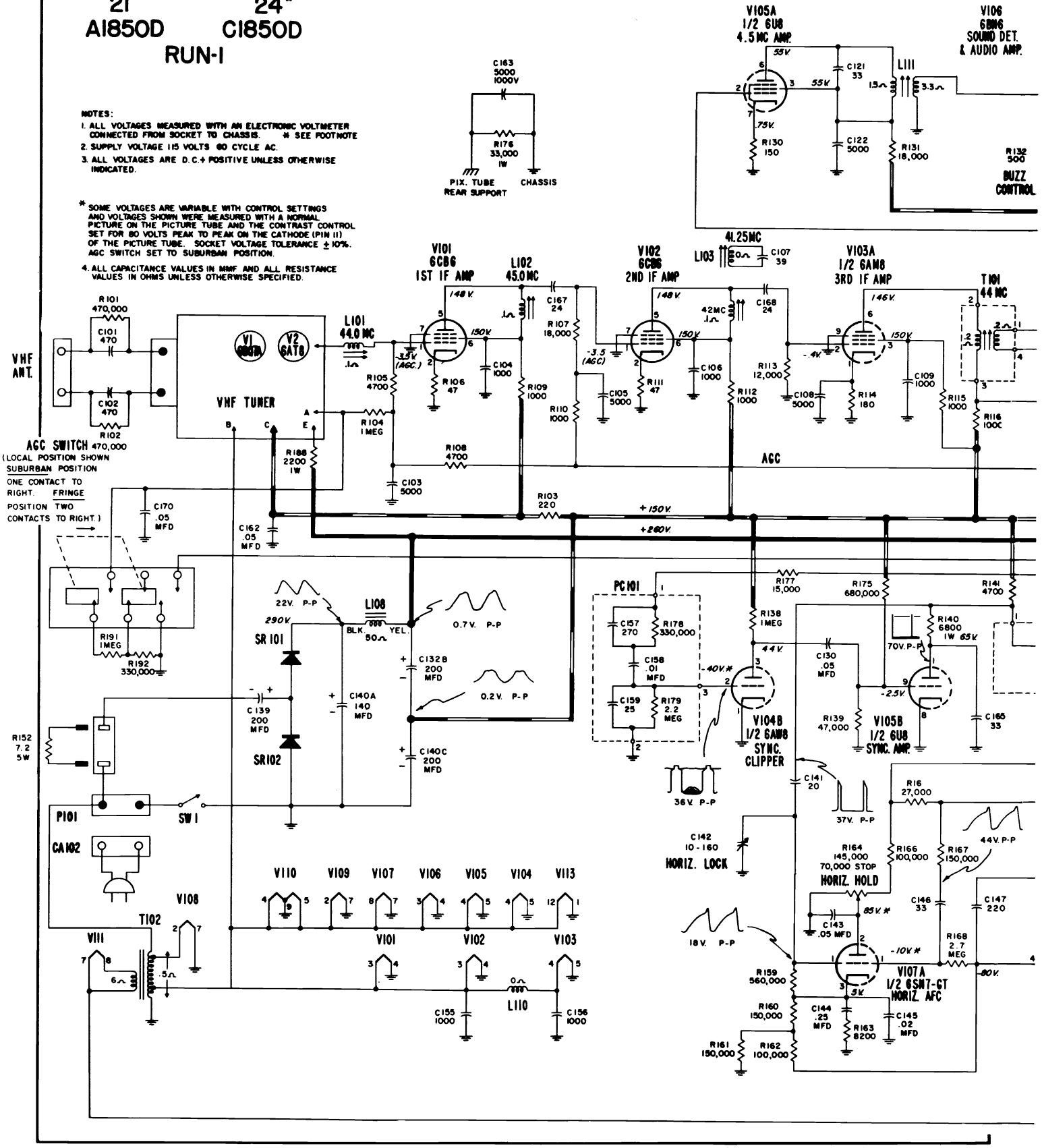
VHF CHASSIS

21" A1850D

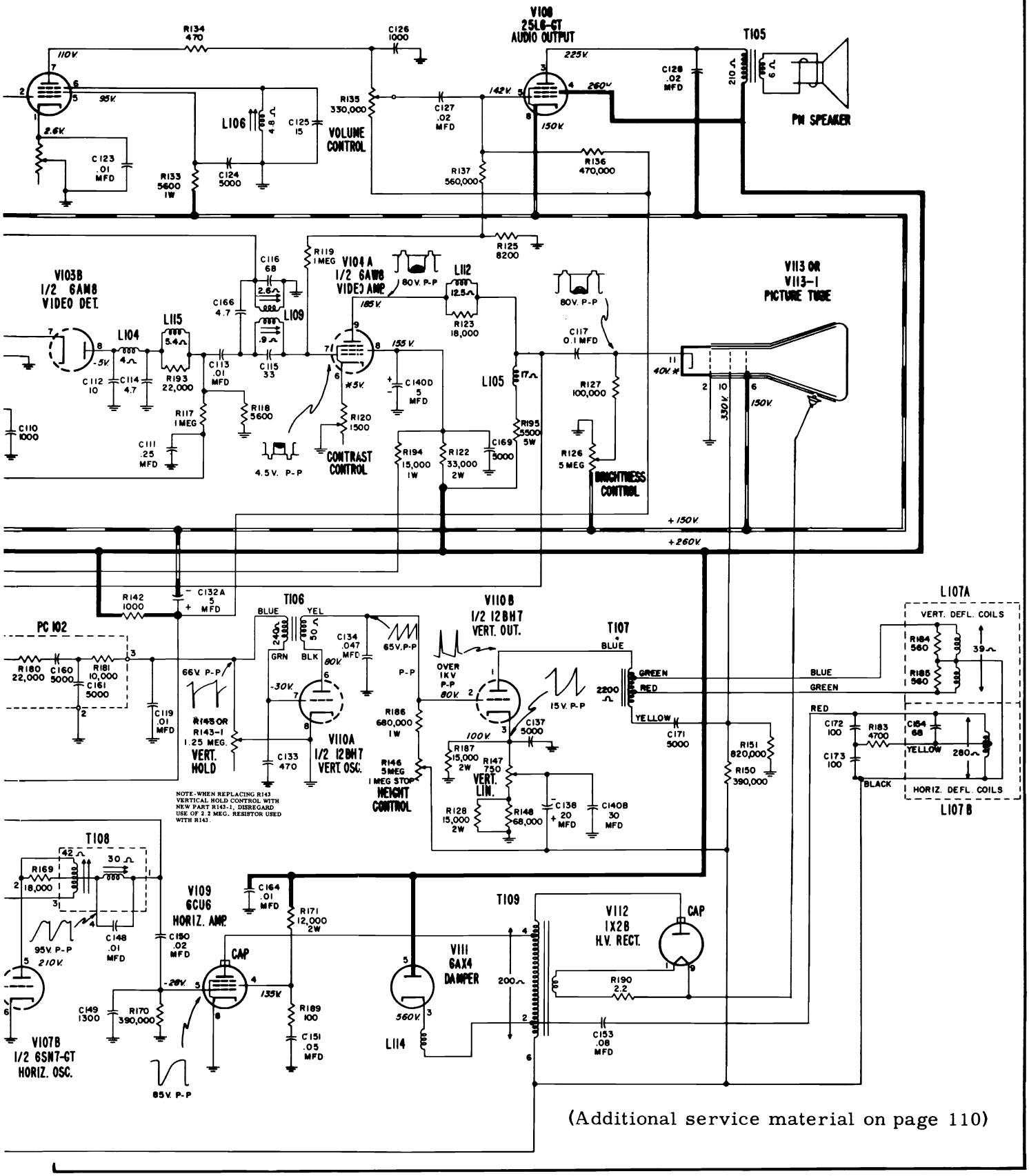
24" C1850D

RUN-1

HALLICRAFTERS Chassis A1850D and C1850D Circuit Diagram



HALLICRAFTERS Chassis A1850D, B1850D, C1850D, D1850D, Continued



(Additional service material on page 110)

HALLICARFTERS Chassis A1850D, B1850D, C1850D, D1850D, Continued

REMOVAL OF CHASSIS FROM CABINET

IMPORTANT: Remove chassis, chassis board, and picture tube from the cabinet as a unit.

TABLE MODELS:

1. Remove the control knobs, the antenna terminal strip, and the wires to the speaker.

2. Remove the two wood screws on the inside rear corners that hold the chassis board to the wood supports on the bottom of each side.

3. Remove the hex head screws and lockwashers that connect the cabinet to the base board along each side from underneath. Also remove the wood screws from the center front.

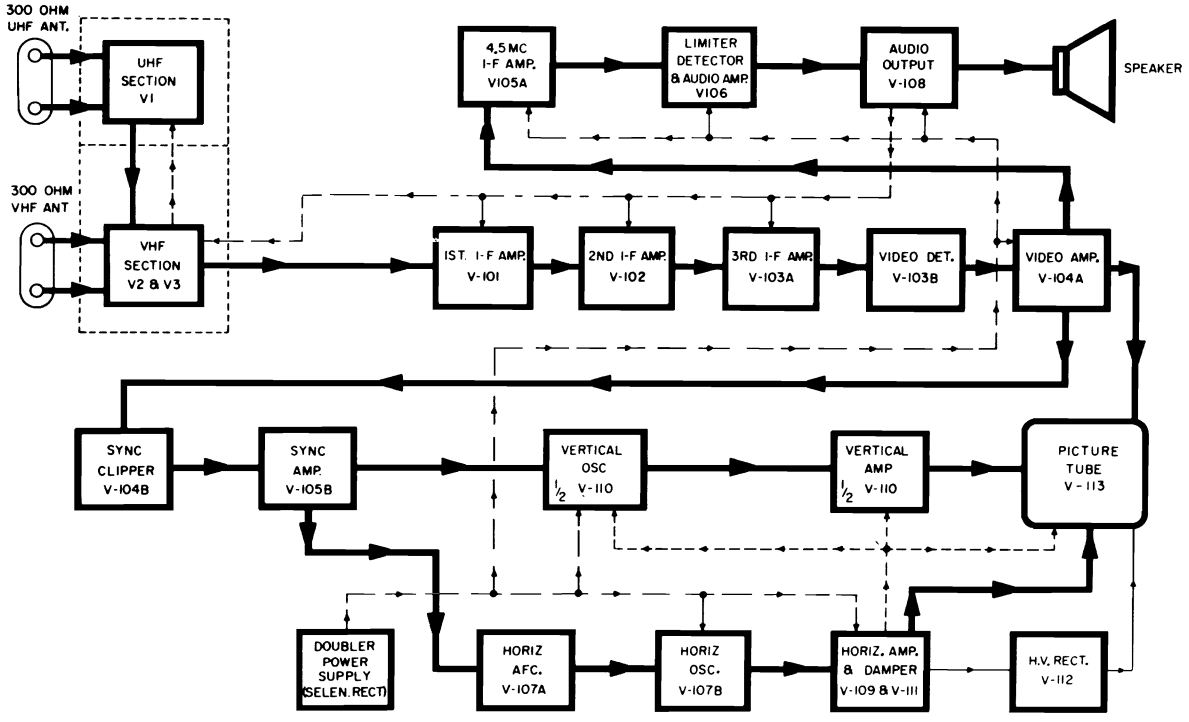
4. Lift the cabinet up and off the chassis board.

CONSOLE MODELS:

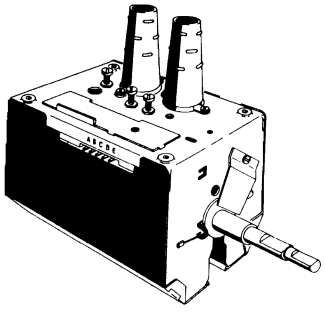
1. Perform step 1 above.

2. Remove the four bolts that hold the chassis board to the cabinet shelf.

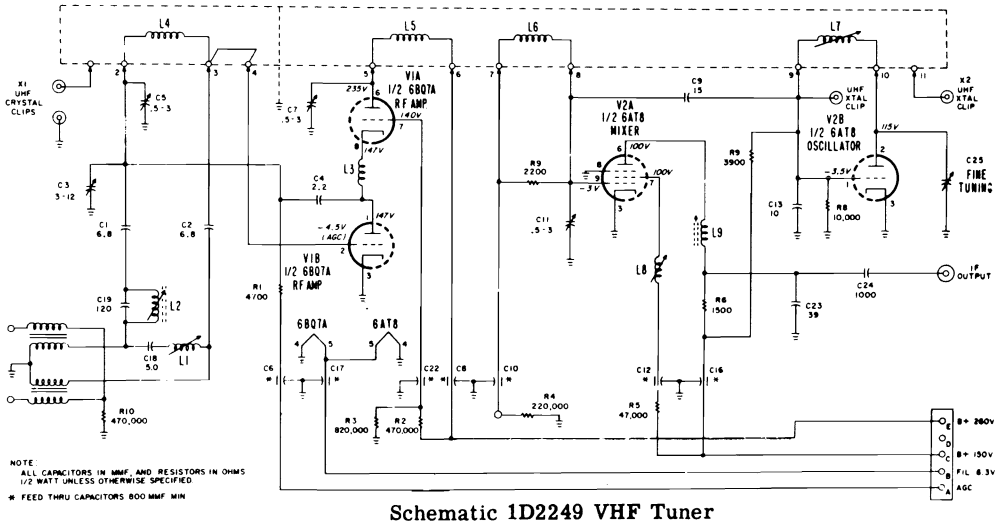
3. Remove chassis board from cabinet.



Block Diagram of a Typical Chassis



Outline Drawing of VHF Tuner



Schematic 1D2249 VHF Tuner

Hoffman
SERVICE DATA
TELEVISION CHASSIS
MARK X SERIES

(Service material on pages 111 through 116)

CHASSIS 306-21, 307-17, 308-21, 309-21, 310-21

NOTE: Some of the models listed below will also have the designations P, P2, U or U2. Example: 7M181P and 21K186U2. These suffixes to the model numbers indicate the use of a different type tuner. The suffix "P" indicates that the receiver has a pentode type tuner which can be identified as having a separate RF coilboard and converter coilboard for each channel. The suffix "P2" indicates that the receiver uses a pentode tuner having a single coilboard per channel. Suffix "U" indicates the use of a step-type All-Wave tuner. "U2" indicates the use of an All-Wave tuner with continuous tuning in the UHF section.

IDENTIFICATION

Chassis 306-21 is used in Models 21M175S, 21B176S, 21P177S, 21M183, 21B184, 21P185, 21U205S, 21M357, 21B358, 21P359.

Chassis 307-17 is used in Models 7M181, 7B182, 7W181

Chassis 308-21 is used in Models 21M183P, 21B184P, 21B185P, 21M357+, 21B358P, 21P359P.

Chassis 309-21 is used in Models 21K186, 21M187, 21B188, 21B189, 21W360, 21M360, 21B361, 21P362.

Chassis 310-21 is used in Models 21W190, 21M190, 21B191, 21P192.

REMOVAL OF THE CABINET — 21 INCH VERTICAL CHASSIS MODELS

1. Remove the backboard and place the receiver on its side in the position indicated in figure 2.
2. Remove the six bottom bolts as indicated (A) on figure 2.
3. Remove two wood screws as shown (B) on figure 2.
4. Restore the receiver to normal upright position shown in figure 1 and remove the front control knobs.
5. Remove the five hex head bolts indicated as (C) in figure 2.
6. Disconnect the speaker leads and slide the cabinet forward and off as shown in figure 3.

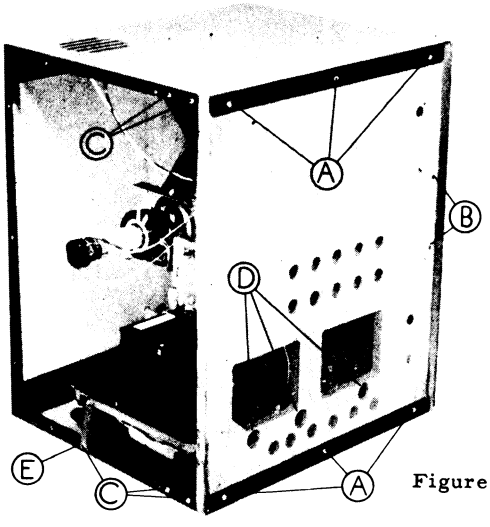


Figure 2

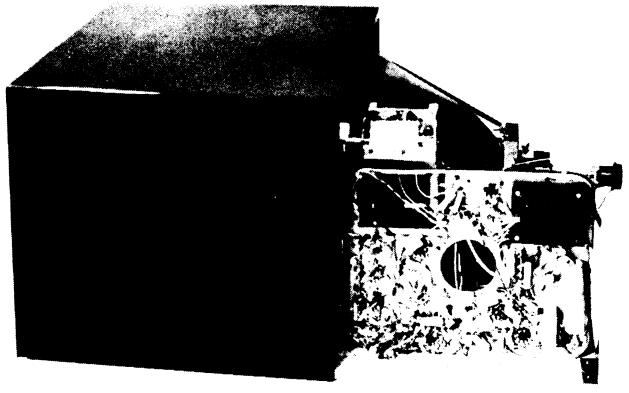


Figure 3

REMOVAL OF THE CHASSIS

1. Remove the backboard and place the receiver in the position indicated in figure 2.
2. Remove the three chassis mounting bolts indicated as (D) on figure 2.
3. Restore the receiver to the normal upright position as shown in figure 1 and remove the front control knobs.
4. Remove the hex head bolt indicated as (E) on figure 2 and the wing nut bolt identified as (F) on figure 4.
5. The chassis may now be slid to the rear of the cabinet and turned to one side to expose the component side of the chassis

HOFFMAN Schematic Diagram for MARK X SERIES Television Chassis

Waveforms should closely resemble those shown on the schematic. All waveforms shown are sketches of actual oscillographs observed on oscilloscope. Slight variations may occur because of type of scope used, signal received on the television set, adjustment of controls, chassis type variation. Receiver used for producing these waveforms has Chassis 309-21 with P2 pentode tuner. All controls were adjusted for a normal picture on a transmitted signal. Operating voltage was 117 volts 60 CPS AC, with B+ values as indicated on the schematic measured with a vacuum tube voltmeter. A negative 5 volts reading was measured across the video detector lead, 4.7 volts I F AGC, 4.5 volts R F AGC.

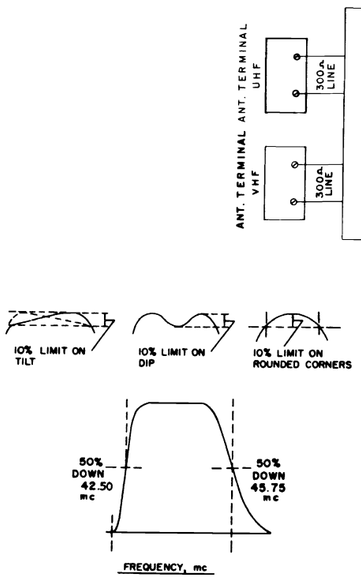


Figure 16 I F RESPONSE CURVE

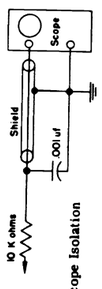
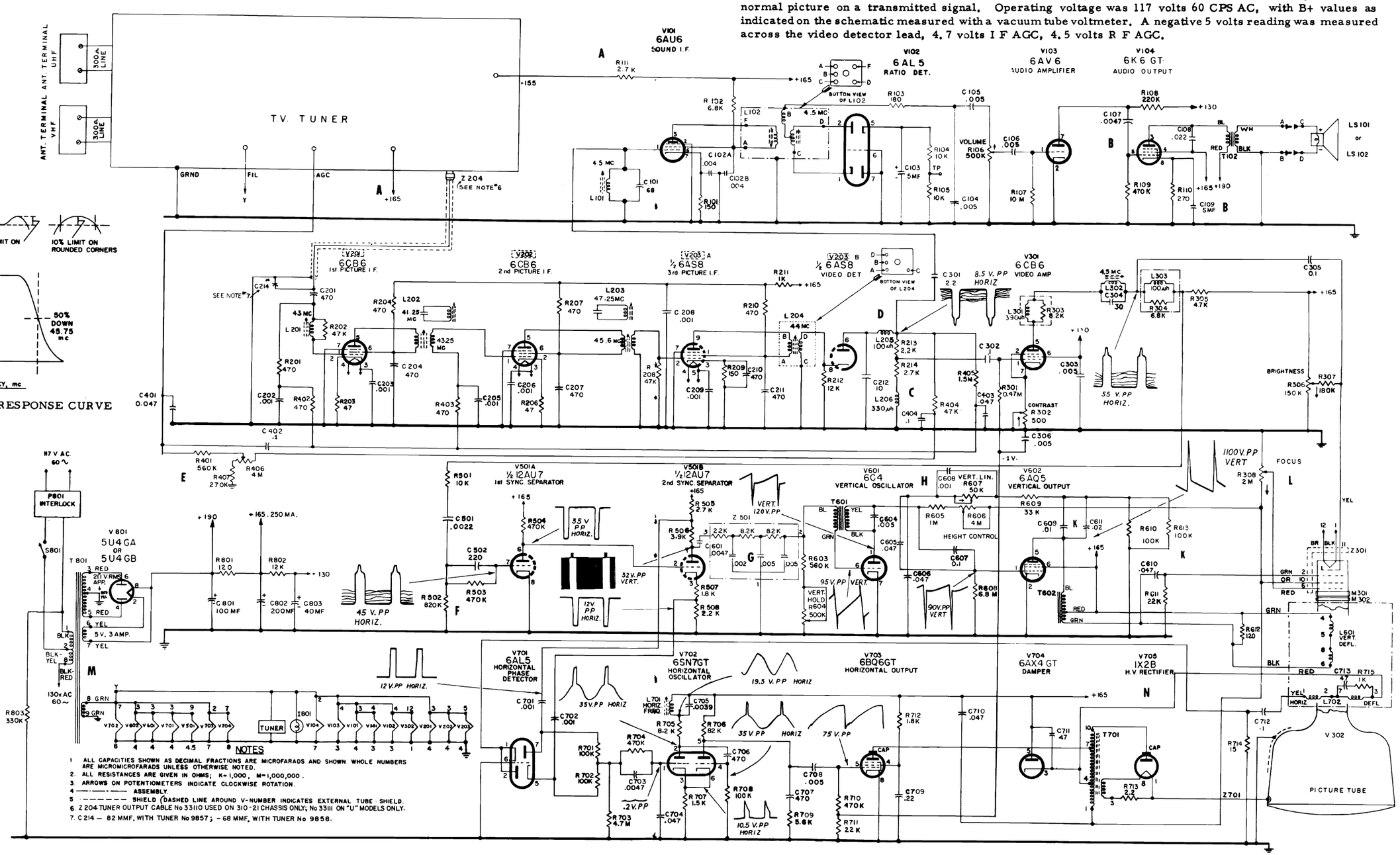


Figure 15



NOTES

1. ALL CAPACITIES SHOWN AS DECIMAL FRACTIONS ARE MICROFARADS AND SHOWN WHOLE NUMBERS ARE MICROMICROFARADS UNLESS OTHERWISE NOTED.
2. ALL RESISTANCES ARE GIVEN IN OHMS; K=1,000, M=1,000,000.
3. ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION.
4. —·—·— ASSEMBLY.
5. – – – – – SHIELD (DASHED LINE AROUND V-NUMBER INDICATES EXTERNAL TUBE SHIELD.
6. Z 204 TUNER OUTPUT CABLE No 33110 USED ON 310-21 CHASSIS ONLY; No 33111 ON "U" MODELS ONLY.
7. C 214 — 82 MMF, WITH TUNER No 9857; — 68 MMF, WITH TUNER No 9858.

SCHEMATIC DIAGRAM FOR CHASSIS 306-21, 307-17, 308-21, 309-21, 310-21

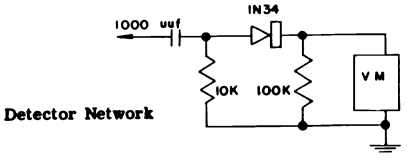
HOFFMAN MARK X SERIES Sound IF and Picture IF Alignment Procedure

1. An accurate CW generator covering the frequencies listed under Alignment Procedure. The generator must have an attenuation control which can be used to vary the level of its output signal. A .005 mfd disc type ceramic capacitor should be used to isolate the generator from the receiver as illustrated in figure 17. If the generator has sufficient output it may be possible to feed the signal to the tuner converter by clipping the "hot" lead directly to the converter tube shield. The tube shield must be raised from the socket and kept in position where it cannot slip down and ground out the generator signal.

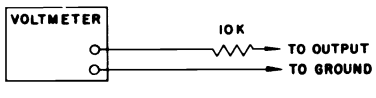
3. A 3 volt negative voltage will be required for connection to the AGC bus during alignment. It is necessary that all tubes normally biased by the receiver AGC system, have a 3 volt bias applied during alignment to assure correct results.

4. The detector network or a detector probe will be required for use with the voltmeter during alignment of the 4.5 MC trap (L302). It is not possible to utilize the receivers detector during this step of the alignment and an external detector must therefore be provided to convert the RF to a DC value which can be measured by the DC voltmeter. The experienced bench technician will find that this trap adjustment can usually be checked by visual inspection of the picture. A 4.5 MC beat will be evident in the picture if this trap is misadjusted.

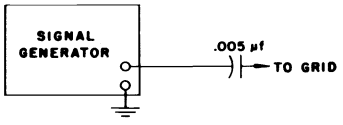
5. A sweep frequency generator with a sweep center frequency of approximately 43.5 MC and 10MC sweep width will be required to check the over-all response of the receiver. An oscilloscope with good vertical gain should be substituted in place of the voltmeter during this part of the alignment. Figure 15 show correct method of hooking the scope to the video detector load. The sweep generator should be connected to the tuner converter grid in the same manner as the CW generator in paragraph 1. Use the same isolating condenser and input connection to the mixer grid. Loosely couple the CW generator (marker) to the input by clipping or touching the CW generator "hot" lead to the unshielded insulated end of the sweep generator "hot" lead. This will afford a small amount of capacitive coupling. If the CW and sweep generators are contained in the same instrument, it will only be necessary to switch on the sweep frequency generator in order to continue the procedure. Tune the sweep frequency generator to a center frequency of approximately 43.5MC. Use a sweep width of approximately 10 MC so that the base of each of the two response curve skirts is well within the ends of the oscilloscope trace. Check the overall bandwidth, position of the picture carrier, dip in bandpass, and trappage by using the marker pip to locate frequency points on the response curve. See Figure 16. Tune the CW generator to 45.75 MC The marker pip should appear at approximately the 50% point on the response curve skirt. Readjust individual coils to give proper bandpass. It should not be necessary to adjust converter or input coil. Once the picture carrier has been correctly positioned at the 50% response point, tune the CW generator to 42.50MC, which should be the 50% point on the sound side. The 10% limits on tilt, dip and rounded corners should carefully be evaluated before making adjustments to change the response curve. This is particularly important in weak signal areas. Sensitivity of the receiver may be reduced in adjusting for the ideal response curve.



Detector Network



Voltmeter Isolation



Signal Generator Isolation

Figure 17 ISOLATION NETWORKS

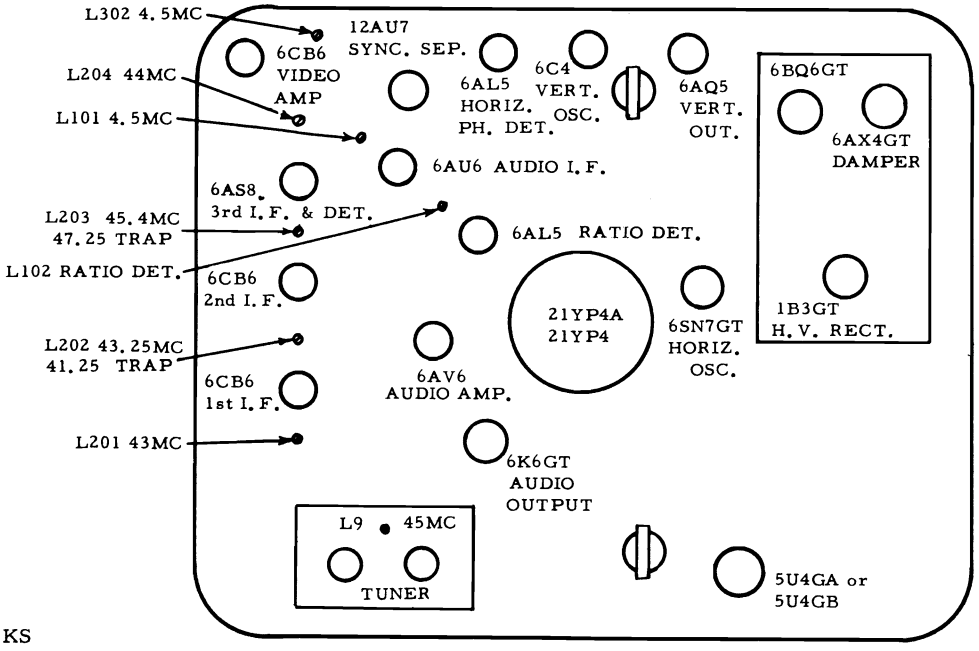


Figure 18 BACKVIEW OF CHASSIS 307

ALIGNMENT PROCEDURE FOR CHASSIS 306, 307, 308, 309, 310 HOFFMAN (Continued)

Alignment should be performed with the set operating on 117 volts AC, contrast set for maximum, channel selector set between channels, 3 volts negative bias on the AGC buss. Allow ten minutes warm-up period before starting alignment. Do not operate the receiver with horizontal oscillator tube removed from the chassis. To eliminate high voltage shock hazard, remove the damper tube.

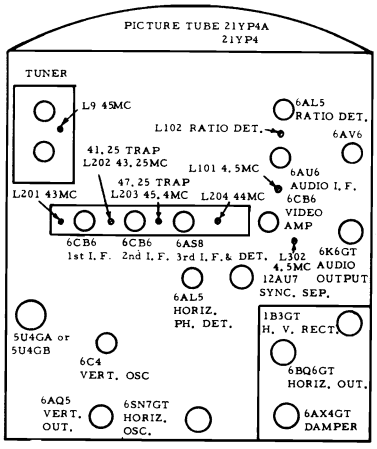


Figure 19 TOP VIEW OF CHASSIS 306 & 308

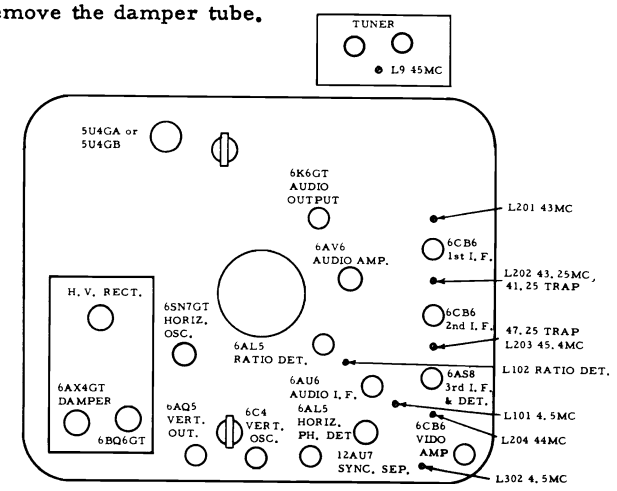


Figure 20 INSIDE VIEW OF CHASSIS 309 & 310

SOUND I. F. ALIGNMENT

1. Connect voltmeter from junction of R104 and R105 (TP on schematic) to chassis ground. Apply a 4.5 MC unmodulated signal through a .005 mfd capacitor to the grid of the video amplifier tube.

2. Align the primary of L102 (bottom slug) and L101 for maximum indication on the meter. Keep the 4.5MC signal from the generator to a level which gives approximately 4 volts reading on the meter.

3. Keep one voltmeter lead attached to T. P. as in step 1 and move the other lead from chassis to the junction of R103, C104, C105 (audio take-off point).

4. Adjust the secondary of the ratio detector transformer (top slug of L102) for zero indication on the meter. Keep 4.5 MC input at the same level as in step 2. Tune in a station on the receiver and readjust Ratio Detector to point of best sound if any buzz is evident in the sound.

5. With 4.5MC input signal applied as in steps 2 and 4, connect a detector network to the picture tube cathode lead and connect the meter across it.

6. Adjust L302 (4.5MC trap in picture tube cathode circuit) for minimum indication on the meter.

VIDEO I. F. ALIGNMENT

Connect a voltmeter from the chassis to the junction of R213, R214, C302, with 10K 1/2W resistor in series with the meter lead. Apply unmodulated R. F. signal to the grid of the tuner, converter tube with frequencies listed below.

INPUT FREQUENCY	ADJUST	TUNE FOR	DESCRIPTION
44.00MC	L204	max.	3rd I F Transformer
47.25MC	L203 (bottom slug)	min.	Adjacent Sound Trap
45.40MC	L203 (top slug)	max.	2nd I. F. Transformer
41.25MC	L202 (bottom slug)	min.	Co-sound Trap
43.25MC	L202 (top slug)	max.	1st I. F. Transformer
43.00MC	L9 or L14	min.	Converter Plate
43.00MC	L201	max.	I. F. Input Coil
45.00MC	L9 or L14	max.	Converter Plate

If an oscilloscope with high vertical gain is available, check the over-all response of the I. F. strip. Connect a sweep generator with center frequency of 43.5MC to the tuner converter grid. Slight readjustment of the I. F. transformers and converter coil may be necessary to give the best response curve. The 10% limits on tilt, dip and rounded corners should carefully be considered before deciding that further adjustment is necessary. Sensitivity may otherwise be sacrificed in obtaining the ideal response curve.

HOFFMAN MARK X SERIES Service Material, Continued

PRODUCTION VARIATIONS

A. B+ Supply to Tuner. R111 value of 1.2K is used with pentode tuner. Value is increased 2.7K with cascode and All Wave tuners. 165Volts B+ terminal for RF section of tuner is used only with cascode and All Wave tuners. Pentode tuner RF section is supplied from common B+ terminal by internal connection to +155 volt lead terminal.

B. Audio Amplifier. Sets produced prior to Serial L588881 did not have C109 and C107 was .001 instead of .0047. If additional sound volume is desired change C107 to .0047 and add C109. Also see Item D.

C. Video Detector Load Circuit. Before Serial J577201, R213 and R214 were reversed in value on pentode tuner models. Cascode tuner models had R213 1K, R214 3.9K. Change to values on schematic when adding AGC circuit.

D. Audio I.F. Gain. Following Serial J577201, L205 was changed from 180 u h to 100 u h to give increased audio I. F. gain at low input signal to the receiver.

VOLTAGE CHART

TUBE NO.	TUBE TYPE	FUNCTION	PLATE PIN	PLATE VOLTS	CATHODE PIN	CATHODE VOLTS	GRID PIN	GRID VOLTS	SCREEN PIN	SCREEN VOLTS
V101	6AU6	Sound I. F.	5	120	7	1.1	1	0	6	125
V102	6AL5	Ratio Det.	7 2	0 15	1 5	13 27				
V103	6AV6	Audio Amp.	7	77	2	0	1	-0.7		
V104	6K6GT	Audio Output	3	185	8	8.3	5	0	4	167
V201	6CB6	1st Pix. I.F.	5	148	2	0.4	1	0.2	6	153
V202	6CB6	2nd Pix. I. F.	5	146	2	0.4	1	0.2	6	153
V203A	1/2 6AS8	3rd Pix. I.F.	9	146	3	1.5	2	0	1	147
V203B	1/2 6AS8	Video Det.	6	-5	8	0				
V301	6CB6	Video Amp.	5	138	7	1.0	1	0	6	135
V501A	1/2 12AU7	1st Sync Sep	6	34	8	0	7	-19		
V501B	1/2 12AU7	2nd Sync Sep.	1	115	3	34	2	34		
V601	6C4	Vert. Osc.	1	147	7	0	6	-27		
V602	6AQ5	Vert. Output	5	160	2	0	1	-8	6	170
V701	6AL5	Hor. Ph. Det.	7 2	-10 0	1 5	0 9.5				
V702	6SN7GT	Hor. Osc.	2 5	141 96	3 6	7 7	1 4	-0.2 -7.8		
V703	6BQGT	Hor. Output	Cap	*	8	0	5	-28	4	154
V704	6W4GT	Damper	5	166	3	430				

*Do not measure - High amplitude spikes of D. C. may damage meter. D. C. value will be about same as boost voltage. Boost voltage at pin #1 of horizontal output transformer about 400 volts.

Voltages taken with VTVM meter on 309-21 chassis operating as follows: A. C. line voltage 117 volts, receiver tuned to station with normal setting of all controls, negative 5 volts developed at plate of video detector by signal received. All voltages are positive D. C.

Motorola TV

CHASSIS
TS-531
TS-609

SERIES

MODELS
(See Receiver Model Breakdown Chart)

RECEIVER MODEL BREAKDOWN CHART

Model	Description	TV Chassis
21T21	Table, red-brn mahogany: metal	WTS-531
Y21T21	Table, red-brn mahogany: metal	WTS-531Y
21T21B	Table, blonde: metal	WTS-531
Y21T21B	Table, blonde: metal	WTS-531Y
21T21E	Table, ebony: metal	WTS-531
Y21T21E	Table, ebony: metal	WTS-531Y
21T22	Table, red-brn mahogany: masonite	TS-531
Y21T22	Table, red-brn mahogany: masonite	TS-531Y
21T22B	Table, limed oak: masonite	TS-531
Y21T22B	Table, limed oak: masonite	TS-531Y
21K29	Console, red-brn mahogany: masonite	WTS-531
Y21K29	Console, red-brn mahogany: masonite	WTS-531Y
21K29B	Console, limed oak: masonite	WTS-531
Y21K29B	Console, limed oak: masonite	WTS-531Y
21K29W	Console, walnut: masonite	WTS-531
Y21K29W	Console, walnut: masonite	WTS-531Y
21K30	Console, red-brn mahogany: masonite	TS-531
Y21K30	Console, red-brn mahogany: masonite	TS-531Y
21K30B	Console, limed oak: masonite	TS-531
Y21K30B	Console, limed oak: masonite	TS-531Y
21K30W	Console, walnut: masonite	TS-531
Y21K30W	Console, walnut: masonite	TS-531Y
21K33E	Console, ebony: masonite	WTS-531
Y21K33E	Console, ebony: masonite	WTS-531Y
24T2	Table, red-brn mahogany: masonite	TS-609
Y24T2	Table, red-brn mahogany: masonite	TS-609Y
24T2B	Table, limed oak: masonite	TS-609
Y24T2B	Table, limed oak: masonite	TS-609Y

(Service material on pages 117 through 122)

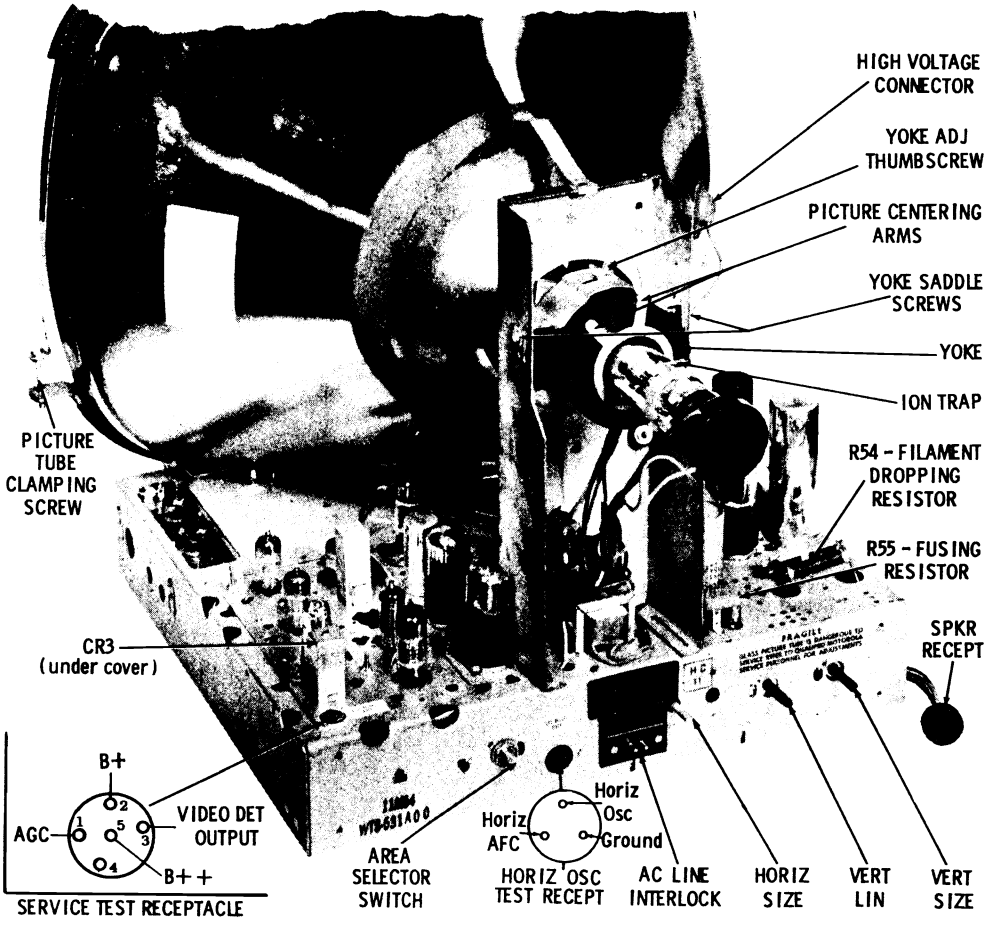
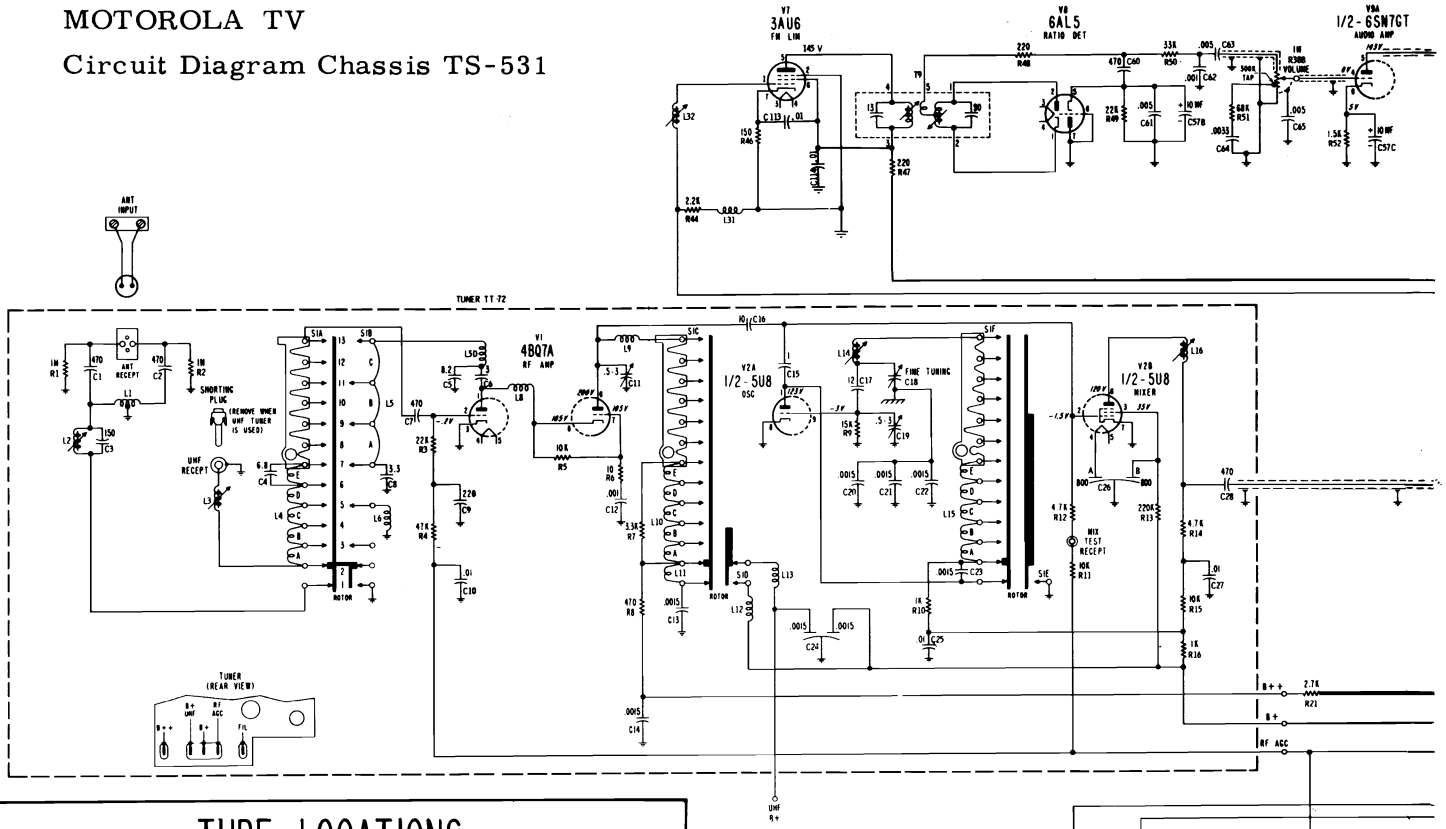
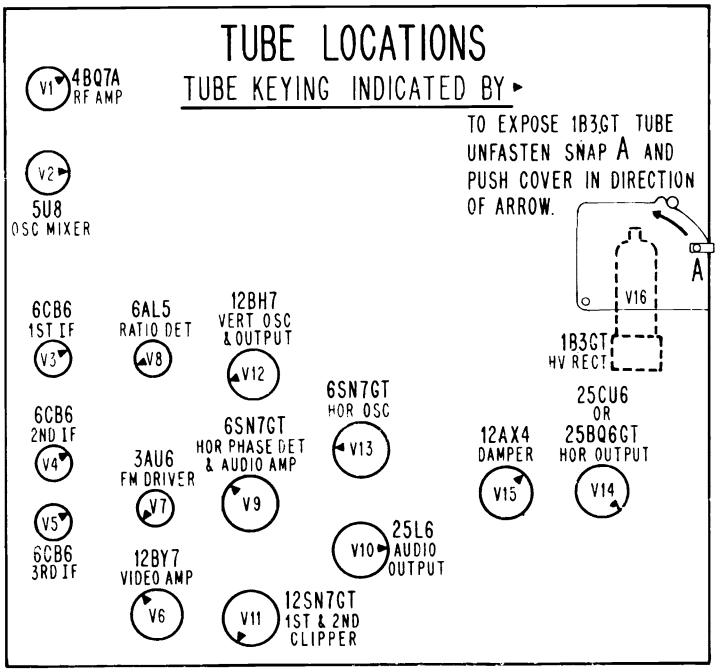


FIGURE 2. REAR VIEW OF CHASSIS

MOTOROLA TV

Circuit Diagram Chassis TS-531





CAPACITOR VALUES UNDER 1000 ARE IN MMF
ALL OTHERS IN MF UNLESS OTHERWISE SPECIFIED

⏚ = GND TO CHASSIS ⏚ = GND TO TUNER SHAFT

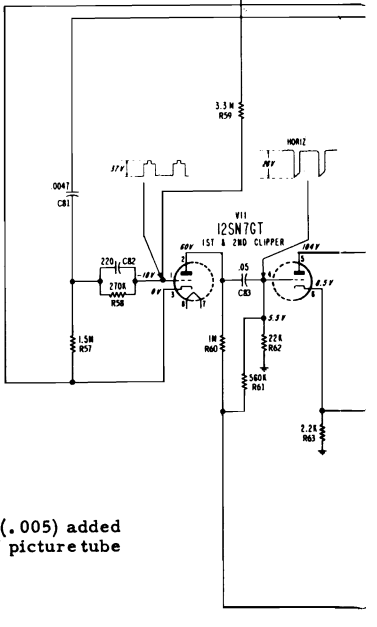
NOTES

VOLTAGE MEASUREMENTS

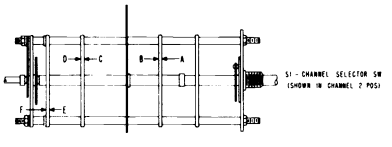
1. Made with a VTVM from point indicated to chassis
2. Line voltage - 117 volts
3. Antenna disconnected
4. Channel selector switch on channel which develops less than 1 volt noise at pin 3 of test recept
5. Contrast control maximum clockwise position
6. All other controls in normal operating position
7. Voltages associated with circuits having variable controls may vary with control settings

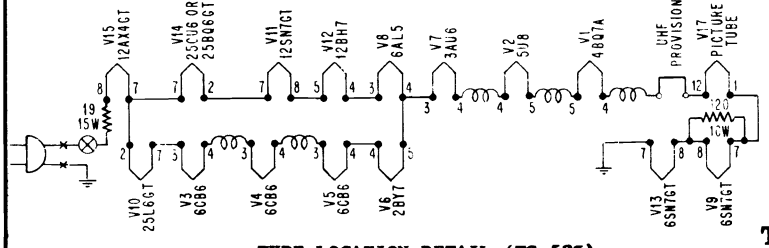
WAVEFORMS

1. Observed on Dumont Model 241 oscilloscope
2. Contrast control set for signal of 45V P to P at plate of video amp tube
3. All other controls in normal operating position
4. Horizontal output tube removed to eliminate HV pulse interference from scope when observing all waveforms, except those from phase det through horiz circuit



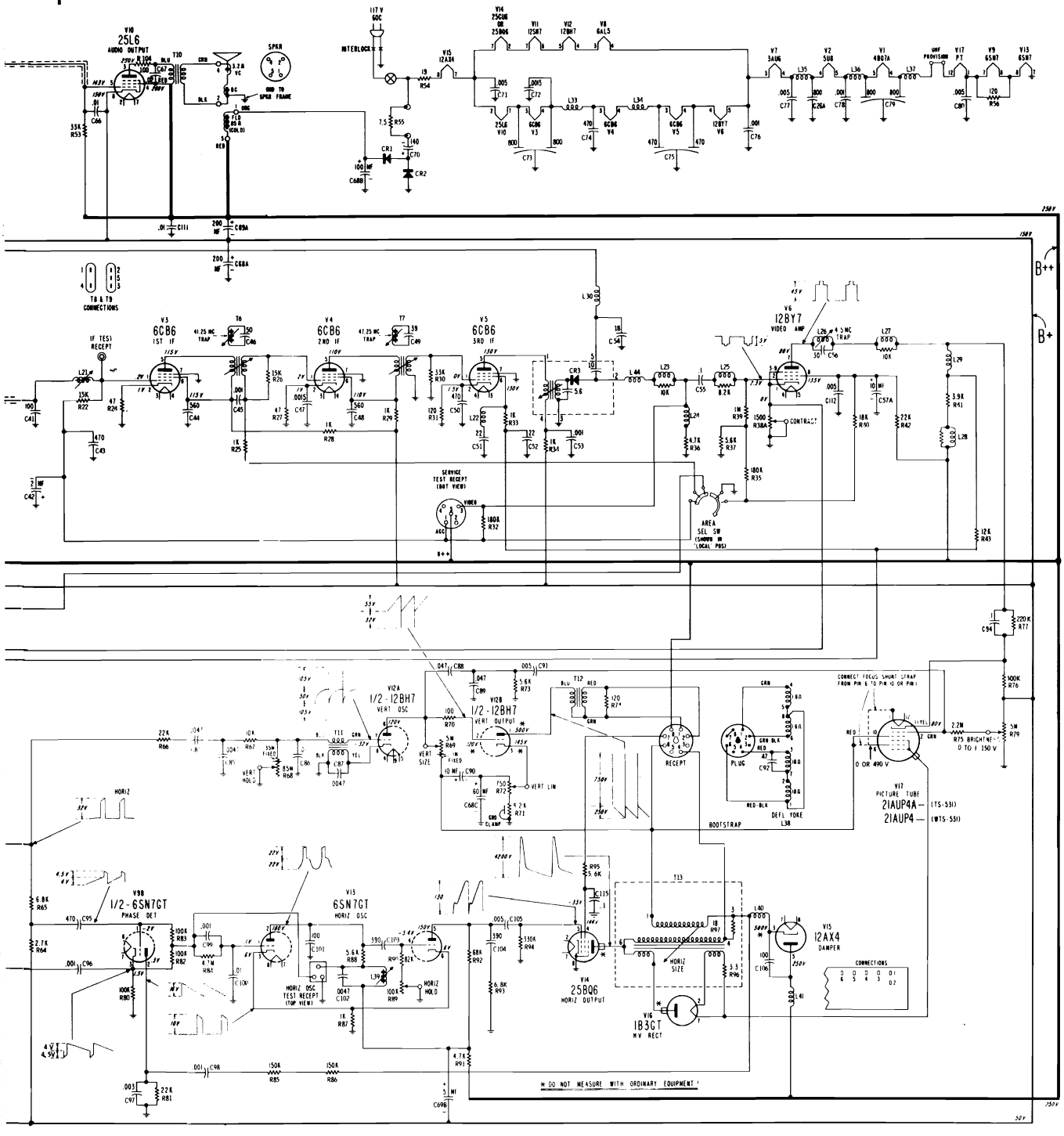
To reduce regeneration C-116 (.005) added between pin #12 (brown lead) of picture tube and ground.





