VOLTAGE CHART FOR 4 TUBE POWER SUPPLY
See previous page for conditions for taking measurements

Sym.	Tube	Function	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Remarks
V501	6SQ7	Audio Amp.	0	-.7	0	NC	NC	78	6.3 AC	0	
V502	6V6GT	Audio Output	NC	6.3 AC	255	265	.2	NC	0	12	
V503	6X5GT	L.V. Rectifier	NC	5.3 AC	160 AC	NC	160 AC	NC	0	160	
V504	5U4G	H.V. Rectifier	NC	380	NC	375 AC	NC	375 AC	NC	380	Pin 2 to pin 8: 5v. AC

TELEVISION CHASSIS VOLTAGE CHART

Sym.	Tube	Function	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Remarks
V101	6AG5	RF Amp.	-.3	0	6.3 AC	0	150	150	0		Point "H" (Fig. 27) is -4 volts measured with tubes in sockets.
V102	6J6	Osc. and Mixer	160	160	6.3 AC	0	0	0	0		
		Voltages at V101 and V102 measured from top of chassis with tubes removed.									
V201	6AU6	1st Sound IF	0	0	6.3 AC	0	80	80	.9		
V202	6AU6	2nd Sound IF	0	0	6.3 AC	0	145	145	2.4		
V203	6AL5	Ratio Det.	0	0	5 AC	0	.3	0	0		
V301	6AU6	1st Video IF	-1.5	0	6.3 AC	0	140	140	.6		
V302	6AU6	2nd Video IF	-1.5	0	6.3 AC	0	140	140	.6		
V303	6AU6	3rd Video IF	0	0	6.3 AC	0	142	142	1.3		
V304	6AL5	Video Det.	0	0	6.3 AC	0	0	0	-.4		
		Vid. Det. & Lim.	0	-8	6.3 AC	0	0	0	-.4		
V305	6AU6	AGC	155	160	6.3 AC	0	200V P.toP.	270	160		
V306	6AC7	Video Amp.	0	0	0	-1	0	45	6.3 AC	150	
V401	6SN7GT	Vert. Osc. and Sync. Inv.	-55	200	0	-8	315	8	6.3 AC	0	
V402	6K6GT	Vert. Output	NC	0	325	325	-.5	38	6.3 AC	50	
V403	12AU7	Sync Sep. and Clipper	270	152	165	6.3 AC	5.3 AC	85	-.6	0	Pin 9: Zero volts.
V404	6AL5	Hor. Sync Disc.	8	(b)-4	0	6.3 AC	.8	0	.8		
V405	6SN7GT	Hor. Osc.	.9	255	9.5	-4.5	100	9.5	6.3 AC	0	
V406	6BG6G	Hor. Output	NC	0	9	NC	-16	NC	6.3 AC	245	Cap: See "Caution" note above.
V407 and V409	1B3GT	Rectifier	See "CAUTION" note above on 1B3GT/8016 voltages.								
V408	6W4GT	Damper	NC	NC	420	NC	360	NC	6.3 AC	NC	
V307		Picture Tube	0	70	NC	NC	NC	NC	NC	NC	Pin 9 Pin 10 Pin 11 Pin 12
		Voltages taken at picture tube socket (removed from tube. For 2nd anode, see "CAUTION" above.									NC 365 60 6.3 AC

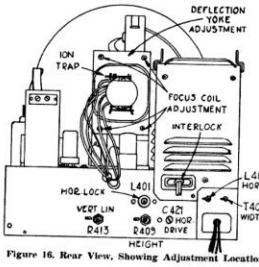
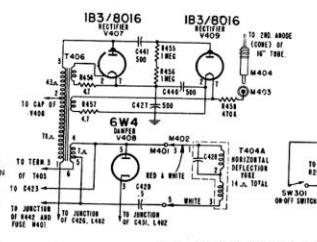
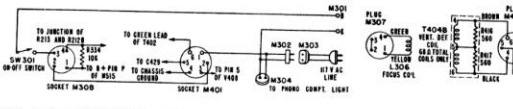


Figure 16. Rear View, Showing Adjustment Locations.





2nd. ANODE SUPPLY, DEFLECTION YOKE, and AC INTERLOCK CIRCUIT USED in 16"(21A1) SETS

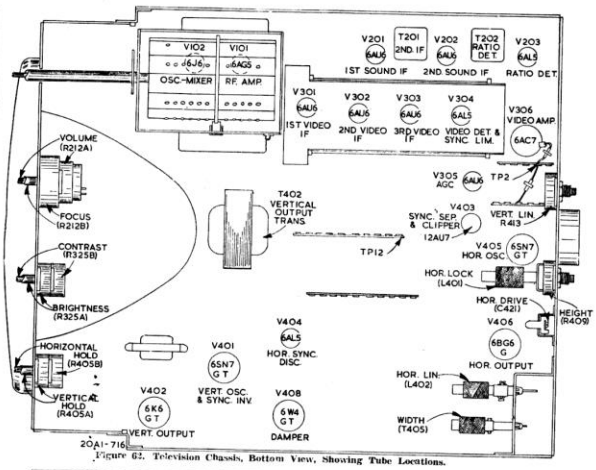


Figure 62. Television Chassis, Bottom View, Showing Tube Locations.

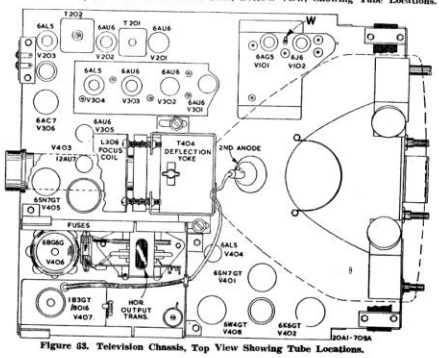


Figure 63. Television Chassis, Top View Showing Tube Locations.

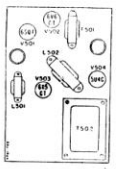
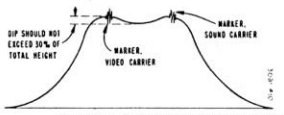


Figure 64. 4 Tube Power Supply.

RF AND MIXER ALIGNMENT

- Disconnect 4½ volt battery, if used earlier.
- Connect a wire jumper from AGC buss (junction of R303, R447 and C305) to chassis. Leave connected for all steps in this alignment.
- Disconnect antenna from receiver.
- Before starting alignment, allow about 15 minutes for receiver and test equipment to warm up.
- Connect sweep generator to antenna terminals.
- Loosely couple marker generator to antenna terminal (to obtain marker pips of video and sound RF carriers). To avoid distortion of the response curve, keep marker generator output at a minimum, marker pips just barely visible.
- Connect oscilloscope through 10,000 ohm resistor to point "W" (figure 26). Keep oscilloscope leads away from chassis.
- Set Contrast control at center of its rotation.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Adjust
1	*205.25 **209.75	Sweeping Channel 12	Check for curve resembling RF response curve shown in figure 30. If necessary, adjust A11, A12 and A13 (figure 26) as required. Consistent with proper band width and correct marker location, response curve should have maximum amplitude and flat top appearance.
2	211.25 215.75	13	Check each channel for curve resembling RF response curve shown in fig. 30. In general, the adjustment performed in step 1 is 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 the weak channel as a compromise adjustment to favor this particular channel. If a compromise adjustment is made, other channels should be checked to make certain that they have not been appreciably affected.
3	199.25 203.75	11	
4	193.25 197.75	10	
5	187.25 191.75	9	
6	181.25 185.75	8	
7	175.25 179.75	7	
8	83.25 87.75	6	
9	77.25 81.75	5	
10	67.25 71.75	4	
11	61.25 65.75	3	
12	55.25 59.75	2	



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

Figure 30. Response Curve.