TUBE LOCATION DETAIL (TS-531)

TELEVISION CHASSIS TS-531A-04 SERIES

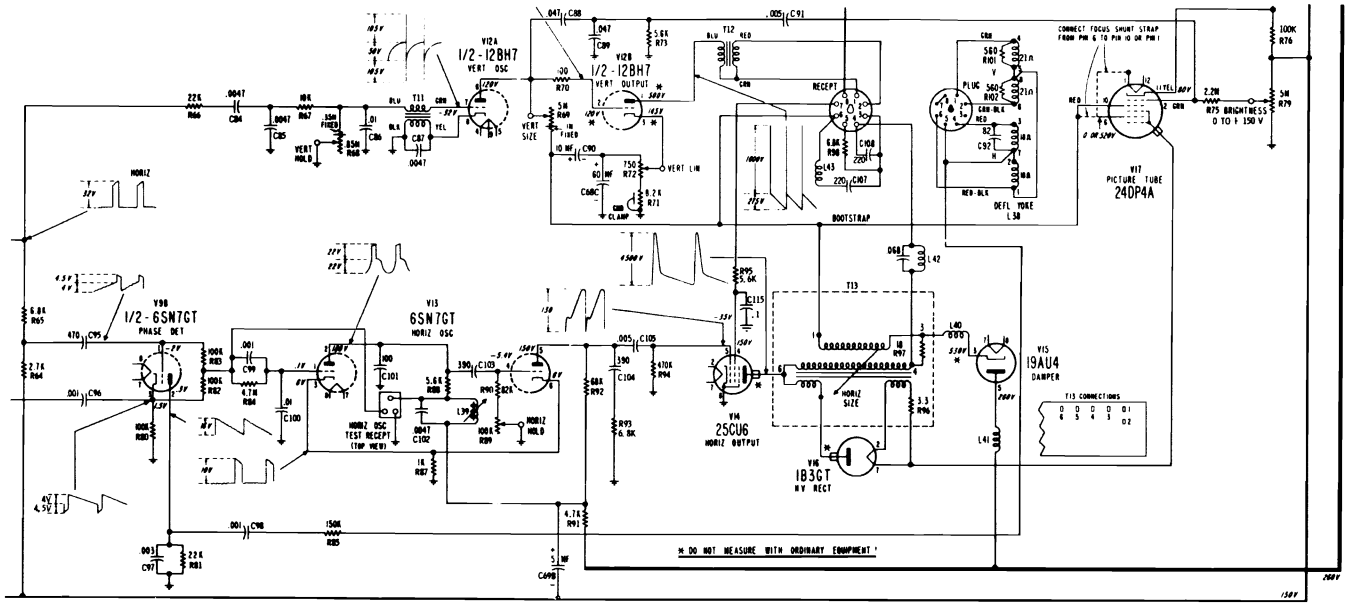


THE B++ AND B+ DIVIDER SYSTEM

Many of the smaller type tubes, such as those used in the tuner, IF, etc., require less operating plate voltage than the larger types used in the sweep system, high voltage driver, etc. This voltage division is often accomplished by the use of resistor voltage divider circuits which dissipate heat and many times tend to increase the possibility of component part breakdown within the chassis. This condition is eliminated in Motorola receivers by utilizing the normal voltage drop occurring through the high current audio output tube (25L6). In this way, the power requirements of the receiver are not increased, the heat is kept above the chassis and away from the component parts and the circuit provides a semi-regulated voltage supply.

MOTOROLA Chassis TS-531 and TS-609, Continued

This service material is correct for Motorola Chassis TS-531 and TS-609. Chassis number with a suffix "Y" have a built-in UHF tuner. Chassis WTS-531 is the same as TS-531 except for 21AUP4 tube. The circuit for TS-531 is shown on pages 118-119. Chassis TS-609 is the same except for 24DP4A, a 24" aluminized picture tube, and the damping diode tube. The vertical and horizontal sweep circuits also differ from TS-531 and these circuits (in part) are shown below. Use these circuits with the main schematic, pages 118-119.



PRODUCTION CHANGES

TS-531 Series A-01 thru A-10; TS-609 Series A-01 thru A-08

Chassis Coding	Changes
TS-609 Schematic Correction	Source of retrace blanking changed so it is similar to TS-531. R-99 (10K), R-100 (5.6K), C-109 (.05), C-110 (.05) and C-91 (.005) removed from ground and connected to junction of C-88 (.047), C-89 (.047) and R-73 (5.6K); C-107 (200) changed to 220; C-108 (200) changed to 220; C-92 (65) changed to 82.
TS-531 & 609 Correction	R-17 (820) added between junction of C-5 (8.2) and C-6 (3) and ground.
TS-531A-01 TS-609A-01	To reduce regeneration and improve video IF alignment C-41 (100) & L-21 removed from junction with R-22 (22K) & R-23 (1K); R-26 (47K) changed to 15K; R-22 (22K) changed to 15K; L-44 moved outside of T-8 and is located between lug 3 of T-8 & L-23;
TS-609A-01 only	R-86 (150K) removed; R-85 (150K) connected to pin #5 of the yoke receptacle.
TS-531A-02 TS-609A-02	To further reduce regeneration R-23 (1K) removed; C-47 (470) connected directly to R-22 (15K).
TS-531A-03 TS-609A-03	To limit brightness and prevent loading of high voltage at high brightness setting, R-78 470K removed; C-93 (.005) removed; R-77 (100K) changed to 220K; R-76 (220K) changed to 100K; R-76 (100K) removed from ground and connected to B+; pin #8 of deflection yoke moved from B+ to B++. To prevent arcing at maximum audio level R-103 (100) added between blue lead of T-10 and pin #3 of V-10 (25L6).
TS-609A-03 only	R-73 (4.7K) changed to 6.8K; R-95 (5.6K) added between pin #4 of V-14 (25CU6) and pin 7 of deflection yoke receptacle; C-115 (.1) added between pin #4 of V-14 and ground; R-52 (1.5K) changed to 1.8K; C-59 (.005) removed; R-46 (150) connected to ground; suppressor grid (pin #2) of V-7 (3AU6) connected to ground.
TS-531A-04 TS-609A-04	To eliminate audio oscillation C-58 (dual .0047) removed; C-113 (.01) added between pins #6 & 7 of V-7 (3AU6); C-114 (.01) added between pin #6 of V-7 and ground.
TS-531A-04 only	To increase horizontal size and stabilize current on 25BQ6, R-93 (4.7K) changed to 6.8K; R-95 (330) changed to 5.6K; C-115 (.1) added between pin #4 of V-14 and ground; R-52 (1.5K) changed to 1.8K; C-59 (.005) removed; R-46 (150) connected to ground; suppressor grid (pin #2) of V-7 connected to ground.
TS-531A-05 TS-609A-05	L-26 (4.5 Mc trap) changed; C-56 (30) changed to 27.
TS-531A-07 TS-609A-07	To improve sensitivity R-17 (820) removed; C-6 (3) changed to 1.5; C-29 (2.2) added. With above changes tuner changed to TT-72A.

MOTOROLA Chassis TS-531 and TS-609, Continued

600 MILLIAMPERE FILAMENT TUBES

Several late tube versions are included in the TS-531 and TS-609 receiver chassis; the 4BQ7A, 3AU6 and 5U8. These new 600 milliampere filament tubes are designed to compensate for the voltage surges occurring in series filament strings due to the difference in "hot" and "cold" resistances. This is accomplished by maintaining the cold resistances of the tubes in the same ratio as the hot resistances of the tubes.

With the exception of heater voltage and current ratings, electrical characteristics of the tubes remain the same as the original types. For example, 5U8 compares to the 6U8 in all electrical respects except the heater. It is not possible to check these tubes in standard tube testers without modification of the tester for changes in filament voltage and current ratings.

ALIGNMENT

IF AND MIXER ALIGNMENT

1. Remove yoke plug to eliminate horizontal interference. Connect a 2500 ohm 10 watt resistor from chassis ground to B++ (250V bus) to normalize voltages.

2. Remove antenna and make following connections: (See Figure 7)

a. Connect a 3 volt battery between pin 1 (IF AGC bus) of service test receptacle and ground. Positive side of battery goes to chassis ground.

b. Disable tuner oscillator by grounding pin 9 of V-2 (5U8) and turn channel selector to channel 13.

c. Turn AREA SELECTOR SWITCH to the "local" position, and the CONTRAST control to minimum.

d. Connect sweep generator to IF test receptacle and oscilloscope to detector load resistor (pin #3 of service test receptacle).

3. Center sweep frequency at 44 Mc with a sweep width of 10 Mc and adjust generator output below point of receiver limiting (approximately 3-5 volts peak-to-peak at detector load).

4.

Adjust	At Marker Freq.	For
T-6 bot	41.25 Mc	Minimum, see Figure 7
T-7 bot	47.25 Mc	Minimum, see Figure 7
T-6 top	42.25 Mc	Marker at proper point, see Figure 7
T-7 top	45.75 Mc	Marker at proper point, see Figure 7
T-8 bot	top of curve	Flat top, see Figure 7

NOTE: Some adjustments interact. Repeat as necessary, to obtain proper curve.

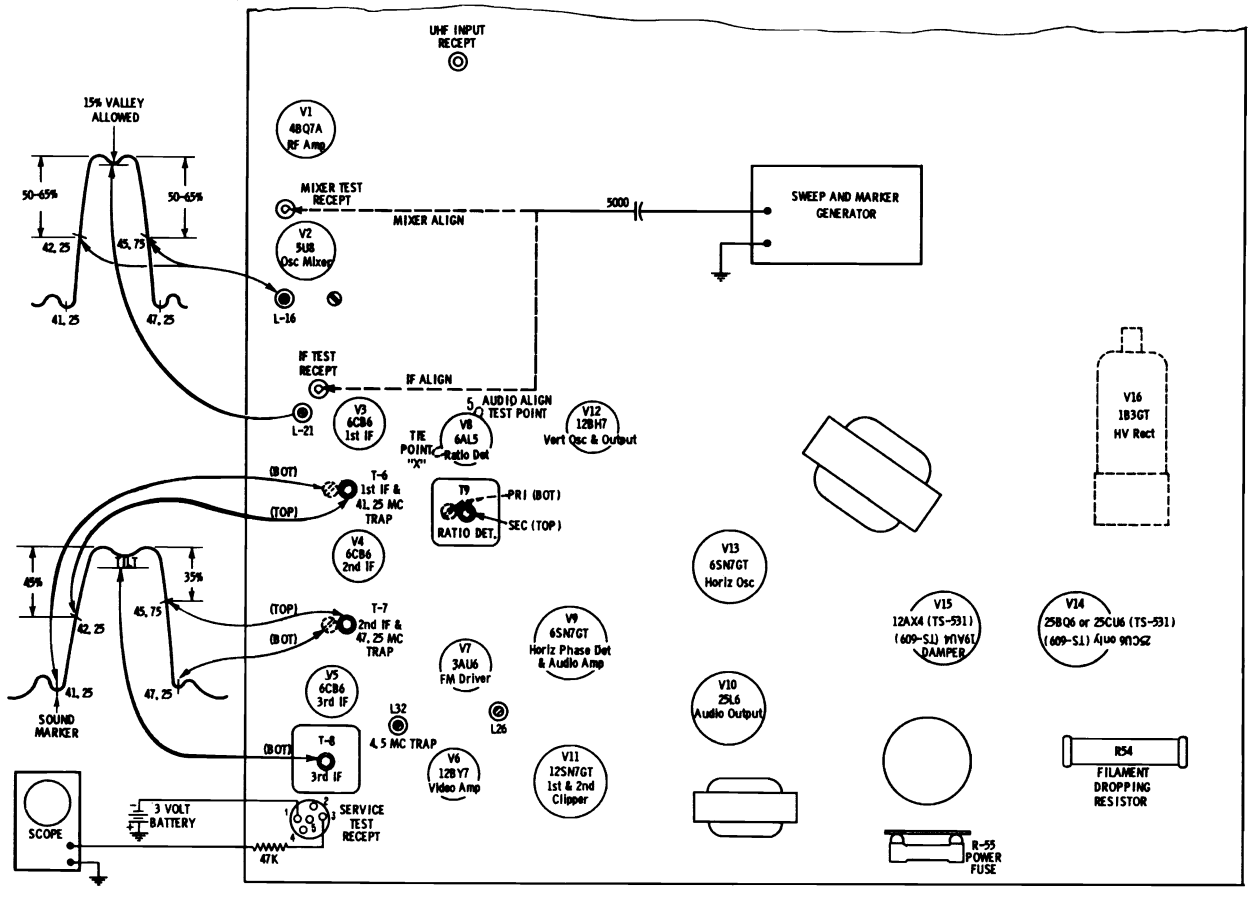


FIGURE 7. TUBE LOCATIONS & IF ALIGNMENT DETAIL

MOTOROLA Chassis TS-531 and TS-609, Continued

5. Move generator to mixer test receptacle and short across R-12 (4.7K ohms).

L-16 & L-21	42.25 Mc & 45.75 Mc	Proper curve, see Figure 7. If desired overall response cannot be obtained, check dressing of bypass capacitors, especially the screen bypassing of the 1st and 2nd IF tubes. These lead lengths are critical and should be kept short and dressed to obtain proper curve.

CHECKS

Bandwidth may be determined by noting the frequencies at which the markers fall at the 50% points. Mixer and IF bandwidth over 3.7 Mc may cause sound bars or burble in the picture; if less than 3 Mc, a loss of resolution or fine detail in the picture may be noticed.

6. Decrease generator signal until there is a marked decrease in the oscilloscope waveform. Unwanted regeneration will be indicated by sharp peaks on the overall response curve. If regeneration is present, check IF cathode resistors, screen bypass capacitors and lead dress. Improper alignment may also cause regeneration.

7. Remove short from oscillator.

AUDIO ALIGNMENT

1. With receiver in operating condition, tune in station.

2. Connect VTVM from positive terminal of electrolytic capacitor C-57B to ground.

3. Maintain 5 volts, or less, at VTVM by adjustment of fine tuning and contrast control (or by removal of antenna, if necessary) while peaking T-9 primary (bottom) and L-32 for maximum output.

4. Tune for normal picture and carefully note voltage developed at the positive terminal of C-57B.

5. Move meter to junction of R-48 and R-50 (dummy pin on V-8 socket, marked "X" in Figure 7).

6. Adjust T-9 secondary (top) to give a reading on the VTVM of exactly one-half of reading obtained in step 4.

4.5 MC TRAP ADJUSTMENT

Tune receiver to a local station and set fine tuner for a noticeable 4.5 Mc beat in picture. Adjust 4.5 Mc trap L-26 for minimum beat interference in the picture by locating the two points of adjustment at which the beat is just noticeable. Rotate the core toward the center of these two points. Use the minimum amount of inductance (core out of coil) that will result in no apparent beat interference.

SERVICE NOTES

PICTURE TUBE REPLACEMENT

To replace picture tube:

1. Remove second anode connector and short the picture tube anode to ground with a well insulated piece of wire.

2. Carefully remove picture tube socket and ion trap magnet.

3. Remove screws holding picture tube clamping band and remove band.

4. Carefully remove picture tube using caution not to damage yoke with neck of tube and not to exert any undue pressure on the tube itself.

5. Insert new tube carefully into yoke and position tube tightly against the front support bracket lugs. If at this time the rear tube support does not bear against the flare of the tube or, if it requires pressure to insert tube behind the mounting lugs, loosen rear tube support bracket mounting screws and slide forward or backward to fit against tube without forcing. If the bracket is too tight, it will cause mispositioning of the yoke. Tighten rear support bracket screws.

6. Reinstall picture tube clamping band and tighten screws securely.

7. Replace ion trap magnet, picture tube socket, and second anode connector. Loosen yoke adjustment thumbscrew and yoke saddle screws and push the yoke up against the flare of the tube. Tighten all screws.

8. Readjust yoke, ion trap and centering device.

REMOVAL OF CABINET SAFETY GLASS

1. Remove the screws and molding strip located along top edge of glass.

2. Safety glass will move outward from cabinet allowing its removal by lifting out of lower retaining channel.

3. When replacing, position rubber on glass with low side of channel facing inside of cabinet.

4. Replace molding and screws.

FUSE REPLACEMENT

B+ and initial surge: 7.5 ohm special resistor

B+ and initial surge fuse (special 7.5 ohm resistor R-55) This fuse is of the plug-in type and is accessible by removing the cabinet back. See Figure 2 for location.

SERVICE TEST RECEPTACLE

A SERVICE TEST RECEPTACLE, accessible from the top of the chassis (see Figure 2) provides the following test points:

Pin	Connection To
1	AGC
2	B+
3	Video detector output
5	B++

These test points are available to the technician merely by removal of the receiver cabinet back and provide rapid checking of the power supply voltages -- giving the approximate condition of the selenium rectifiers and the line voltage. Operation of the receiver from the antenna to the detector may be checked by the use of pin #3 (detector output). Pin #1 allows rapid checking of the AGC voltage. It is suggested that this voltage be checked and recorded at the first opportunity by the service technician using a receiver in normal operating condition. Such AGC voltage information may be invaluable when checking sets in which the AGC action is doubtful. This voltage varies according to the signal strength and may range from a very low value to about 5 volts minus.

MuntzTV INC.

CHASSIS MODEL 47A4			
CABINET MODELS	42ITI	42IT2, 42ICI	42IC2
	52ISTI	52IST2, 52IS/UHF	
	52ICI	52IC2, 52IC/UHF	

CHASSIS MODEL 49A4	
CABINET MODELS	427C/527C SERIES
	427T/527T SERIES
	524T/524C SERIES

The circuit shown on pages 124-125 is exact for latest version of Chassis 47A4. Circuits of other versions and Chassis 49A4 are practically identical to this. Chassis 49A4 uses 24" or 27" picture tubes. Alignment data on page 126.

ALIGNMENT OF HORIZONTAL OSCILLATOR (A.F.C.)

Tune in a good signal (preferably a test pattern) and allow the receiver to warm up for a few minutes. When the horizontal oscillator adjustments are properly set the actions of the horizontal hold control are as follows.

Rotate the horizontal hold control fully counter-clockwise. The picture should remain in horizontal sync. Rotate the control fully clockwise and the picture should fall out of of sync showing one vertical black blanking bar near the center of the picture. If the Horizontal Oscillator does not fill the above requirements, the circuit needs readjusting and can usually be done in the customer's home by readjustment of the Horz. Range Trimmer, the top Horz. AFC Slug, and the Horz. Hold control until settings are found that fulfill the above requirements. If these conditions cannot be obtained, the bottom slug of T-3 probably requires adjustment. Then follow the procedure listed.

(A) Tune in a known good signal (Test pattern where possible) and adjust contrast control well below an over-contrast condition.

(B) Turn both slugs of T3 out as far as possible.

(C) Pre-set Horizontal Range Trimmer 1/4 turn out from full "in" position. Turn Horiz. Hold control fully clockwise. Adjust top slug of T3 to sync. picture. Readjust Horiz. Range Trimmer slightly if necessary in order to sync. picture.

(D) Connect a scope (capable of a flat square wave response at 15,750 C.P.S.) through a low capacity probe to point C Fig. 2. Adjust the bottom slug of T3 until the broad and sharp peaks are of equal height, Fig. 3 keeping the picture in sync. at all times. REMOVE SCOPE.

(E) Set the Horizontal Hold Control in the extreme clockwise position and adjust top slug of T3 for one vertical blanking bar. Rotate the Horizontal Hold Control fully counter-clockwise. Picture should remain in sync. If it does not re-adjust Horizontal Range Trimmer and top slug of T3. Then repeat step "E".

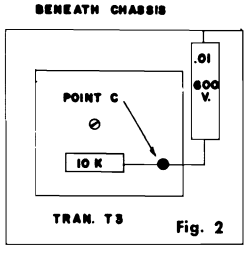


Fig. 2

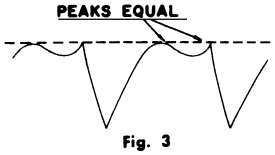


Fig. 3

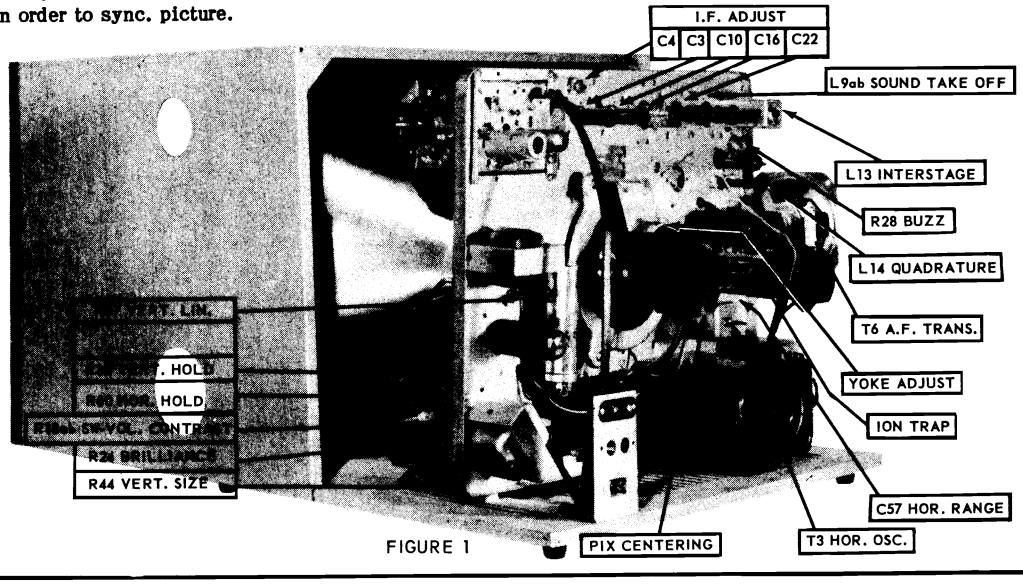
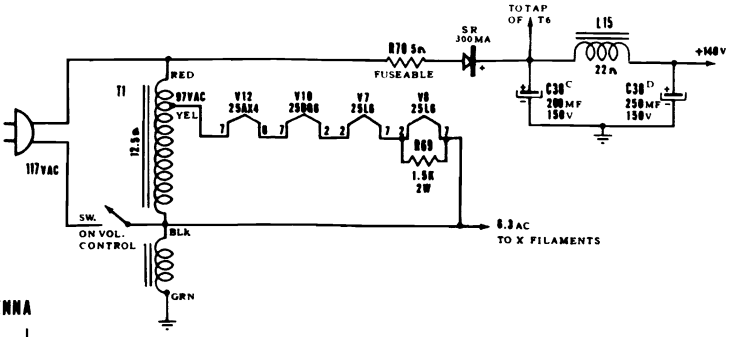
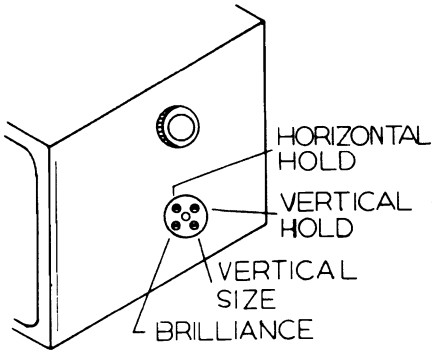


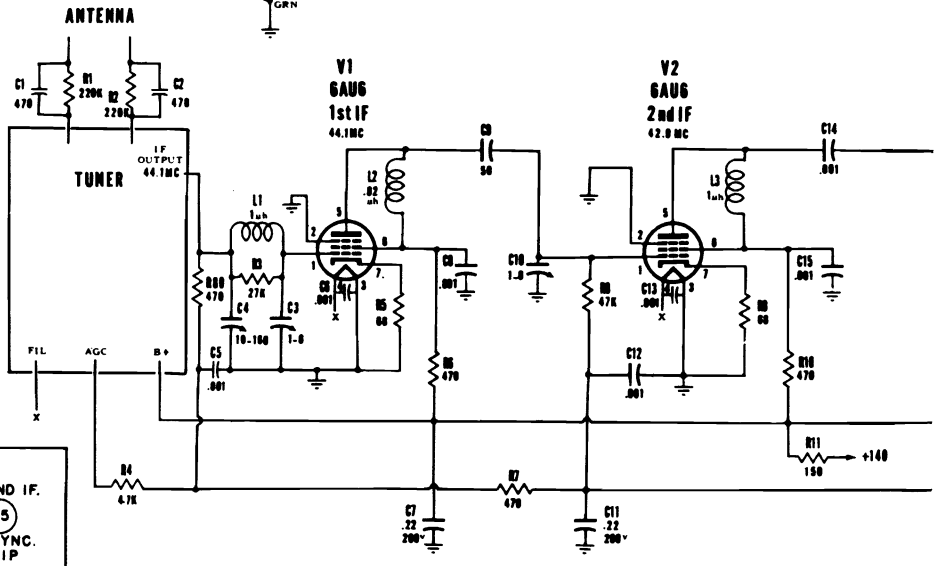
FIGURE 1

MuntzTV INC.

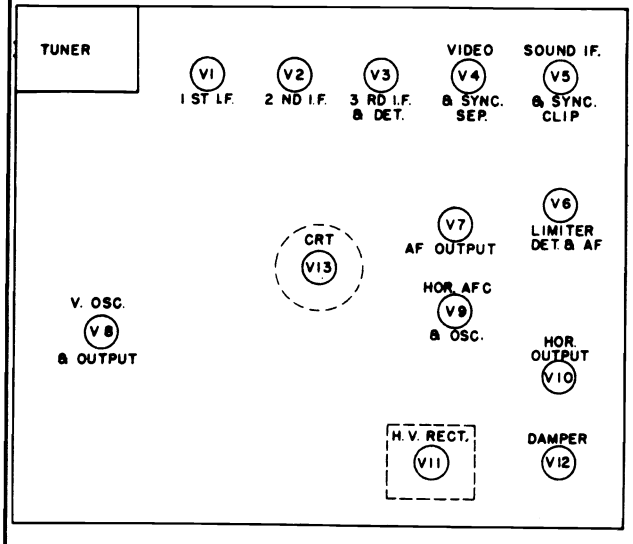
Chassis 47A4 Circuit Diagram



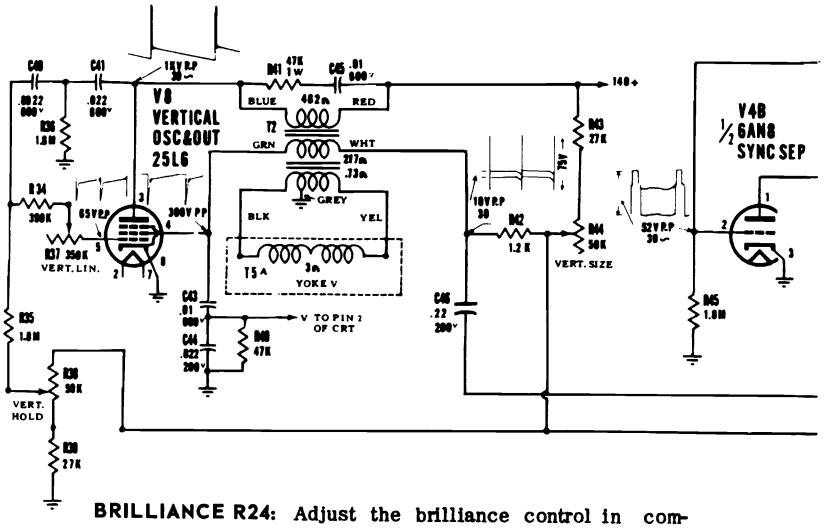




TUBE LAYOUT DIAGRAM



REAR VIEW



OPERATION OF SERVICE CONTROLS

HORIZONTAL HOLD R60: The horizontal hold control is a vernier adjustment in the Horizontal AFC circuit to lock the picture in horizontal synchronization.

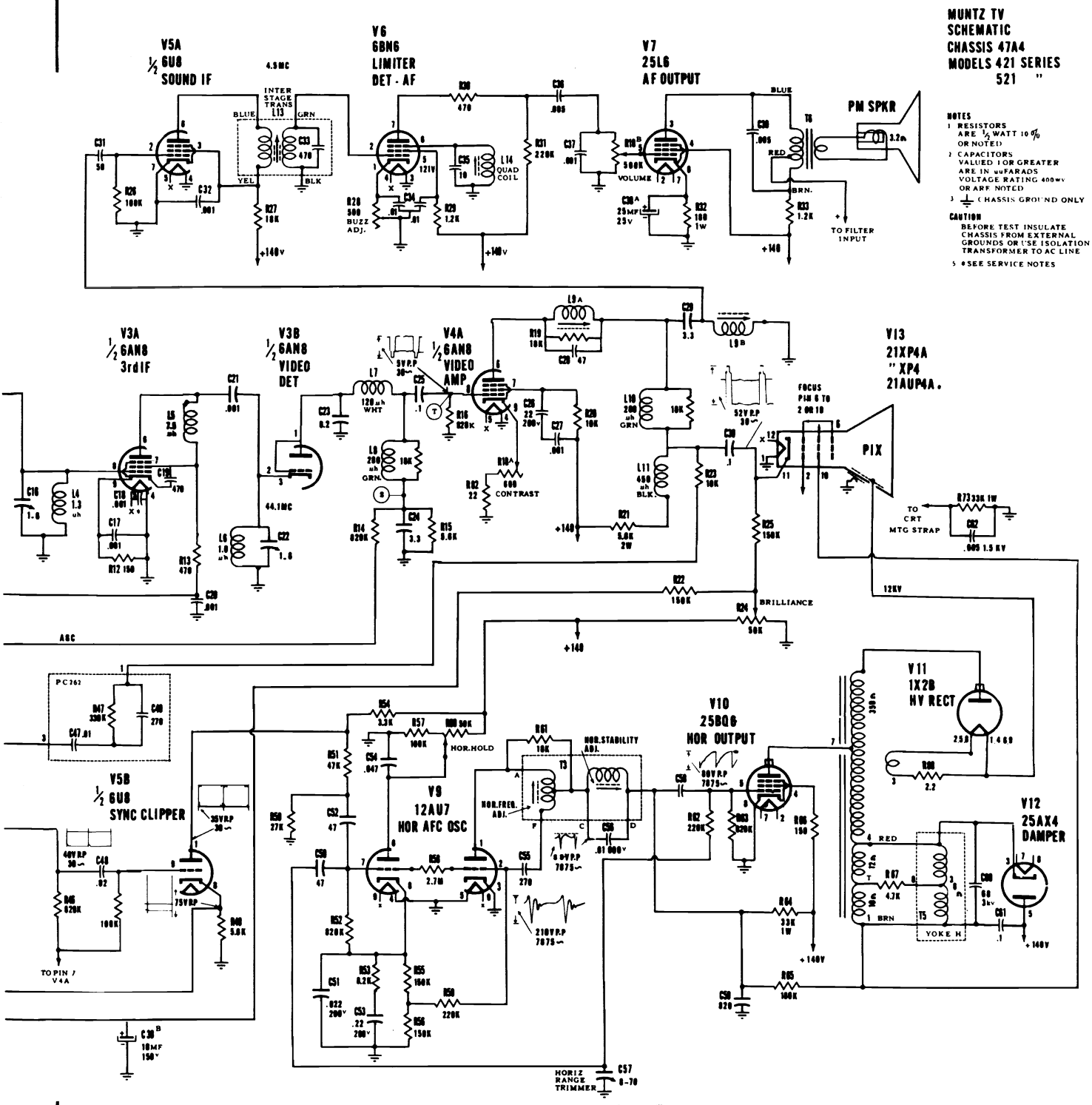
VERTICAL HOLD R38: The vertical hold control has a lock-in range to lock the receiver in vertical synchronization; with best interlace of sweep lines.

VERTICAL SIZE R44: The vertical size control affects only the height of the picture and has no interaction on vertical linearity setting.

BRILLIANCE R24: Adjust the brilliance control in combination with the picture control for the most pleasing picture. Set the brilliance to the point where the picture control will give a dark black, a brilliant white and varying degree of grey.

VERTICAL LINEARITY R37: The vertical linearity control, unlike most conventional circuits, affects only the very top portion of the picture.

HORIZONTAL RANGE C57: Sets the locking range of the horizontal hold control. For full details of the setting of this control see Alignment for Horizontal AFC.



VOLTAGE CHART

Line Voltage 117 A.C. All Readings made to chassis ground. Readings taken with an RCA V.T.V.M. model 97 A. Readings subject to a ± 10% variation.

Symbol	Type	Function	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9	NOTES
V1	6AU6	1st I.F.	-.7	0	0	6.3AC	123	123	.8			
V2	6AU6	2nd I.F.	-.8	0	0	6.3AC	123	123	.6			
V3 ab	6AN8	3rd I.F. & Det.	-.5	-.5	0	0	6.3AC	123	123	0	1.5	
V4 ab	6AN8	Video & Sync Sep.	15	*-1.2	0	0	6.3AC	*60 to 115	120	0	*2.7	*Varies with cont.
V5 ab	6U8	Sound I.F. & Sync Clip	108	-.5	50	0	6.3AC	50	0	50	50	
V6	6BN6	Sound Disc.	*0 to 6	0	0	6.3AC	120	0	*20 to 140			*Varies with buzz Control
V7	25L6	Sound Output	0	47AC	134	140	0	TP	22AC	10		
V8	25L6	Vert. Osc. & Output	0	22AC*	120 to 128			0	0	0		*Varies with V lin, V hold, V size.

Symbol	Type	Function	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9	NOTES
V9	12AU7	Hor. AFC & OSC.	142	-44	0	0	0	*95 to 140	*-4 to +2	*8 to 18	6.3AC	*Varies with H hold.
V10	25BQ6	Hor. Output	T.P.	47 A.C.	T.P.	138	-18	T.P.	72 A.C.	0		
V11	1 X 2	H. V. Rect.								H.V. 12K.V.		
V12	25AX4	Damper	0	0	345	0	140	T.P.	97 A.C.	72A.C.		
V13	21XP4 21XP4A 21AUP4	Kinescope	PIN 10 345	PIN 11 140	PIN 12 6.3 A.C.							

Muntz TV Chassis 47A4 and 49A4 Alignment Information

ADJUSTING THE PR-0228 AND THE PR-0237

The tuning slugs may be reached by removing the channel selector and fine tuning knobs. Set the fine tuning shaft in the center of its range and adjust the oscillator tuning slug for the best compromise of picture and sound.

ADJUSTING THE PR-0235-1 TUNER

Set fine tuning control to center of its range and on highest channel of channels 7 to 13 operating in range of receiver, adjust high channel oscillator screw for clearest picture with best definition and sound. Turn selector to highest channel of channels 2 to 6 operating in range of receiver and adjust low channel oscillator screw

ALIGNMENT INSTRUCTIONS

When observing the television receiver band pass characteristics on the scope, it is important to avoid distortion of the response curve which would occur when using an abnormal signal input from the sweep and marker generators.

Always set the generator attenuator below the point where its output voltage starts to alter the shape of the response curve shown on the scope. This applies to both sweep and marker generators.

VIDEO I. F. ALIGNMENT

STEP NO.	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	SCOPE CONNECTIONS	ADJUSTMENTS FIG. 1	REMARKS
1	Apply sweep to grid of 1st I.F. tube. (Pin #1 of V1)	44 M.C. (10 M.C. sweep)	43.2 44.75 45.75	12	V. input to testpoint S Ground shielded lead at both scope and pick-up point.	C-10 C-16 C-22	Check response for curve similar to Fig. 4. C-22 affects the 45.75 marker. C-10 and 16 affect amplitude and the 43.2-44.75 markers.
2	High side through ungrounded tube shield floating over Osc.-Mixer tube.	44 M.C. (10 M.C. sweep)	41.25 42.5 43.2 44.75 45.75 47.25	12	SAME	C-3 C-4 C-10 C-16 C-22	Adj. C-3, C-4, and tuner I.F. coil for response similar to Fig. 5. Note: C-4 has most effect on the high freq. side of the curve. Retouch C-10, 16, and 22 if necessary.

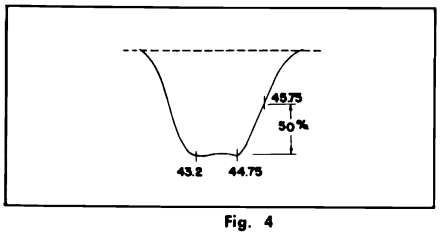


Fig. 4

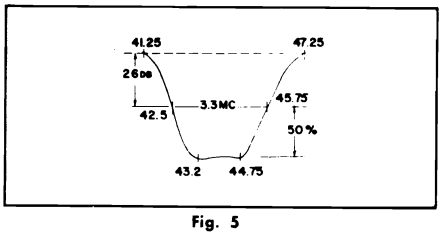


Fig. 5

SOUND ALIGNMENT PROCEDURE

STEP NO.	CHANNEL SET TO	ADJUST	REMARKS
1	Local	De-tune the fine tuning on the tuner so that the 4.5 m.c. beat is more apparent. Adjust L9 A & B individually starting at the extreme counter clockwise (out) position for minimum 4.5 m.c. in the pix.	

Proceed with the sound alignment as follows, using a local T.V. station for signal.

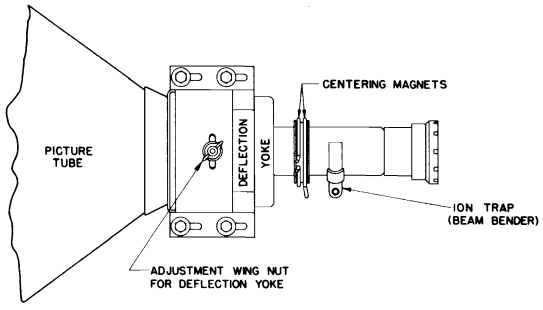
STEP NO.	SIGNAL ADJ.	ADJUSTMENT	REMARKS
2	Strong	L14 Quadrature and R28 Buzz control for maximum sound and minimum buzz.	
3	Weak	L13 inter-stage for maximum sound and minimum hiss. L9-B may need a slight touch up.	MAINTAIN a weak enough signal with this procedure to cause a hiss to accompany the sound.
4	Weak	Repeat step 2. for optimum performance and elimination of any remaining buzz.	

OLYMPIC RADIO & TELEVISION INC.

MODELS

AA CHASSIS	AB CHASSIS	AC CHASSIS	AJ CHASSIS
17CA20	21CB35	21CC55	24CJ68
17TA19	21CB41	21CC70	
17TA32	21DB71	21DC71	AK CHASSIS
17TA33	21KB24	21KC44	24CJ68BK
	21KB26	21KC46	24CJ68MK
	21KB36	21KC56	24CK77
	21KB76	21TC54	
	21TB34	22DC Series	
	21TB40		
	22DB Series		

(See also pages 128 through 130)



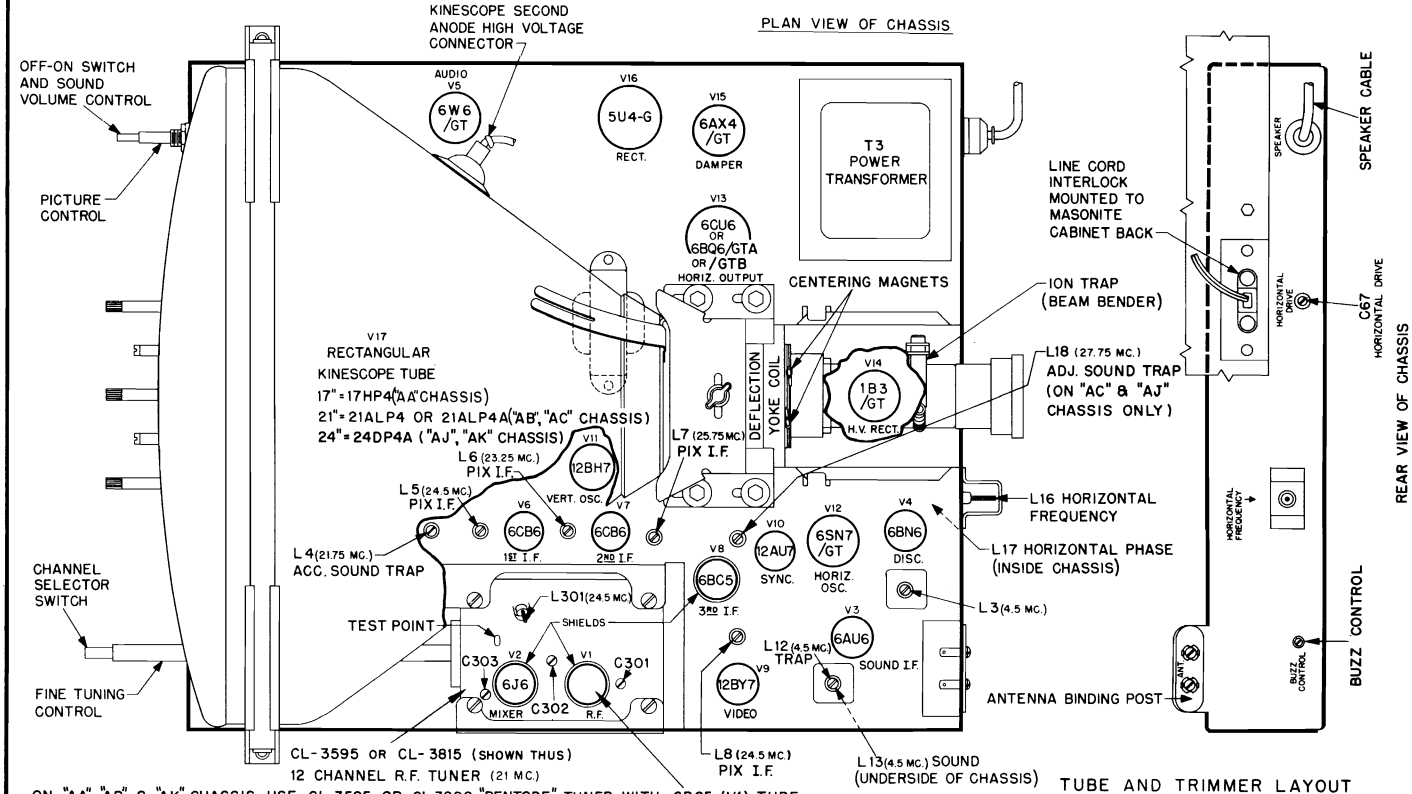
DEFLECTION YOKE ADJUSTMENT

If the lines of the raster are not horizontal or squared with the picture mask, loosen the deflection yoke adjustment screw and rotate the deflection yoke until this condition is obtained, and retighten the yoke adjustment screw. If neck shadow is evident or the corners of the raster are dark, the deflection yoke must be moved as far as possible and the wing screw retightened.

HORIZONTAL WIDTH & DRIVE ADJUSTMENT

The Horizontal Drive Trimmer should be screwed tight (clockwise) and then backed off (counterclockwise) until Horizontal Drive bars appear. Then turn Drive Trimmer in again (clockwise) until drive bars just disappear. (Note: In some sets no horizontal drive bars will appear regardless of Drive Trimmer adjustment. In these sets the trimmer should be set for proper width.)

Important: The horizontal oscillator frequency must be checked for proper range of horizontal control after any adjustment of horizontal drive (C67). Any adjustment of C67 will usually require resetting of the horizontal frequency adjustment coil (L16).



TUBE AND TRIMMER LAYOUT

OLYMPIC (Continued)

TO REMOVE CHASSIS FROM CABINET

Remove: (1) Line cord from power outlet.
(2) Masonite back.
(3) Antenna Lead-in from terminal posts.
(4) Speaker plug from rear of chassis.
(5) Knobs from front of cabinet.
(6) Four mounting screws and washers from bottom of cabinet.

In sliding chassis out of cabinet, be careful that the kinescope tube does not strike against speaker or any other obstrusction.

Before proceeding it will be necessary to use an extra line (or "cheater") cord to supply AC current to the chassis as the set's line cord is attached to the masonite back of the cabinet.

ORDER OF ALIGNMENT

When complete receiver alignment is necesary, it should be performed in the following sequence:
(1) Accompanying and Adjacent Sound Trap
(2) Pix IF Coils
(3) 4.5 MC Trap
(4) 4.5 MC Sound IF and Sound Discriminator

After removing chassis from cabinet re-connect power and speaker plugs.

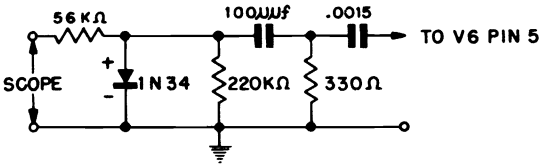
If a local station is not operating on Channel 9 set the tuner to this channel, turn on power switch and proceed as follows: (If 9 is a local station, use Channel 8 or 10.)

ACCOMPANYING & ADJACENT SOUND TRAP

Insert a 100,000 ohm ½ watt resistor in series with the "Hot Lead" of the electronic voltmeter and connect it to the junction of L10 and C25. Meter switch should be set to the lowest negative scale. Ground lead of meter should be connected to chassis.

Remove the shield of the RF Oscillator and Mixer tube (V2) from ground clips leaving shield resting on tube and connect hot lead of the RF Signal Generator to it. This will couple generator output to mixer plate.

Set the generator frequency accurately to 21.75 MC, and adjust (L4) sound trap for minimum reading on voltmeter. For "AC" & "AJ" chassis, set generator to 27.75 MC and adjust (L18) adjacent sound trap for minimum reading on voltmeter.



CRYSTAL PROBE FOR OVERCOUPLED STAGE ALIGNMENT

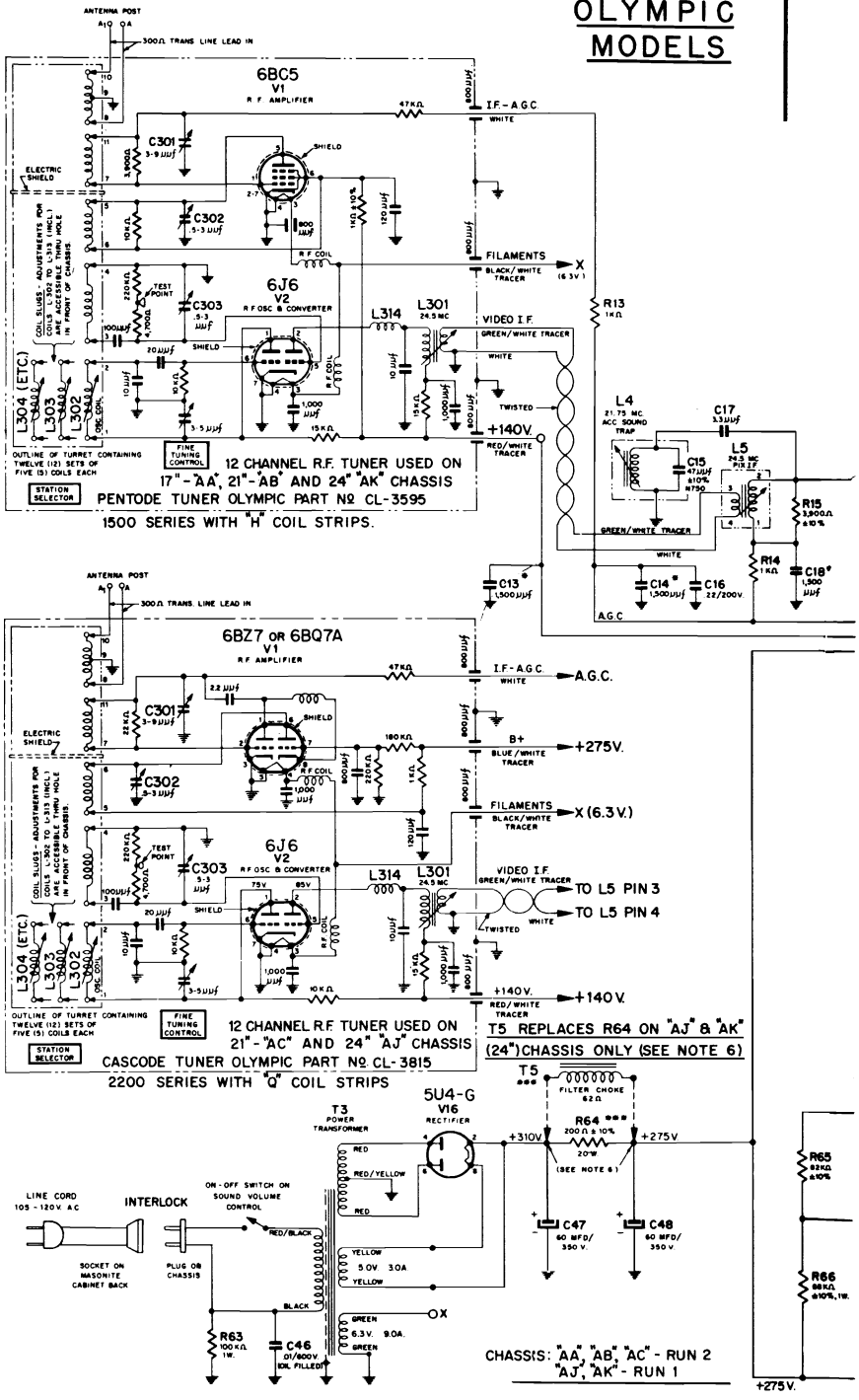
FIG. 4

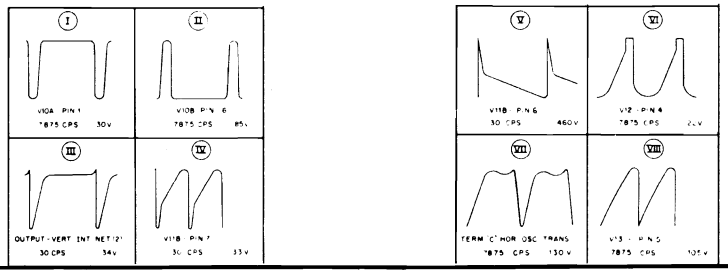
PIX IF COIL ADJUSTMENT

Align the overcoupled stage L301 and L5, before adjusting any other I.F. coils, in the following manner: Connect a jumper wire from junction of R13 and C14 (A.G.C.) to chassis and remove last I.F. tube (V8). Connect the I.F. Sweeper to the shield of V2 (as in Trap Adjustment) and the crystal probe (shown in figure 4) between the vertical input terminals of the

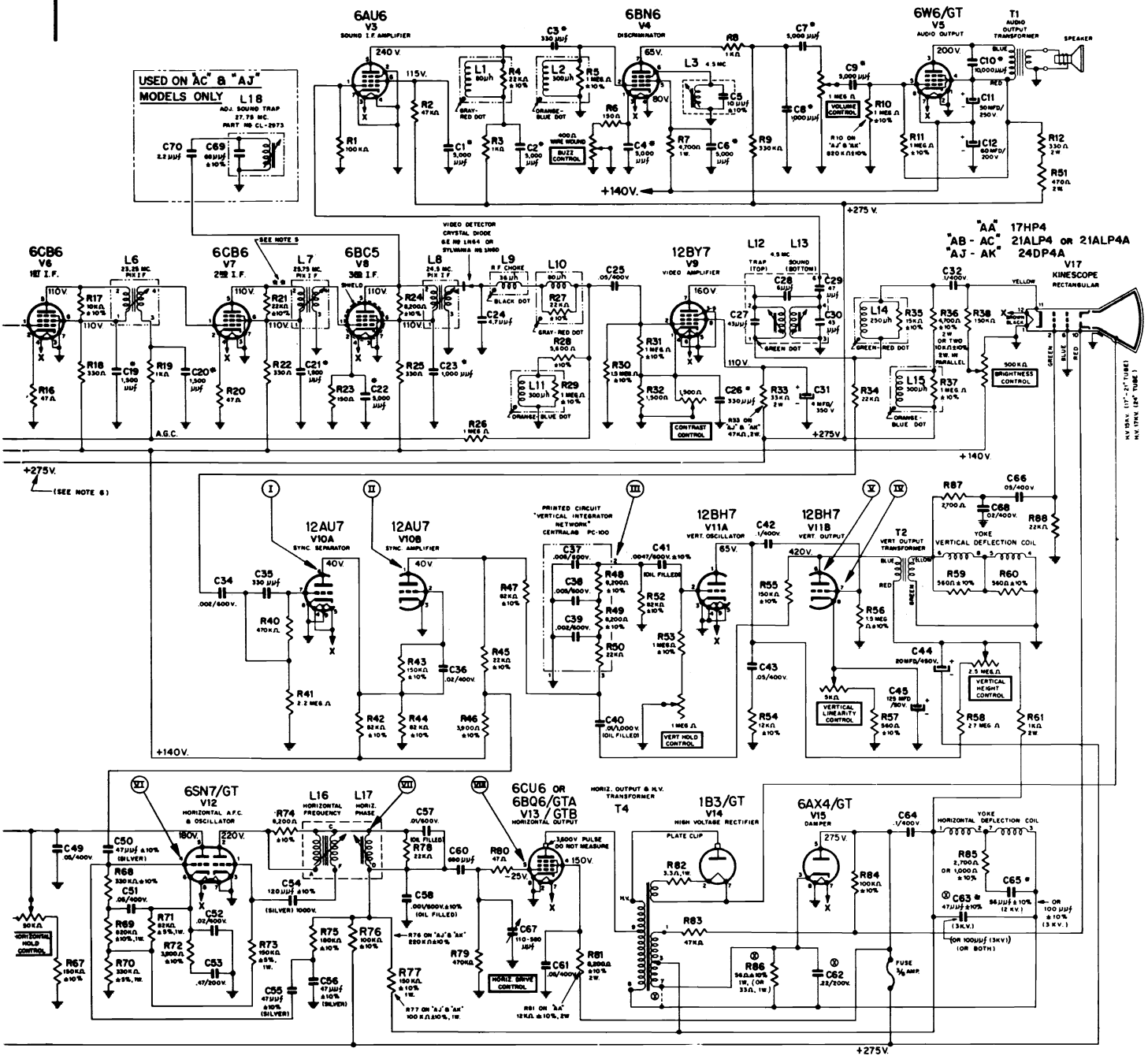
(Continued on page 130)

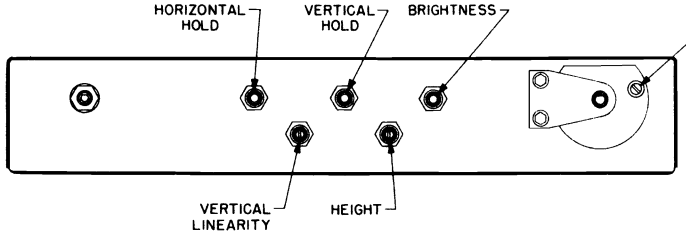
OLYMPIC MODELS



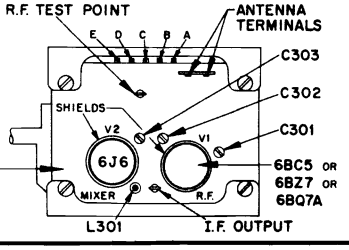


17"-"AA", 21"-"AB" & 24"-"AK" CHASSIS WITH PENTODE TUNER
21"-"AC" & 24"-"AJ" CHASSIS WITH CASCODE TUNER





FRONT VIEW OF CHASSIS



TUNERS CL-3998 OR CL-3963 (SHOWN THUS)

NOTES:

1. ALL RESISTORS ±20% TOLERANCE, 1/2 WATT UNLESS OTHERWISE SPECIFIED.
2. ALL MICA AND CERAMIC CONDENSERS ±20% TOLERANCE, UNLESS OTHERWISE SPECIFIED.
3. ALL VOLTAGES MEASURED BETWEEN POINTS INDICATED AND CHASSIS, USING AN ELECTRONIC VOLTMETER. ALL VOLTAGE READINGS ±15%. MEASURED WITH AN INPUT VOLTAGE OF 117 VOLTS, 60 CYCLES, A.C. WITH INCOMING SIGNAL AND WITH CONTRAST CONTROL SET TO PRODUCE 50 VOLTS PEAK TO PEAK AT K'NESCOPE.

* ◆ CERAMIC CONDENSERS, DISC TYPE

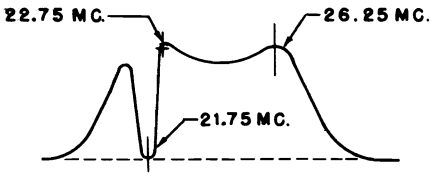
*** "AC" & "AJ" MODELS ONLY: USE TUNER CL-3815. ADD L18 (ADJ. SOUND TRAP), C69 & C70 CONDENSERS, CHANGE RESISTOR R21 TO 10K Ω ±10%.

**** "AJ" & "AK" MODELS ONLY: FILTER RESISTOR R64 IS REPLACED BY T5 62 Ω FILTER CHOKE (SHOWN DOTTED 1). "B+" VOLTAGES ARE APPROXIMATELY 10% HIGHER THAN SHOWN ON DIAGRAM, EXCEPT +140 VOLT STRING WHICH REMAINS APPROX. +140 VOLTS.

Ⓧ 7. CIRCUIT CHANGE:— R86, C62 AND C63 ARE NOT USED IN THE "AA" CHASSIS. TERMINALS 7 & 8 OF THE HORIZONTAL OUTPUT TRANSFORMER (T4) ARE CONNECTED TOGETHER AS SHOWN IN DOTTED LINES IN THE "AA" CHASSIS.

oscilloscope and the plate (pin 5) of the 1st I.F. tube (V6). Adjust the tuner slug L301 and first I.F. slug L5 so that the 22.75 MC marker falls just on the trap (21.75MC) side of the peak. Both slugs should be adjusted such that both peaks are of equal maximum height as illustrated in figure 5. Remove jumper wire and replace V8.

Note: After setting L301 and L5 DO NOT readjust to improve wave shape.



NORMAL CURVE FOR OVERCOUPLED STAGE

FIG. 5

Adjust the following slugs for maximum output at frequencies and sequence indicated with meter and generator connected as in "ACC. Sound Trap" adjustment.

L6	23.25 MC
L7	25.75 MC
L8	24.5 MC

If oscillation occurs during alignment, temporarily raise frequency of L8 by turning screw counterclockwise until screw projects approximately ¾". Oscillation is evidenced by high reading on voltmeter (— 5V to — 20V) with signal generator OFF and no signal coming in through the antenna terminals. After properly adjusted L301, L5, L6 and L7 reset L8 to proper frequency, if it had been necessary to detune.

Connect hot lead of sweep generator through a 330 uuf condenser to test point on tuner and connect ground lead to chassis.

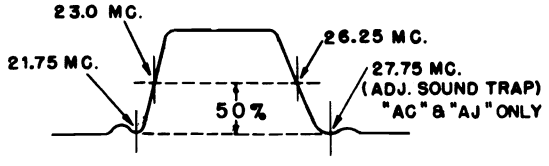
Connect vertical input terminal of oscilloscope to junction of peaking coil L10 and C25 and connect ground lead of scope to chassis.

Connect 1.5V flashlight battery with positive terminal to chassis and negative terminal to junction of R13 and C14. This point is AGC bias voltage. Set tuner to Channel 9 unless local station is operating on this frequency, in which case an adjacent channel should be used.

Set Sweep Generator frequency to IF sweep on the 20 to 30 MC range.

Adjust sweep generator output to produce a curve on the scope which is approximately ⅔ of the screen diameter.

Loosely couple output of RF signal generator by using shield on V2 and set frequency of RF signal generator to 26.25 MC (marker).



STANDARD RESPONSE CURVE

FIG. 6

Curve shown on scope should be similar to the response curve shown in Figure 6. For proper setting of the pix carrier the 26.25 MC marker should appear on the curve at apoint approximately 50% of the vertical height of the curve.

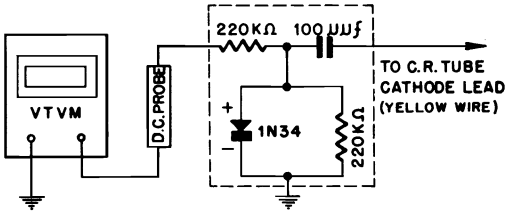
To obtain this setting retouch L8.

Reset RF signal generator frequency to 23.0 MC and retouch L6 for correct positioning of marker on curve.

Recheck setting at 26.25 MC marker to make sure that position has not shifted on curve.

Disconnect bias battery.

Note: If the curve cannot be made to appear as above due to a local station or other interference, or if multiple markers appear, remove (V1 — 6BC5) RF tube from tuner.



VOLTMETER AND CRYSTAL DIODE CONNECTIONS

FIG. 7

4.5 MC TRAP ALIGNMENT

Connect voltmeter lead to Diode crystal rectifier as shown in Fig. 7. Connect Diode crystal rectifier between C. R. Tube Cathode lead (yellow wire) and chassis ground. Signal generator is connected at junction of L10 and C25. Set contrast control at maximum and voltmeter to 3 volt scale (negative). Remove 6BC5 (V8) from socket. Use maximum output of generator at 4.5 MC. Adjust L12, top of TR-3386 for minimum reading on meter.

When it is necessary to retouch this trap in the field, proper adjustment can be made by using the local station signal and turning the Fine Tuning Control to bring fine herringbone sound beat into the picture. The 4.5 MC trap (L12) should then be adjusted to minimize this beat interference.

SOUND DISCRIMINATOR (4.5 MC) ADJUSTMENT

In view of the fact that the transmitted sound signal from a TV station is probably the most accurate available, as far as frequency is concerned, it is recommended that a working signal be used for sound alignment. The set should be connected to an antenna, turned on, allowed to warm up for about 5 to 10 minutes and then tuned for the best picture. A vacuum tube voltmeter should be connected to Pin 2-V4 and the meter set to the minus 30 volt scale. The bottom of the 4.5 MC Sound IF Transformer (L13) should be tuned for maximum deflection of the meter.

The Quadrature coil L3 should be adjusted for maximum audio output using the transmitted signal from a TV station. This is done with the "BUZZ CONTROL" set to mid-range. An output meter connected to the voice coil terminals may be used for this adjustment, or it may be done by ear since the coil slug must be set carefully for elimination of Buzz. Both the "BUZZ CONTROL" and L3 coil must be adjusted for maximum audio output and elimination of Buzz.

Packard-Bell

CHASSIS TYPE T-10

Models 17101, 17104, 21102, 21201, 21204, 21206, 21402

DESCRIPTION OF MODELS:

The seven Packard-Bell television models described in this manual utilize chassis T-10, containing 18 tubes, including the 17 or 21 inch rectangular picture tube. The sets are identical electrically, except for the R-F tuner, which may be either VHF or VHF-UHF. In the latter case the model number is followed by the suffix "-U".

FOCUSING is controlled by the voltage on grid four (terminal 6) of the picture tube. Grid is connected to either the ground, 205 volt, or 335 volt lead, whichever gives the best result. This varies with the picture tube used.

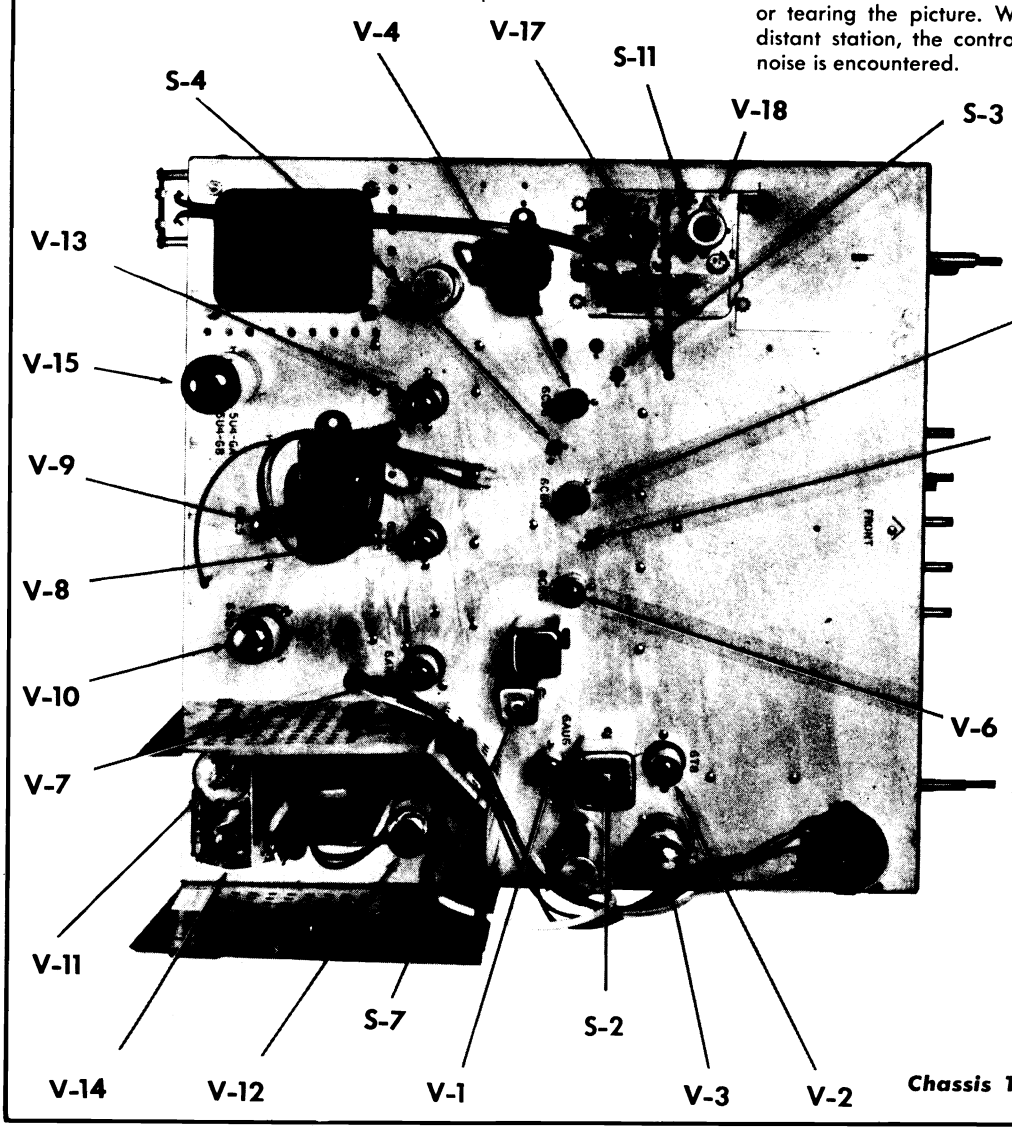
AGC SWITCH:

A switch on the front panel is used to add "delayed AGC" to the tuner. In most areas this switch should be left in the normal position. In some weak-signal areas an improvement in signal to noise ratio will be obtained when operating this switch in the delayed position.

PICTURE LOCK CONTROL:

In all but extremely noisy locations this control should be left as set at the factory, in the counterclockwise position. In fringe areas, if noise affects the sync stability, the control should be set as far clockwise as possible without pulling or tearing the picture. When switching from a local to a distant station, the control may require resetting if strong noise is encountered.

(Circuit diagram on pages 132-133, alignment data on page 134.)



Chassis T-10, Top View

LIST OF ADJUSTMENTS

S-1	Ratio detector primary
S-2	Ratio detector sec
S-3	1st I-F: 42.50 Mc.
S-4	2nd I-F: 45.00 Mc.
S-5	3rd I-F: 44.00 Mc.
S-6	4th I-F. 43.25 Mc.
S-7	Trap, 4.5 Mc.
S-8	Intercarrier sound
S-9	Horiz hold
S-10	Width
S-11	Tuner I-F: 44.80 Mc.

Packard-Bell Models 17101, 17104, 21102, 21201, 21204, 21206, 21402

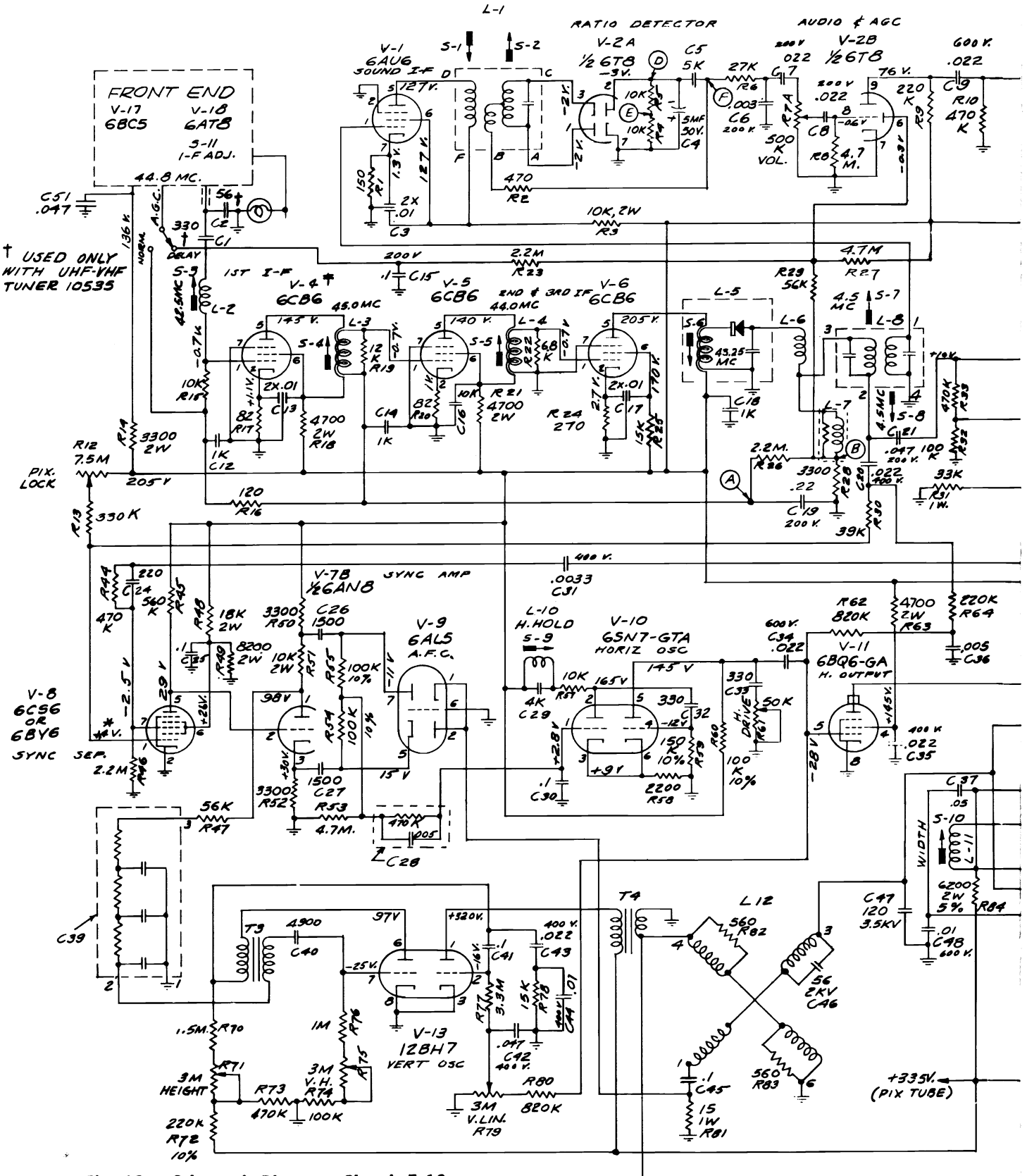
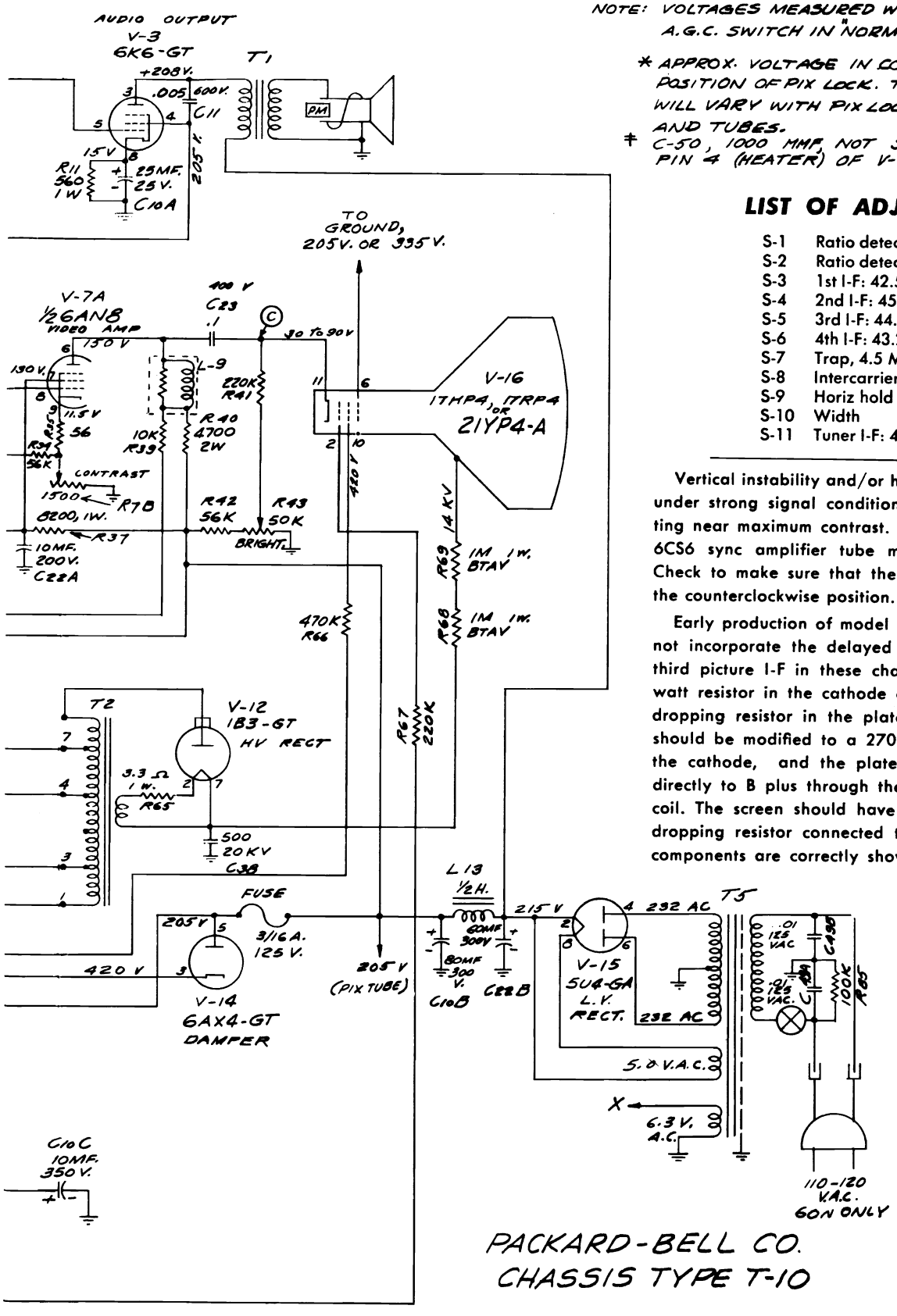


Fig. 10. Schematic Diagram, Chassis T-10

Packard-Bell Models 17101, 17104, 21102, 21201, 21204, 21206, 21402



NOTE: VOLTAGES MEASURED WITH NO SIGNAL, A.G.C. SWITCH IN "NORMAL" POSITION.

* APPROX. VOLTAGE IN COUNTER-CLOCKWISE POSITION OF PIX LOCK. THIS VOLTAGE WILL VARY WITH PIX LOCK POSITION AND TUBES.

‡ C-50, 1000 MMF, NOT SHOWN, FROM PIN 4 (HEATER) OF V-4 TO GROUND.

LIST OF ADJUSTMENTS

S-1	Ratio detector primary
S-2	Ratio detector sec
S-3	1st I-F: 42.50 Mc.
S-4	2nd I-F: 45.00 Mc.
S-5	3rd I-F: 44.00 Mc.
S-6	4th I-F: 43.25 Mc.
S-7	Trap, 4.5 Mc.
S-8	Intercarrier sound
S-9	Horiz hold
S-10	Width
S-11	Tuner I-F: 44.80 Mc.

Vertical instability and/or horizontal pull may appear under strong signal conditions when the set is operating near maximum contrast. Variations in the 6BY6 or 6CS6 sync amplifier tube may cause this condition. Check to make sure that the picture lock control is in the counterclockwise position.

Early production of model 17101 (chassis T-10) did not incorporate the delayed AGC control switch. The third picture I-F in these chassis had a 120 ohm, ½ watt resistor in the cathode and a 3300 ohm, 2 watt dropping resistor in the plate and screen circuit. This should be modified to a 270 ohm, ½ watt resistor in the cathode, and the plate (pin 5) should be tied directly to B plus through the primary of the third I-F coil. The screen should have a 15,000 ohm, ½ watt dropping resistor connected to the B plus line. These components are correctly shown in the schematic.

PACKARD-BELL CO.
CHASSIS TYPE T-10

Packard-Bell Models 17101, 17104, 21102, 21201, 21204, etc. Alignment Data

ALIGNMENT PROCEDURE

GENERAL:

It is important that the service technician read and adhere to the alignment instructions in this section, especially in the case of the picture I-F.

Some service technicians may be accustomed to aligning the picture I-F response curve on the oscilloscope alone. This procedure is not recommended because it is actually quite possible to get what appears to be an acceptable curve and still be lacking in horizontal resolution.

Instead, the spot frequency alignment outlined below should be followed.

In this procedure the sweep generator is fed in through the antenna terminals, therefore the output impedance of the generator must match the 300 ohms impedance of the set. A matching network may be devised to accomplish this. Figure 6 shows a network for a sweep generator with 75 ohms output impedance. If the generator impedance is 50 ohms, change the values to 56 ohms for the shunt resistor and 130 ohms for each of the series resistors.

Loose-coupling the signal generator to the mixer tube (done in step 2, below) is accomplished by lifting the tube shield from ground and connecting the generator between the shield and ground. Keep leads less than 1½ inches long.

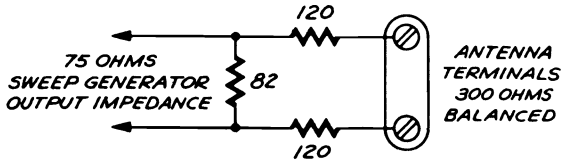


Fig. 6. Matching Network

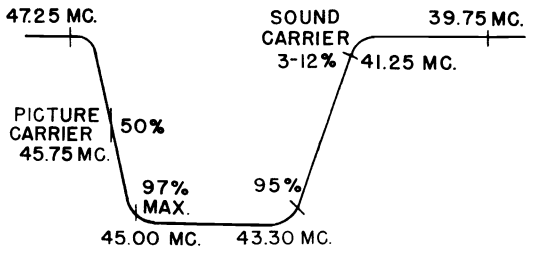
PICTURE I-F ALIGNMENT:

1. Connect a VTVM between point "A" and ground.
2. Loosely couple signal generator to mixer tube in tuner (6AT8 in VHF, 6U8 in UHF). This is done by connecting generator between tube shield and ground. Set generator output at maximum.

Step	Sig Gen. Freqncy	Adjust	For
3.	44.80 Mc. (mixer I-F in tuner)	S-11	MAXIMUM
4.	42.50 Mc.	S-3	MAXIMUM
5.	45.00 Mc.	S-4	MAXIMUM
6.	44.00 Mc.	S-5	MAXIMUM
7.	43.25 Mc.	S-6	MAXIMUM

REPEAT STEPS 3 THROUGH 7

8. Connect oscilloscope to point "B", using a 22,000 ohm isolating resistor in series with the scope probe. Connect an electrolytic capacitor, 5 mfd, 50 volts, between point "A" and ground, the negative lead to point "A".
9. Connect sweep generator to antenna terminals through an impedance matching network. (Antenna terminals 300 ohms balanced.)



I-F Response Curve, Chassis T-10

10. Rotate tuner to channel 3, and set sweep generator to center frequency of channel (63 Mc.). With a sweep width of 8 Mc., adjust generator output to develop about 3.6 volts of AGC.
11. With signal generator still coupled to mixer tube, adjust output to provide the markers shown on the illustrated response curve. Check the position of the markers one at a time.
12. Some further touching-up may be necessary to make the waveform and markers conform to the illustration. The adjustments have the following effects:

    S-3 controls the overall band width.

    S-11 moves the 45.75 Mc. marker up or down the curve (should be 50%).

    S-4 controls the position of the 45.00 Mc. marker (should be at a maximum of 97% response).

    S-5 controls the 41.25 Mc. position (should be between 3% and 12% response). This control also tilts bottom portion of response curve.

    S-6 must not be changed from the 43.25 Mc. position or sync trouble will occur.

ALIGNMENT OF 4.5 Mc. TRAP:

1. Connect signal generator between point "B" and ground through a .001 mfd isolating capacitor.
2. Turn contrast control to maximum.
3. Connect an R-F vacuum tube voltmeter to point "C". If an R-F VTVM is not available, use a conventional VTVM with a germanium diode and an isolating capacitor (.01 mfd) in series with the probe.
4. Set signal generator to 4.50 Mc., with the output at one volt or more.
5. Adjust trap, S-7, for minimum VTVM reading.

NOTE: If generator is not capable of one volt output, observe the picture and adjust S-7 to eliminate the 4.5 Mc. beat.

SOUND I-F AND RATIO DETECTOR ALIGNMENT:

1. Connect signal generator between point "B" and ground.
2. Connect VTVM between point "D" and ground.
3. With generator frequency at 4.50 Mc., adjust S-8 and S-1 for MAXIMUM.
4. Connect VTVM between points "E" and "F".
5. Adjust ratio detector secondary, S-2, for zero between positive and negative peaks.

PHILCO

PHILCO TELEVISION CUSTOM 400 CHASSIS

Philco Chassis TV-400 is used in Models 22C4020, 22C4128, and 22C4132L.

(The material on above listed sets is reproduced on pages 135 to 145 inclusive, through the courtesy of the Philco Corp.)

CIRCUIT DESCRIPTION

The TV-400 is the deluxe receiver of the new line employing a single chassis. The VHF tuner used is a 12 channel, 13 position tuner mounted on a separate sub-chassis. The thirteenth position is used for the reception of UHF signals in conjunction with a UT-26 UHF tuner. The R.F. amplifier is a 6BZ7 tube, while the local oscillator and mixer stages use a type 6X8 tube. The pentode section of the 6X8 is used for mixing, while the triode is used as a local oscillator.

The output of the mixer, a 40-MC signal, is link coupled to four stagger tuned video I-F stages employing four 6CB6 tubes. This I-F system is an improved I-F, in that it contains additional trapping to improve the adjacent channel interference. In the grid circuit of the first I-F, we have the 47.25-MC adjacent channel sound trap and the 41.25-MC accompanying sound trap. In the grid circuit of the third Video I-F, we have an additional 47.25-MC adjacent sound trap along with a 39.75-MC adjacent channel picture trap.

A 1N64 crystal diode is used as a video detector. Following the video detector is a video amplifier consisting of two stages. The first stage uses the pentode section of the 6AX8 and the output stage uses a 6AQ5 which drives the grid of the picture tube.

Sound I-F (intercarrier) is obtained by utilizing the beat frequency produced when the 45.75-MC video carrier and the 41.25-MC sound carrier are mixed in the video detector. The beat frequency 4.5-MC is the difference between 45.75-MC and 41.25-MC and contains the FM sound signal. This 4.5-MC signal contains only a negligible amount of the video AM amplitude modulation, provided that the amplitude of the 41.25-MC signal is considerably lower than that of the 45.75-MC signal. The proper relative amplitude of the two carriers is established in the alignment of the receivers. There is sound output only when both the video and sound carriers are present.

A-G-C voltage for the video I-F system and the R-F amplifier is obtained from a keyed a-g-c system which uses a 6AU6 tube, as the a-g-c gate. Composite video from the video-amplifier plate circuit through a cathode follower, is fed to the grid of the a-g-c gate tube, while a gating or keying pulse, obtained from a winding on the horizontal-output transformer, is applied to the plate. The sync-pulse polarity applied to the grid of S12 is positive; therefore, the a-g-c gate can conduct in proportion to the amplitude of the sync-pulse tips if the gating or keying pulse occurs at the same time as the sync. Because the keying or gate pulse is a constant amplitude, approximately 500 volts peak, the amplitude of the sync pulse will determine the amount of conduction in the gate tube. The plate current of the keyed a-g-c gate tube flows through a resistor network, developing a voltage which is negative with respect to the chassis and whose amplitude is proportional to the plate current. This negative voltage is used to control the gain of the receiver. Since conduction cannot occur in the a-g-c gate tube unless the sync pulse and gating pulse occur at the same time, noise disturbances that occur between sync-pulse intervals cannot affect the a-g-c voltage.

Composite video for the sync circuits is taken from the plate of the first video amplifier. The output is fed to a cathode follower which delivers the information into the noise inverter circuit. The noise inverter is operated with a low value of plate voltage and high bias which keeps the tube beyond cut-off. When the composite video signal is applied to the grid of the noise inverter the sync appears as positive pulses: noise which could affect the sweep circuits also appears as positive pulses. Harmful noise pulses usually have amplitudes far greater than the sync pulses, and therefore, drive the grid of the noise inverter positive sufficiently to allow conduction in the noise-inverter plate circuit.

The output of the noise inverter consists of negative-going noise pulses. It should be noted that the noise pulses which exceed the sync level have been passed and their polarity reversed by the noise inverter. The output of the noise inverter is now mixed with the composite video and fed to the grid of the sync separator, the triode section of the 6AX8 tube. Since the composite video fed to the grid of the sync separator has positive sync polarity, the positive noise pulses carried with the composite video would be passed by the sync separator; however, the output of the noise inverter consists of these same noise pulses, but they are of opposite polarity; thus, the noise pulses are cancelled. The output of the sync separator contains only the sync pulses which are fed to the vertical and horizontal circuits. The vertical pulses are fed from the plate of the sync separator to the vertical oscillator through an integrator circuit.

Horizontal sync information is fed into the phase comparer circuit which controls the frequency of the horizontal oscillator. A 6AL5 tube is employed as the phase comparer in the horizontal circuits. The plate of one diode is grounded, the cathodes of both diodes are tied together and, from a winding on the horizontal output transformer, a pulse is fed, through a shaping network to the plate to the other diode. The horizontal sync pulses from the sync separator are fed to the cathodes. If the incoming sync pulse is not in phase with the pulse from the horizontal output transformer, a difference voltage occurs in the output of the phase comparer which is fed to the horizontal oscillator and is used to control its frequency. A cathode coupled multivibrator using a 12AU7A tube provides the horizontal oscillator signal. Two variable resistors in series to the grid of the second triode section of the oscillator are employed as the horizontal hold control and horizontal hold centering control. With these controls, the horizontal oscillator frequency is adjusted within the range of the phase comparer control voltage.

When the voltage is delivered to the horizontal oscillator grid by the phase comparers circuit is positive, it increases the frequency of the oscillator; when the voltage is negative, it reduces the frequency of the oscillator. This control voltage holds the horizontal oscillator in phase with the sync signal. The HORIZ. HOLD control, adjusts the horizontal oscillator to the proper frequency, so that it may be controlled by the phase comparer. The output of the horizontal oscillator is fed to the horizontal-output amplifier, which uses a 6CU6 tube, V19.

VIDEO PEAKING-COIL ADJUSTMENT — TV-400

The peaking coil, T5, is adjusted at the factory for proper transient response of the video circuits. Ordinarily, this coil will require no further adjustment by the serviceman. On any station where excessive overshoot or excessive smear is present, a slight adjustment of T5 may improve the picture quality on that station; however, this adjustment may sacrifice the quality on other channels. If T5 is replaced in servicing, adjustment will be required.

Before adjusting T5, check the tuner alignment and I-F alignment. (Never adjust T5 until the alignment of a receiver is correct.) Then tune in a station and adjust T5 until there are no trailing whites or smear in the picture. Turning T5 clockwise reduces trailing whites and overshoot; turning T5 counterclockwise reduces picture smear and increases trailing whites. The proper position is the point where no smear or trailing whites appear in the picture.

The above procedure for adjustment of T5 applies to a particular station exhibiting smear or overshoot. After T5 is adjusted, reception on all the other stations should be checked, to make certain that the adjustment has not impaired the picture quality.

TELEVISION ALIGNMENT

General

The alignment procedure follows the general pattern of first checking the tuner response with an FM sweep generator and oscilloscope, comparing the response curve with that given in the manual, and aligning the tuner if necessary. After it is established that the tuner is in correct alignment, the video I-F channel is aligned by tuning each coil to its assigned pole frequency, using an AM signal, and then feeding in a sweep signal at the antenna terminals and retouching the I-F adjustments to obtain the desired pass band. Finally, the sound channel is aligned, using an AM signal, by tuning the sound take-off coil and the I-F and ratio-detector transformers.

The over-all response curve (r-f, i-f) of the circuits from the antenna terminals to the video detector, after the I-F stages have been aligned, should appear essentially the same, regardless of the channel under test. If not, the tuner should be aligned.

The video-carrier intermediate frequency is 45.75 mc., and the sound intermediate (intercarrier) frequency is 4.5 mc. Alignment of these circuits requires careful workmanship and good equipment.