*Sound Carrier Frequency (MC)
**Picture Carrier Frequency (MC)

g. Adjust as follows:

Channel	Generator Freq. (MC)	Adjust
13	215.75	A14 (Fig. 31) for zero VTVM reading between a positive and a negative peak with Sharp Tuning control at electrical center. Do this carefully as only a slight rotation of slug may be required. Note that if mis-alignment is evident on a major number of channels, an over-all HF oscillator adjustment (A15) can be made.
12	209.75	
11	203.75	
10	197.75	
9	191.75	
8	185.75	
7	179.75	
6	87.75	
5	81.75	
4	71.75	
3	65.75	
2	59.75	

OVERALL OSCILLATOR ADJUSTMENT (A15)

Overall oscillator adjustment should only be necessary when tubes or other components in the oscillator circuit have been replaced. (When replacing the oscillator-mixer tube (6J6), it is recommended that several tubes be tried to select one which causes least frequency shift.)

This over-all adjustment can be made using a VTVM and signal generator, or using a television signal.

a. Remove chassis from cabinet.
b. Set selector to channel 13, or other high channel.
c. **When using a signal generator,** follow steps (a), (b), (c), (d) under "Individual Channel Adjustments Using Signal Generator and VTVM", then adjust A15 (figure 31) for zero VTVM reading between a positive and a negative peak.

OR

c. **When using a television signal,** set the Channel Selector knob for a station and adjust controls for normal picture and sound. Set Sharp Tuning control at electrical center by rotating approximately 150° or half rotation as shown in figure 31. Note position of dielectric rotor. Then adjust A15 (figure 31) for best sound and clearly defined picture.
d. Recheck adjustment of individual channels and touch-up (A14) if necessary.

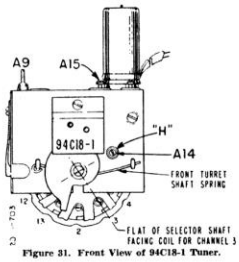


Figure 31. Front View of 94C18-1 Tuner.

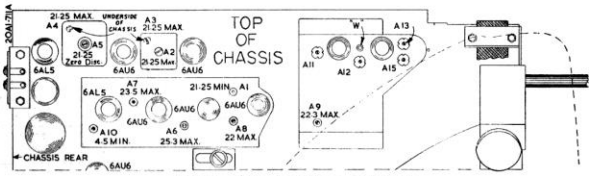


Figure 26. Alignment Locations and Frequencies.

HF OSCILLATOR ALIGNMENT

INDIVIDUAL CHANNEL ADJUSTMENTS USING SIGNAL GENERATOR and VTVM

a. Allow about 15 minutes for receiver and test equipment to warm up. Disconnect antenna from receiver.
b. Connect signal generator high side to one antenna terminal, ground to chassis.
c. See Figure 27. Connect VTVM high side to "Z"; common to "V" in ratio detector V203 circuit. Use VTVM 3 volt center scale if available.
d. Set Sharp Tuning control at half rotation by rotating it approximately 150° as shown in figure 31.
e. Use a NON-METALLIC alignment screw driver with a ⅛-inch blade.
f. For more accurate oscillator alignment, it is advisable to first check sound IF amplifier alignment (A2, A3, A4 and A5) before aligning HF oscillator. IF's and ratio detector must be accurately aligned to correct IF frequency. Retouch IF and ratio detector adjustments if necessary.

OVER-ALL RF and VIDEO IF RESPONSE CURVE CHECK

(Using Sweep generator and oscilloscope with sweep input to antenna terminals.

1. Disconnect signal generator and VTVM (if used in previous alignment).
2. Connect a 4½ volt battery; negative to AGC buss (junction of R303, R447, C305), positive to chassis.

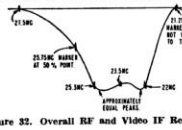


Figure 32. Overall RF and Video IF Response Curve.