HORIZONTAL-OSCILLATOR ADJUSTMENT — TV-400

To adjust the horizontal-oscillator circuit, tune in a station and proceed as follows:

1. Decenter the picture until blanking can be observed at the right-hand side.
2. Increase the BRIGHTNESS control setting until the blanking becomes visible This will appear as a dark vertical bar on each side of the picture.
3. Connect a .1 mf condenser from the test point, to ground. (The plate side of the horizontal ringing coil, T6, is connected to the test point.)
4. Set the HORIZONTAL HOLD control to the approximate center of its mechanical rotation.
5. Adjust the HORIZONTAL HOLD CENTERING control until equal portions of the blanking bar appear on both sides of the picture.
6. Remove the .1 mf condenser from the test point.
7. Adjust the horizontal ringing coil until equal portions of the blanking bar again appear on both sides of the picture.
8. Rotate the HORIZONTAL HOLD control through its range. The picture should fall out of sync on both sides of the center of its rotation. If the picture does not fall out of sync on both sides, readjust the HORIZONTAL HOLD CENTERING control.
9. Rotate the HORIZONTAL HOLD control through its range, and observe the number of diagonal blanking bars that appear just before the picture pulls into sync. The pull-in should occur with from 1 to 2 diagonal bars when the sync position is approached from either direction. If proper pull-in is not obtained, repeat the above procedure.

JIGS AND ADAPTERS REQUIRED — TV-400

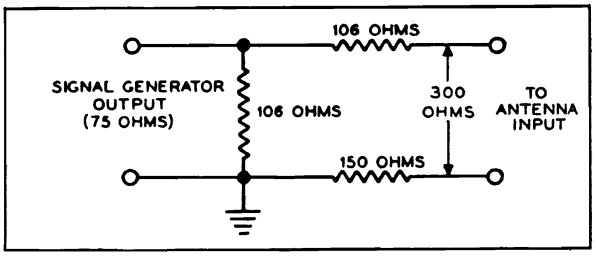


Fig. 1. Antenna-Input matching network.

Mixer Jig

Connections to the grid of the mixer tube may be made through the test point provided for this purpose. To connect the generator to this point, a mixer-grid jig, Philco Part No. 45-1739, and a connecting cable, Philco Part No. 45-1635, may be used. As an alternate, a Philco alligator-clip adapter, Part No. 45-1636, with as short a ground lead as possible, may be used to connect the alignment jack. The ground lead should be connected as close as possible to the mixer tube. It is essential that the signal-generator output lead be terminated with a 68-ohm resistor (carbon), so that regeneration, caused by connection of the lead to the mixer, is held to a minimum.

Antenna-Input Matching Network

An impedance-matching network for coupling the signal generator to the antenna input terminals of the receiver is shown in figure 1. This network, which is designed to have an input impedance of 75 ohms and an output impedance of 300 ohms is used to match a 75-ohm generator to a 300-ohm antenna-input circuit. The resistors used in this network should be of carbon-composition construction, and should be chosen from a group, to obtain values within ten percent of those indicated. The resistors should be placed in a shield can, to prevent variable effects. An antenna-matching jig, Philco Part No. 45-1736, which consists of a matching transformer and connecting box, may be used in place of the resistor network.

Video I-F Alignment Jig

(Video Test Jack Adapter No. 1)

The alignment jig used at TS1 and shown in figure 2, should be used during the i-f alignment, to apply the proper bias to the a-g-c bus, and to provide a convenient oscilloscope connection. This adapter consists of a five-pin plug, two 10,000 ohms resistors, and a 1500 mmf condenser for isolation of the bias supply. To isolate the oscilloscope from the receiver circuits, a 15,000-ohm resistor, by-passed by a 1500 mmf. condenser, is used. A suggested method of fabricating the jig is also shown in figure 2. This jig should not be used to observe the composite video from the video detector output.

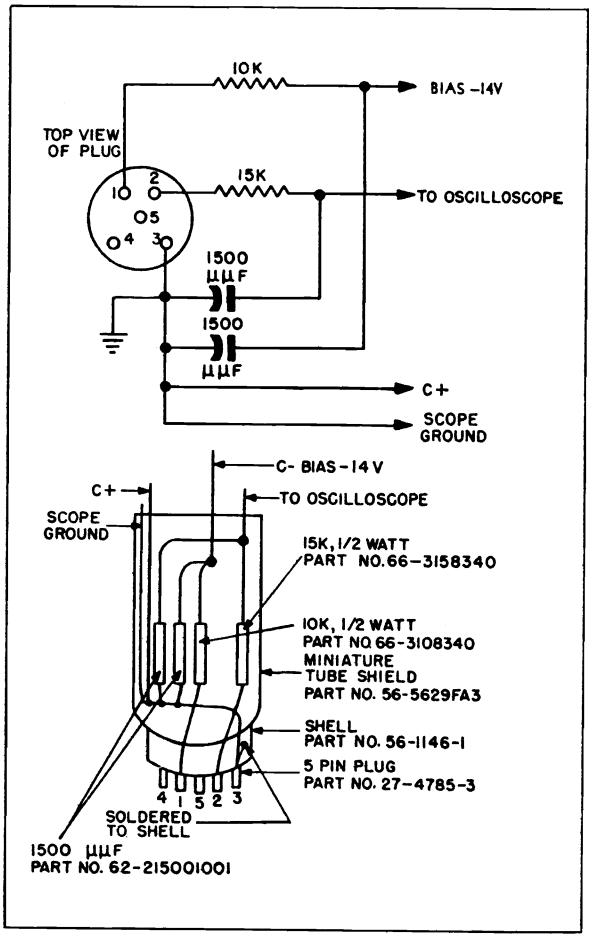


Fig. 2. Video I-F Alignment Jig (Video Test Jack Adapter No. 1).

JIGS AND ADAPTERS REQUIRED (Continued)

Sound I-F Input Alignment Jig

(Video Test Jack Adapter No. 2)

To observe the composite video, at TS1, a jig may be made with a five-pin plug and a 2200 ohm resistor. (See figure 3.) The 2200 ohm resistor should be connected to pin 2 of the plug. A ground lead should be connected to pin 3. To observe the composite video, connect the oscilloscope to the 2200 ohm resistor and the ground lead. This jig is also used for injection of the 4.5 mc. signal during s-i-f alignment.

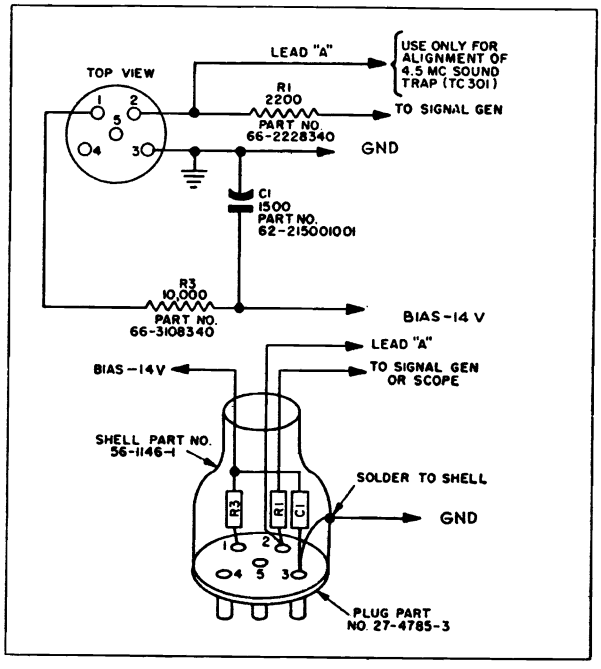


Fig. 3. Sound I-F Input Alignment Jig (Video Test Jack Adapter No. 2).

TUNER BAND PASS ALIGNMENT

(See Table No. 2 on Page 6)

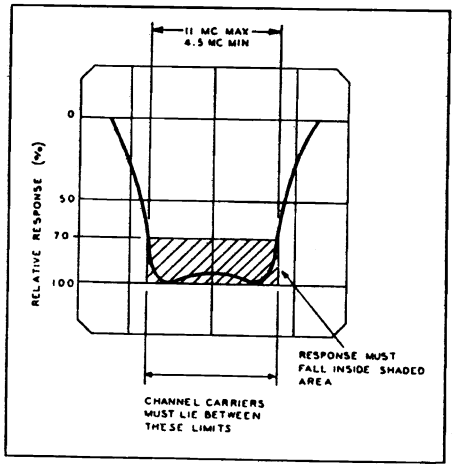


Fig. 4. Television tuner response curve, showing bandpass limits.

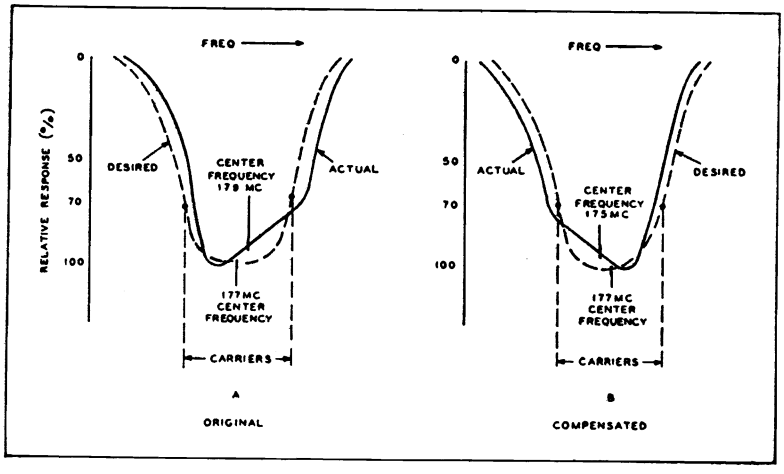


Fig. 5. Television tuner response curve, showing tracking compensation.

TUNER OSCILLATOR ALIGNMENT
TABLE NO. 1

AM GENERATOR: Connect to receiver antenna-input terminals. (No matching network is required.) Use unmodulated r-f output.

OSCILLOSCOPE: Connect the vertical-input lead, in series with a 1000-ohm resistor, to the mixer grid test point. Connect the scope ground lead to the chassis, near the test point.

RECEIVER CIRCUIT ALTERATIONS: Disconnect tuner a-g-c (pink tracer) lead from main chassis, and connect a 1.5 volt bias battery, with negative terminal to white lead from tuner, and positive terminal to chassis.

STEP	AM GENERATOR DIAL SETTING	RECEIVER TUNING	ADJUST	REMARKS
1	257 mc.	channel 13	T2 for zero beat on scope.	a. If regeneration occurs, inject bias; bias may be increased up to 3 volts, if necessary at pin 1 video test jack — TS1. b. Preset fine tuning adjustment so that it is in the middle of its range.
2	251 mc.	channel 12	VC8 for zero beat on scope.	
3	245 mc.	channel 11	VC7 for zero beat on scope.	
4	239 mc.	channel 10	VC6 for zero beat on scope.	
5	233 mc.	channel 9	VC5 for zero beat on scope.	
6	221 mc.	channel 7	VC4 for zero beat on scope.	
7	64.5 mc.	channel 6	T7 for zero beat on scope.	2nd harmonic gives 129 mc.
8	113 mc.	channel 4	T5 for zero beat on scope.	
9	101 mc.	channel 2	T3 for zero beat on scope.	

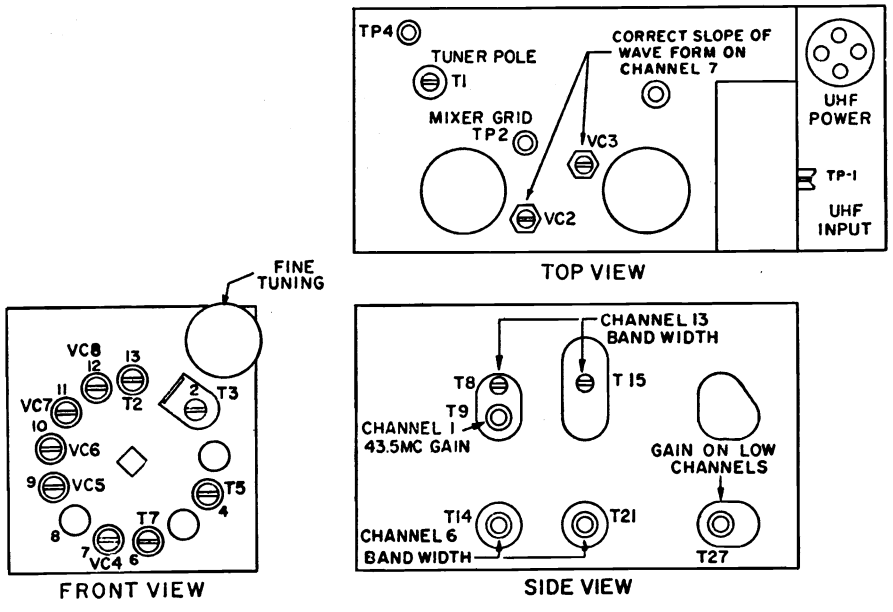


Fig. 6. Tuner Layout.

TUNER BANDPASS ALIGNMENT — TABLE 2

SWEEP (FM) GENERATOR: Connect to receiver antenna-input through Antenna-input Matching Network. (See figure 1.)

OSCILLOSCOPE: Connect the oscilloscope to the junction of R518(15K,1W) and the tuner red lead. Clip ground lead of scope to chassis.

RECEIVER CIRCUIT ALTERATIONS: Disconnect tuner a-g-c (white) lead from main chassis and connect a 1.5-volt bias battery; negative terminal to white lead from tuner, and positive terminal to chassis. Disconnect tuner coupling link leads, and connect a 40- to 70-ohm carbon resistor across the open end of the lead, from the tuner.

STEP	SWEEP (FM) GENERATOR		RECEIVER TUNING	ADJUST	REMARKS
	Sweep Dial Setting	Marker Dial Setting			
1	Channel 13 (213 mc., with 10-mc. sweep width.)	Set first to 210 mc. and note position of marker on response curve. Set to 216 mc. and note position of marker on response curve.	Channel 13		Oscilloscope gain as high as possible with respect to hum level and "bounce". Pips fix channel limits on curve. Response curve to be flat between limits (see figure 4). If not, proceed with step 2.
2	Channel 13	213 mc.	Channel 13	T8 counterclockwise until single peak appears.	CAUTION: Care must be taken not to unscrew core far enough to make it drop out of the coil.
3	Channel 13	213 mc.	Channel 13	T15 until peak falls on 213 mc. marker.	Sweep Generator output may have to be increased.
4	Channel 7 (177 mc., with 10-mc. sweep width.)	Set first to 174 mc. and note position of marker on response curve. Set to 180 mc. and note position of marker on response curve.	Channel 7		Note curve with respect to tilt and center frequency. Curve should be centered in pass-band and symmetrical. If not, proceed with step 5.
5	Channel 7	174 mc. and 180 mc.	Channel 7	VC3 and VC2 to get correct tilt on top of curve.	VC3 and VC2 compensate for the tuning effect of Channel 13 adjustment upon Channel 7. (See figure 5.)
6	Channel 13	213 mc.	Channel 13	Retouch T15 and T8 for symmetrical response centered about 213 mc. marker.	To retouch, only turn cores slightly.
7	Channel 7	117 mc.	Channel 7	Repeat step 5.	Check response curve for correct center frequency and symmetry.
8				Repeat steps 6 and 7.	Repeat Channel 13 and Channel 7 adjustments, alternately, until favorable curves are obtained on both.
9	Channel 6 (85 mc. with 10-mc. sweep width.)	Set first to 82 mc. and note position of marker on response curve. Set to 88 mc. and note position of marker on response curve.	Channel 6		Curve should be symmetrical and centered in pass-band. If not, proceed with step 10.
10	Channel 6	85 mc.	Channel 6	T14 counterclockwise until single peak appears.	CAUTION: Care must be taken not to unscrew core far enough to make it drop out of the coil.
11	Channel 6	85 mc.	Channel 6	T21 until peak falls on 85-mc. marker.	Sweep Generator output may have to be increased.
12	Channel 6	85 mc.	Channel 6	T27 for maximum curve height and symmetry of single peak.	After adjusting T27 recheck as in step 9. If necessary, reduce Sweep Generator output to avoid overloading.
13	Channel 6	85 mc.	Channel 6	Retouch T21 and T14 for symmetrical response centered about 85-mc. marker.	To retouch, only turn cores slightly.
14	43.5 mc. (with 10-mc. sweep width.)	Set first to 45.75 mc. and note position of marker on response curve. Set to 41.25 mc. and note position of marker on response curve.	UHF (Channel 1 position.)		Disconnect sweep (FM) generator from antenna-input terminals and connect to 40-mc. input jack TP1, using a matching network. Curve should be symmetrical and flat-topped. Markers should fall along flat-topped portion of curve. If not, proceed with step 15.
15	43.5 mc. (with 10-mc. sweep width.)	43.5 mc.	UHF (Channel 1 position.)	T9 for most symmetrical flat-topped response curve, centered about 43.5 mc. marker.	Recheck band-pass as in step 14, and repeat adjustment if necessary.

VIDEO I-F ALIGNMENT

AM GENERATOR: Connect to mixer test point, TP-2, through a mixer jig, and adjust the generator for approximately 30 percent modulation at 400 cycles. Adjust the output of the generator during alignment, to keep the output at the second detector below 4 volts peak to peak.

SWEEP (FM) GENERATOR: After step 9, connect to antenna-input circuit through antenna-input matching network. (See figure 1).

OSCILLOSCOPE: Connect the vertical-input lead to the 15,000-ohm resistor of the video i-f alignment jig. Connect scope ground lead to the ground lead of the jig. (See figure 2). Plug jig into TS-1.

PRESET: Contrast and Brightness controls fully counterclockwise, and channel selector to channel 4.

BIAS: Apply 10 volts of negative bias, through 10,000-ohm resistor, to pin 1 of video I-F alignment jig; ground positive side of bias supply to pin 3 of jig. (See figure 2).

NOTE: If the i-f shield has been removed fro repairs, it must be replaced before proceeding with the alignment.

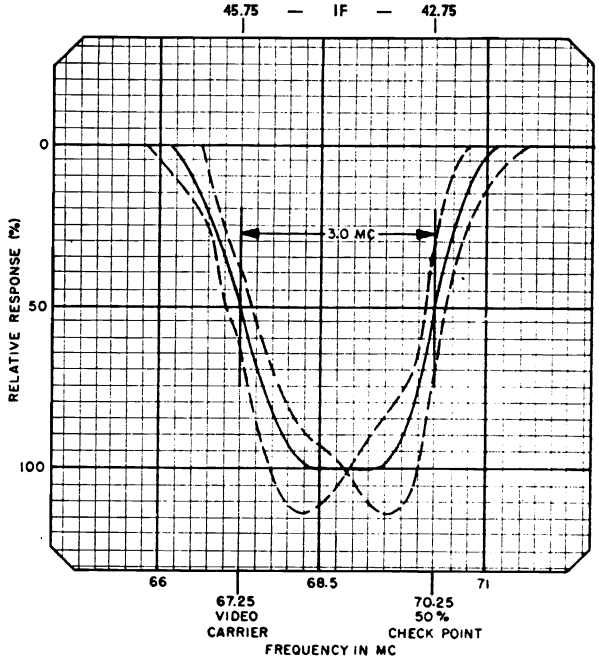


Fig. 7. Over-all R-F, I-F response curve, showing tolerance limits.

STEP	AM GENERATOR DIAL SETTING	SWEEP (FM) GENERATOR		ADJUST	REMARKS
		Sweep Dial Setting	Marker Dial Setting		
1	47.25 mc.	not used	not used	VC3 and VC8 for minimum indication on scope.	
2	41.25 mc.	not used	not used	VC9 for minimum indication on scope.	
3	39.75 mc.	not used	not used	VC4 for minimum indication on scope.	It is necessary to keep the generator output sufficiently high that a null indication may be observed on the oscilloscope; however, avoid overloading of the receiver by excessive signal.
4	42.7 mc.	not used	not used	T1 for maximum indication on scope.	T1 located on tuner. Adjust the output of the AM generator when necessary, to keep the output at the second detector below '4 volt, peak to peak. (For convenience, the oscilloscope may be calibrated for this purpose beforehand.)
5	43.1 mc.	not used	not used	VC1 for maximum indication on scope.	
6	44.4 mc.	not used	not used	VC2 for maximum indication on scope.	
7	42.0 mc.	not used	not used	VC6 for maximum indication on scope.	
8	45.0 mc.	not used	not used	VC5 for maximum indication on scope.	
9	45.7 mc.	not used	not used	VC7 for maximum indication on scope.	
10	not used	Channel 4 (69 mc., with 6 mc., width.)	Run marker along curve checking against the curve limits given in figure 8.	If necessary, retouch T1, VC6, VC7, VC5 and VC1 as directed in REMARKS column. CAUTION: Do not touch the setting 1, 2 and 3.	Set fine tuning cam to middle of range. If response curve does not fall within limits shown in figure 7, retouch VC5 and VC1 alternately. T1, VC5 and VC1 affect dip of curve and VC2 affects tilt of curve. Adjust VC6 for proper slope at 42.0 mc., side of curve, and VC7 for proper level of curve, at video carrier frequency. If curve still does not fall within the limits, a slight readjustment of VC1 is permissible. CAUTION: To retouch, only turn the adjustments slightly.

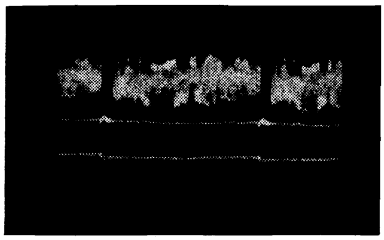


Fig. 8. Video Detector Output, Pin 2 of TS1, 3.5 volts, 60 c.p.s.

OSCILLOSCOPE WAVEFORM PATTERNS

These waveforms were taken with the receiver adjusted for an approximate peak-to-peak output of 3.5 volts at the video detector. The voltages given with the waveforms are approximate peak-to-peak values. The frequencies shown are those of the waveforms — not the sweep rate of the oscilloscope. The waveforms were taken with an oscilloscope having good high-frequency response. With oscilloscopes having poor high-frequency response, the sharp peaks of the horizontal waveforms will be more rounded than those shown, and the peak-to-peak voltages will differ from those shown.

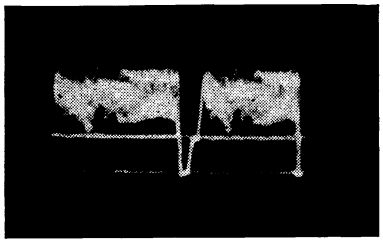


Fig. 9. Video Detector Output, Pin 2 of TS1, 3.5 volts, 15,750 c.p.s.

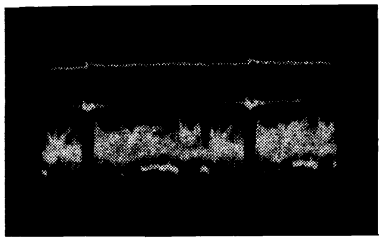


Fig. 10. Video Amplifier Plate, Pin 6, 40 volts, 60 c.p.s.

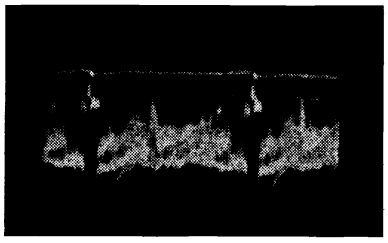


Fig. 11. Sync Separator Grid, Pin 9, 30 volts, 60 c.p.s.

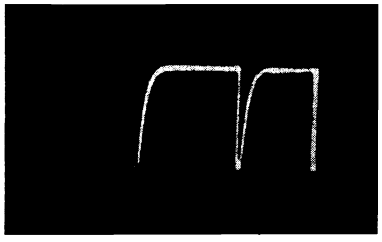


Fig. 12. Sync Separator Plate, Pin 1, 20 volts, 15,750 c.p.s.

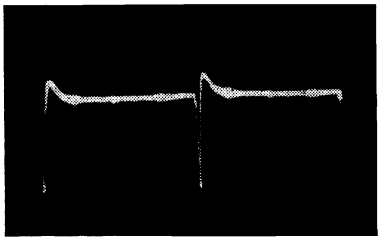


Fig. 13. Vertical-Oscillator Grid, Pin 2, .34 volts, 60 c.p.s.

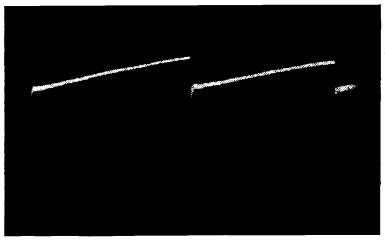


Fig. 14. Vertical-Output Grid, Pin 2, 140 volts, 60 c.p.s.

Fig. 15. Vertical-Output Plate, Pin 9, 1100 volts, 60 c.p.s.

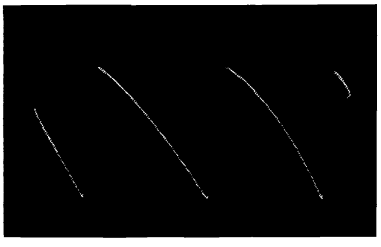


Fig. 16. Phase Comparer, Pin 2, 11 volts, 15,750 c.p.s.

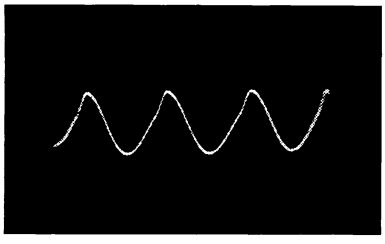


Fig. 17. Horizontal Oscillator, 40 volts, 15,750 c.p.s. test point.

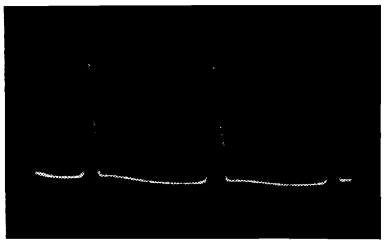


Fig. 18. Horizontal-Oscillator Cathode, Pins 3 and 8, 15 volts, 15,750 c.p.s.

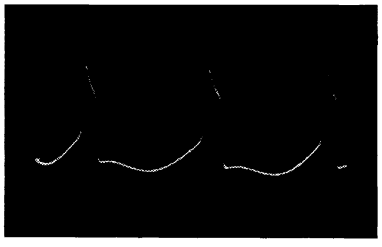


Fig. 19. Horizontal-Oscillator Grid, Pin 2, 60 volts, 15,750 c.p.s.

Fig. 20. Horizontal-Output Grid, Pin 5, 160 volts, 15,750 c.p.s.

SOUND I-F ALIGNMENT
TABLE 4

AM GENERATOR: Connect "hot" lead through a 2200-ohm resistor to pin 2 of TS1, using the sound i-f alignment jig. (Figure 3.) Connect ground lead of generator to ground lead of jig.

VOLTMETER: Use v.t.v.m. or 20,000 ohms-per-volt voltmeter. Connect to sound test point and ground.

OSCILLOSCOPE: Connect through crystal probe to grid (pin 2) of picture tube.

BIAS: —15V into AGC system.

STEP	AM GENERATOR DIAL SETTING	ADJUST	REMARKS
1	4.5 mc.	T1 primary (bottom of T-1) for maximum indication on voltmeter.	Remove 1st video i-f tube, and adjust the Volume control for moderate speaker output.
2	4.5 mc.	T2 secondary (top of T2) for maximum indication on voltmeter.	
3	4.5 mc.	T2 primary (bottom) for maximum indication on voltmeter.	
4	4.5 mc.	T3 for maximum indication on voltmeter and minimum speaker output.	
5	4.5 mc.	T4 for minimum indication on oscilloscope.	If scope and crystal probe are not available, T4 may be adjusted for minimum beat pattern on picture tube, using station signal.
6	Use Station Signal	T1 top (secondary) for minimum AM (noise or buzz), using speaker output for indication.	Replace 1st video i-f tube, and tune in a station, setting fine tuning control to obtain a crisp picture, with a small amount of beat.

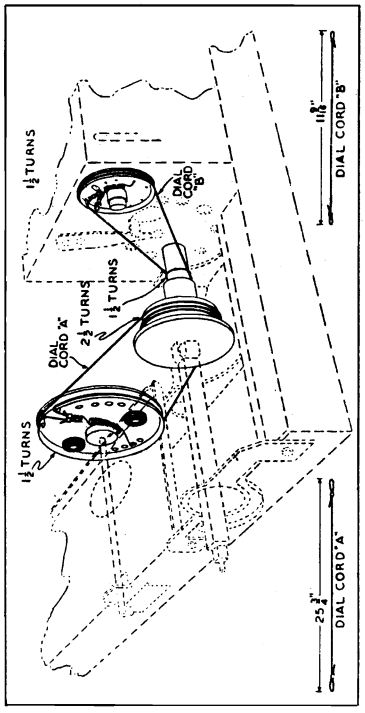


Fig. 25. Dial Cord Stringing Arrangement.

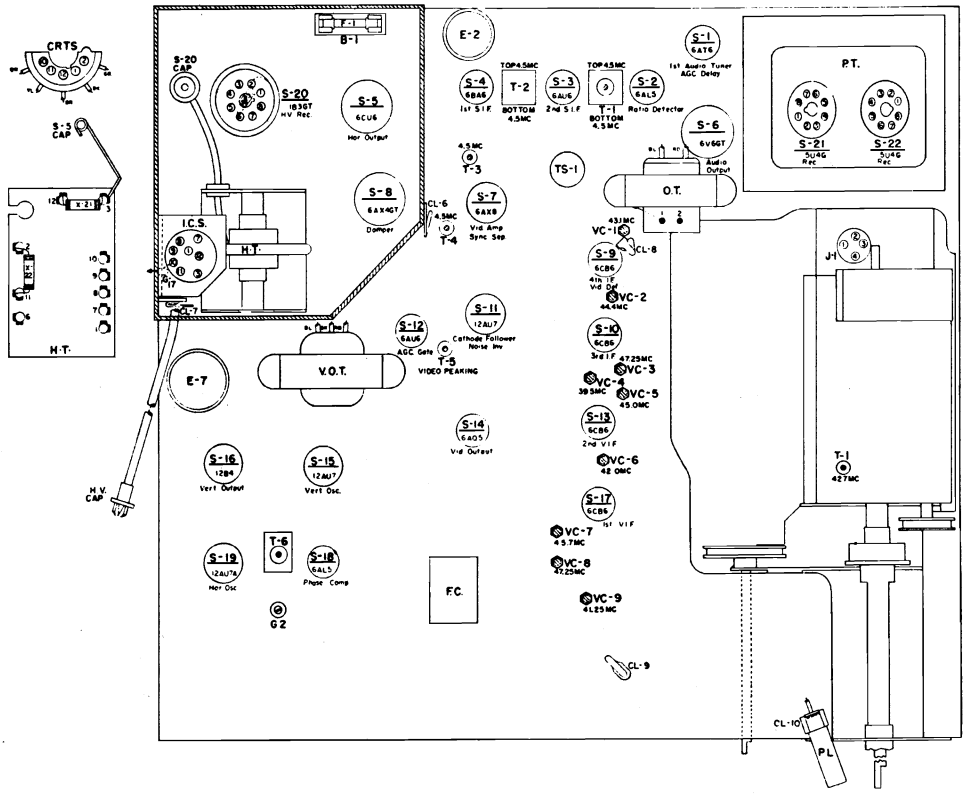


Fig. 21. Base Layout, Top view—TV-400.

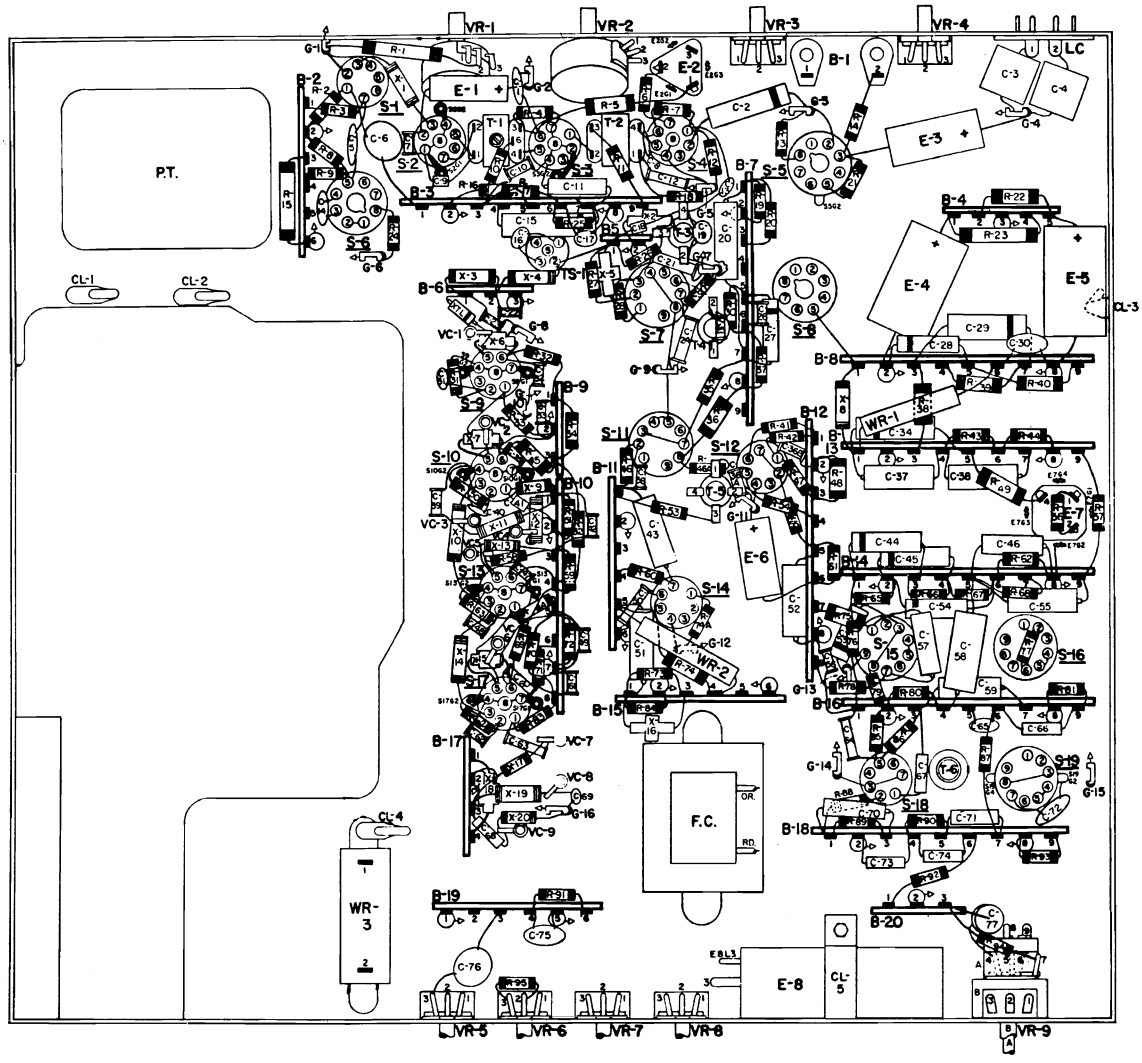


Fig. 22. Wiring Diagram, Bottom view—TV-400.

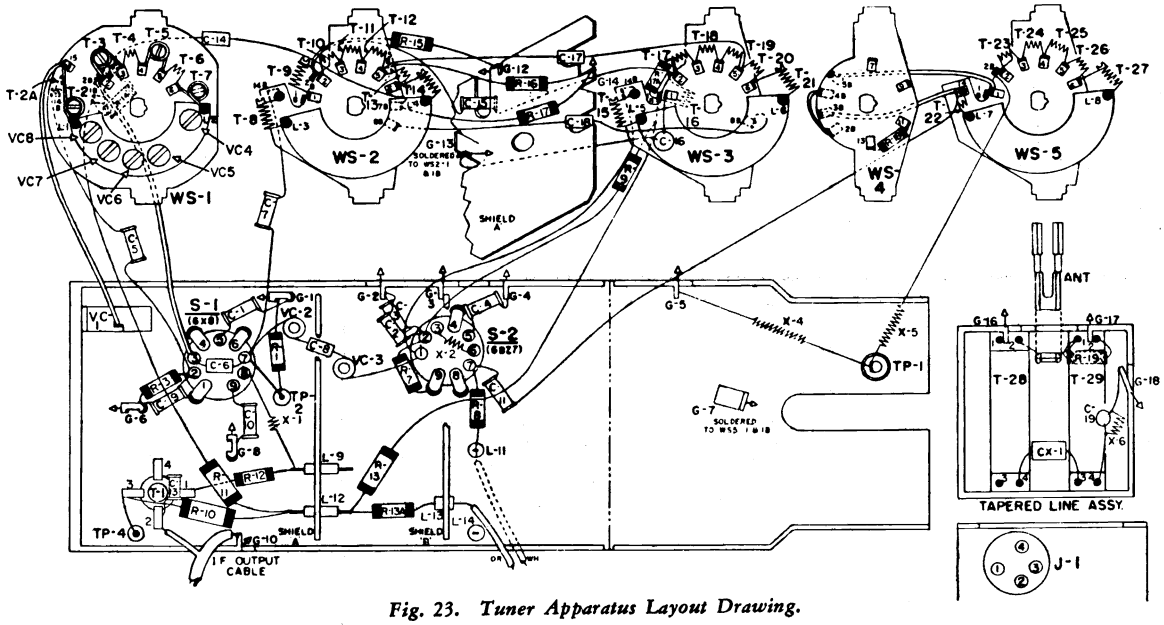


Fig. 23. Tuner Apparatus Layout Drawing.

VOLUME TV-10, ADDITIONAL 1955 TELEVISION SERVICING INFORMATION

PHILCO TV-400 CHASSIS CIRCUIT DIAGRAM

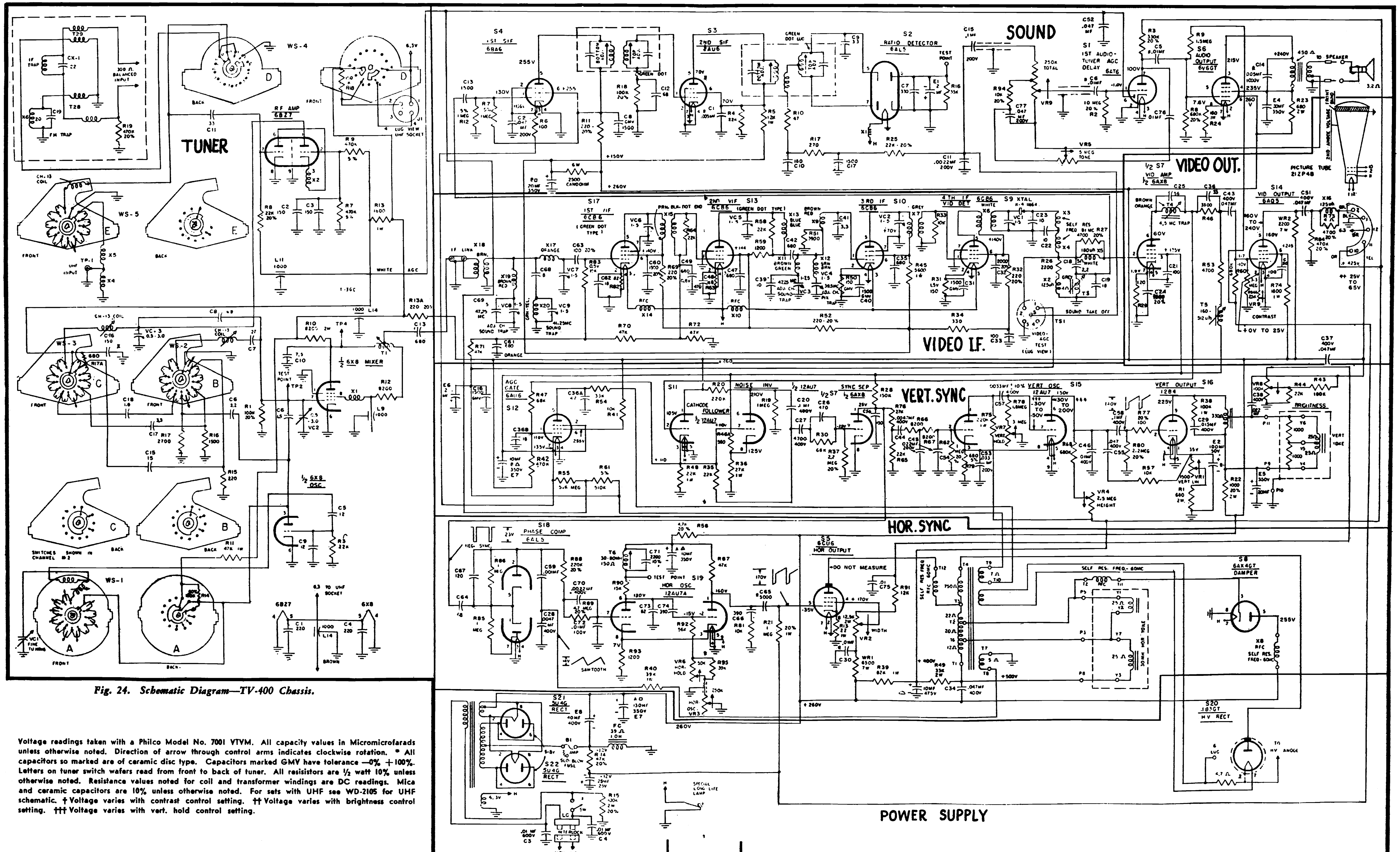


Fig. 24. Schematic Diagram—TV-400 Chassis.

Voltage readings taken with a Philco Model No. 7001 VTVM. All capacity values in Micromicrofarads unless otherwise noted. Direction of arrow through control arms indicates clockwise rotation. * All capacitors so marked are of ceramic disc type. Capacitors marked GMV have tolerance —0% +100%. Letters on tuner switch wafers read from front to back of tuner. All resisistors are ½ watt 10% unless otherwise noted. Resistance values noted for coil and transformer windings are DC readings. Mica and ceramic capacitors are 10% unless otherwise noted. For sets with UHF see WD-2105 for UHF schematic. † Voltage varies with contrast control setting. †† Voltage varies with brightness control setting. ††† Voltage varies with vert. hold control setting.

RCA VICTOR

21-S-503N(NU), 21-S-504N(NU), 21-S-505N(NU) 21-S-506N(NU), 21-S-507N(NU), 21-S-510N(NU) 21-S-511N(NU), 21-S-516N(NU), 21-S-519N(NU) 21-S-521N(NU), 21-S-522N(NU), 21-S-523N(NU) 21-S-526N(NU), 21-S-537N(NU)

Chassis Nos. KCS92, KCS92A, KCS92B, KCS92C, KCS92D, KCS92E, KCS92F, KCS92H, KCS92L or KCS92M

Combination Models 21-S-548N and 21-S-548NU, using Chassis KCS-92J and KCS-92K, have similar television sections to the sets listed at left and described on pages 146 through 150.

ALIGNMENT PROCEDURE

PICTURE I-F TRANSFORMER ADJUSTMENTS.—

Models 21-S-503N to 21-S-537N Incl.

Connect the i-f signal generator, in series with a 1500 mmf. ceramic capacitor, to the mixer grid test point TP2.

Connect the "VoltOhmyst" to the junction of R118, R146 and C120 and to ground. Turn the AGC control fully clockwise.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the battery positive terminal of one to the chassis and the potentiometer arm to the junction of R118, R146 and C120. The second battery will be used later.

Set the bias to produce approximately —4.0 volt of bias at the junction of R118, R146 and C120.

Connect the "VoltOhmyst" to the junction of R129 and L103 and to ground.

Set the VHF signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." (Note: These transformers should be peaked with their cores at the ends of the coils nearest the chassis.) During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R129 and L103 with —4.0 volts of i-f bias at the junction of R118, R146 and C120.

44.5 mc. T107
45.5 mc. T106
43.0 mc. T105

Set the VHF signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R129, L103. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the adjustment is made.

47.25 mc. L102

(Note: Core should be at end of coil nearest chassis when properly adjusted.)

Models 21-S-503NU to 21-S-537NU Incl.

Connect the i-f signal generator in series with a 1500 mmf. ceramic capacitor, to the mixer grid test point TP2.

Connect the "VoltOhmyst" to the junction of R118, R146 and C120.

Turn the AGC control fully clockwise.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction R118, R146 and C120. Adjust the potentiometer for —4.0 volts indication on the "VoltOhmyst."

Connect the "VoltOhmyst" to the junction of R129 and L103 and to ground.

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

During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R129 and L103 with —4.0 volts of i-f bias at the junction of R118, R146 and C120.

44.5 mc. T107
45.5 mc. T106
43.0 mc. T105

(Note: Peak transformers with cores at end of coils nearest chassis.)

Set the signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at junction of R129 and L103. Use sufficient signal input to produce 3.0 volts of d-c on the meter when adjustment is made.

47.25 mc. L102

(Note: Core should be at end of coil nearest chassis when properly adjusted.)

SWEEP ALIGNMENT OF PICTURE I-F.—

Models 21-S-503N to 21-S-537N Incl.

To align the mixer plate circuit, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Clip a 330 ohm resistor between pin 1 of V107 and ground.

Preset C116 to minimum capacity.

Adjust the bias box potentiometer to obtain —4.0 volts of bias as measured by a "VoltOhmyst" at the junction of R118, R146 and C120.

Connect a 180 ohm composition resistor from pin 5 of V105 to pin 6 of V105. Connect the oscilloscope diode probe to pin 5 of V105 and to ground.

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

Adjust T1 (top) and T104 (top) for maximum gain and with 45.75 mc. at 75% of maximum response.

Set the sweep output to give 0.3 to 0.5 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C116 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 9. Maximum allowable tilt is 20%.

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

Connect the oscilloscope to the junction of R129 and L103.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 to 5.0 volts peak-to-peak on the oscilloscope.

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

Retouch T105, T106 and T107 to obtain the response shown in Figure 10.

Increase sweep output ten times and check attenuation at 41.25 mc. Adjust T105 and T107 to set 41.25 mc. between 25 and 35 times down with curve as shown in Figure 10.

Move the sweep generator to the antenna terminals. Connect —3.0 volts bias to pin 5 of V103. Adjust T106 and T107 slightly to correct for any overall tilt while switching from channel to channel.

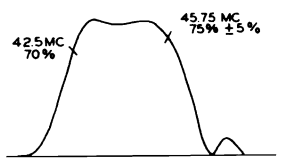


Figure 9— KRK22D T1 and T104 Response

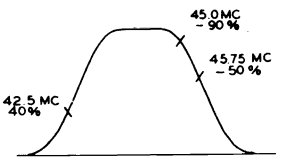


Figure 10— Overall I-F Response with KRK22D

RCA-Victor

ALIGNMENT PROCEDURE

21-S-503N to 21-S-537N incl.
21-S-503NU to 21-S-537NU incl.

Models 21-S-503NU to 21-S-537NU Incl.

To align the mixer plate circuit, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Clip a 330 ohm resistor between pin 1 of V107 and ground.

Preset C116 to minimum capacity.

Adjust the bias box potentiometer to obtain —4.0 volts of bias as measured by a "VoltOhmyst" at the junction of R118, R146 and C120.

Connect a 180 ohm composition resistor from pin 5 of V105 to pin 6 of V105. Connect the oscilloscope diode probe to pin 5 of V105 and to ground.

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

Adjust T2 (top) and T104 (top) for maximum gain and with 45.75 mc. at 75% of maximum response.

Set the sweep output to give 0.3 to 0.5 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C116 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 11. Maximum allowable tilt is 20%.