3. Set Contrast control fully clockwise.
4. Connect oscilloscope between point "X" and chassis ground through a decoupling filter (see figure 27). Keep leads away from receiver.
5. Connect sweep generator to antenna terminals.
6. Connect IF marker generator high side to tube shield of 6J6 mixer tube (insulate tube shield from chassis). Connect low side of marker generator to chassis.
7. Sweeping the RF pass band for an unassigned high channel (see frequencies in "RF and Mixer Alignment"), check the overall response curve obtained against the ideal curve, figure 32.

Important: To avoid distortion of the response curve, keep the sweep generator and marker generator outputs at a very minimum. Marker pips should be kept just barely visible. Setting sweep generator output for VTVM reading from .5 to 1 volt DC (measured from decoupling network at point "X" and chassis, figure 27) will avoid distortion of response curve.

Check sound IF trap (21.25 MC) and video IF carrier (25.75 MC) points with marker generator. It is important that marker pips be in proper location on the response curve. Consistent with proper band width and correct location of markers, the response curve should have maximum amplitude and flat top appearance and peaks with approximately equal amplitudes, as shown in figure 32.

If necessary to adjust for peaks with approximately equal amplitude, carefully adjust IF slug A7 (23.5 MC coil) while observing the response curve. Turn slug about one-quarter to one-half turn in either direction until correct results are obtained. See figure 32.

If 25.75 MC marker does not locate reasonably close to the 50% point on the slope of the response curve, carefully adjust A6 (25.3 MC coil) about ¼ to ½ turn in either direction until correct results are obtained.

IF AMPLIFIER AND TRAP ALIGNMENT

- **Connect a 4½ volt battery; negative to AGC buss (junction of R303, R447 and C305), positive to chassis. Leave connected for all steps in this alignment.**
- Allow about 15 minutes for receiver and test equipment to warm up.
- Disconnect antenna from receiver.
- Set Channel Selector to channel 13 or other unassigned high channel (to prevent signal interference during IF alignment).
- Connect RC filter of 10,000 ohm resistor and 330 mmfd. condenser in series from point "X" to chassis. See figure 27. Leave connected for all steps in this alignment.
- For steps 1 to 8, connect signal generator high side to tube shield of 6J6 oscillator-mixer tube. Be sure to insulate tube shield from chassis. Connect generator low side to chassis close to 6J6 tube base.
- Set Contrast control at center of its rotation. Retain setting for all IF and trap adjustments.
- Use VTVM on lowest scale. (3 volts DC for steps 1 to 8 and 3 volts AC for step 9.) The AC range of VTVM must have response to 4.5 MC.
- Refer to figures 26 and 27 for alignment adjustment and test point locations.

Step	Signal Gen. Frequency (MC)	Connect VTVM to	Test Connections and Instructions	Adjust
1	*21.25	High side to junction of resistor and condenser of RC filter connected to "X" (video amplifier V306 circuit; common to chassis. See Figure 27.	Use lowest signal generator output for adequate meter indication, then gradually increase generator output as VTVM reading decreases. Use VTVM DC range.	A1 for minimum.
2	*21.25	High side to "Y", common to chassis. See figure 27.	While peaking, keep reducing signal generator output so VTVM reading is approx. plus 1.5 V. DC.	A2, A3 and A4 for maximum.
3	*21.25	High side to "Z", common to "V" in ratio detector V203 circuit.	Use 3 volt zero center DC scale if available.	A5 for zero between pos. and neg. peak. If far off readjust A4.
4	25.3	Same as Step 1.	While peaking, keep reducing signal generator output so VTVM reading is approx. –1 volt DC.	A6 for maximum.
5	23.5	"	"	A7 for maximum.
6	22.0	"	"	A8 for maximum.
7	22.3	"	"	A9 for maximum.
8	*21.25	"	Same as Step 1.	Check A1; if off, readjust. Repeat step 6.
9	**4.5 AM modulated	VTVM RF probe (3 volts range) to pin 8 of V306 video ampliner (6AC7); common to chassis. The frequency range of VTVM must have response to 4.5 MC.	Connect signal generator high side through a .005 mfd. condenser to pin 7 of V304 video detector (6AL5) with tube removed; low side to chassis close to tube base.	A10 for minimum.
10	To insure proper alignment, make Overall Video IF and audio IF checks as indicated on pages 14 and 15.			