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

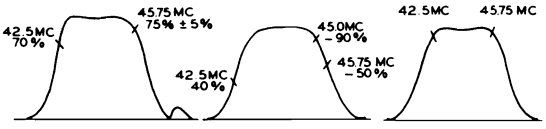


Figure 11— KRK30 T2 and T104 Response

Figure 12— Overall I-F Response with KRK30

Figure 13— KRK30 L9 and C308 I-F Response

Connect the oscilloscope to the junction of R129 and L103.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 3.0 to 0.5 volts peak-to-peak on the oscilloscope.

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

Retouch T105, T106 and T107 to obtain the response shown in Figure 12.

Increase sweep output ten times and check attenuation at 41.25 mc. Adjust T105 and T107 to set 41.25 mc. between 30 and 40 times down with curve as shown in Figure 12.

To align the I-F amplifier circuit of the KRK30, connect the VHF sweep generator to the front terminal of the 1N82 crystal holder in series with a 1000 ohm resistor and a 1500 mmf. ceramic capacitor. Use the shortest leads possible, grounding the sweep ground lead to the tuner case.

To do this, remove the crystal cover and connect the resistor, after insulating the lead with tubing, to the crystal front terminal.

Set the UHF CHANGEOVER switch to the UHF position, and the UHF TUNING between channels 68 and 69 at 800 mc.

Connect a 180 ohm composition resistor and a 1500 mmf. capacitor in series between test point TP3 and ground with the capacitor connected to TP3 and the resistor to ground.

Connect the oscilloscope diode probe to the junction between the resistor and capacitor. (See Figure 20.)

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

Connect the potentiometer arm of the second bias supply to the AGC terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce —3.0 volts of bias, as measured by the "VoltOhmyst" at the AGC terminal on the tuner.

Set the sweep generator to produce 0.5 volt or less peak-to-peak on the oscilloscope.

Adjust C308, on the UHF section, and L9, on the VHF section, of the tuner for maximum gain with 45.75 mc. and 42.5 mc. markers as shown in figure 13.

If necessary adjust L27 to place the 45.75 mc. marker at the peak of the curve. Adjust L43 for minimum tilt of the curve as shown in figure 13.

Remove the resistor, capacitor and diode probe from TP3 and connect the oscilloscope to the junction of R129 and L103. Use 3.0v peak-to-peak on the oscilloscope.

Connect the VHF sweep generator to the antenna terminals. Keep the AGC bias at —3.0 V and the I-F bias at —4.0 volts.

Couple the signal generator loosely to the grid of the first picture I-F amplifier.

Switch through all VHF channels and check for proper curve shape as in figure 12. Retouch T106 and T107 slightly to correct for any overall tilt that is essentially the same on all channels.

Disconnect the VHF sweep generator and connect the UHF sweep generator to the antenna terminals. Check on all UHF channels for proper wave shape as shown in figure 12, retouching C308 and L9 if necessary to correct any overall tilt.

Do not retouch T2, T104, T105, T106 or T107.

Remove the sweep and marker generators and the bias supplies.

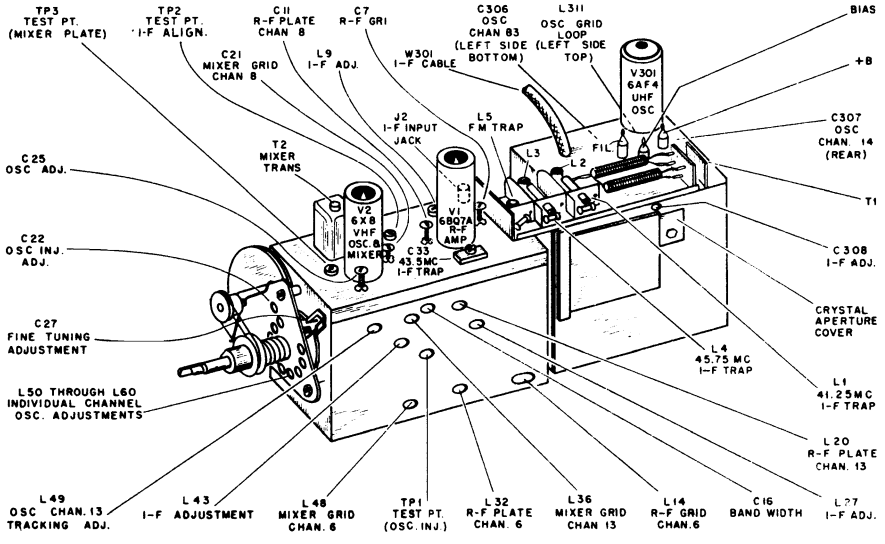


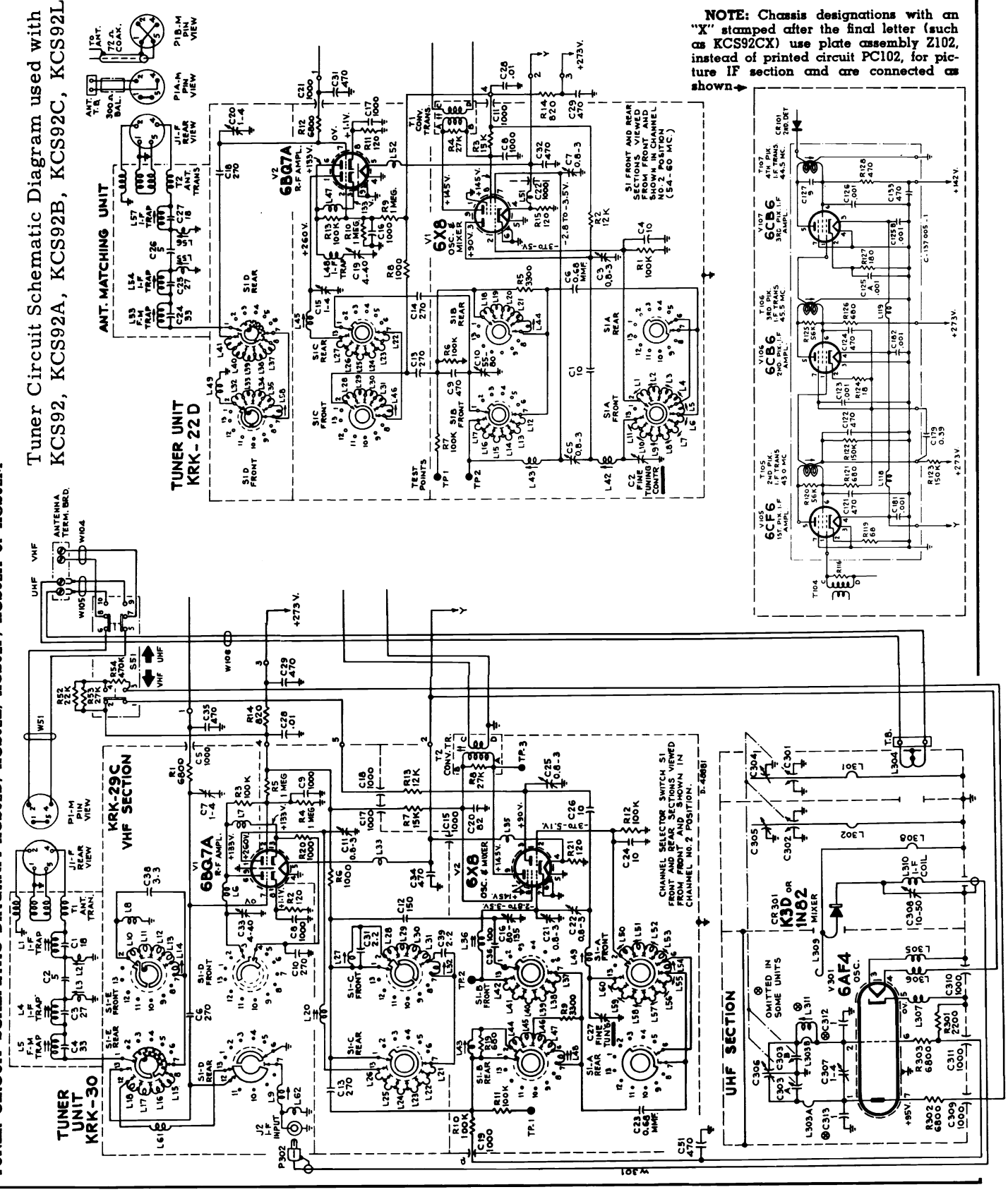
Figure 20

KRK30 UHF/VHF TUNER

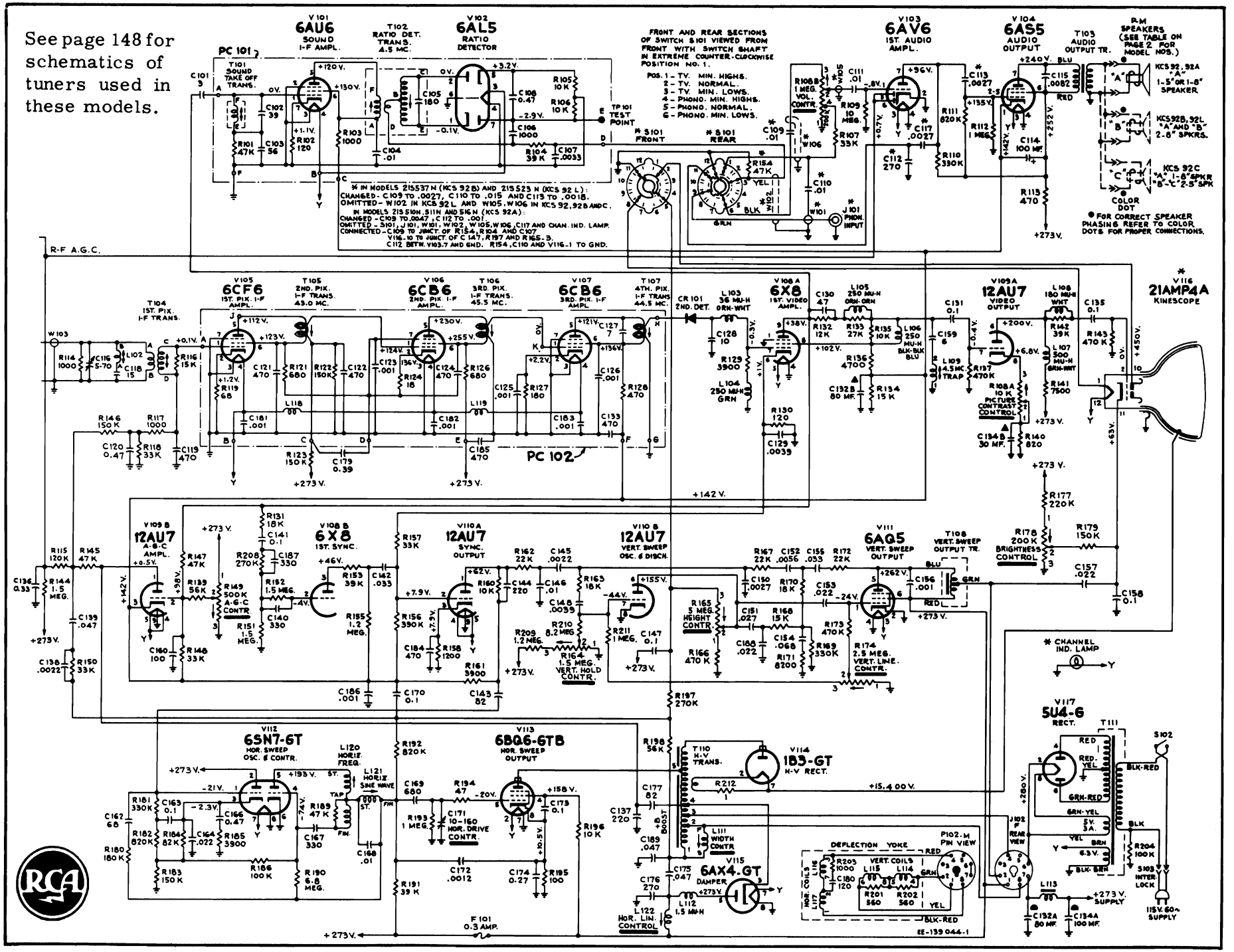
RCA-Victor Tuner Schematic Diagrams used with Models 21S503N, 21S503NU, etc.

Tuner Circuit Schematic Diagram used with KCS92, KCS92A, KCS92B, KCS92C, KCS92L

NOTE: Chassis designations with an "X" stamped after the final letter (such as KCS92CX) use plate assembly Z102, instead of printed circuit PC102, for picture IF section and are connected as shown→



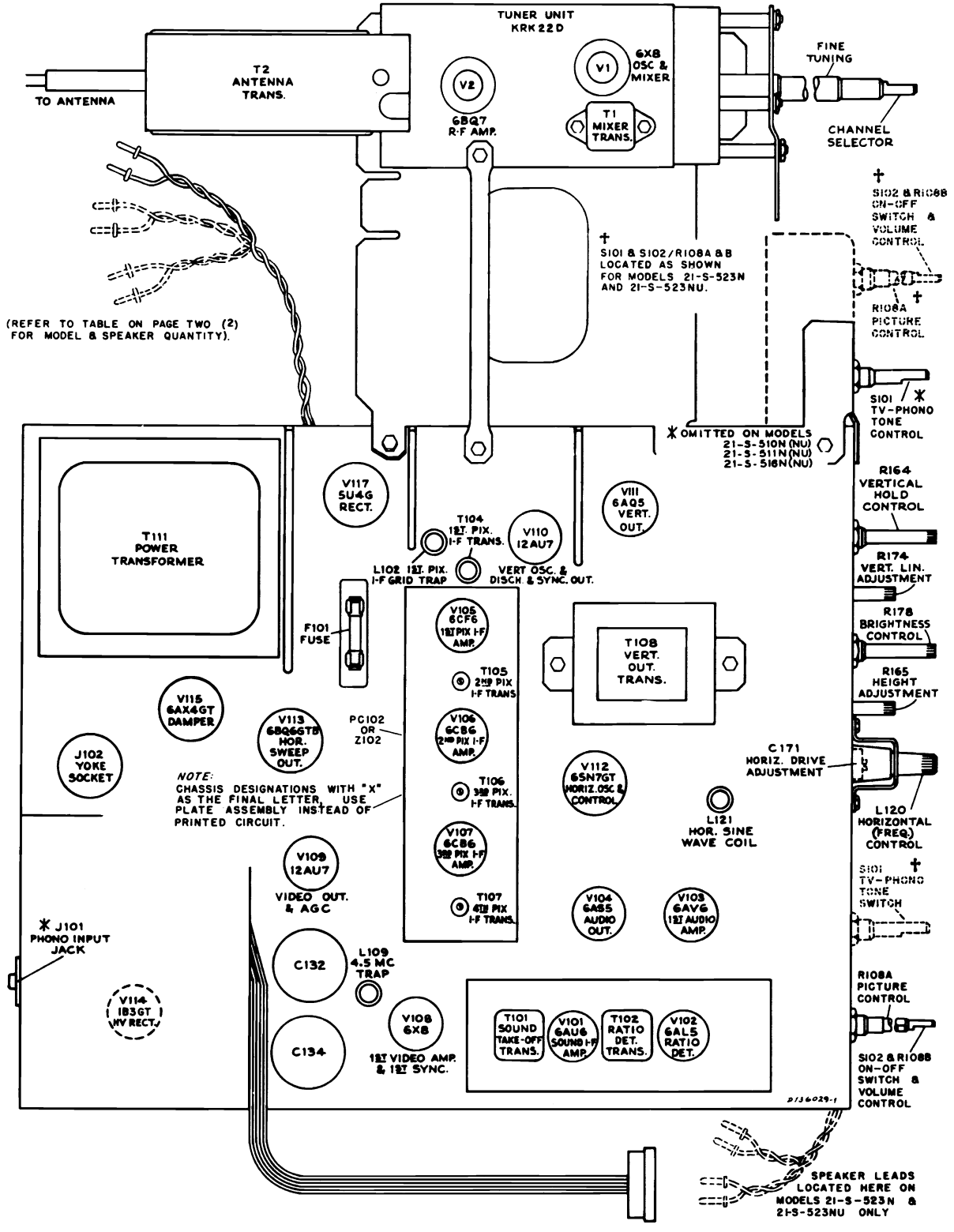
See page 148 for schematics of tuners used in these models.



RCA-Victor (Continued)

21-S-503N to 21-S-537N incl.
21-S-503NU to 21-S-537NU incl.

CHASSIS TOP VIEW

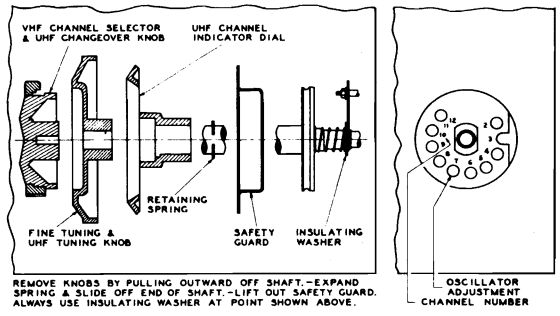


Chassis Top View (shown with KRK22D Tuner)

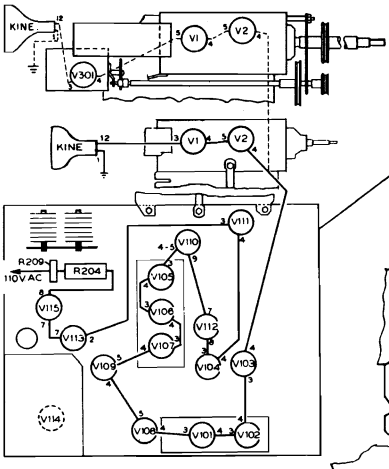
RCA VICTOR

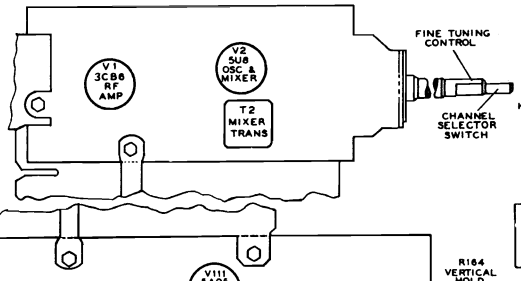
Models 17S450R, 17S451R, 17S453R, Chassis KCS-93 (17" tube, VHF only)
Models 17S450RU, 17S451RU, 17S453RU, Chassis KCS-93A (17", VHF/UHF)
Model 21S500R, Chassis KCS-93B (21" picture tube, VHF only, tuner KRK-32A)
Model 21S500RU, Chassis KCS-93C (21" tube, VHF/UHF, tuner KRK-33A)

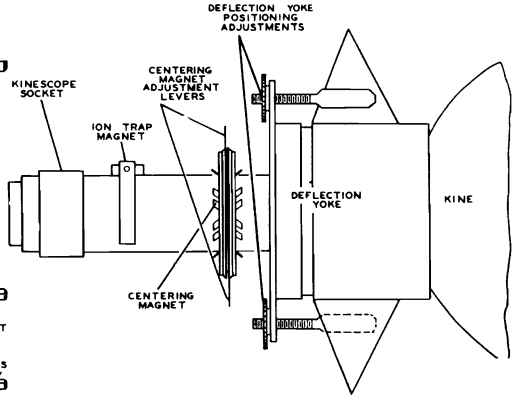
Service material on pages 151 to 156 is applicable to all models listed above. The main schematic for 17-inch sets is printed on page 153, while the circuits for the two types of tuners used are on page 152. The 21-inch sets are correspondingly exactly the same except for the picture tube and cabinet.



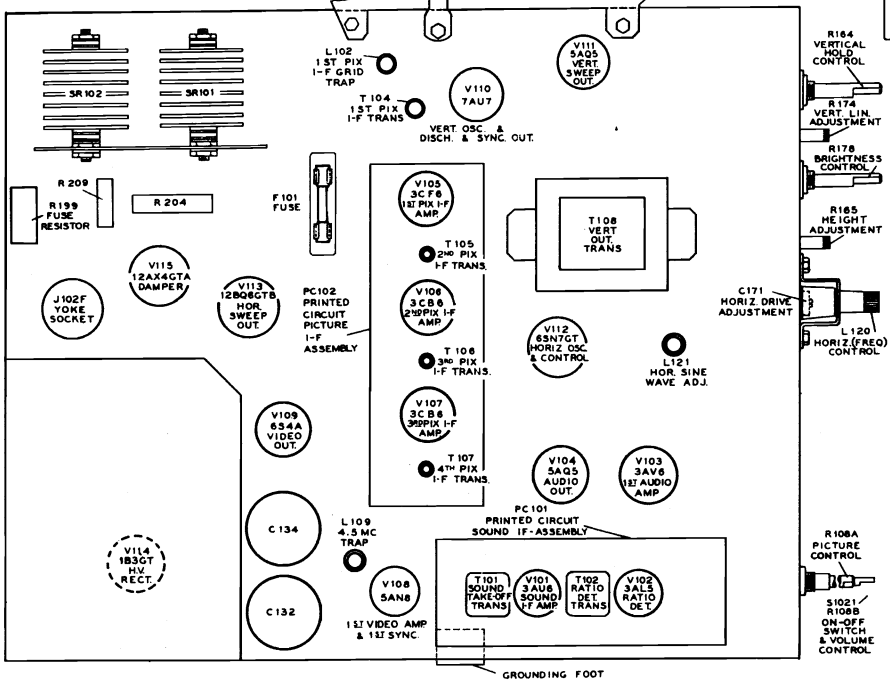
KRK33 VHF R-F OSCILLATOR ADJUSTMENTS



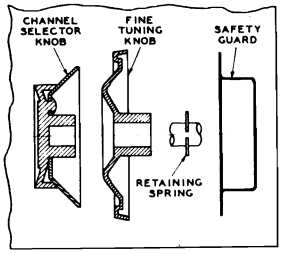


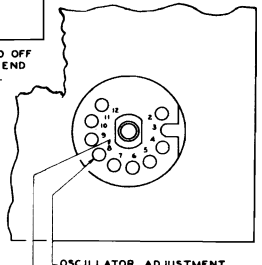


YOKE AND CENTERING MAGNET



CHASSIS TOP VIEW

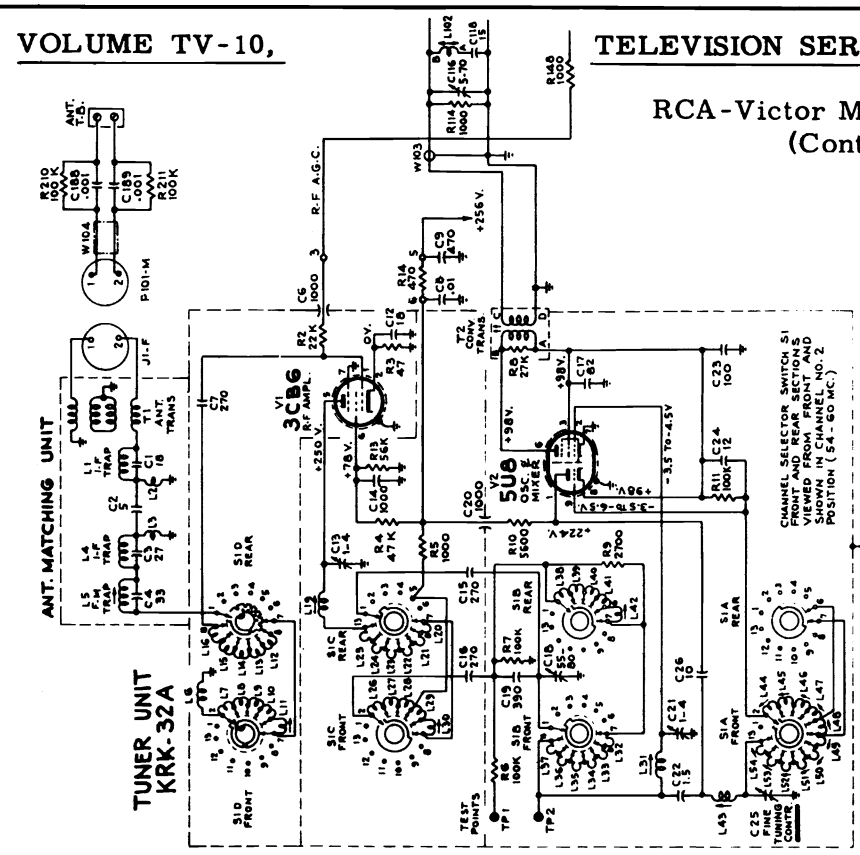




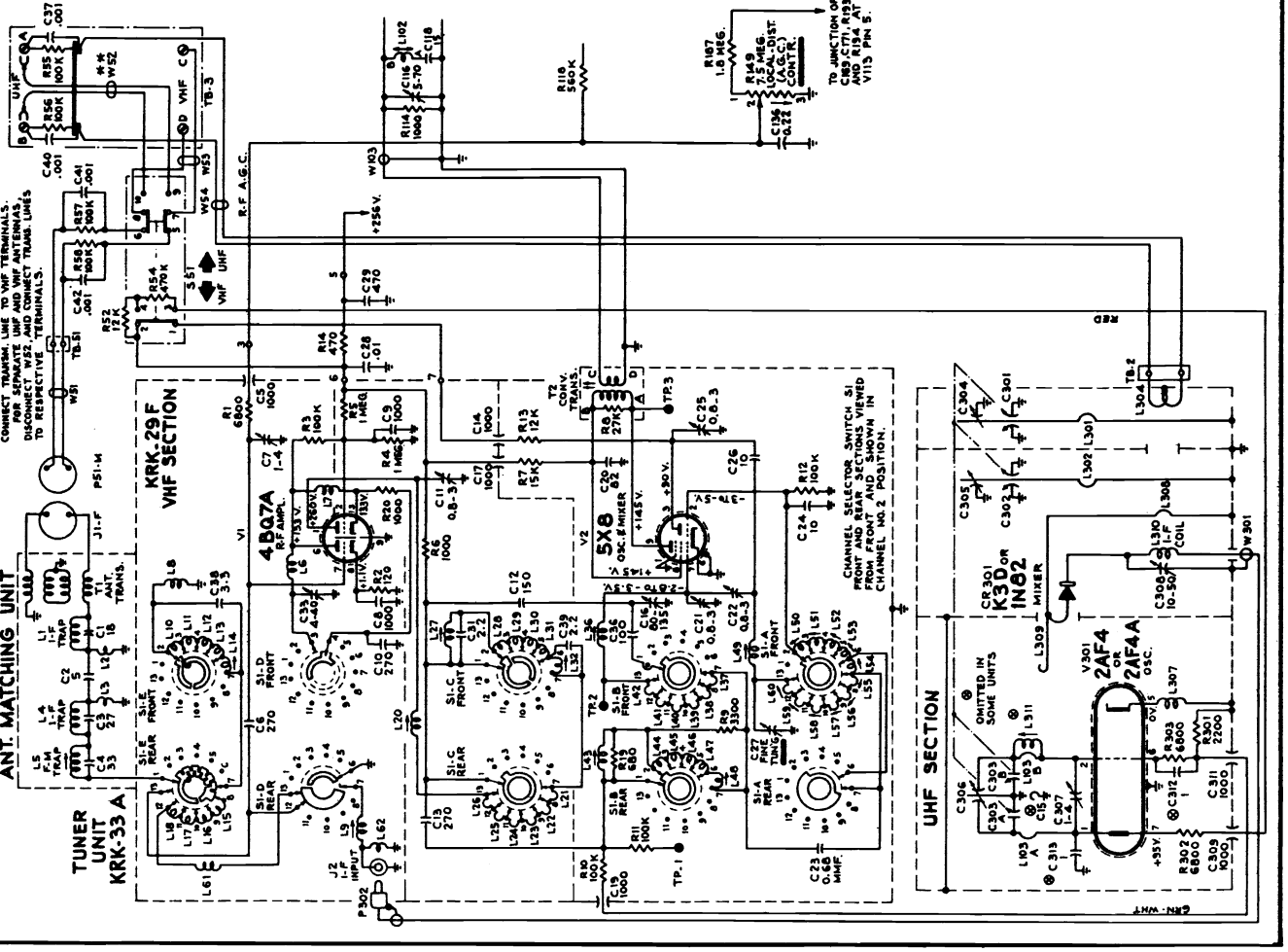
KRK32A R-F OSCILLATOR ADJUSTMENTS

RCA-Victor Models 17S450R(U), etc.
(Continued)

TUNER SCHEMATIC DIAGRAM KCS93
MODELS 17-S-450R, 17-S-451R, 17-S-453R



TUNER CIRCUIT SCHEMATIC DIAGRAM KCS93A—
MODELS 17-S-450RU, 17-S-451RU, 17-S-453RU

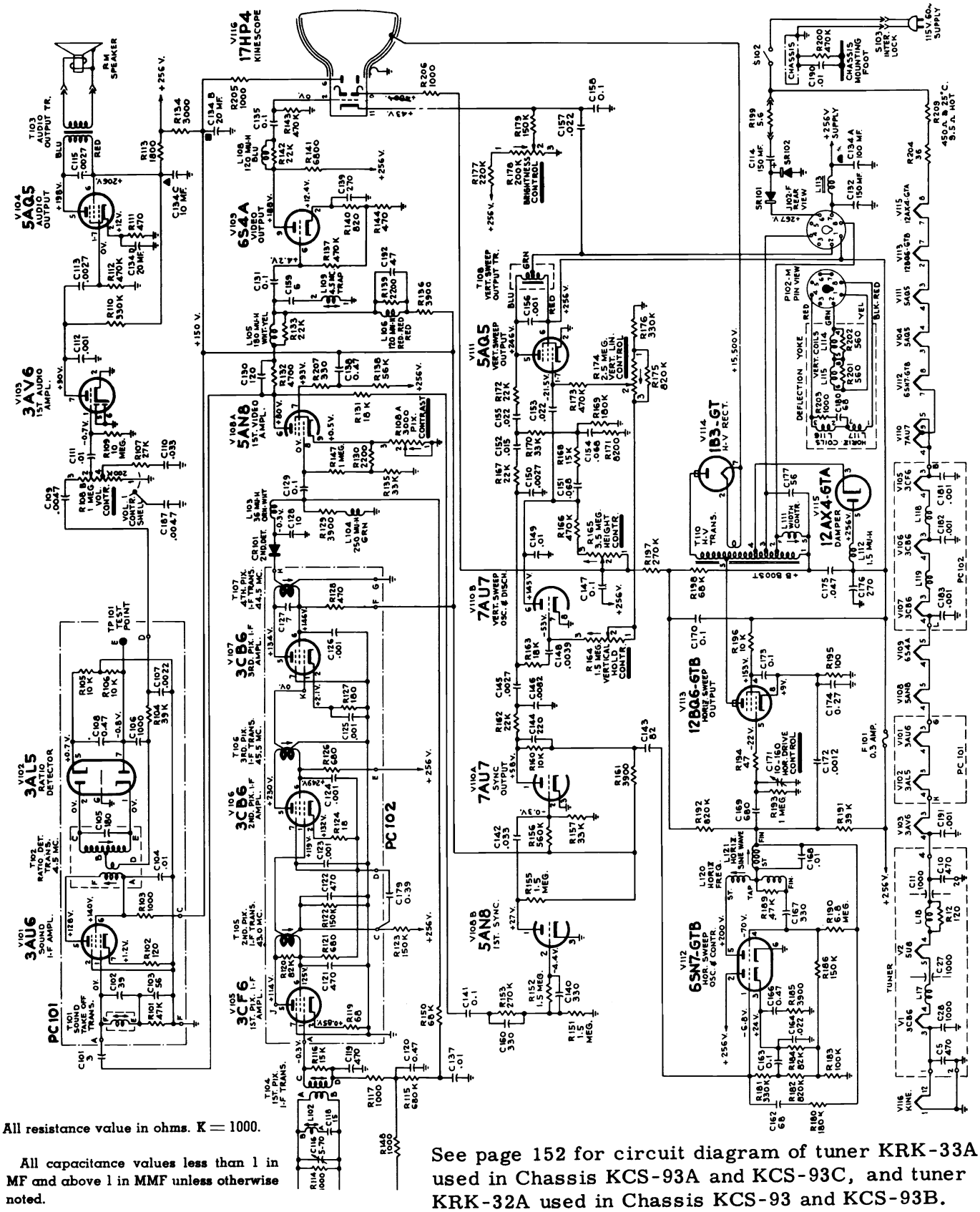


See main schematic on page 153.

PRODUCTION CHANGES IN KCS93 CHASSIS

In some receivers C124 at pin 6 of V106 was 470 mmf.
In some receivers a 470 mmf. capacitor (C133) was connected between PC102 (F) and ground.
In some receivers C139 at pin 2 of V109 was 220 mmf.
In some receivers a 470 mmf. capacitor (C185) was connected between PC102 (E) and ground.
In some receivers a .001 mfd. capacitor (C186) was connected between 150V buss and ground at V110A.
In some receivers L108 at pin 9 of V109 was 180 microhenries (white).
In some receivers R120 at pin 5 of V105 was omitted.
In some receivers R133 at pin 6 of V109 was omitted.
In some receivers R139 at pin 6 of V109 was 6800 ohms.
In some receivers R142 at pin 9 of V109 was 39,000 ohms.

RCA-Victor Main Circuit Diagram for Chassis KCS-93 and KCS-93A



All resistance value in ohms. K = 1000.

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

See page 152 for circuit diagram of tuner KRK-33A used in Chassis KCS-93A and KCS-93C, and tuner KRK-32A used in Chassis KCS-93 and KCS-93B.

RCA-Victor Models 17S450R(U), 17S451R(U), 17S453R(U), 21S500R(U), Continued

ALIGNMENT PROCEDURE

PICTURE I-F TRANSFORMER ADJUSTMENTS.—Connect the i-f signal generator, in series with a 1500 mmf. ceramic capacitor, to the mixer grid test point TP2.

Connect the "VoltOhmyst" to the junction of R115, R117 and C120 and to ground.

Obtain two 7.5 volt batteries capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across each. Connect the battery positive terminal of one to the chassis and the potentiometer arm to the junction of R115, R117 and C120. The second battery will be used later.

Set the bias to produce approximately —4.0 volts of bias at the junction of R115, R117 and C120.

Connect the "VoltOhmyst" to the junction of R129 and L103 and to ground.

Set the VHF signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." (Note: These transformers should be peaked with their cores at the ends of the coils nearest the chassis.) During alignment, reduce the input signal if necessary in order to produce 3.0 volts of d-c at R129 and L103 with —4.0 volts of i-f bias at the junction of R115, R117 and C120.

44.5 mc.	T107
45.5 mc.	T106
43.0 mc.	T105

Set the VHF signal generator to the following frequency and adjust the picture i-f trap for minimum d-c output at R129, L103. Use sufficient signal input to produce 3.0 volts of d-c on the meter when the adjustment is made.

47.25 mc.	L102

(**Note:** Core should be at end of coil nearest chassis when properly adjusted.)

SWEEP ALIGNMENT OF PICTURE I-F.—To align the mixer plate circuit, connect the sweep generator to the mixer grid test point TP2, in series with a 1500 mmf. ceramic capacitor. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable. Connect the sweep ground lead to the top of the tuner.

Set the channel selector switch to channel 4.

Preset C116 to minimum capacity, maximum counter-clockwise.

Adjust the bias box potentiometer to obtain —4.0 volts of bias as measured by a "VoltOhmyst" at the junction of R115, R117 and C120.

Connect a 180 ohm composition resistor from pin 5 of V105 to pin 6 of V105. Connect the oscilloscope diode probe to pin 5 of V105 and to ground.

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

Adjust T2 (top) and T104 (top) for maximum gain and with 45.75 mc. at 75% of maximum response.

Set the sweep output to give 0.3 to 0.5 volt peak-to-peak on the oscilloscope when making the final touch on the above adjustment.

Adjust C116 until 42.5 mc. is at 70% response with respect to the low frequency shoulder of the curve as shown in Figure 7. Maximum allowable tilt is 20%.

Readjust T2 and T104 if necessary to obtain proper wave shape as in Figure 7.

Disconnect the diode probe and the 180 ohm resistor.

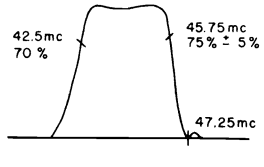


Figure 7—
T2 and T104
Response

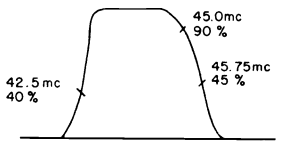


Figure 8—
Overall I-F
Response

Connect the oscilloscope to the junction of R129 and L103.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible.

Adjust the output of the sweep generator to obtain 5.0 volts peak-to-peak on the oscilloscope.

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

Retouch T105, T106 and T107 to obtain the response shown in Figure 8.

Increase sweep output ten times and check attenuation at 41.25 mc. Adjust T105 and T107 to set 41.25 mc. between 25 and 35 times down with curve as shown in Figure 8.

Move the sweep generator to the antenna terminals. Adjust T106 and T107 slightly to correct for any overall tilt while switching from channel to channel.

RATIO DETECTOR ALIGNMENT.—Set the signal generator at 4.5 mc. and connect it to the first video amplifier grid, pin 8 of V108A, in series with a 1500 mmf. capacitor.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. In such a case, connect the calibrator to the grid of the third pix r-f amplifier, pin 1 of V107.

Set the frequency of the calibrator to 45.75 mc. (pix carrier) and modulate with 4.5 mc. crystal. The 4.5 mc. signal will be picked off at pin 6 of V108A and amplified through the sound i-f amplifier.

Connect the "VoltOhmyst" to pin 7 of V-102.

Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst." (Peak with core at end of coil away from chassis.) Adjust the signal level from the signal generator for 5 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R104 and C107.

Tune the ratio detector secondary T102 bottom core for zero d-c on the "VoltOhmyst." (Adjust with core at chassis end of coil.)

Repeat adjustments of T102 top for maximum d-c at pin 7 of V102 and T102 bottom for zero d-c at the junction of R104 and C107. Make the final adjustments with the signal input level adjusted to produce 5 volts d-c on the "VoltOhmyst" at pin 7 of V102.

SOUND TAKE-OFF ALIGNMENT.—Connect the signal generator to the first video amplifier grid, pin 8 of V108A.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed as above.

Connect the "VoltOhmyst" to pin 7 of V102.

Tune the T101 top core for maximum d-c on the "VoltOhmyst." (Peak with core at chassis end of coil.)

The output from the signal generator should be set to produce approximately 5 volts on the "VoltOhmyst" when the final touches on the above adjustment are made.

(Alternate Method for Ratio Detector and Sound I-F Alignment)

Set the signal generator at 4.5 mc. and connect it to the first video amplifier grid, pin 8 of V108A in series with a .01 mfd. capacitor.

Connect the "VoltOhmyst" to pin 7 of V102.

Tune the ratio detector secondary T102 bottom core for maximum d-c on the "VoltOhmyst." (Peak with core at chassis end of coil.)

Tune the ratio detector primary, T102 top core for maximum d-c output on the "VoltOhmyst." (Peak with core at end of coil away from chassis.) Adjust the signal level from the signal generator for 5 volts on the "VoltOhmyst" when finally peaked, when making the above adjustments.

Tune the T101 (top) core for maximum d-c on the "VoltOhmyst." (Peak with core at chassis end of coil.)

The output from the signal generator should be set to produce approximately 5 volts on the "VoltOhmyst" when the final touches on the T101 adjustment are made.

Connect the "VoltOhmyst" to the junction of R104 and C107.

Tune T102 bottom for zero d-c at the junction of R104 and C107. (Make adjustment with core at chassis end of coil.)

RCA-Victor Models 17S450R(U), 17S451R(U), 17S453R(U), 21S500R(U), Continued

4.5 MC. TRAP ADJUSTMENT.—Connect the signal generator in series with a 1500 mmf. capacitor to pin 8 of V108A. Set the generator to 4.5 mc. and modulate it 30% with 400 cycles. Set the output to approximately 0.5 volt.

Short the third pix i-f grid to ground, pin 1, V107, to prevent noise from masking the output indication.

Connect the crystal diode probe of an oscilloscope to the plate of the video output, pin 9 of V109.

Adjust the core of L109 for minimum output on the oscilloscope. (Make adjustment with core at chassis end of coil.)

Remove the short from pin 1, V107 to ground.

As an alternate method, this step may be omitted at this point in the alignment procedure and the adjustment made "on the air" after the alignment is completed.

If this is done, tune in a station and observe the picture on the kinescope. If no 4.5 mc. beat is present in the picture, when the fine tuning control is set for proper oscillator-frequency, then L109 requires no adjustment. If a 4.5 mc. beat is present, turn the fine tuning control slightly clockwise so as to exaggerate the beat and then adjust L109 for minimum beat.

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

Turn the horizontal drive trimmer C171 fully clockwise then counter-clockwise one full turn. Set the stud of the width coil L111 flush with the inside rear edge of the chassis.

Place a jumper across the terminals of the sine wave coil L121 and adjust the horizontal (frequency) control until the picture pulls into sync. Remove the short across the sine wave coil.

Connect the low capacity probe of an oscilloscope to the junction of L120, L121 and R189. Turn the horizontal (frequency) control clockwise until the picture falls out of sync, then counter-clockwise until the picture just pulls into sync. The pattern on the oscilloscope should be as shown in Figure 14C. Adjust the sine wave adjustment core L121 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the horizontal (frequency) control if necessary.

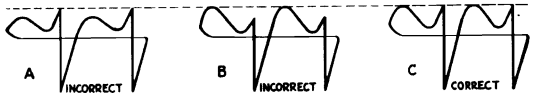


Figure 14—Horizontal Oscillator Waveforms

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 may occur. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

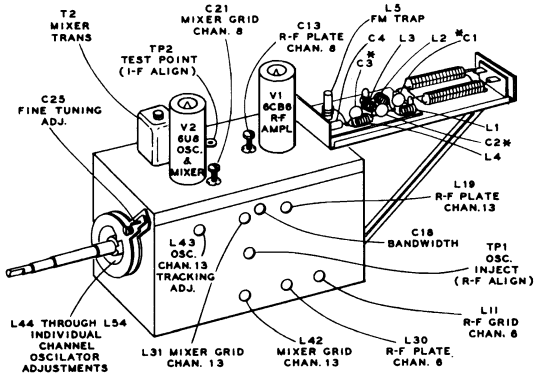
Horizontal Drive Adjustment.—Turn the horizontal (frequency) control until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal control counter-clockwise and note the number of diagonal bars obtained just before the picture pulls into sync.

Pull-in should occur with one and one-half to three bars present.

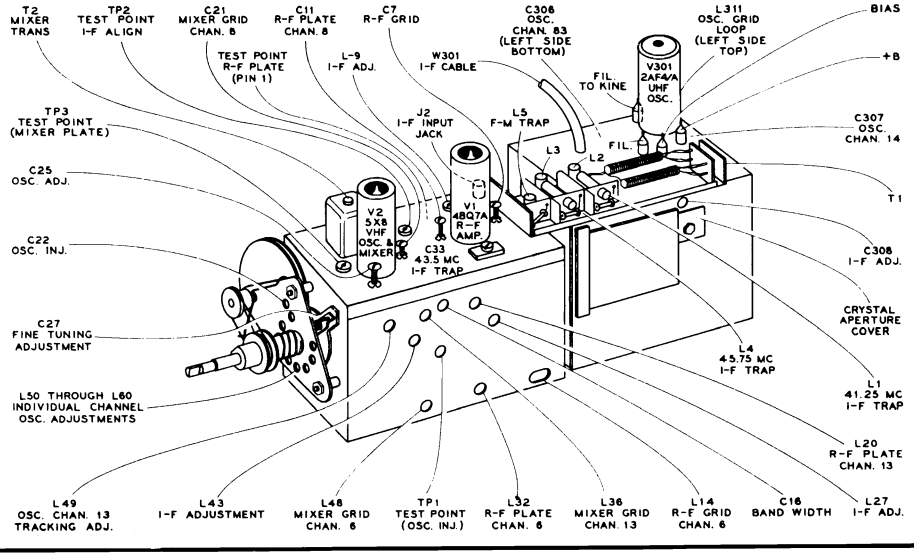
With the horizontal control set at the pull-in point, adjust the horizontal drive trimmer C171 counter-clockwise for a bright vertical line in the center of the picture. Turn the trimmer clockwise until the line just disappears.

Set the brightness control to maximum and adjust the width control so the picture fills the mask. Return the brightness control to normal and readjust the horizontal drive trimmer as above.

The picture should pull into sync with one and one-half to three bars present, remain in sync for approximately two full turns counter-clockwise from pull-in, and fall out of sync with between 2 and 5 bars present before interrupted oscillation (motorboating) occurs.



KRK32A TUNER



KRK33 UHF/VHF TUNER

RCA-Victor Models 17S450R(U), 17S451R(U), 17S453R(U), 21S500R(U), Continued

VOLTAGE CHART

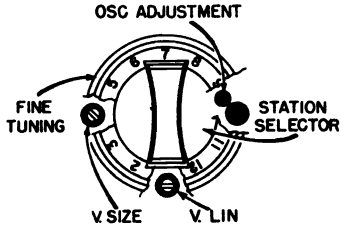
The following measurements represent two sets of conditions. In the first condition, a 30000 microvolt test pattern signal was fed ino the receiver, the picture synced and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c. The symbol < means less than.

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	
V1	3CB6	R-F Amplifier	30000 Mu. V. Signal	5	260	6	135	2	0	1	—	
KRK32A			No Signal	5	250	6	78	2	0	1	—	
V2	5U8	Mixer	30000 Mu. V. Signal	6	103	3	103	7	0	2	—3.0 to —4.0	
KRK32A			No Signal	6	98	3	98	7	0	2	—3.5 to —4.5	
		R-F Oscillator	30000 Mu. V. Signal	1	228	—	—	8	103	9	—4.5 to —7.5	
			No Signal	1	224	—	—	8	98	9	—3.5 to —6.5	
V101	3AU6	Sound I-F Amp.	30000 Mu. V. Signal	5	136	6	148	7	1.0	1	0.5	
			No Signal	5	128	6	140	7	1.2	1	0	
V102	3AL5	Ratio Detector	30000 Mu. V. Signal	7	—7.9	—	—	1	*0.5	—	—	7.5 kc deviation at 1000 cycles
			No Signal	7	—0.8	—	—	1	*0	—	—	*1 meg. ½ watt in series with probe
		Ratio Detector	30000 Mu. V. Signal	2	*—0.4	—	—	5	7.5	—	—	
			No Signal	2	*0	—	—	5	0.7	—	—	
V103	3AV6	1st Audio Amplifier	30000 Mu. V. Signal	7	92	—	—	2	0	1	—0.7	At min. volume
			No Signal	7	90	—	—	2	0	1	—0.7	At min. volume
V104	5AQ5	Audio Output	30000 Mu. V. Signal	5	202	6	210	2	12.5	18.7	0	At min. volume
			No Signal	5	198	6	206	2	12.0	18.7	0	At min. volume
V105	3CF6	1st Pix. I-F Amplifier	30000 Mu. V. Signal	5	125	6	138	2	0	1	—4.0	*Unreliable measuring point
			No Signal	5	114	6	125	2	0.85	1	*—0.3	
V106	3CB6	2nd Pix. I-F Amplifier	30000 Mu. V. Signal	5	245	6	260	2	138	1	121	
			No Signal	5	230	6	249	2	132	1	119	
V107	3CB6	3rd Pix. I-F Amplifier	30000 Mu. V. Signal	5	138	6	150	2	2.2	1	0	
			No Signal	5	134	6	146	2	2.1	1	0	

RAYTHEON

21T24, 21T25 AND 21T27 CHASSIS

Three basic chassis are covered and differ only in the number of speakers and tone controls. The 21T24 has one speaker and one tone control. The 21T25 chassis has three speakers and two tone controls, and the 21T27 chassis has two speakers and one tone control.



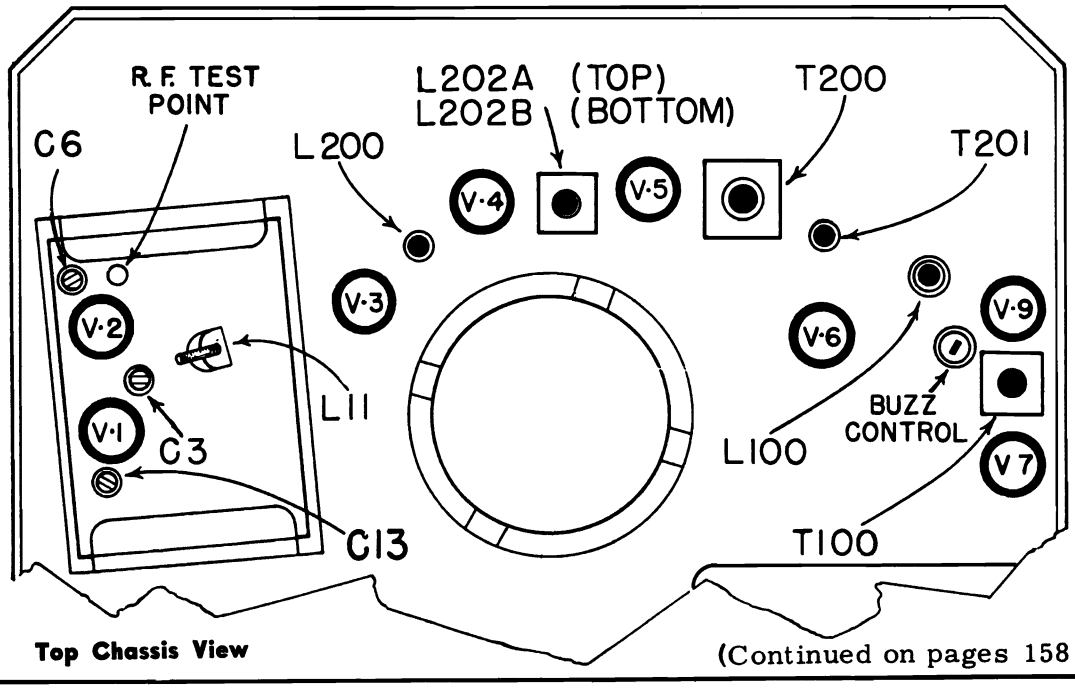
Model	*Chassis*	*Cabinet*	*Type*
C-2163 (Mahogany)	21T27	Console	Mahogany
C-2163 (Blond)	21T27	Console	Blond
M-2165 (Mahogany)	21T24	Mantel	Mahogany
M-2165 (Blond)	21T24	Mantel	Blond
C-2166 (Mahogany)	21T25	Console	Mahogany
C-2166 (Blond)	21T25	Console	Blond

DEFLECTION YOKE

The correct position for the deflection yoke as as far forward on the neck of the picture tube as the shape of the tube will allow. Tube shadow or a tilted raster may result from an incorrectly positioned yoke. If a positioning adjustment is necessary, loosen the yoke positioning hex head nut located near the top of the yoke housing assembly.

OSCILLATOR ADJUSTMENT

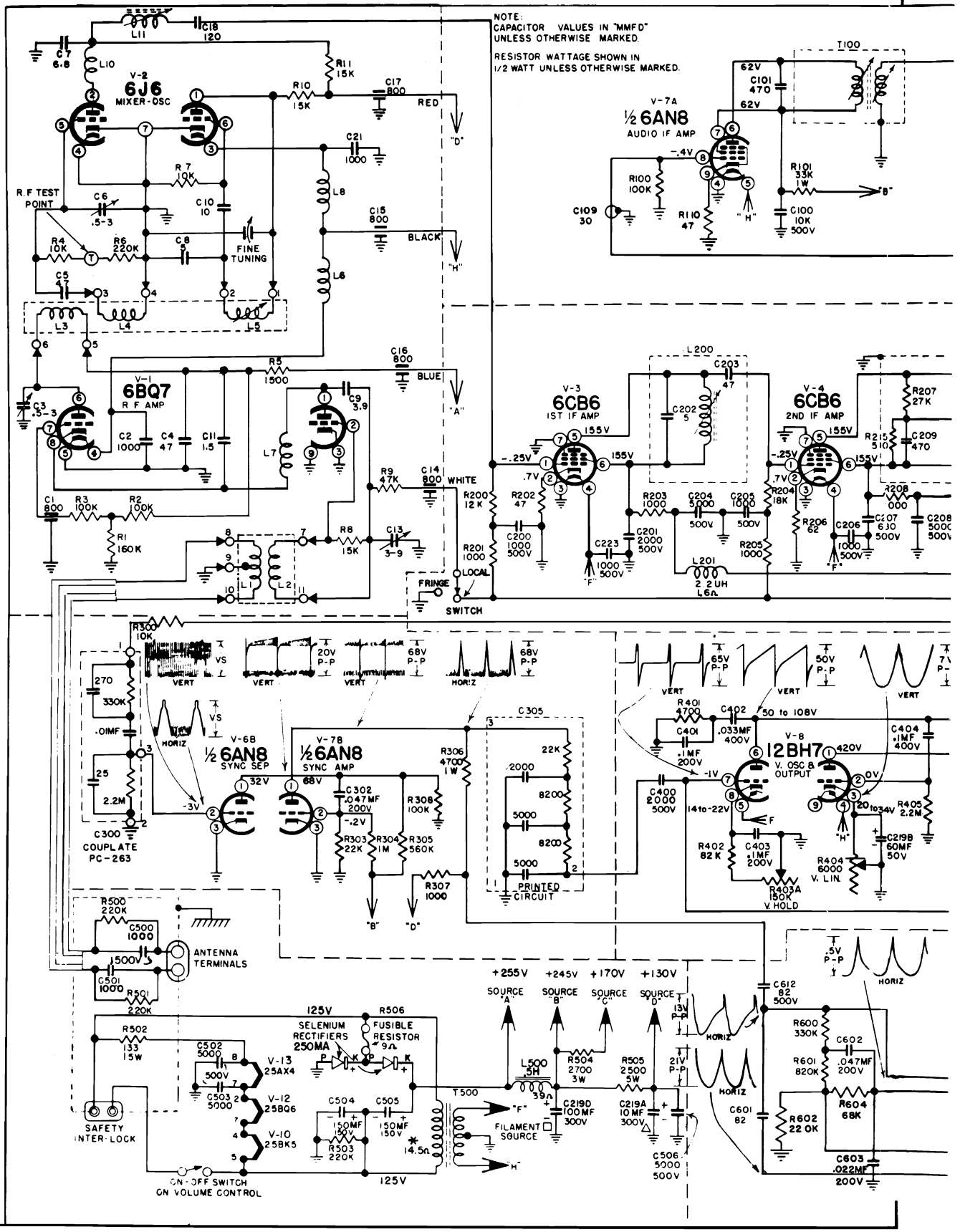
This adjustment varies the frequency of the oscillator for each channel. Turn the fine tuning control to its mid-position (flat surface of fine tuning shaft parallel with bottom of set). Adjust oscillator slug for the best picture with adequate sound.



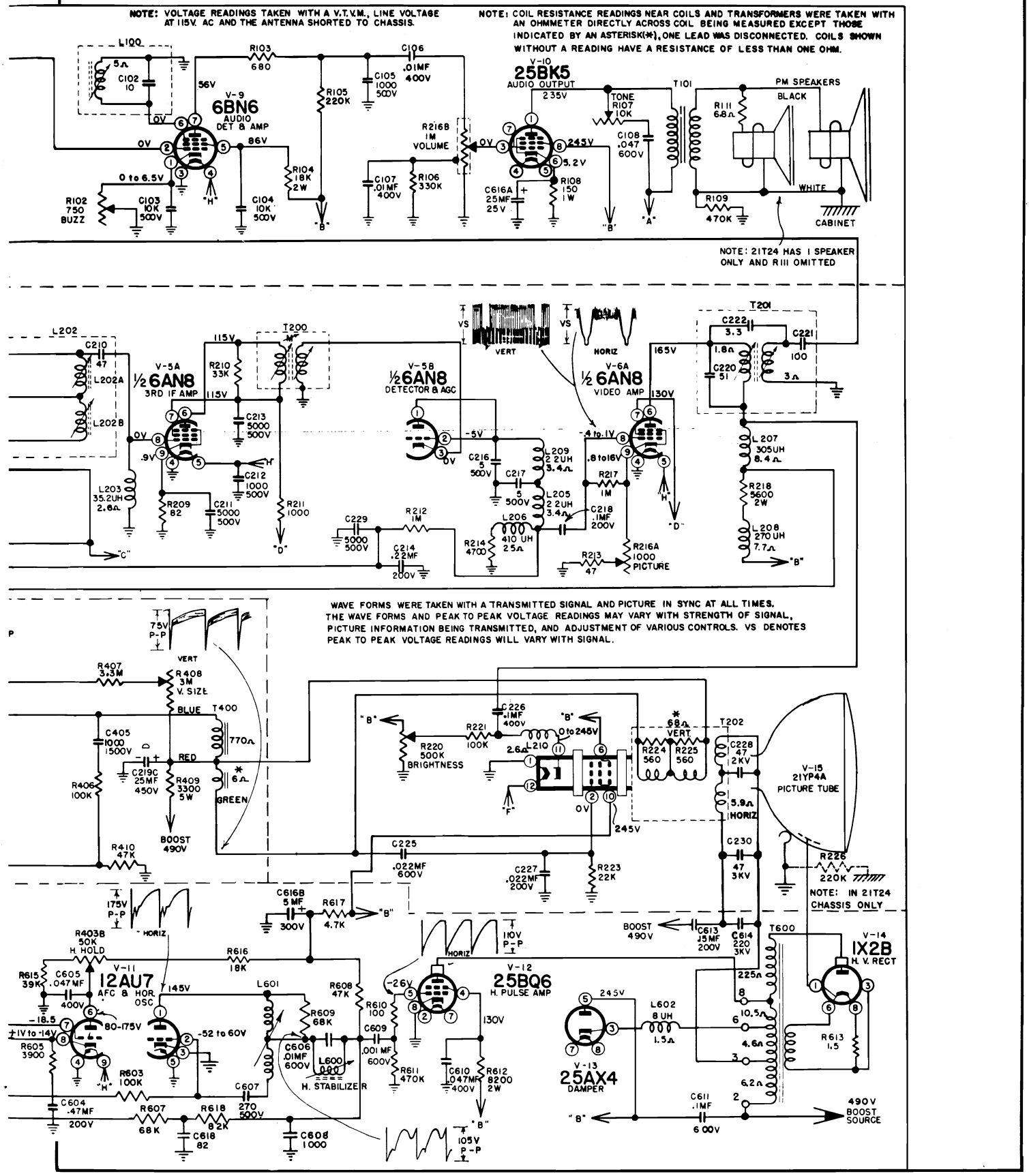
Top Chassis View

(Continued on pages 158 to 160)

RAYTHEON Chassis 21T24, 21T25, and 21T27 Schematic Diagram



RAYTHEON Chassis 21T24, 21T25, and 21T27 Schematic Diagram



RAYTHEON Chassis 21T24, 21T25, and 21T27 Alignment Information

PRE-ALIGNMENT PRECAUTIONS

1. If sweep generator does not have a balanced output, connect a 150 ohm resistor in series with the ground lead and 150 ohms minus the internal resistance of the generator in series with the hot lead.
2. Connect a 1000 mmf capacitor across scope terminals and a 10K ohm resistor in series with hot lead as close to test point as possible.
3. Connect signal generator through a 1000 mmf capacitor.
4. When aligning the IF Amplifier be sure tuner is set to channel 10.

VIDEO IF ALIGNMENT

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	23.9 26.3	25	Pin 8 of V-5A	Scope at IF detector output (R214 & L206 junction)	Connect short between pin 5 and 6 of V-4	T200 pri. (top) T200 sec. (bot.) Coupling rod	
2	Markers should fall 10% down. If response curve is not as shown, readjust coupling rod (bottom T200) for proper bandwidth and T200 primary and secondary for flat response and maximum gain.						
3	21.3	———	Converter grid	VTVM at Pin 8 of V-6A	Remove short. Adjust generator for output of approx. 2 volts DC on VTVM	L202B (bottom core)	Maximum reading
4	26.5	———	Converter grid	VTVM at Pin 8 of V-6A	Adjust generator for output of approx. 2 volts DC on VTVM	L202A (top core)	Maximum reading
5	21.3	———	Converter grid	VTVM at Pin 8 of V-6A	Adjust generator for output of approx. 2 volts DC on VTVM	L202B (bottom core)	Maximum reading
6	24.0	———	Converter grid	VTVM at Pin 8 of V-6A	Adjust generator for output of approx. 2 volts DC on VTVM	L200	Maximum reading
7	25.0	———	Converter grid	VTVM at Pin 8 of V-6A	Adjust generator for output of approx. 2 volts DC on VTVM	L11	Maximum reading
8	———	25	Converter grid	Scope at Pin 8 of V-6A	———	L11	Rock for flat response
9	23.8 26.65	25	Converter grid	Scope at Pin 8 of V-6A	Markers should be 50% down and response curve should be as shown. If not, repeat alignment	Check point only	

Picture IF frequency 26.75 MC — Sound IF frequency 22.25MC.
NOTE: A very short lead from the generator must be used to prevent regeneration.

SOUND IF ALIGNMENT

Sound Alignment can be performed without test equipment and without removing the picture tube from the chassis.

1. Tune in a TV station and adjust fine tuning until sound bars just appear.
2. Turn T201 primary (furthest from chassis pan) slug all the way out (counter-clockwise).
3. Turn same T201 slug in (clockwise) until the horizontal scanning lines are smooth and continuous.
4. Readjust fine tuning for best picture with adequate sound.
5. Reduce signal strength at antenna terminals by use of an attenuator or similar device until a "hiss" accompanies the sound.
6. Adjust sound pick-off transformer (T201 secondary), interstage transformer (T100), quadrature coil (L-100) and buzz control (R102) for maximum clear sound and minimum buzz.
7. If "hiss" disappears during step 3, further reduce signal strength.

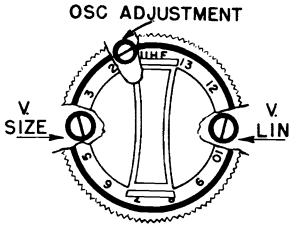
RAYTHEON

21T26AGH & 21T274AGH Chassis

The models covered in this manual are a 16 tube, including the picture tube, AC operated, direct view, 21" rectangular UHF-VHF television receivers. The receivers are complete in one unit and feature full coverage of all 12 VHF and 70 UHF channels.

Two basic chassis are covered and differ only in the number of speakers and tone control. The 21T26 AGH chassis has one speaker, no tone control. The 21T27 AGH chassis has two speakers and one tone control.

MODEL	CHASSIS	CABINET	TYPE
UC-2167 (MHG)	21T26AGH	Console	Mahogany
UC-2167 (Blond)	21T26AGH	Console	Blond
UC-2168 (MHG)	21T274AGH	Console	Mahogany
UC-2168 (Blond)	21T274AGH	Console	Blond



VERTICAL SIZE AND LINEARITY CONTROLS

The vertical size and linearity controls should both be adjusted at the same time while a test pattern is being transmitted. The linearity control affects the upper portion of the picture while the size control affects the overall size especially the lower portion of the picture. Adjust both controls simultaneously until the test pattern is symmetrical and fills the entire screen vertically. Readjust the vertical hold control if necessary.

OSCILLATOR ADJUSTMENT

This adjustment varies the frequency of the oscillator for each channel. Turn the fine tuning control to its mid-position (flat surface of fine tuning shaft parallel with the bottom of set). Adjust oscillator slug for the best picture with adequate sound. All available channels should be adjusted in this manner so that each station may be selected with a minimum of fine tuning control adjustment.

REPLACING SELENIUM RECTIFIERS

Replacement of selenium rectifiers may be accomplished without removing chassis from cabinet. Loosen one hex nut (each rectifier) and move rectifiers to one side. The terminals may then be unsoldered.

REAR CONTROLS

HORIZONTAL HOLD (R606 or 403B-L600-L601)

The front control (R606 or 504B), must be capable of producing an out-of-sync condition (equal number of sloping bars) at either stop position. If not, follow alignment procedure below.

1. Set top H. Hold control (R606 or 403B) to center of mechanical range.
2. Short out H. Stabilizer coil (L600) with a clip lead.
3. Adjust H. Blocking transformer (L601) until picture is in sync.
4. Remove clip lead from L600 and connect a scope with a low capacity probe at the junction of L600, L601, C609 and R609. Wave form illustrated on schematic must be obtained.
5. Adjust H. Stabilizer coil (L600) until peaks of wave form are equal in amplitude.

ION TRAP MAGNET

The position of the ion trap magnet MUST be over the screen grid of the picture tube (second cylinder from the base identified by a flared forward lip). If the adjustment is necessary, rotate and slide along the neck of the picture tube until the position which gives maximum illumination is found. Adjustment should be made with brightness and picture controls set for normal viewing.

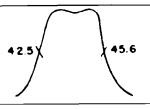
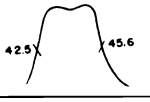
CENTERING CONTROL

The centering tabs should be rotated until the picture is properly framed, keeping in mind that the effect of the control is governed by the posifion of the tabs in relation to one another. After proper centering, recheck the position of the ion trap magnet.

(Continued on pages 162 to 165)

RAYTHEON Chassis 21T26(AGH) and 21T274(AGH) Alignment Information

VIDEO IF ALIGNMENT

Step No.	Signal Generator Freq. (mc.)	Sweep Generator Freq. (mc.)	Signal Input Point	Output Point	Remarks	Adjust	Response
1	44.3	———	Pin 1 of V3	VTVM at junction of L205-R212	Adjust generator for output of not to exceed 2 volts on VTVM	T202	Maximum Reading
2	45.4	———	Pin 1 of V3	VTVM at junction of L205-R212	Adjust generator for output of approx. 2 volts on VTVM	T201	Maximum Reading
3	43.0	———	Pin 1 of V3	VTVM at junction of L205-R212	Adjust generator for output of approx. 2 volts on VTVM	T200	Maximum Reading
4		43	Pin 1 of V3	Scope at junction of L205-R212	Keep generator output as low as possible Adjust for flat response	T202	
5	42.5 45.6	43	Pin 1 of V3	Scope at junction of L205-R212	Markers should be 60% down and response curve should be as shown. If not, repeat steps 1 thru 4	Check point only	
6	41.25	———	Converter grid	VTVM at junction of L205-R212	Keep generator output as low as possible to obtain required response.	L200 (top core)	Minimum Reading
7	42.5 45.6	43	Converter grid	Scope at junction of L205-R212	Markers should be 50% down and response curve should be as shown. If not repeat alignment.	L200 (bottom core) L7	

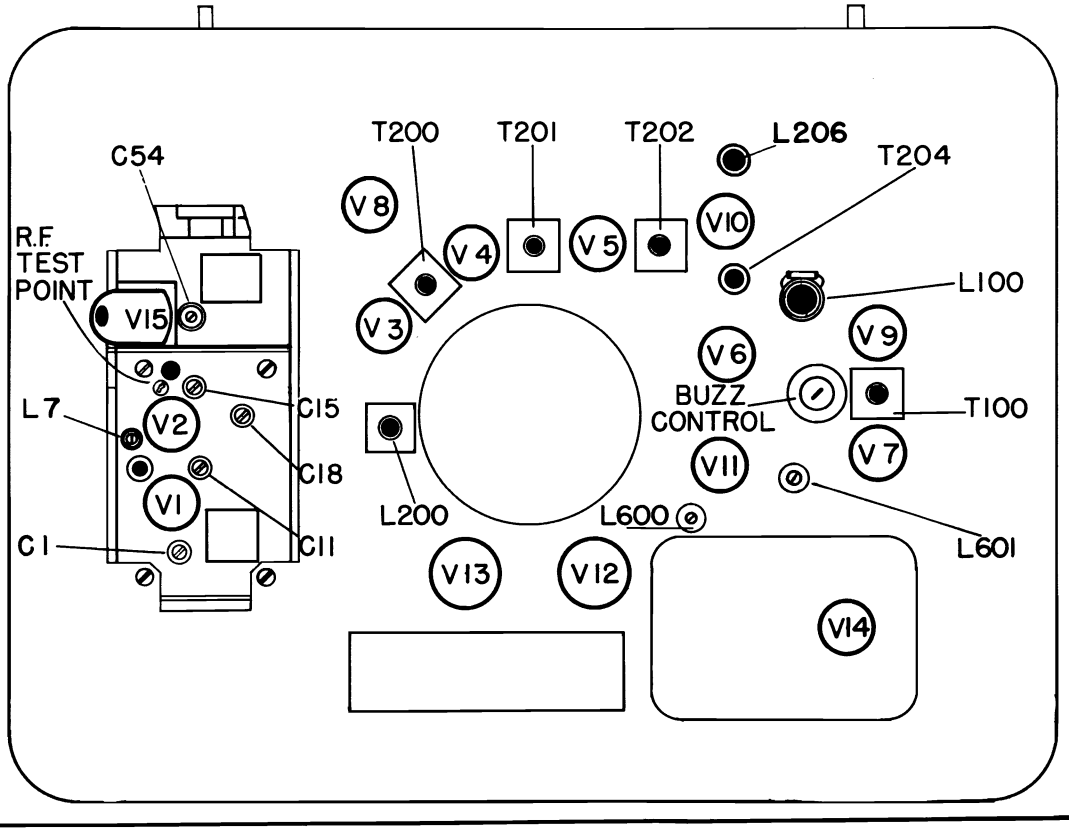
L200 (bottom core) has a band width control effect and should be adjusted for marker positioning.
NOTE: A very short lead from the generator must be used to prevent regenration.
Picture IF frequency 46.75 MC—Sound IF frequency 42.25 MC.

PRE-ALIGNMENT PRECAUTIONS

Connect a 1000 mmf capacitor across scope terminals and a 10K ohm resistor in series with hot lead as close to test point as possible.

Connect signal generator through a 1000 mmf capacitor.

When aligning the IF Amplifier be sure tuner is set to channel 10.



RAYTHEON Chassis 21T26(AGH) and 21T274(AGH) Alignment Continued

SOUND IF ALIGNMENT

Sound Alignment can be performed without test equipment and without removing the picture tube from the chassis.

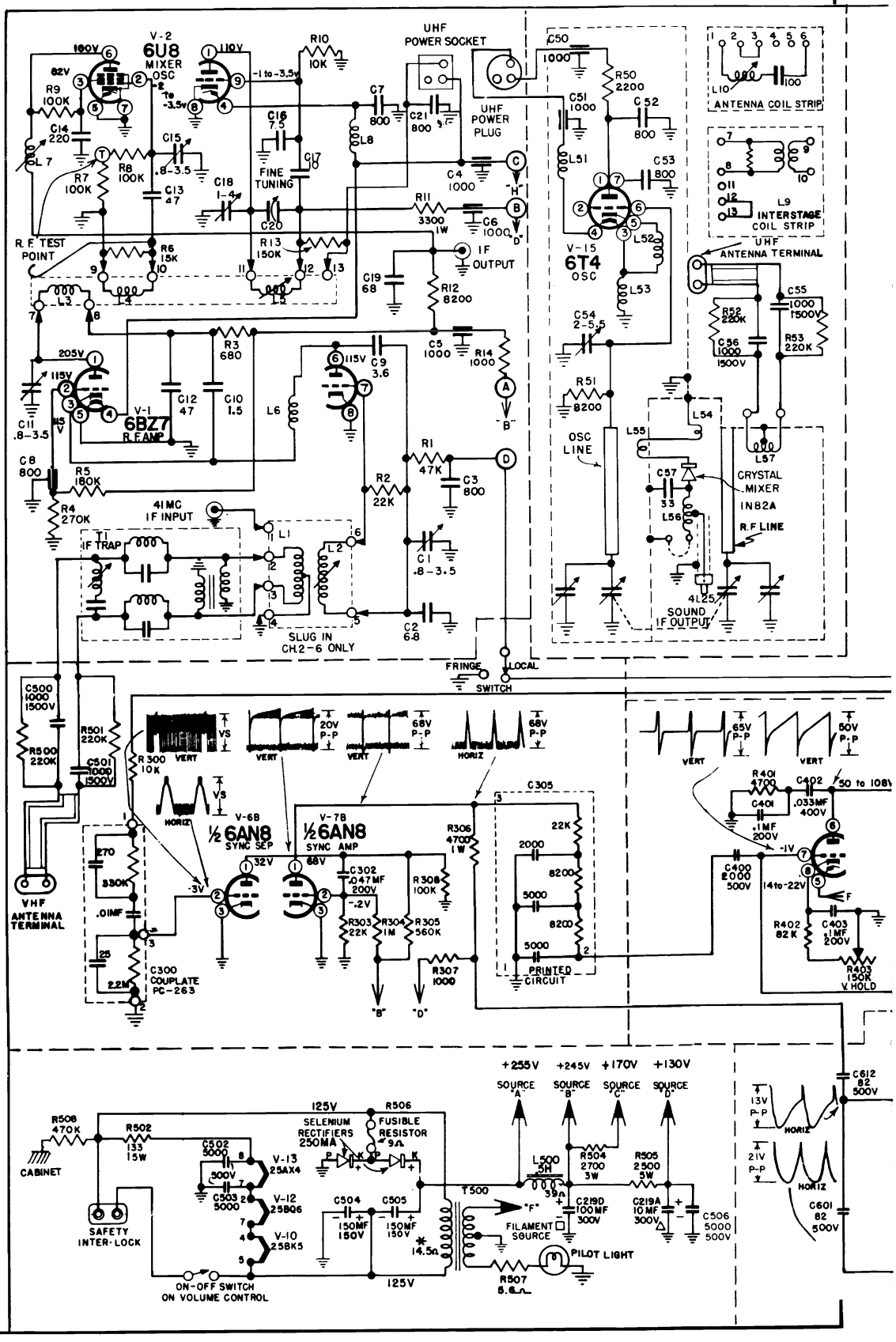
1. Tune in a TV station and adjust fine tuning until sound bars just appear.
2. Turn T204 primary (furthest from chassis pan) slug all the way out (counter-clockwise).
3. Turn same T204 slug in (clockwise) until the horizontal scanning lines are smooth and continuous.
4. Readjust fine tuning for best picture with adequate sound.
5. Reduce signal strength at antenna terminals by use of an attenuator or similar device until a "hiss" accompanies the sound.
6. Adjust sound pick-off transformer (T204 secondary), interstage transformer (T100 primary and secondary), quadrature coil (L-100) and buzz control (R102) for maximum clear sound and minimum buzz.
7. If "hiss" disappears during step 3, further reduce signal strength.

TROUBLE-SHOOTING

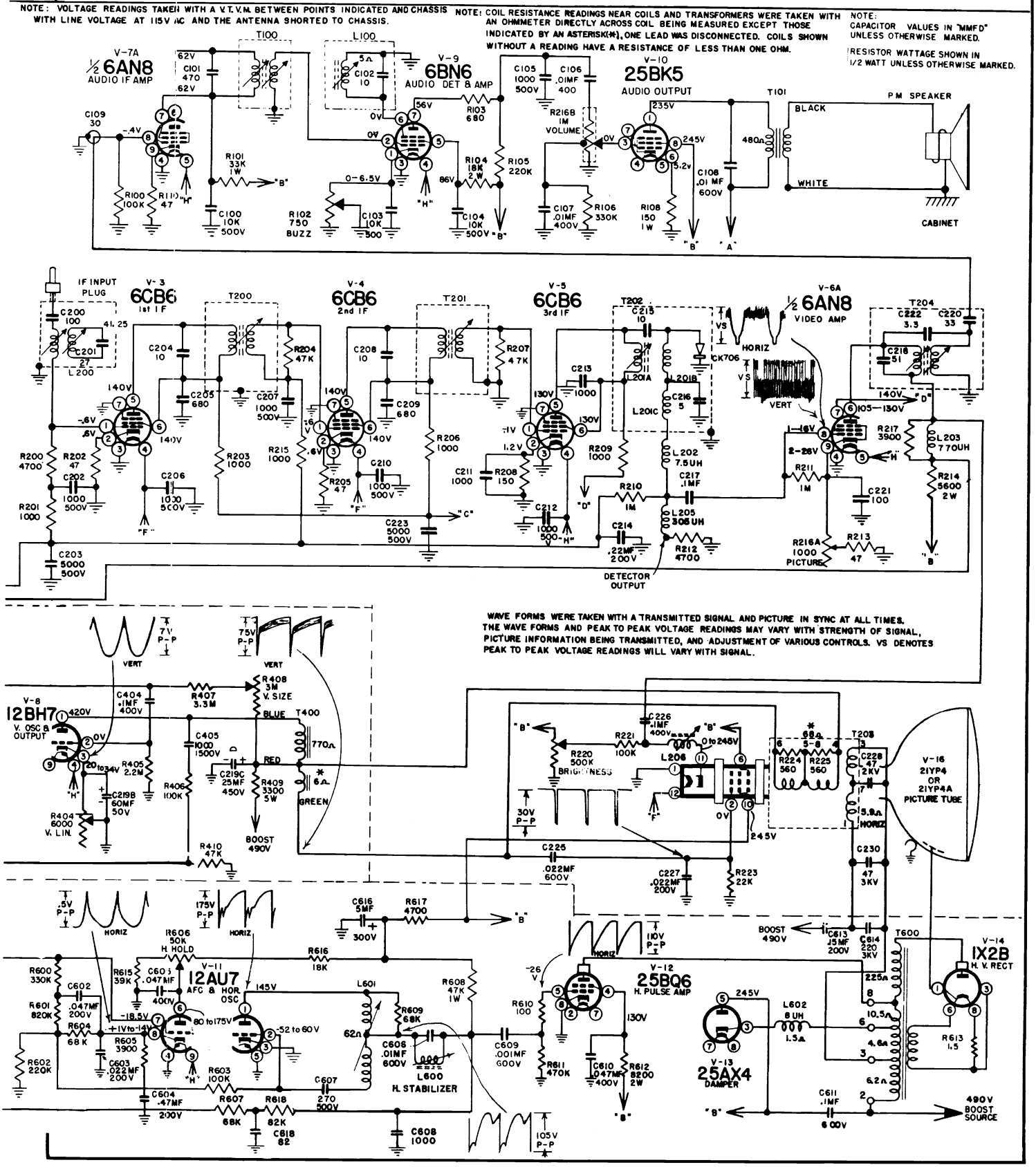
Trouble	Probable Location
No Raster No Sound	1. Defective tubes V10-12-13. 2. Defective selenium rectifers 3. Defective resistors R502, R504 thru R506. 4. Defective capacitors C504-505-219-506. 5. Defective transformer T500 or choke L500. 6. Defective safety interlock or on-off switch.
No Raster Sound Normal	1. Insufficient or no high voltage, (refer to "No High Voltage section). 2. Defective picture tube. 3. Second anode lead disconnected. 4. Ion trap magnet misadjusted. 5. Defective C.R.T socket.
No High Voltage	1. Defective tubes V11-12-13-14. 2. Defective transformer T600, yoke T203, or coil L600-601-602. 3. Defective capacitors C604-605-607-609-610-611-613. 4. Defective resistors R604-(R606 or 403B)-607-610-612-613-615-616-617.
No Picture No Sound Raster Normal	1. Defective antenna or lead-in. 2. Defective tubes V1-2-3-4-5-6. 2a. Defective tube 15 (UHF) 3. Improper voltages or resistances at sockets of tubes V1-2-3-4-5-6 or 15. 4 Improper alignment.
No Sound Picture Normal	1. Defective tubes V7-9-10. 2. Improper voltages or resistances at socket of tubes V7-9-10. 3. Defective speaker or leads broken or not in place. 4. Defective transformer T100-101 or coil L100. 5. Improper sound alignment.
No Sync	1. Defective tubes V6-7. 2. Defective capacitors 302. 3. Defective resistors R300, R303 thru R307. 4. Defective C300 (couplate).
Insufficient or no Vertical Sweep	1. Defective tube V8. 2. Defective transformer T400 or yoke T203. 3. Defective capacitor C401-402-403-404-405-219C or C224. 4. Defective resistor R401-404-405-406-407-408-409-410.
Picture cannot be Centered	1 Defective picture tube. 2. Defective centering control. 3. Defective ion trap magnet.
Poor Focus	1. Improper adjustment on ion trap. 2. Defective picture tube.
Poor Horizontal Linearity	1. Defective tubes V12-13. 2. Defective capacitors C228-620-611-613-614. 3. Defective transformer T203-600 or coil L602.
Snow or Poor Picture	1. Insufficient signal input. 2. Defective antenna or lead-in. 3. Weak tubes V1-2-3-4-5-6 or 15. 4. Improper video IF alignment.
Lack of Contrast	1. Defective tubes V4-5-6. 2. Defective resistors R203-206-209-210. 3. Defective capacitors C217-226. 4. Defective coils L202-205.
Washed Out or Picture Smear	1. Gassy tubes V1-2-3-4-5-6. 2. Defective resistors R210-216-212-211-214 3. Defective capacitors C214-217-226. 4. Defective coils L202-203-205 and transformer T204. 5. Improper Video IF alignment.

RAYTHEON Chassis 21T26(AGH) Schematic Diagram

Chassis 21T274(AGH) is exactly the same as 21T26(AGH) except that it has two speakers and a tone control.



RAYTHEON Chassis 21T26(AGH) Schematic Diagram



STROMBERG-CARLSON

MODEL 1X—1XP SERIES TELEVISION RECEIVER

Models 1X21-22 and 1XP21-22 are modifications of 21T-22T series receivers covered by material on pages 157 to 160, in the early "1955 Television Servicing Information" manual. You probably already own this manual. Below are listed these modifications and also various changes and corrections to bring the data in the early "1955 Television Servicing Information" manual up to date.

The 1X 21-22, 1X P21-22 chassis is a modification of the Model 21-22. The following changes have been made in the circuit.

		Ind.	Color Code	S-C Part #
L-20	Peaking Coil	270 Uh	Green Green Green	114776
L-23	Peaking Coil	140 Uh	White White White	114774
L-24	Peaking Coil	250 Uh	Red Red Red	114779
L-25	Peaking Coil	179 Uh	Blue Blue Blue	114780

1. L-24 peaking coil is removed from Pin #7 of the 12BY7 video amplifier (V-14) and connected from Pin #5 of 1st video amplifier (V-13, 6AU6) to R-132. A direct connection is made from Pin #7 (V-14) to the junction of C-150 and R-146. The sync lead is removed from Pin #5 of the 1st video amplifier and connected to the junction of R-132 and R-133.
2. Add a 4700 ohm ½ watt resistor R-192 (S-C Part #28166) between Pin #4 of the 6W6 audio output (V-19) and the junction of C-192 and R-194.
3. Add a 27K, ½ watt resistor R-172 (S-C Part #28174) from pin #6 of 6AU6 2nd sound I.F. to ground.
4. Add C-134 (S-C Part #110715) .003 400v. capacitor from cathode to ground of V-13 (6AU6 1st video amplifier).
5. Add R-293, 470 ohm, 1 watt resistor between terminal "B" on tuner to 150 volt line (S-C Part #149136).
6. Change R-194 to 270 ohm, 2 watt, S-C Part #149072.
7. Change R-190 to 330K ohm, ½ watt, S-C Part #28185.
8. Change R-197 to 330K ohm, ½ watt, S-C Part #28185.
9. Change R-192 to 220 ohm, 2 watt, S-C Part #149072.
10. Change R-196 to 22K, 2 watt, S-C Part #149084.
11. Change T-17 Audio output transformer, S-C Part #161284.
12. Change C-233 so as to be connected between the red and green leads of T-19 vertical output transformer.
13. Delete R-209, 220K, ½ watt resistor.
14. Delete C-265 56 mmf capacitor in receivers using the 21XP4 CR tube.
    In the chassis using the 21AUP4A, C-265 is changed to 110 mmf (S-C Part #110844).
    In the chassis using the 21FP4C, C-265 is 56 mmf (S-C Part #110819).

MODELS 21-22 SERIES TV RECEIVERS — Correction of Service Notes.

T-11 has been changed in production (effective as follows):

1. Remove white lead from bottom terminal of trap coil to cathode of tube.
2. Disconnect ground end of cathode resistor (330 ohm) and by-pass (330 MMF) and connect to cathode of tube.
3. Connect jumper, between the ground point of which the cathode resistor-condenser combination was connected, and the bottom terminal on the same side of the coil.

MODELS 21-22 SERIES TV RECEIVERS — Correction of Service Notes.

The following changes have been made in production. Please correct the service notes as follows: (Code date 54-211).

1. Delete C-131 .0047 MF capacitor.
2. Delete C-133 100 MMF capacitor.
3. Delete C-191 .1 MF capacitor.
4. Delete R-191 560K resistor.
5. Delete R-185 120K ohm resistor.
6. Change R-184 from 270K ohm to 560K ohm resistor. (S-C Part #28188).
7. Add 1 680K ½ watt resistor R-108 (S-C Part #28189) from pin 5 of V-19 (6W6 audio output) to junction of R-193 and C-193.
8. Add 470K ohms ½ watt resistor R-197 S-C Part #28187) from R-190 270K ohm resistor to ground.
9. Add 2 6.8K 2 watt resistors R-185 (S-C Part #149053) in series from B plus 150 volts to ground.
10. Remove R-243 3.9K ohm resistor from junction of R-204 and R-215 and connect to B plus 150 volts.
11. Remove B plus 150 volts from 1st IF V-9 (6CB6) at junction of R-94, R-93, C-94 and connect to B plus 110 volts.

MODELS 21-22 SERIES TV RECEIVERS — Change to Prevent Pulling at Top of Picture.

A change in the circuit of the 21-22 series TV receivers to prevent pulling at the top of the picture, has been put in production. A 2.2 meg. ½w. resistor R-249 (S-C Part #149121) has been added from B plus 310 volts to pin 1 of V-20 (6AU6) keyed AGC tube. A 47K ½w resistor R-216 (S-C Part #149111) is added across L-28 horizontal frequency coil. (Code date 54-211).

MODELS 21-22- SERIES TV RECEIVERS — Correction of Schematic.

The following changes have been made in production. Please correct the Service Notes as follows: (Code Date 54-35).

1. Add 82 ohm ½ watt resistor from the cathode of the 6W6 audio output tube between pin 8 and the junction of R-192, C-192 and C-291-A. This will be designated as R-199, (S-C Part #28145).
2. Delete R-266, 1.8K and C-264, 3.30 mmf.
3. Change R-143 from 2.2K to 1.5K (S-C Part #149178).
4. Delete two 6.8K, 2 watt resistors R-184, R-185, (S-C Part #149053) in series from B+ 150 volts to ground.
5. Return screen of picture tube (orange wire) to junction of R-235 and red lead of vertical output transformer.

All 21-22 models using audio output transformer S-C Part #161281, will have the following change:

R-198 is changed from 680K ½ watt resistor (S-C Part #28189) to 820K ½ watt rseistor (S-C Part #28190). This is connected from pin 5 of V-19 (6W6 audio output) to junction of R-193 and C-193. Delete C-193, .033 mfd, (S-C Part #110740). Add C-193, .01 mfd, (S-C Part #110737). (Reference Current Flash #3, Volume 6, Dated 6-10-54).

To improve operation at 50 cycles the Models 21 and 22 are presently being wired as follows:

1. R-239 and C-233 are terminated on 310 volt B+ line rather than ground.
2. The junction of C-121 and R-120 are terminated at ground.

SYLVANIA ELECTRIC PRODUCTS INC.

CHASSIS 1-526-1,-2,-3,-4,-5,-6

MODELS 612, 614, 622, 21T103, and 21C402.

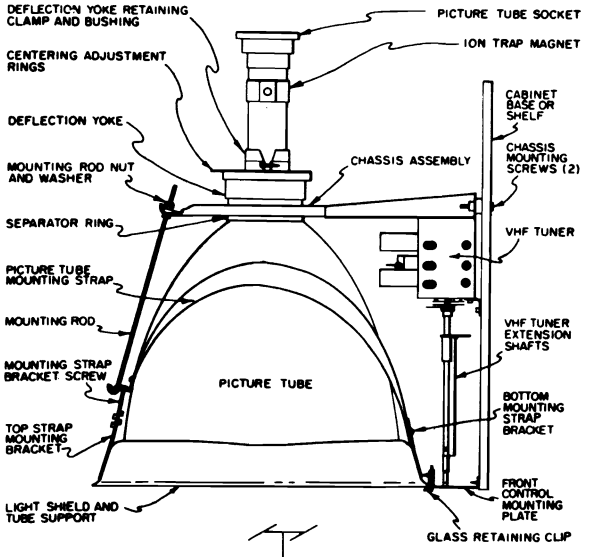
The service material for these models, as presented on pages 167 to 170, may also be used for Chassis 1-527-1, -2, used in Models 511 Series, which are practically identical electrically.

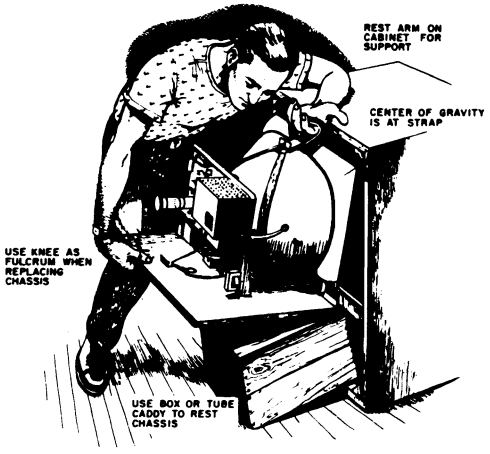
Refer to chassis serial number identification described below to associate a chassis with its proper schematic variations and specific code changes:

Engineering Variation — Code Change

526202 - 123 - 4567

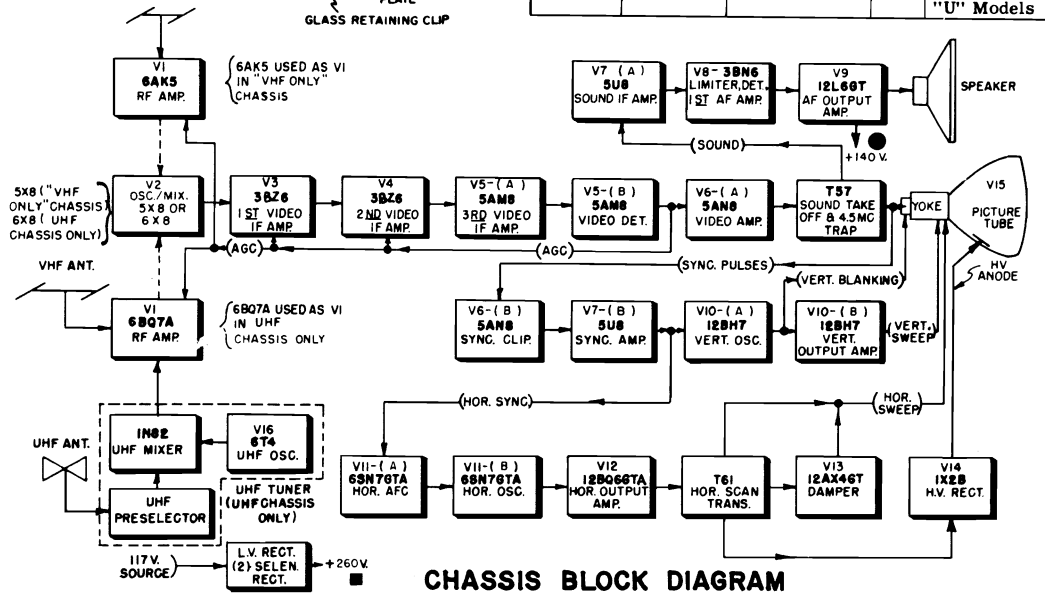
Chassis Series — Factory Information





CHASSIS VARIATIONS

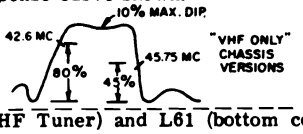
CHASSIS	PICTURE TUBE	CHANNEL COVERAGE	HALO-LIGHT	MODEL SERIES	MODEL TYPE
1-526-1	21YP4A	VHF only	Yes	614	Table
1-526-2	21YP4A	VHF and UHF	Yes	614 "U" Models	Table
1-526-3	21AVP4A	VHF only	Yes	612	Table
1-526-4	21AVP4A	VHF and UHF	Yes	612 "U" Models	Table
1-526-5	21AVP4A	VHF only	Yes	622	Console
1-526-6	21AVP4A	VHF and UHF	Yes	622 "U" Models	Console



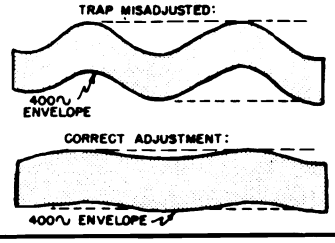
CHASSIS BLOCK DIAGRAM

SYLVANIA Chassis 1-526-1, -2, -3, -4, -5, -6, Alignment Information

VIDEO IF ALIGNMENT

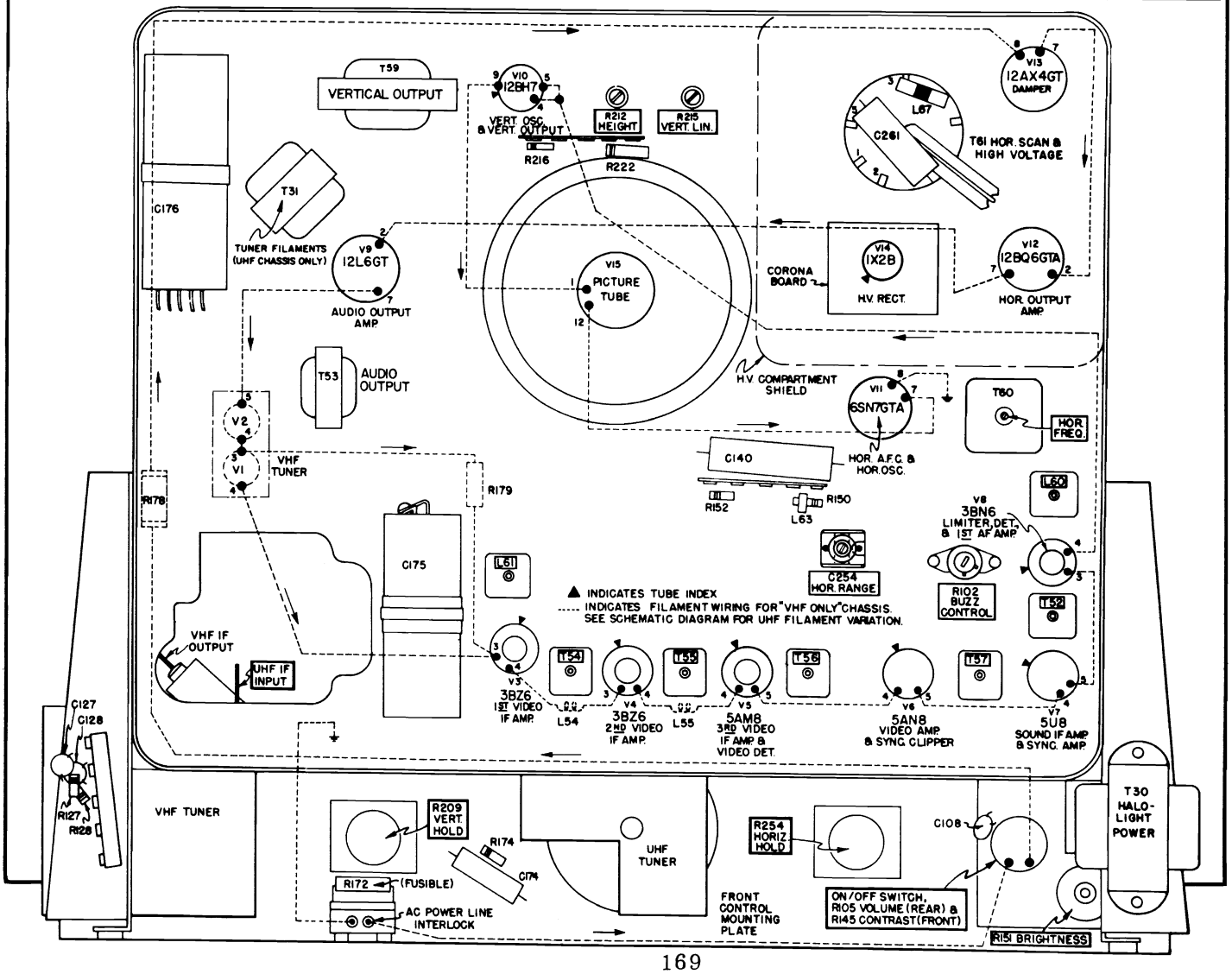
STEP	ALIGNMENT SETUP NOTES	TEST EQUIPMENT HOOKUP	ADJUST
1.	Connect 3.5V. DC source (-) terminal to junction of R142 (1 megohm) and C137 (.22 mfd.) and connect (+) terminal to chassis. Set VHF Tuner to signal-free channel with minimum interference.	SIGNAL GENERATOR - to ungrounded tube shield on Osc./Mix. tube (5X8 or 6X8) on VHF tuner. VTVM - D.C. Probe to junction of C139 (.1 mfd.) and R143 (3.3K).	L61 (top core) for MIN. at 47.25 MC. T54 (top core) for MIN. at 41.25 MC. Use a high signal generator output for satisfactory VTVM reading.
2.	Same as 1.	Same as 1.	T56 for MAX. at 44.0 MC. T55 for MAX. at 45.3 MC. T54 (bottom core) for MAX. at 42.6 MC. Reduce signal generator output to keep VTVM reading between 1 and 2 volts.
3.	Same as 1.	SWEEP GENERATOR - through blocking capacitor to pin 1 of V3 (3BZ6). Set to 43.5 MC with 10 MC sweep. SIGNAL GENERATOR - loosely couple as a marker to sweep generator lead. OSCILLOSCOPE - through 33K resistor to junction of C139 (.1 mfd.) and R143 (3.3K).	T56, T55 and T54 (bottom core) for response curve shown: 
4.	Leave 3.5V. AGC voltage connected as in step 1. Set VHF tuner to signal-free high band channel that causes minimum distortion of response curve.	SWEEP GENERATOR - to ungrounded tube shield on Osc./Mixer tube (5X8 or 6X8) on VHF tuner. SIGNAL GENERATOR - loosely couple as a marker to sweep generator lead. OSCILLOSCOPE - through 33K resistor to junction of C130 (.1 mfd.) and R143 (3.3K).	L10 (VHF Tuner) and L61 (bottom core) for response curve shown:  L17 (VHF Tuner) and L61 (bottom core) for response curve shown:  NOTE: IF MARKERS DO NOT FALL AT CORRECT POINTS, "TOUCH-UP" T54 (BOTTOM CORE) AND T55. SHOULD THESE ADJUSTMENTS INTRODUCE EXCESSIVE TILT, "TOUCH-UP" T56.
5.	Repeat step 1 trap adjustments.		
6.	Repeat step 4 adjustments until response curve is flat as possible with markers positioned as shown. Curve should be symmetrical within 5% and "dip" in center should be 10% or less.		
7.	Remove test equipment.		