*Before proceeding, be sure to check the signal generator used in alignment against a crystal calibrator or other frequency standard for absolute frequency calibration required for this operation.

**See figures 27 and 28 for alternate locations.

ALIGNMENT ADJUSTMENT IDENTIFICATION

Adj.	Symbol	Function
A1	L201	21.25 MC Sound Trap
A2	T201	1st IF Transformer (Sound)
A3	T201	1st IF Transformer (Sound)
A4	T202	Ratio Detector Transformer
A5	T202	Ratio Detector Transformer
A6	T301	1st Video IF Tranformer and Sound Link
A7	T303	3rd Video IF Transformer
A8	T302	2nd Video IF Transformer
A9	L106	1st IF Coil
A10	L303	4.5 MC Trap Coil
A11	C102	Trimmer Condenser (RF Amp.)
A12	C104	Trimmer Condenser (RF Amp.)
A13	C107	Trimmer Condenser (Mixer)
A14	L102	HF Osc. Coils (All Channels)
A15	C110	Trimmer Condenser (Oscillator)

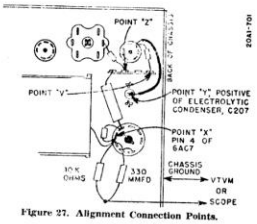


Figure 27. Alignment Connection Points.

Figure 28. Overall Video IF Response Curve.

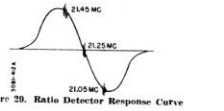


Figure 29. Ratio Detector Response Curve

OVERALL VIDEO IF RESPONSE CURVE CHECK

(Using sweep generator and oscilloscope with sweep input to mixer)

Differences in tube gain and component values affect video response. These differences are not apparent in alignment of video IFs using a signal generator and VTVM (single frequency alignment); hence it is preferable that a video IF response curve check be made after completion of alignments.

Since feeding the sweep signal through the entire RF and IF system provides a better overall response, this check should be made (after RF and HF Oscillator alignments) as indicated under "Overall RF and Video IF Response Curve Check" on page 16. However, a procedure is given below if it is desired to take video IF response curve as a check.

If the procedure given below is followed and the response curve obtained differs greatly from the curve shown in figure 28, repeat video IF alignment steps for adjustments A1, A6, A7, A8 and A9, making sure generator frequencies are precise and adjustments are accurately made. Note: Touch-up to correct the location of the 25.75 MC marker and adjustment for equal peaks of the response curve should be made only as instructed in "Overall RF and Video IF Response Curve" on page 17.

1. Disconnect signal generator and VTVM (if used in previous alignment). Set Contrast control fully clockwise. Connect a 4½ volt battery; negative to AGC buss (junction of R303, R447 and C305), positive to chassis.
2. Connect oscilloscope between point "X" and chassis ground through a decoupling filter (see figure 27). Keep leads away from receiver.
3. Connect sweep generator high side to tube shield of 6J6 mixer tube. Be sure to insulate tube shield from chassis. Connect sweep generator low side to chassis close to 6J6 tube base. Set sweep generator to sweep the video IF pass band (19 to 29 MC).
4. Loosely couple marker generator high side to the sweep generator lead connected to tube shield on tuner; low side to chassis ground.

IMPORTANT

To avoid distortion of the response curve, keep the sweep generator and marker generator outputs at a very minimum. Marker pips should be kept just barely visible. Setting sweep generator output for VTVM reading from .5 to 1 volt DC (measured from decoupling network at point "X" and chassis figure 27) will avoid distortion of response curve. See page 16 for "Overall RF and Video IF Response Curve Check."