4.5MC TRAP ALIGNMENT

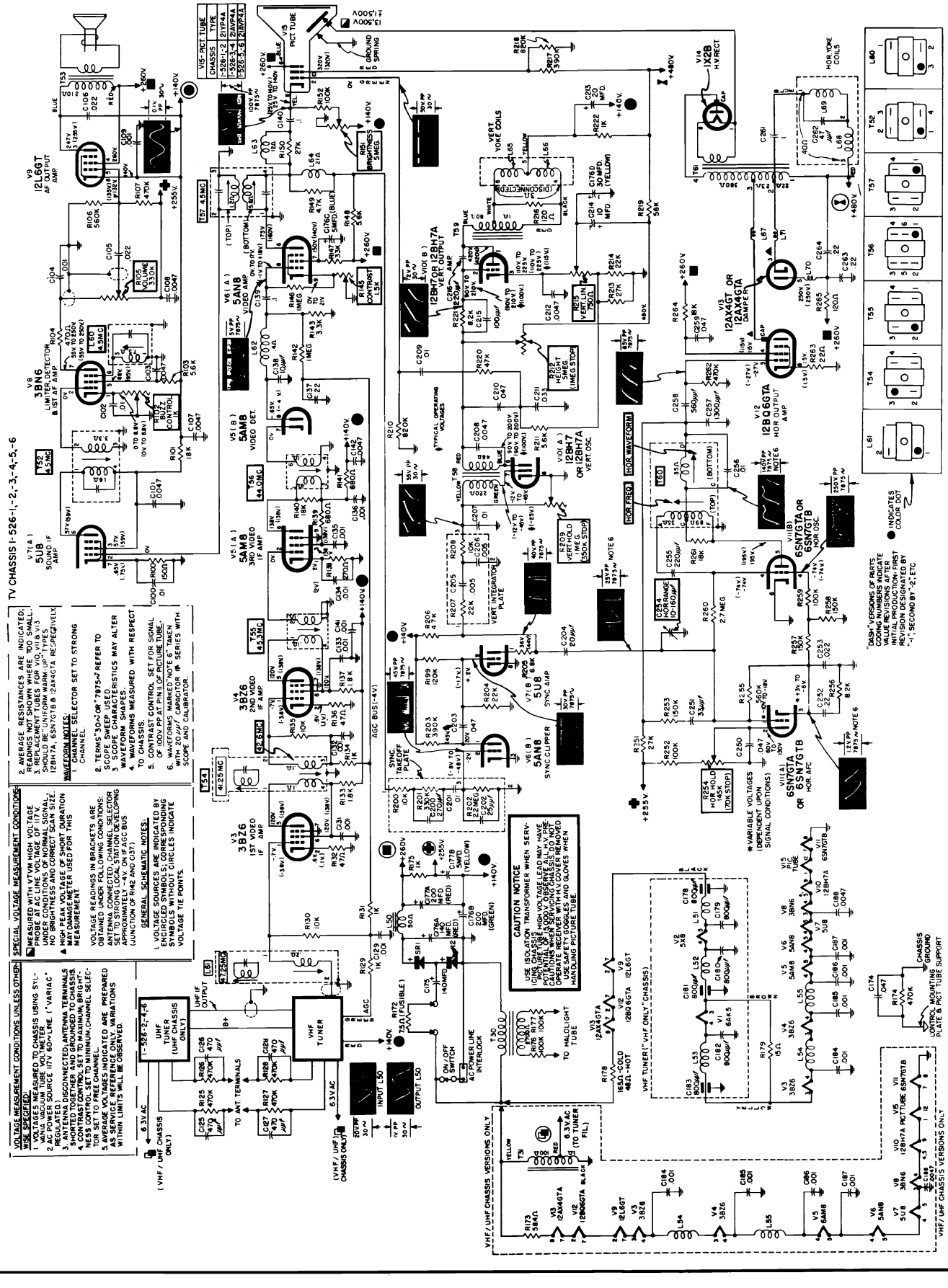
STEP	ALIGNMENT SETUP NOTES	TEST EQUIPMENT HOOKUP	ADJUST
1.	Set VHF tuner to signal-free channel with minimum interference. Set Volume control (R105) to a low level.	SIGNAL GENERATOR - to pin 8 of V6 (5AN8). Set to 4.5 MC amplitude modulated (AM) by 400 cycles. OSCILLOSCOPE - through detector circuit to junction of C140 (.1 mfd.) and yellow lead to pin 11 of V15 (picture tube). Set scope sweep frequency to approximately 200 cycles.	T57 (bottom core) for MIN. 400 cycle scope deflection. Use sufficient signal generator output to display the 400 cycle envelope. 

SOUND ALIGNMENT

STEP	ALIGNMENT SETUP NOTES	TEST EQUIPMENT HOOKUP	ADJUST
1.	PERFORM THE COMPLETE "4.5 MC TRAP ALIGNMENT" PROCEDURE OUTLINED ABOVE BEFORE PROCEEDING WITH STEP 2.		
2.	Set Buzz control (R102) approximately 60 degrees back from full clockwise position. Set Volume control (R105) to a low level. Set VHF tuner to signal-free channel with minimum interference.	SIGNAL GENERATOR - to pin 8 of V6 (5AN8). Set to 4.5 MC frequency modulated (FM) by 400 cycles 25 KC deviation. OSCILLOSCOPE - across secondary of audio output transformer (T53). Set scope sweep frequency to approximately 200 cycles.	L60 for MAX. 400 cycle scope deflection. T52 and T57 (top core) for MAX. 400 cycle scope deflection. Keep signal input as low as practical.
3.	Leave VHF tuner and Volume control (R105) set as in step 2.	SIGNAL GENERATOR - to pin 8 of V6 (5AN8). Set to 4.5 MC amplitude modulated (AM) by 400 cycles. OSCILLOSCOPE - across secondary of audio output transformer (T53). Set scope sweep frequency to approximately 200 cycles.	R102 (Buzz control) for a null point between two positions of maximum 400 cycle scope deflection. Use a high signal generator output setting.
4.	Same as 3.	SIGNAL GENERATOR - to pin 8 of V6 (5AN8). Set to 4.5 MC frequency modulated (FM) by 400 cycles 25 KC deviation. OSCILLOSCOPE - across secondary of audio output transformer (T53). Set scope sweep frequency to approximately 200 cycles.	L60 for MAX. 400 cycle scope deflection.
5.	Repeat steps 2, 3 and 4.		
6.	Remove test equipment.		
7.	Connect receiver to an antenna. Set VHF tuner to a weak signal and adjust Buzz control (R102) for MINIMUM background noise and "hiss".		
8.	Leave receiver connected to antenna. Set VHF tuner to a strong signal and adjust L60 for CLEAREST sound.		



SYLVANIA Chassis 1-526-1, etc. Schematic Diagram



Westinghouse

CHASSIS ASSEMBLY V-2315 and V-2325

Several different variations of the V-2315 and V-2325 chassis are used in current production. The difference will be found in the type of RF tuner and CRT used. The dash numbers following the basic chassis number identifies these variations.

Model Information

The V-2315 chassis will be found in the following models:

H-882T21 (V)	H-884K21 (V)	H-886K21 (V)
H-882T21 (S)	H-884K21 (S)	H-886K21 (S)
H-883T21 (V)	H-885K21 (V)	H-887K21 (V)
H-883T21 (S)	H-885K21 (S)	H-887K21 (S)

The letter in parenthesis listed with the model number signifies the type VHF RF tuner used and also its adaptability to UHF. Example: H-882T21 (V). The "V" indicates a switch type VHF-RF tuner with coverage of channels 2 through 13. H-882T21 (S) the "S" indicates a turret type VHF-RF tuner with coverage channels 2 through 13 plus UHF channels 14 through 83 with the installation individual UHF strips.

The V-2325 chassis will be found in the following models:

H-882TU21	H-884KU21	H-886KU21
H-883TU21	H-885KU21	H-887KU21

Note: When the letter "U" appears in the model number it indicates that the receiver contains a type V-2325 chassis. The V-2325 chassis is identical to the V-2315 chassis with the exception that an all-channel VHF-UHF combination tuner has been factory installed to provide UHF reception of the UHF television channels (14 through 83) in addition to the VHF channels (2 through 13).

HORIZONTAL RINGING COIL

The horizontal ringing coil (L400) should be adjusted as follows:

1. Short out the ringing coil with a short jumper wire.

2. Set the horizontal hold control to the middle of its range, and leave it in this position during the steps that follow.

3. Connect a VTVM to the pin #2 grid circuit of the horizontal multivibrator, so as to measure the DC voltage between this point and ground.

4. With the receiver tuned to a TV station, adjust C423 (located on the rear of the chassis) for **zero** voltage on the meter. If zero voltage can be approached but not quite reached at one extreme of the C423 adjustment, it may be necessary to set the horizontal hold control slightly to one side of mid-position to obtain zero voltage.

5. Remove the jumper from across the ringing coil.

6. Adjust the ringing coil for **zero** voltage on the meter, and check the adjustment by switching to another channel and then back again. The receiver should pull into horizontal synchronization on all channels.

AGC CONTROL

To check the adjustment of the AGC control, tune the receiver to the strongest signal in the area. Turn the channel selector off channel and then back. If the picture reappears normally, the AGC control is set properly. If the picture re-appears with excessive bends or if it requires some time to tune in, the receiver is overloaded and the AGC control should be readjusted as follows:

Turn the AGC control clockwise (fringe position) until the receiver begins to overload or a slight bend occurs in the picture. Then turn the control counter-clockwise (toward LOCAL position) to a position where the overload or bends disappear.

If the signal is weak, bending or overload may not occur. In this case turn the AGC control clockwise (fringe position) to a position where best picture with minimum snow is obtained.

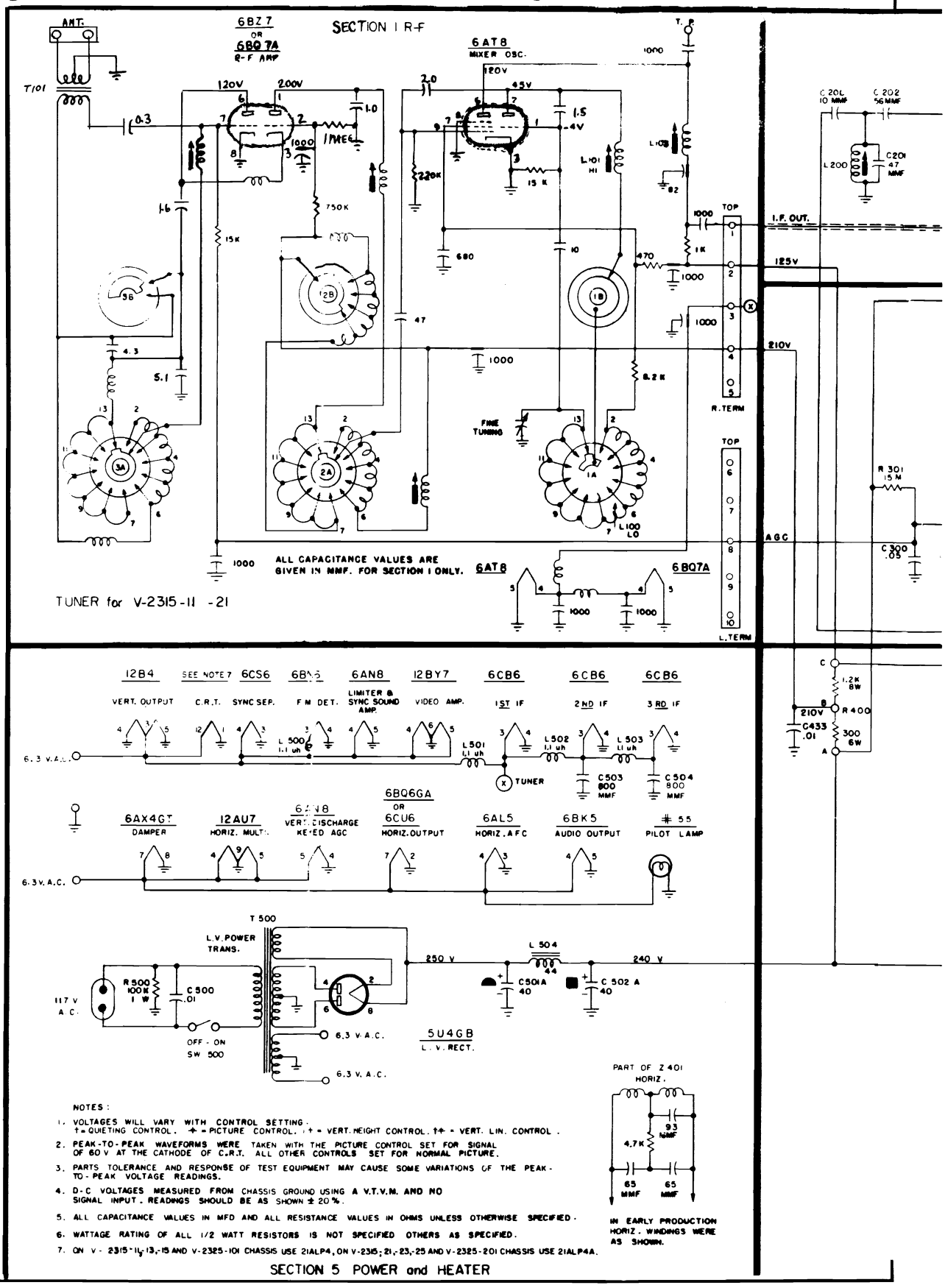
NOTE: It is important that the AGC control be set at the time of installation and the setting should be made on the strongest signal in the area.

ALIGNMENT TOOL

To adjust the slugs in the common I-F transformers a special tool is required. This tool must fit into the .035" x .093" slot in the slug.

(Circuit diagram is on pages 172-173; alignment is on page 174.)

Westinghouse Chassis V-2315 and V-2325 Circuit Diagram

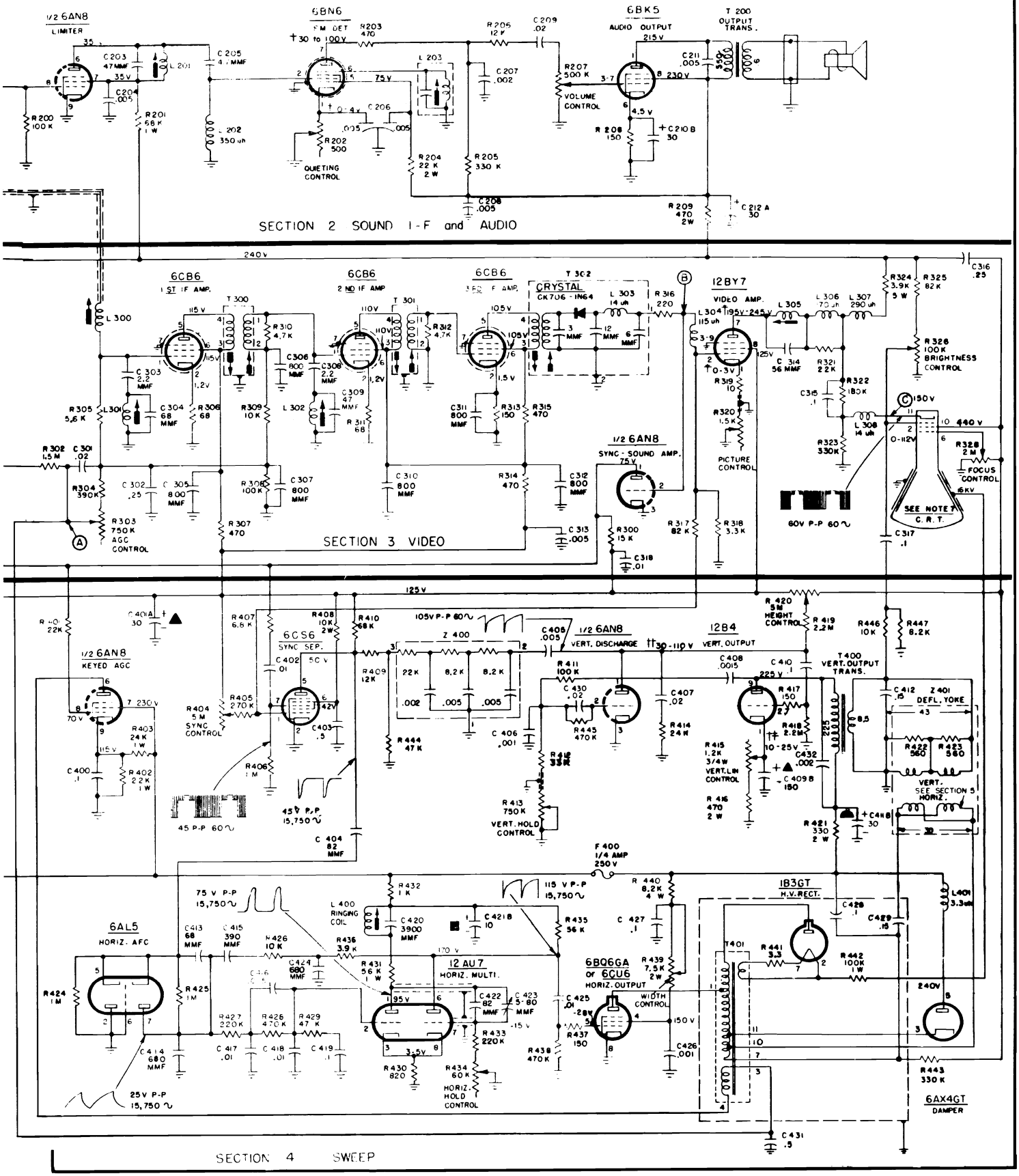


NOTES:

1. VOLTAGES WILL VARY WITH CONTROL SETTING. † = QUIETING CONTROL. ✣ = PICTURE CONTROL. †† = VERT. HEIGHT CONTROL. ✣✣ = VERT. LIN. CONTROL.
2. PEAK-TO-PEAK WAVEFORMS WERE TAKEN WITH THE PICTURE CONTROL SET FOR SIGNAL OF 60 V AT THE CATHODE OF C.R.T. ALL OTHER CONTROLS SET FOR NORMAL PICTURE.
3. PARTS TOLERANCE AND RESPONSE OF TEST EQUIPMENT MAY CAUSE SOME VARIATIONS OF THE PEAK-TO-PEAK VOLTAGE READINGS.
4. D-C VOLTAGES MEASURED FROM CHASSIS GROUND USING A V.T.V.M. AND NO SIGNAL INPUT. READINGS SHOULD BE AS SHOWN ± 20 %.
5. ALL CAPACITANCE VALUES IN MFD AND ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
6. WATTAGE RATING OF ALL 1/2 WATT RESISTORS IS NOT SPECIFIED OTHERS AS SPECIFIED.
7. ON V-2315-11, -13, -15 AND V-2325-101 CHASSIS USE 21ALP4, ON V-2315-21, -23, -25 AND V-2325-201 CHASSIS USE 21ALP4A.

SECTION 5 POWER and HEATER

Westinghouse Chassis V-2315 and V-2325 Circuit Diagram



Westinghouse Chassis V-2315 and V-2325 Alignment Information

ALIGNMENT CHARTS

COMMON I-F SECTION

Rotate the channel selector to channel 13.

Connect the oscilloscope to the video test terminal, point "B" through the decoupling network shown in Fig. 2.

Connect a 9 volt bias battery to the AGC line, point "A"

Couple the marker generator output to the sweep generator output. In the steps that follow, use the marker to check the response curve at the frequencies indicated on Fig. 4.

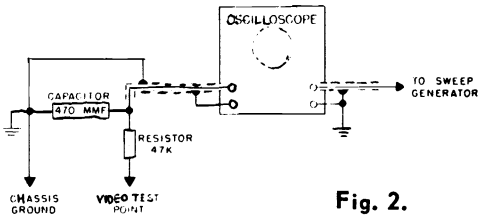


Fig. 2.

Step	*Alignment Signal*	*Remarks*	*Adjustments*
1.	Remove the RF amplifier tube.		
2.	44 mc. sweep to 3rd IF grid.	Connect detuning clips to 1st & 2nd IF plates.	Pri. of T302 for max. response and sec. of T302 for symmetrical curve shown in Fig. 4A.
3.	47.25 mc. amplitude modulated to 1st IF grid.	Use sufficient signal to produce sine wave response on oscilloscope.	L302 for min. response
4.	44 mc. sweep to 2nd IF grid.	Connect detuning clip to 1st IF plate	Pri. of T301 for max. response and sec. of T301 for symmetrical curve shown in Fig. 4B.
5.	44 mc. sweep to 1st IF grid.	Detune L103 or T-100 when V-14130 tuner is used	Pri. of T300 for max. response and sec. of T300 for symmetrical curve.
6.	44 mc. sweep to 1st IF grid.		L102 or T100 when V-14130 tuner is used for "suck-out" at 44 mc. (center of curve), see Fig. 4C.
7.	Replace the RF amplifier tube.		
8.	213 mc. sweep to antenna terminals through network.	Feed in 213 mc. marker and adjust the local oscillator (fine tuning) so that the marker appears in the center of the response curve (44 mc. on response curve 4D). The fine tuning control is then set at mid-range.	Feed in 215.75 mc. marker and adjust the 41.25 mc. sound trap (L301) for "Suck-out" as shown in Fig. 4D.

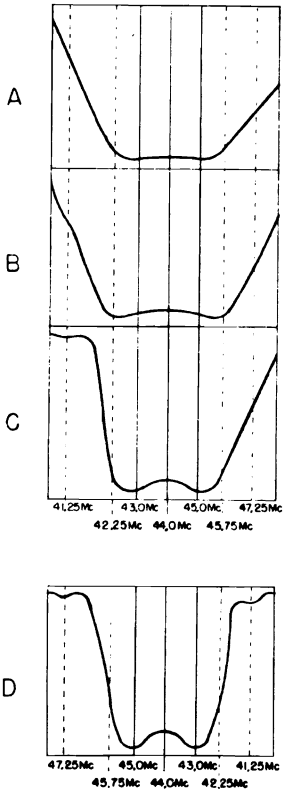


Fig. 4. Response Curves at Various Stages of Alignment

4.5 MC. TRAP

Connect the signal generator to point B (see V-2315 and V-2325 schematic diagram) through .001 mfd. capacitor.

Step	*Signal Gen. Frequency*	*VTVM Connections*	*Remarks*	*Adjust—*
1.	4.5 mc. unmodulated	R-F probe to point "C" (see Fig. 5, schematic diagram) and common lead to chassis.	Use strong signal from generator.	L305 for minimum voltage.

Westinghouse

CHASSIS V-2316, V-2326, and V-2317, V-2327

Chassis V-2316 and V-2317 are identical except that the first uses a 17" picture tube and V-2317 uses a 21" tube. Models using these chassis and having a suffix (V) employ a switch type 12-position VHF tuner, while suffix (S) indicates that a turret type 12-position VHF tuner is used. Chassis V-2326 and V-2327 are the same as chassis V-2316 and V-2317 respectively, with the exception that a built-in VHF-UHF all-channel tuner, part number V-15310-1, has been factory installed to provide reception of UHF channels 14 through 83, and VHF channels 2 through 13. Suffix numbers such as -11, -601, following the chassis number indicate differences in picture tube or tuner. Below is a list of models using these chassis:

Chassis V-2316, Models H-892T17, H-894T17, H-908T17, H-909T17, H-910T17, H-916T17, H-919T17, H-920T17, H-921T17.

Chassis V-2317, Models H-896T21, H-898T21, H-899T21, H-900C21, H-901C21, H-902K21, H-903K21, H-904K21, H-905K21, H-912T21, H-913T21, H-914T21, H-924T21, H-927T21, H-928T21, H-929T21, H-965K21, H-966K21.

Chassis V-2326, Models H-892TU17, H-894TU17, H-908TU17, H-909TU17, H-910TU17, H-916TU17, H-919TU17, H-920TU17, H-921TU17.

Chassis V-2327, Models H-896TU21, H-898TU21, H-899TU21, H-900CU21, H-901KU21, H-902KU21, H-903KU21, H-904KU21, H-905KU21, H-912TU21, H-913TU21, H-914TU21, H-924TU21, H-927TU21, H-928TU21, H-929TU21, H-965KU21, H-966KU21.

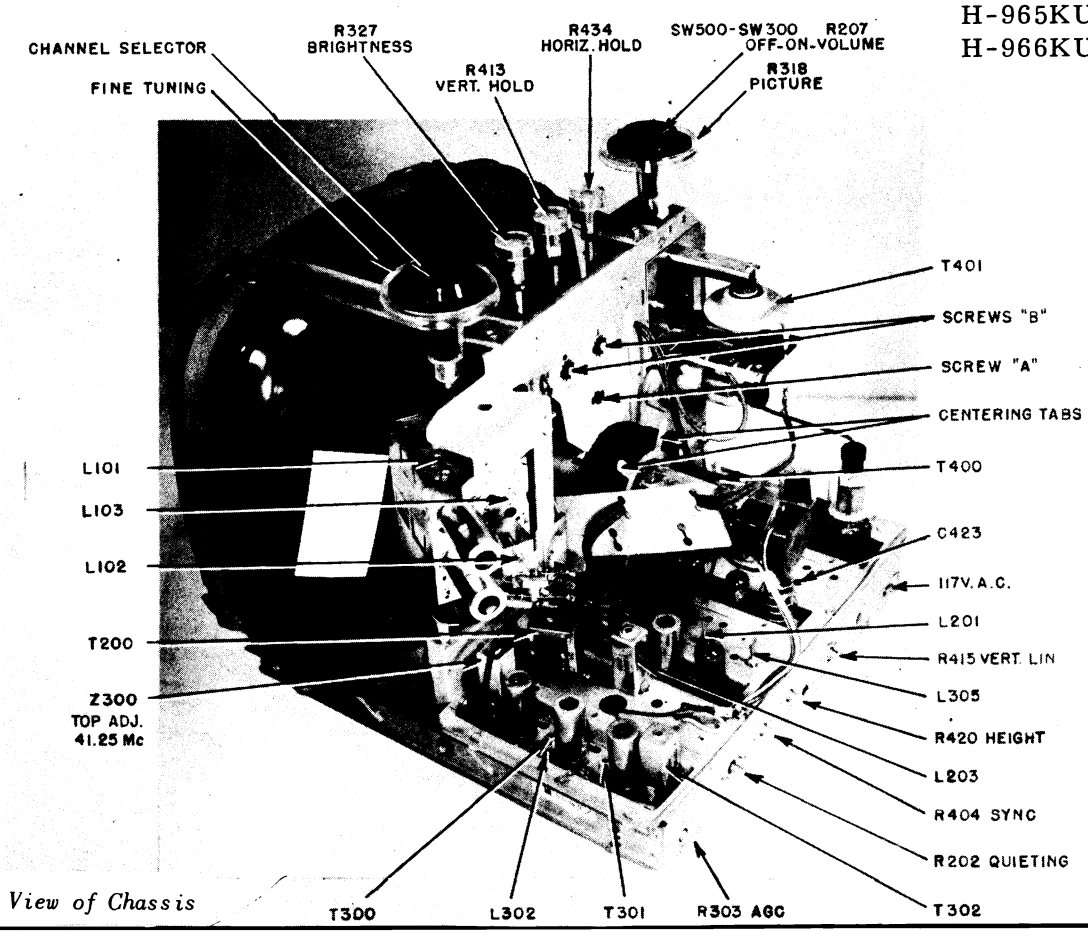


Fig. 1 Rear View of Chassis

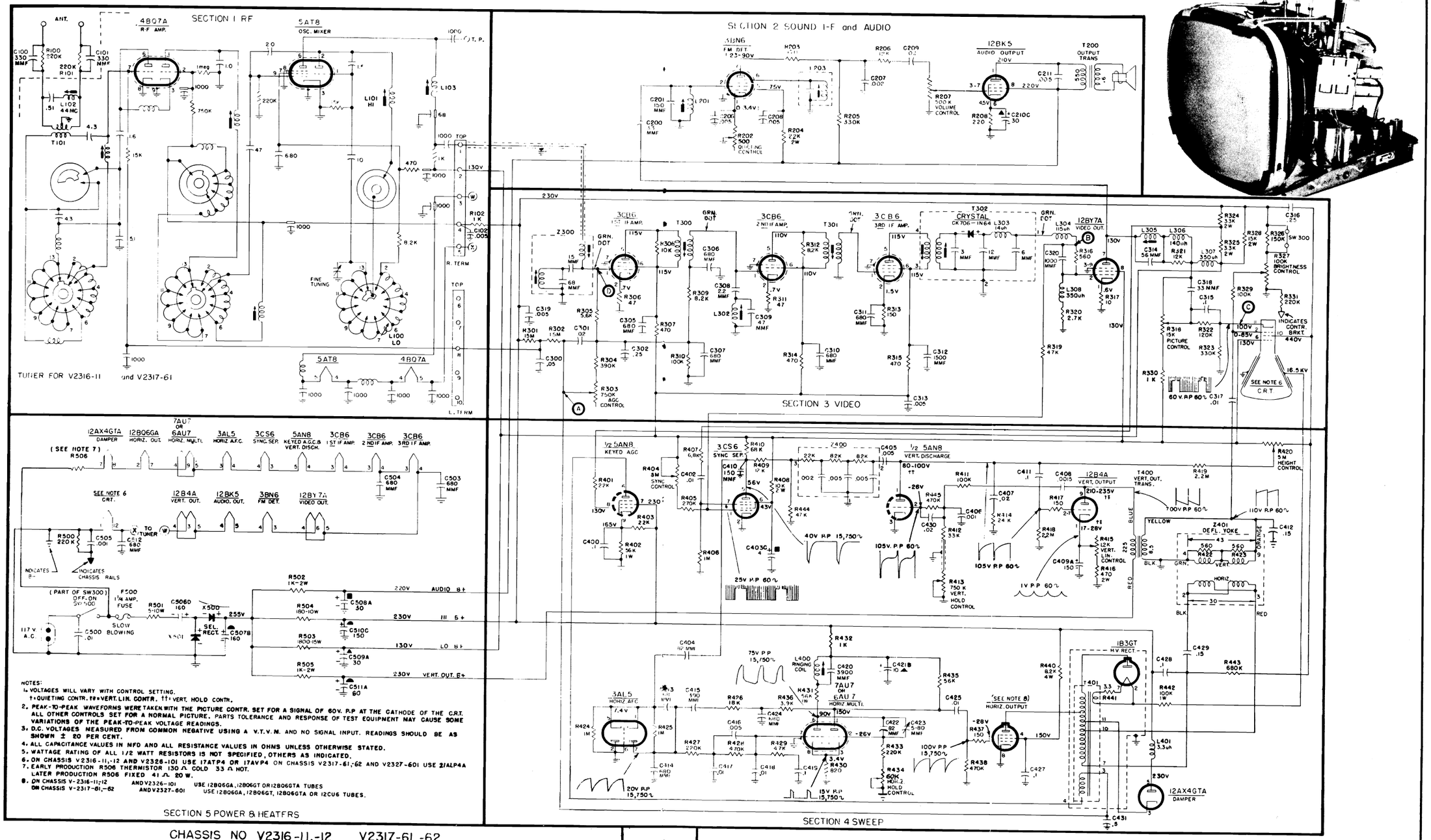
WESTINGHOUSE Chassis V-2316, V-2317, Schematic Diagram

HORIZONTAL DRIVE VOLTAGE

To increase the horizontal drive voltage to the horizontal output tube, capacitor C424 (680 mmf.) was reduced to 390 mmf. and resistor R426 (18,000 ohms ½W.) was increased to 22,000 ohms ½W.

HORIZONTAL STREAKING

Horizontal streaking appearing only on the white portion of the picture and occuring on low channels with week signals. This condition is corrected by inserting R446 (1 megohm) from the junction of C429, C428, and R443 to pin 10 of the C.R.T.



CHASSIS NO V2316-11,-12 V2317-61,-62
V2326-101 V2327-601

WESTINGHOUSE Chassis V-2316, V-2317

Fig. 8 Schematic Diagram

WESTINGHOUSE Chassis V-2316, V-2317, V-2326, V-2327, Alignment (Continued)

IF ALIGNMENT

The Video IF system uses staggered tuned transformers to obtain the required bandwidth. In this type of system, both the meter and visual methods are used.

The alignment procedure to be used is given in the following steps:

1. Connect the VTVM (-5 volt range) to point "B" as shown on the schematic diagram Fig. 8.

2. Connect the RF generator, capable of providing frequencies ranging from 40 to 50 mc. (unmodulated) to point "D" as shown on the schematic diagram (See Fig. 8).

3. Apply -9 volts bias to point "A" as shown on the schematic diagram Fig. 8.

4. Adjust L302, T302, T301, and T300 as given in the following chart:

SIGNAL GENERATOR FREQUENCY	ADJUST	OUTPUT
47.25 mc.	L302 Adj. sound	Min.
43.9 mc.	T302 (3rd IF) Top and bottom	Max.
43.1 mc.	T301 (2nd IF)	Max.
45.2 mc.	T300 (1st IF)	Max.

The output of the signal generator should be adjusted to provide a constant 1 volt output on the VTVM.

NOTE: To adjust the slugs in the IF transformers, Z300, T300, T301, and the 47.25 mc. trap L302 a special tool is required. This tool must fit into the 3/32" hex type hole in the slug. An incorrectly designed tool will cause chipping of the slug. A suitable tool is shown in Fig. 3.

To adjust the slugs in T302 (3rd IF transformer) an alignment tool that will fit into

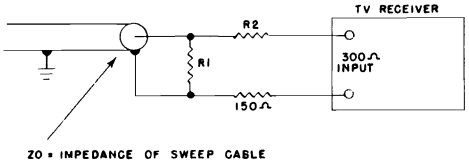
Fig. 3 Alignment Tool

the .035" x .093" slot in the slug should be used. A suitable tool is stocked under Westinghouse part number V-8345.

5. Remove the VTVM and connect the vertical input of the oscilloscope to point "B" see Fig. 8 using the isolation network as shown in Fig. 5.

6. Remove the RF signal generator from point "D" see Fig. 8.

7. Couple the marker generator output to the sweep generator output so that the two signals are applied together to the points specified in the steps that follow. Some sweep generators have facilities for connecting the marker output directly into the sweep generator. With other sweep generators, the marker can be coupled to the sweep by wrapping a few turns of insulated wire around the center conductor of the sweep generator output cable



ZO	R1	R2
50 Ω	56 Ω	120 Ω
72 Ω	82 Ω	110 Ω

Fig. 4 Impedance Matching Network

and connecting the marker generator to this wire. The loose coupling obtained in this manner is desirable because *excessive marker signal injection will distort the response curve.*

8. Connect the sweep generator output cable to the antenna terminals with the proper inpedance match (See Fig. 4).

9. Set the channel selector to channel 13 and set sweep generator to sweep channel 13 frequencies.

10. Adjust L103 on tuner, for proper bandpass, and the bottom of Z300 correcting the tilt for the response curve as shown in Fig. 6, with markers as indicated. It may be necessary to retouch the IF transformers T302, T301 and T300 to the proper response curve. The top adjustment of Z300 is the 41.25 mc. sound trap and should be adjusted so that the 215.75 mc. fall as shown in Fig. 6.

11. Set the fine tuning control to mid-range (the red mark on the fiber disc on the front of the tuner should be in a vertical plane with respect to the fine tuning shaft), and adjust L101 (See Fig. 1) so that the video carrier marker (211.25 mc.) falls at the 50% point on the curve (See Fig. 6).

12. Set the sweep generator to channel 6 (82-88 mc.) and the marker to channel 6 video carrier frequency (83.25 mc.) and adjust L100 so that the video carrier marker appears at the 50% point on the curve.

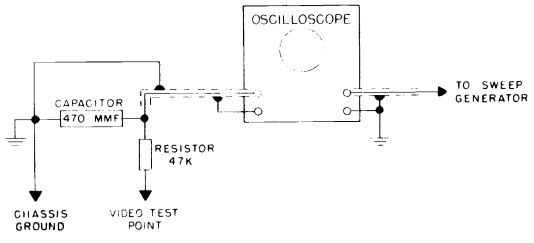


Fig. 5 Oscilloscope Connections

ANTENNA TRAP

Antenna trap L102 is adjustable over the IF range of the receiver and is pre-set at the factory to 44 mc.

Any interfering signal, other than 44 mc. and falling in the IF range of the receiver, can be minimized or eliminated by one of the following methods.

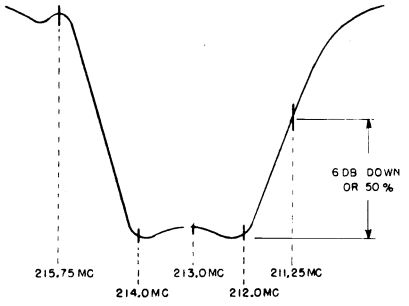


Fig. 6 Response Curve

1. Using an air signal with the interference present, adjust the trap L102 for maximum rejection.

2. If the specific frequency of the signal causing the interference is known, connect an RF signal generator (unmodulated) tuned to the interfering frequency to the antenna terminals. Connect a VTVM to the video detector, point B on Fig. 8 and adjust trap L102 for minimum reading.

4.5 MC. TRAP ALIGNMENT PROCEDURE

1. Connect the high side of the signal generator to the video test point (point "B" on Fig. 8) through a .001 mfd mica capacitor, and ground to B-.

2. Adjust the signal generator to 4.5 mc. (unmodulated). The accuracy of this frequency is very important. If a crystal controlled signal generator is not available, the frequency should be checked with an accurate frequency meter.

3. Connect the common lead from the VTVM to B-, and connect the *R-F probe* from the VTVM to the cathode of the CRT. This point is shown as (point "C" on Fig. 8). Note that this point is above ground potential and, therefore the R-F probe must contain a blocking capacitor.

4. Using a strong 4.5 mc. signal, adjust the 4.5 mc. trap, L305 for minimum indication on the meter.

SOUND ALIGNMENT PROCEDURE

The sound system can be aligned using either locally generated signals or a received TV signal. Since the latter method does not require signal generating equipment, it will be described first and will be followed by the procedure using locally generated signals.

To use an "air" TV signal for alignment:

1. Tune the receiver to a TV station and connect an attenuator between the receiver and the antenna so that the strength of the signal can be varied from weak to strong.

2. Set the quieting control (R202) located on the back of the chassis approximately to its mid-position.

3. Adjust the 4.5 mc. IF slug (L201) for maximum program sound. If peaks occur at two different positions of the slug, use the peak that occurs when the slug is farthest counterclockwise. Reduce the signal to its lowest usable level and recheck the adjustments.

4. Apply a *strong* signal to the receiver, and adjust the quadrature coil (L203) for maximum program sound. If peaks occur at two different positions that are widely separated, use the one that occurs with the slug farthest counterclockwise. If two peaks occur within a *narrow* range of adjustment, sufficient signal is not being applied to the receiver or the quieting control is not set at the desired position.

5. Apply a very weak signal that allows noise to be heard and adjust the quieting control (R202) for minimum noise. The position at which the noise is minimized depends on the strength of the signal; therefore, the weakest usable station in the area should be used for this adjustment. This control determines the AM rejection characteristics of the sound system, and its correct setting is normally about mid-position. *Do not leave the quieting control set at its maximum counterclockwise position.*

To use locally generated signals for alignment:

1. Connect an oscilloscope or an AC voltmeter across the volume control for use as an indicator.

2. Apply a 4.5 mc. FM signal (deviation approximately 7.5 kc.) to pin #2 of the 12BY7A video amplifier.

3. Using the lowest signal level that will produce an indication, adjust L201 for maximum output.

4. Using a *strong* signal, adjust L203 for maximum output.

5. Apply a 4.5 mc. AM signal (modulated approximately 30 percent) to pin #2 of the 12BY7A video amplifier.

6. Beginning with a very low signal level, increase the generator output, while rotating the quieting control back and forth, until the signal level is such that the AM output across the volume control dips to *zero* with a rise on each side as the quieting control is rotated. Set the quieting control for zero output at this signal level.

WESTINGHOUSE Chassis V-2316, V-2317, V-2326, and V-2327, Continued

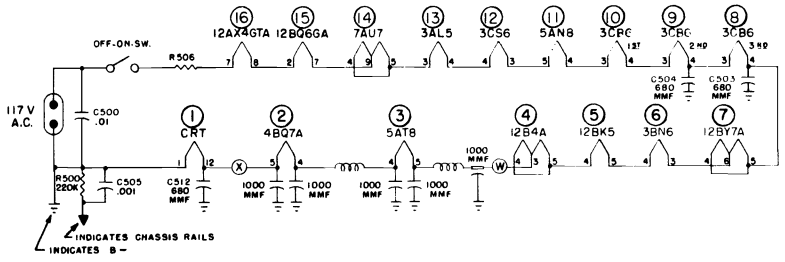


Fig. 10 Filament Sequence

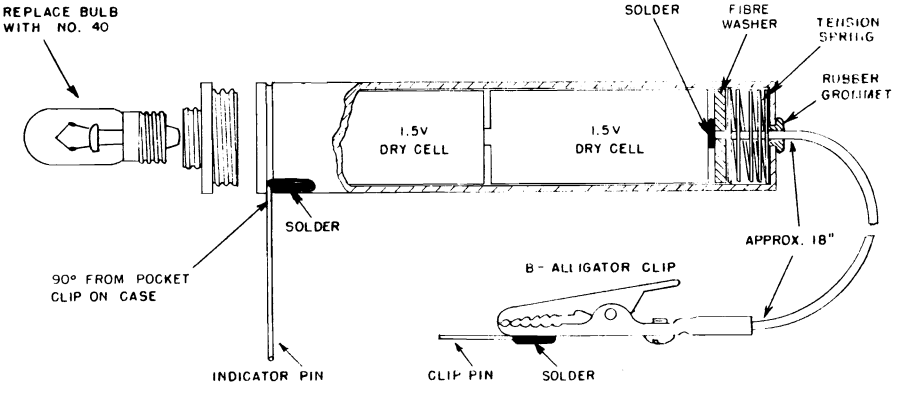
LOCATING OPEN FILAMENT TUBE

Figure 11 shows the construction of a simple tool made from suitable tubing or by modifying a small pocket flashlight. A low current drain (150 mil) bulb such as the type 40 screw base or type 47 bayonet base is required for checking across a large number of tubes. Also, the higher voltage rating of these types assures long bulb life.

STEP 1. With the back cover off, remove tube No. 8 (3CB6) and check the tube from pins 3 to 4 for continuity. If the indicator does not light insert a new 3CB6. If the original 3CB6 filament is good, connect the clip lead of the indicator to any convenient point on the horizontal chassis (B-) and insert the indicator pin into the No. 4 position of the tube socket No. 8. If the indicator does not light, the open filament lies between tube No. 8 and B- and can be located by checking at successive tube sockets between tube No. 8 and B- in the order shown by the dotted line in Figure 9. If the indicator lights, continuity exists between tube No. 8 and B- and all the tube filaments between these points are good.

STEP 2. Then remove tube No. 16 (12AX4GTA) from its socket and insert the indicator pin into the No. 8 position of tube socket No. 16 and the pin of the clip lead into the No. 3 position of tube socket No. 8. If the indicator does not light the open filament lies between tube No. 16 and tube No. 8 and can be located by checking at successive tube sockets between tube No. 16 and tube No. 8 in the order shown by the dotted line in Fig. 9. If the indicator lights, continuity exists between tube No. 16 and tube No. 8.

STEP 3. The Damper tube No. 16 (12AX4GTA) should next be checked for continuity between pins No. 7 and 8. If continuity does not exist replace with new tube. If filament string still doesn't function, the resistor R506 should be checked for its proper resistance value. *NOTE: In early production R506 is a special negative coefficient resistor (Thermister) which measures 130 ohms when cold and 33 ohms when it is hot. In later production R506 is a fixed 41 ohm, 20 watt resistor.*



MODIFIED PEN LITE OR PENCIL LIGHT USED FOR CHECKING SERIES FILAMENT STRING.

Fig. 11 Modified Pencil Light

ZENITH

"T" SERIES TELEVISION RECEIVERS

The 16T20 and 17T20 chassis described in this manual are similar in design. Alignment and adjustment procedures are identical. The 17" 16T20 chassis utilizes selenium rectifiers and series filaments using the new 600 mill tubes in which the heater thermal characteristic is so controlled that voltage surges during the warmup period are greatly minimized. Because of the controlled warmup of these tubes always use the exact replacement type. One side of the power line is tied to the 16T20 chassis and use of an isolation transformer is recommended in servicing. The 21" 17T20 chassis is equipped with a power transformer, rectifier tube and parallel heater string.

MODEL	TYPE	PICTURE TUBE	CHASSIS
T1814R	Table	17AVP4	16T20
T1816B,E,L & R	Table	17AVP4A	16T20
T2220R	Table	21ALP4	17T20
T2222B,E,L & R	Table	21ALP4A	17T20
T2224E & R	Table	21ALP4A	17T20

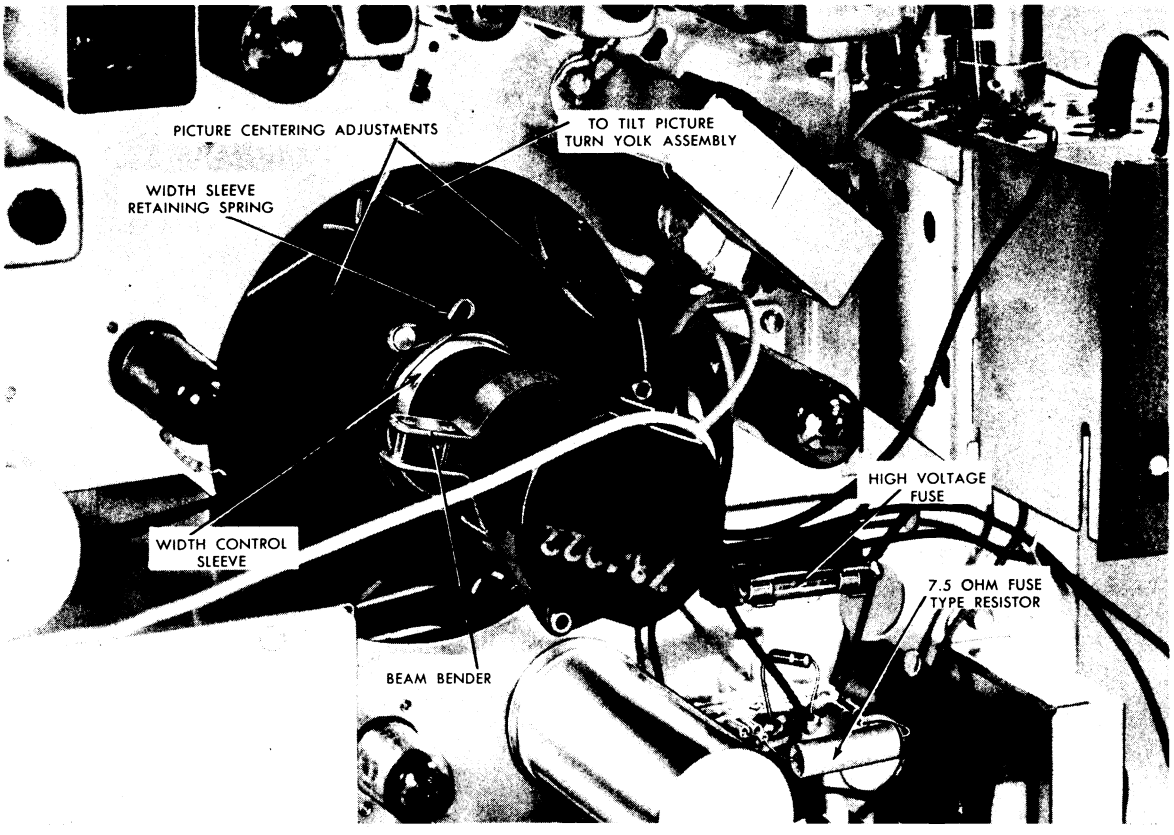


Fig. 14 Adjustments on Neck of Picture Tube of 16T20 and 17T20 Chassis.

ZENITH Chassis 16T20, 17T20 (Continued)

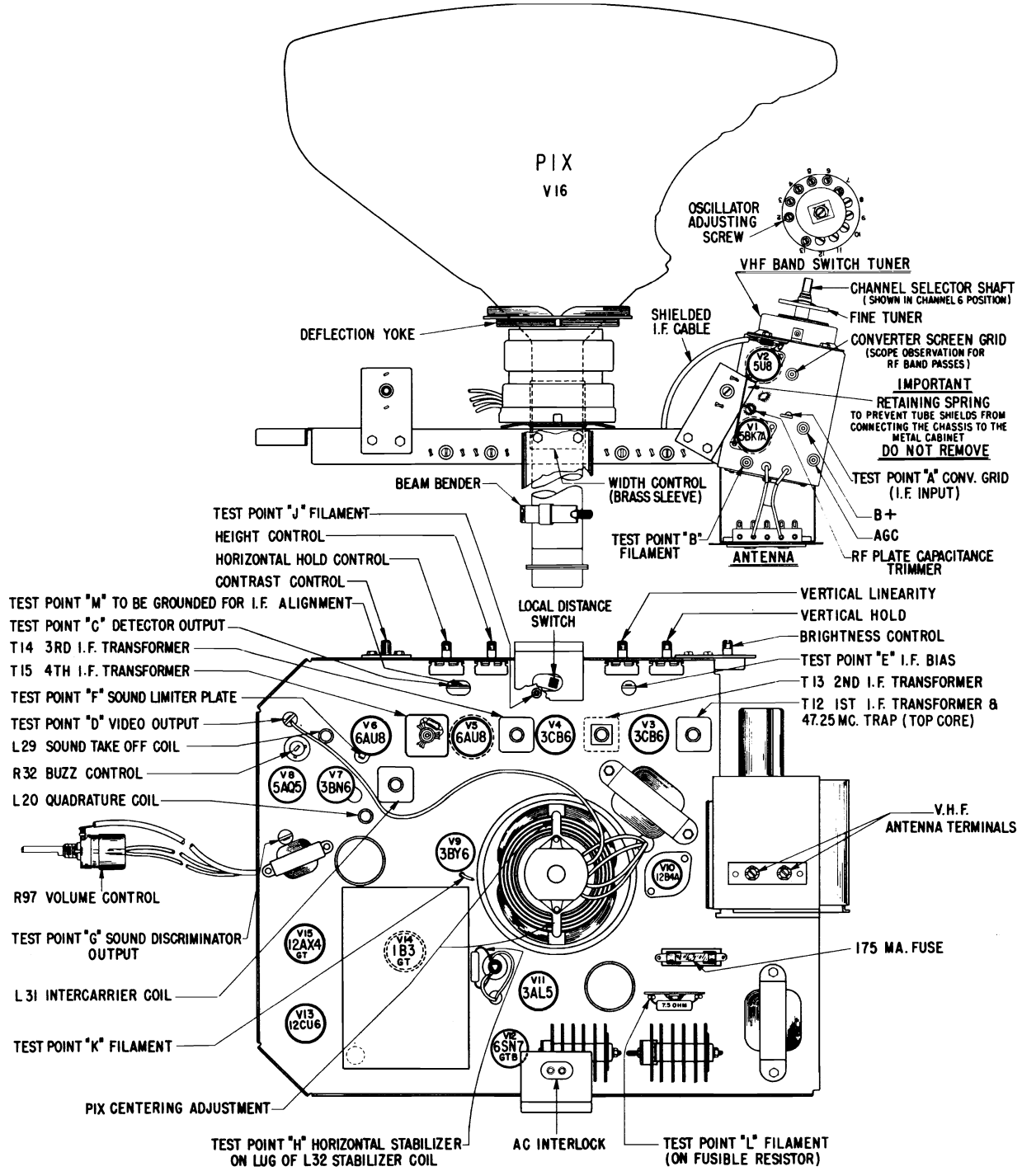


Fig. 4 Tube and Trimmer Layout 16T20 Chassis.

ZENITH Chassis 16T20, 17T20 (Continued)

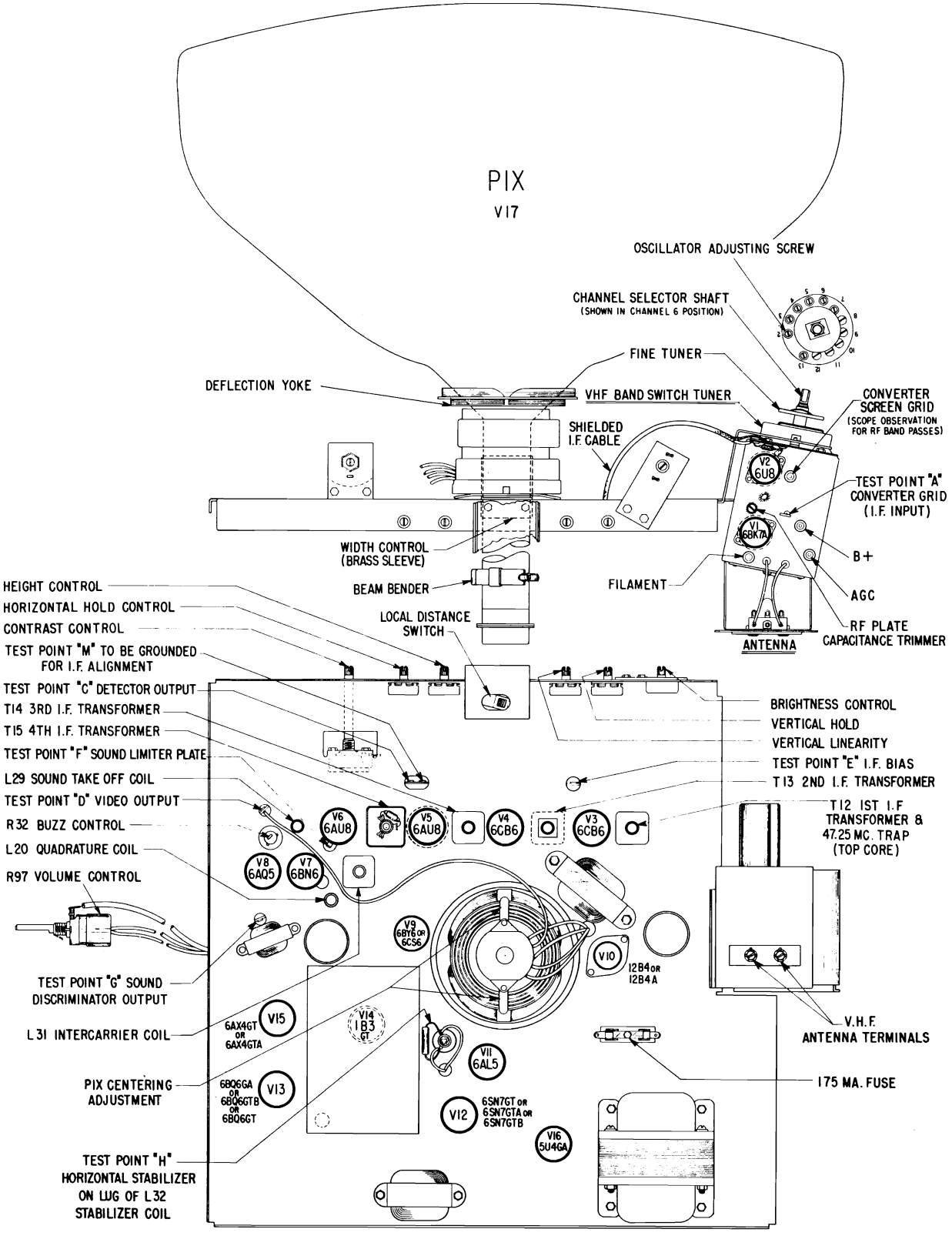


Fig. 5 Tube and Trimmer Layout 17T20 Chassis.

ZENITH Chassis 16T20, 17T20 (Continued)

ADJUSTMENTS

HORIZONTAL STABILIZER COIL ADJUSTMENT

The horizontal stabilizer coil has been adjusted in the factory and usually does not require adjustment in the field unless the coil is replaced. When required, adjustment is made as follows:

1. Tune in a TV station.

2. Connect a .5 mfd. capacitor between test point "H" (See Fig. 4) and chassis.

3. Turn the horizontal hold control for best synchronization.

4. Remove the capacitor. If the picture shifts, adjust the core until the picture is in the same position as obtained in step 2.

FILAMENT TEST POINTS 16T20 CHASSIS

Test points L, K, J and B are provided for ease in locating open filaments in the series string. Use an AC voltmeter (from chassis to various test points) or a neon indicator to determine which group contains the open filament.

TUNER OSCILLATOR ADJUSTMENT

To adjust the receiver oscillator adjustment screws set the fine tuning control to its approximate center position as shown in Fig.15. Without further adjustment of the fine tuning control insert a 68-24 alignment tool into the tuner and adjust each operating channel to resonance starting with the highest channel and following each lower channel in sequence. Be certain not to move the fine tuning shaft when switching channels. It will be noted that tuning to one side of resonance results in a faded, washed-out picture with the spacing between the wedge lines fogged and tuning in the opposite direction causes the spaces between the lines to clear up. However, going beyond this point causes the picture to take on a "wormy" appearance from sound getting into the picture. Correct adjustment is obtained by tuning to the "wormy" picture and then backing the control off slightly until the picture clears up.

REMOVING THE PICTURE TUBE

1. Disconnect the deflection coil leads.
2. Remove the 4 self-tapping screws which hold the picture tube and escutcheon to the chassis rails (See Fig. 18).
3. Loosen the ring clamping screw.
4. Remove the mounting springs and rods from the yoke assembly. Also remove beam bender, width sleeve and yoke assembly from neck of picture tube.
5. Remove the 4 picture tube mounting straps and lift tube from escutcheon.

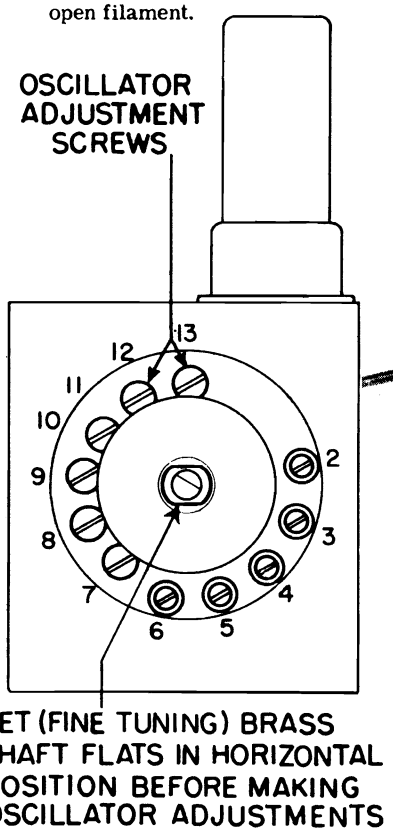


Fig. 15 RF Oscillator Adjustments

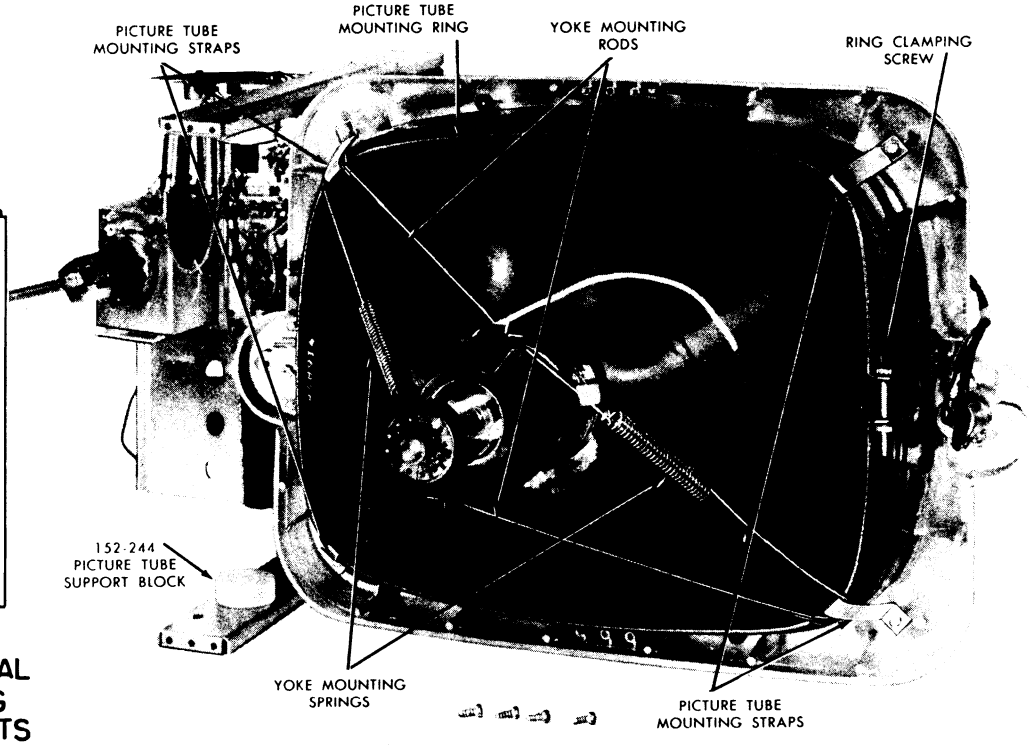


Fig. 18 Removing Picture Tube from Chassis.

SOUND ALIGNMENT

Proper alignment of the 4.5 Mc intercarrier sound channel can only be obtained if the signal to the receiver antenna terminals is reduced to a level below the limiting point of the 6BN6 (or 3BN6) Gated Beam Detector. This level can be easily identified by the "hiss" which then accompanies the sound.

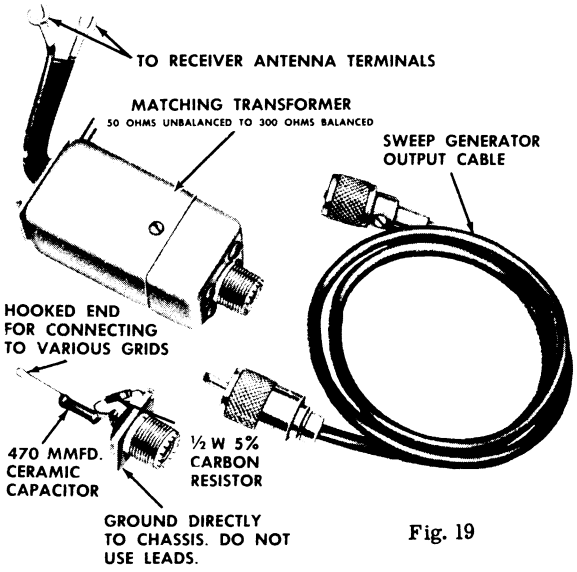


Fig. 19

1. Connect the step attenuator between the antenna and the receiver antenna terminals.

2. Tune in a tone modulated TV signal and adjust the step attenuator until the signal is reduced to a level where "hiss" is heard with the sound.

3. Adjust the sound take-off coil L29 (top and bottom slugs), intercarrier coil L31, quadrature coil L20 and buzz control R32 for the cleanest sound and minimum buzz. It must be remembered that any of these adjustments may cause the "hiss" to disappear and further reduction of the signal will be necessary so that the "hiss" does not disappear during alignment.

VIDEO IF AMPLIFIER

The video IF amplifier is stagger tuned, using 4 single tuned circuits. The first IF tunes to 43.5mc, the second IF to 42.75mc, the third IF to 44.75mc, and the fourth IF to 45.5mc. One trap is used. It is part of the 1st IF assembly and tunes to 47.25mc. Attenuation of the 41.25mc associated sound carrier is controlled by adjusting the band width.

A sweep generator must be used for alignment work. A slight deviation from the abovementioned frequencies is permissible to obtain the proper band pass, however, the order must be maintained.

VIDEO IF ALIGNMENT

To align the IF, it is necessary to disable the tuner local oscillator. This can be done by removing the 5U8 or 6U8 tube, wrapping a bare wire around the oscillator grid (pin 9) and inserting the tube. Ground this wire. On "U" models it is only necessary to switch the tuner to the UHF positions.

1. Connect the negative lead of a 5 volt battery or a low impedance bias supply to terminal "E" (Fig. 4) and the positive lead to chassis. Ground point "M".

2. Connect a calibrated oscilloscope through a 10K ohm isolation resistor between terminal "C" and chassis.

3. Connect the sweep generator through the terminating network shown in Fig. 19 to test point "A" (Fig. 4) and adjust attenuator to obtain a 3 volt peak

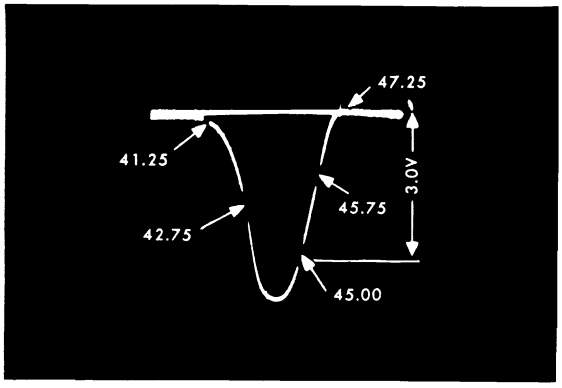


Fig. 20 Overall IF Response.

to peak detector output. Do not exceed this output level during any of the adjustments.

4. Adjust the fourth, third, second and first IF to obtain a response curve similar to Fig.20. It will be noticed that the 1st IF coil has the greatest effect on rounding out the nose of the band pass.

Switch the oscilloscope to 10X the gain used in the above steps to "blow up" the trap slots. Adjust the scope centering controls until the base line is visible as in Fig.21. Adjust the 47.25mc. trap and check the position of the 41.25mc. marker. If the marker is not in the approximate position as shown in Fig.21, or nearer to the base line a slight readjustment of the 1st and 2nd IF coils may be required to move it into position.

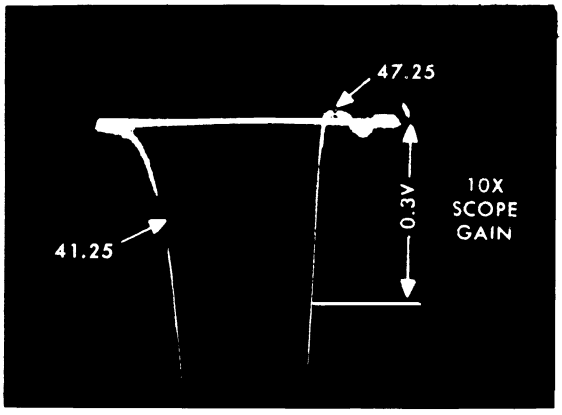
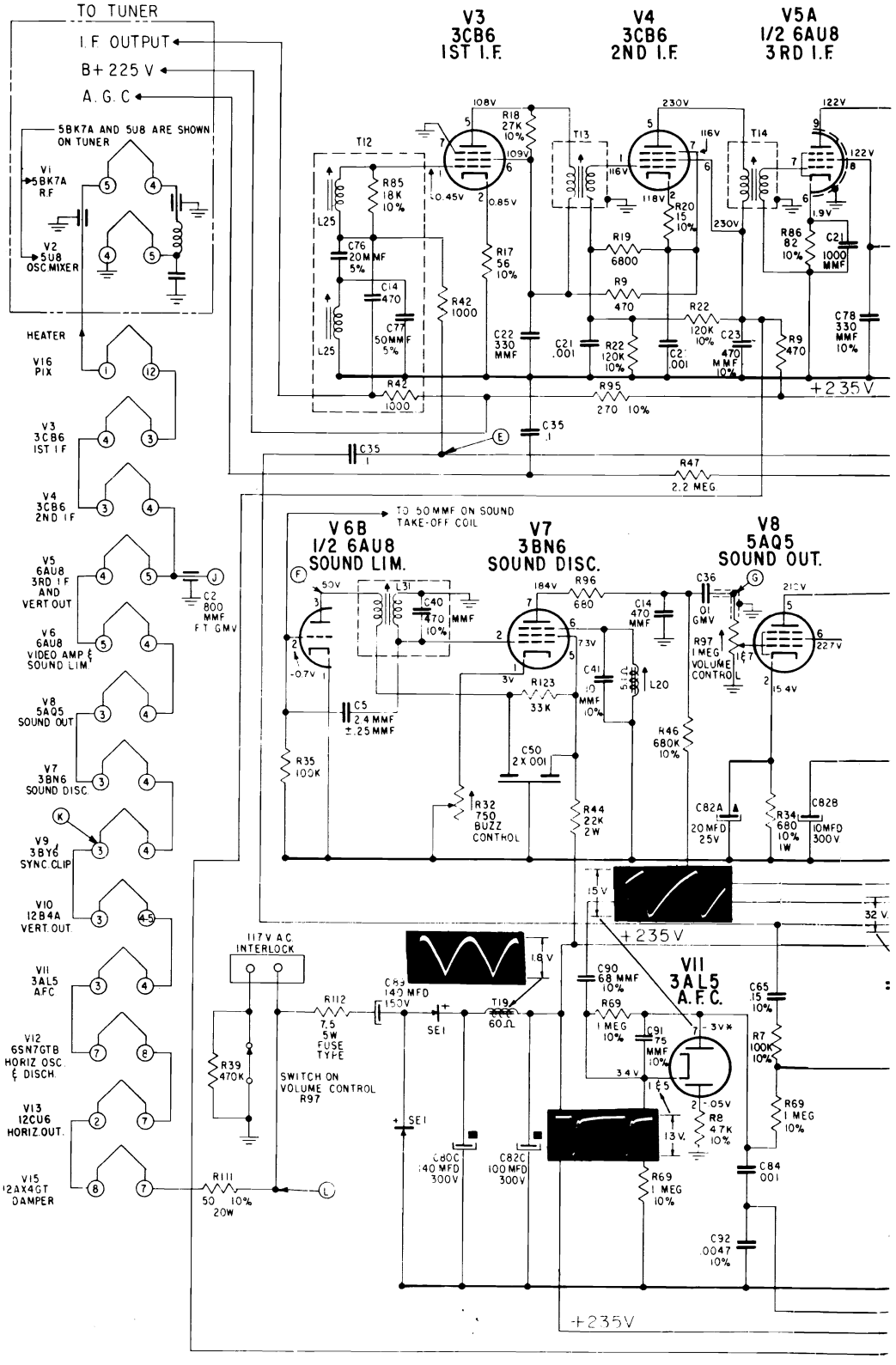


Fig. 21 Exploded View of Sound Carrier and 47.25 Mc Trap.

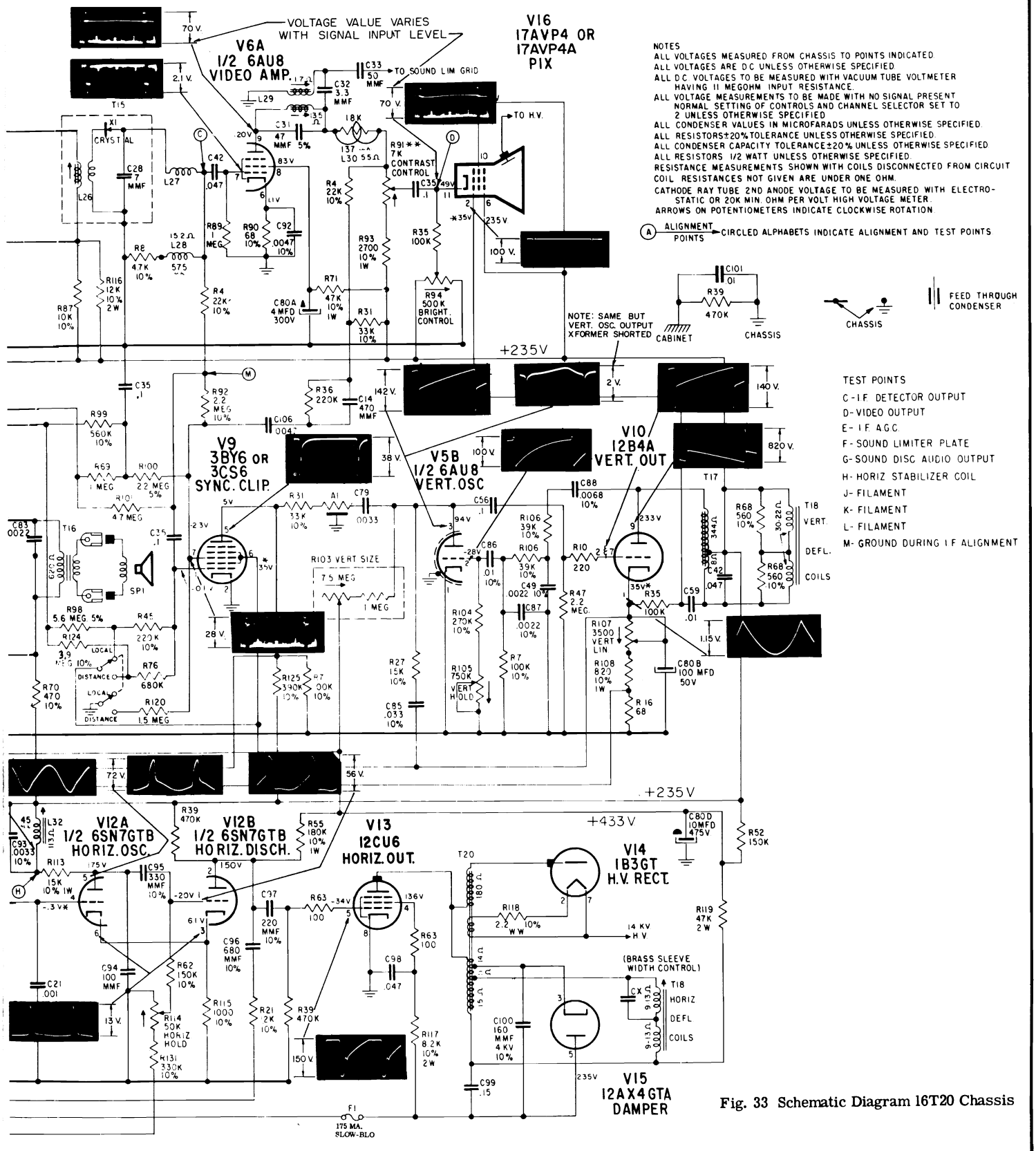
ZENITH Schematic Diagram 16T20 Chassis



TUBE COMPLEMENT 16T20 CHASSIS

TUBE	FUNCTION
5BK7A	RF Amplifier
5U8	V2A Mixer V2B RF Oscillator
3CB6	1st IF Amplifier
3CB6	2nd IF Amplifier
6AU8	V5A 3rd IF Amplifier V5B Vertical Osc.
6AU8	6A Video Amplifier 6B Sound Limiter
3BN6	Sound Discriminator
5AQ5	Sound Output
3BY6/3CS6	Sync Clipper
12B4A	Vertical Output
3AL5	Horizontal AFC
6SN7GTB	V12A Horizontal Osc. V12B Horiz. Discharge
12CU6 12BQ6GA 12BQ6GTB	Horizontal Output
1B3GT	High Voltage Rectifier
12AX4GTA	Damper
17AVP4 or 17AVP4A	Picture Tube

ZENITH Schematic Diagram 16T20 Chassis



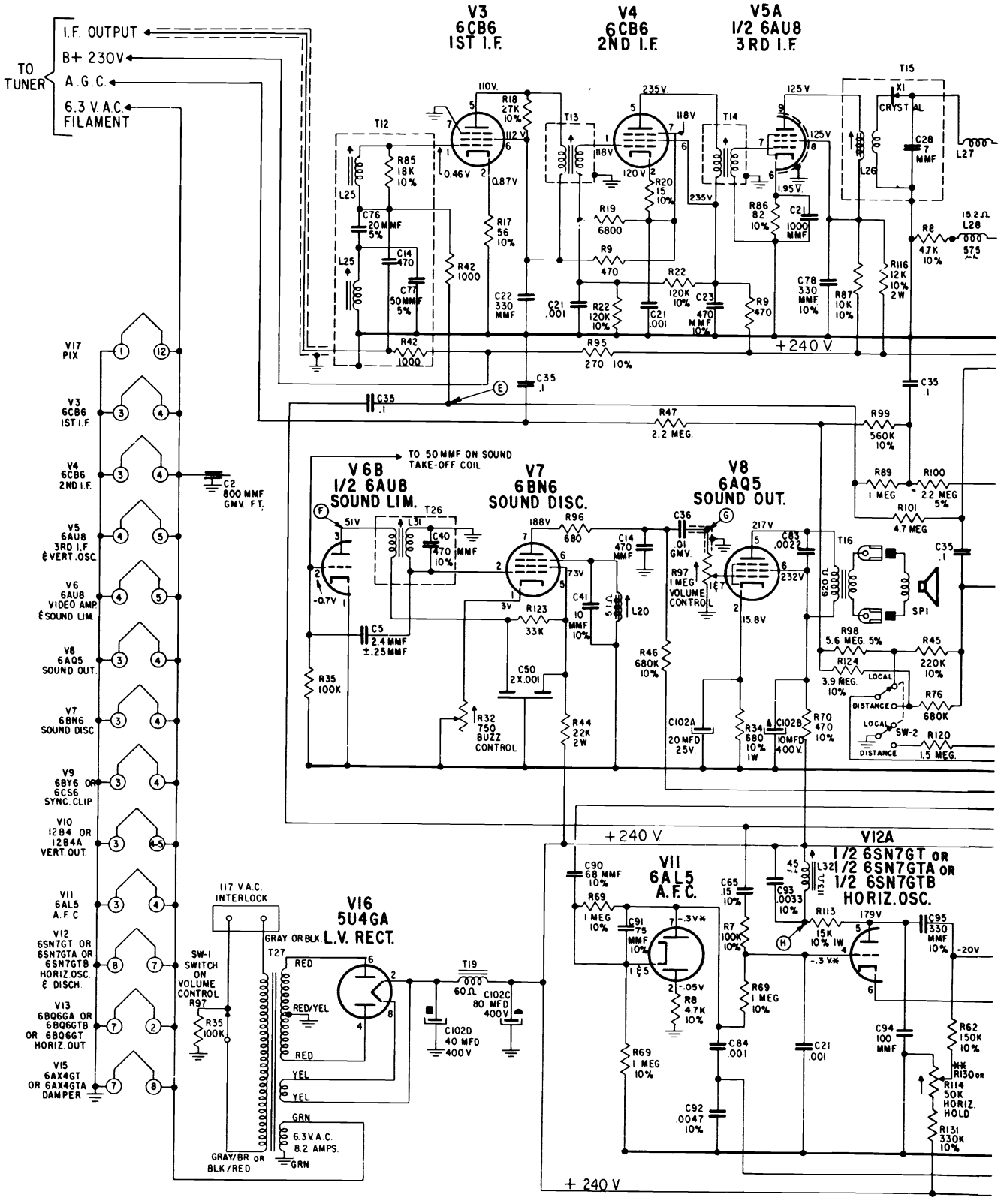
NOTES
ALL VOLTAGES MEASURED FROM CHASSIS TO POINTS INDICATED.
ALL VOLTAGES ARE D.C. UNLESS OTHERWISE SPECIFIED.
ALL D.C. VOLTAGES TO BE MEASURED WITH VACUUM TUBE VOLTMETER HAVING 11 MEGOHM INPUT RESISTANCE.
ALL VOLTAGE MEASUREMENTS TO BE MADE WITH NO SIGNAL PRESENT NORMAL SETTING OF CONTROLS AND CHANNEL SELECTOR SET TO 2 UNLESS OTHERWISE SPECIFIED.
ALL CONDENSER VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
ALL RESISTORS ±20% TOLERANCE UNLESS OTHERWISE SPECIFIED.
ALL CONDENSER CAPACITY TOLERANCE ±20% UNLESS OTHERWISE SPECIFIED.
ALL RESISTORS 1/2 WATT UNLESS OTHERWISE SPECIFIED.
RESISTANCE MEASUREMENTS SHOWN WITH COILS DISCONNECTED FROM CIRCUIT.
COIL RESISTANCES NOT GIVEN ARE UNDER ONE OHM.
CATHODE RAY TUBE 2ND ANODE VOLTAGE TO BE MEASURED WITH ELECTROSTATIC OR 20K MIN. OHM PER VOLT HIGH VOLTAGE METER.
ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION.

(A) ALIGNMENT POINTS → CIRCLED ALPHABETS INDICATE ALIGNMENT AND TEST POINTS

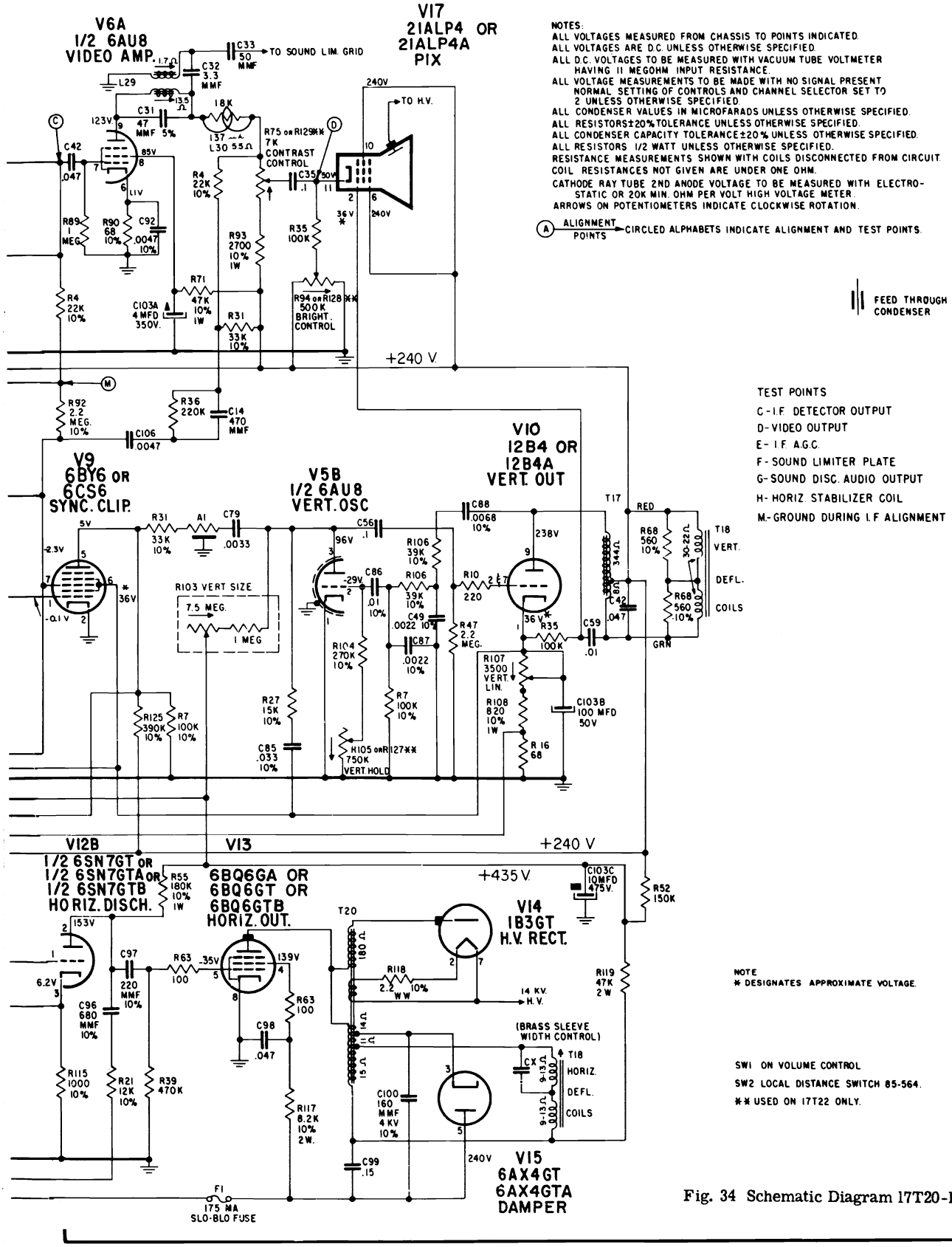
TEST POINTS
C - I.F. DETECTOR OUTPUT
D - VIDEO OUTPUT
E - I.F. A.G.C.
F - SOUND LIMITER PLATE
G - SOUND DISC. AUDIO OUTPUT
H - HORIZ. STABILIZER COIL
J - FILAMENT
K - FILAMENT
L - FILAMENT
M - GROUND DURING I.F. ALIGNMENT

Fig. 33 Schematic Diagram 16T20 Chassis

ZENITH Schematic Diagram 17T20 Chassis



ZENITH Schematic Diagram 17T20 Chassis



NOTES:
ALL VOLTAGES MEASURED FROM CHASSIS TO POINTS INDICATED.
ALL VOLTAGES ARE D.C. UNLESS OTHERWISE SPECIFIED.
ALL D.C. VOLTAGES TO BE MEASURED WITH VACUUM TUBE VOLTMETER HAVING 11 MEGOHM INPUT RESISTANCE.
ALL VOLTAGE MEASUREMENTS TO BE MADE WITH NO SIGNAL PRESENT. NORMAL SETTING OF CONTROLS AND CHANNEL SELECTOR SET TO 2 UNLESS OTHERWISE SPECIFIED.
ALL CONDENSER VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
ALL RESISTORS ±20% TOLERANCE UNLESS OTHERWISE SPECIFIED.
ALL CONDENSER CAPACITY TOLERANCE ±20% UNLESS OTHERWISE SPECIFIED.
ALL RESISTORS 1/2 WATT UNLESS OTHERWISE SPECIFIED.
RESISTANCE MEASUREMENTS SHOWN WITH COILS DISCONNECTED FROM CIRCUIT.
COIL RESISTANCES NOT GIVEN ARE UNDER ONE OHM.
CATHODE RAY TUBE 2ND ANODE VOLTAGE TO BE MEASURED WITH ELECTROSTATIC OR 20K MIN. OHM PER VOLT HIGH VOLTAGE METER.
ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION.

(A) ALIGNMENT POINTS — CIRCLED ALPHABETS INDICATE ALIGNMENT AND TEST POINTS.

FEED THROUGH CONDENSER

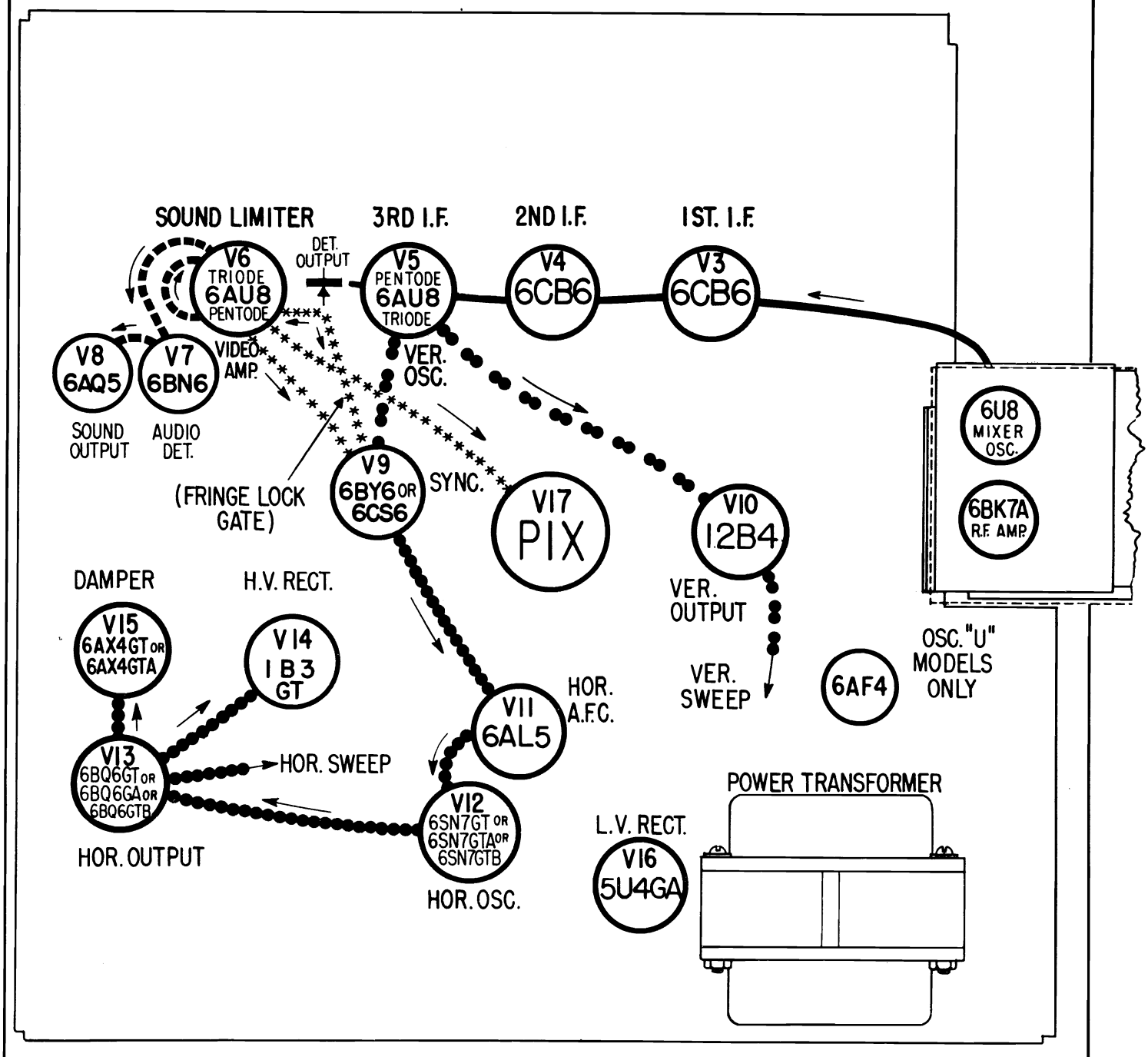
TEST POINTS
C - I.F. DETECTOR OUTPUT
D - VIDEO OUTPUT
E - I.F. A.G.C.
F - SOUND LIMITER PLATE
G - SOUND DISC. AUDIO OUTPUT
H - HORIZ. STABILIZER COIL
M - GROUND DURING I.F ALIGNMENT

NOTE
* DESIGNATES APPROXIMATE VOLTAGE.

SW1 ON VOLUME CONTROL
SW2 LOCAL DISTANCE SWITCH 85-564.
** USED ON 17T22 ONLY.

Fig. 34 Schematic Diagram 17T20-17T22 Chassis

ZENITH Chassis 17T20, 17T22, Signal Path Chart



SOUND CIRCUIT ▬▬▬▬▬▬▬▬

COMPOSITE VIDEO ********

INTERMEDIATE FREQUENCY ——

60 CYCLES VOLTS 117 AC

VERTICAL CIRCUIT ●● ●● ●● ●● ●●

HORIZONTAL CIRCUIT ●●●●●●●●●●●●

WATTS 160

Index

Under each manufacturer's name are listed that make chassis and models in numerical order, at left. The corresponding page number at right of each listing refers to the first page of each section dealing with such material.

VOLUME TV-10, ADDITIONAL 1955 TELEVISION SERVICING INFORMATION

This manual is made up of factory prepared service material. Editorial changes and selections were made to conform with the objectives of this manual. Our sincere thanks and appreciation is extended to every manufacturer whose products are covered by the material in this manual and who aided us in the preparation of this book.

M. N. Beitman, Chief Editor of the Engineering Staff, Supreme Publications.

Another

Supreme Publications

Service Manual