SOUND IF ALIGNMENT CHECK

(Using sweep generator and Oscilloscope)

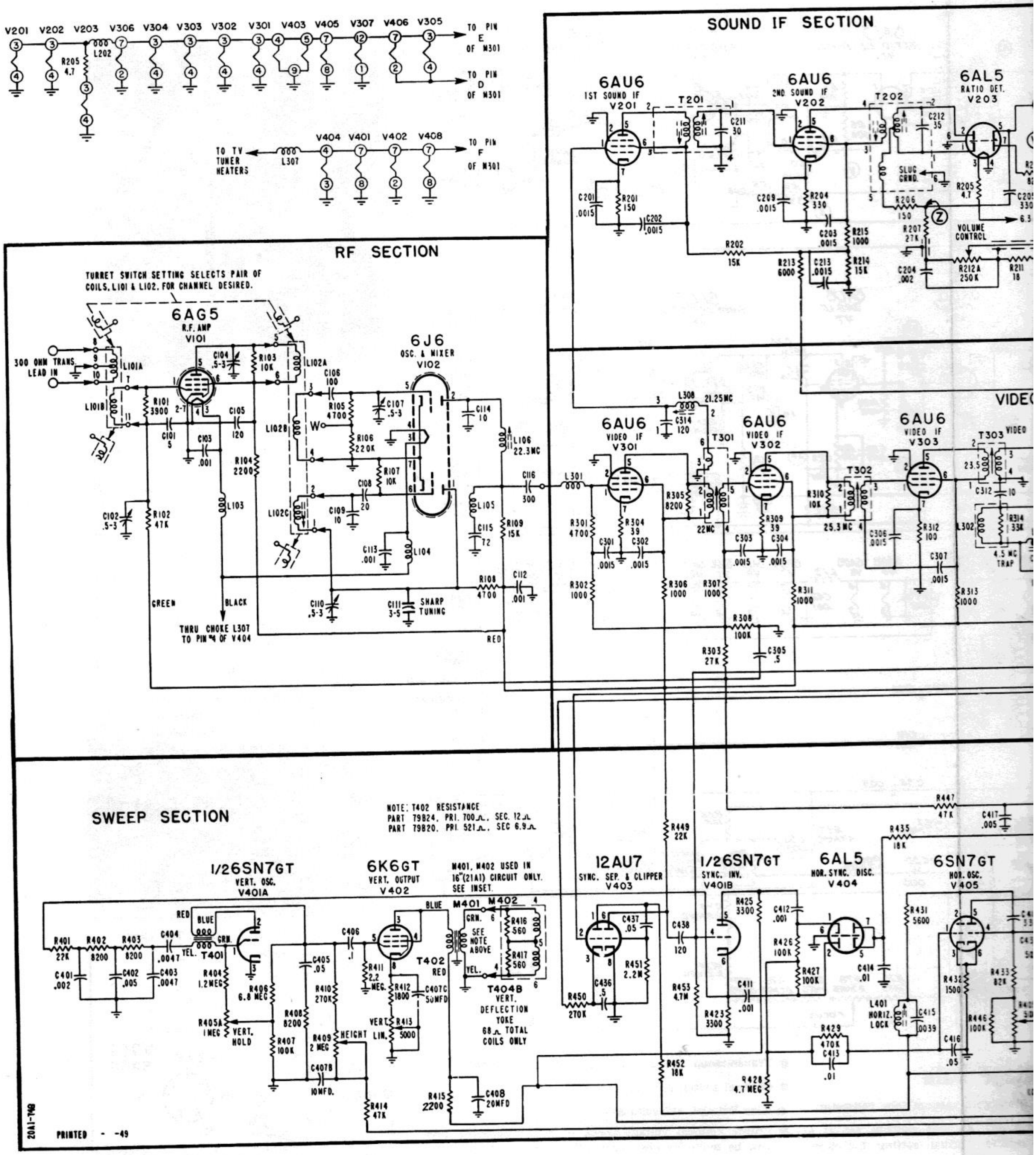
1. Disconnect signal generator and VTVM; if used in previous alignment.
2. Connect oscilloscope between point "Z" and chassis ground (see figure 27). Keep leads away from receiver.
3. Connect sweep generator high side to grid (pin 1) of V201 through 500 mmfd. condenser; low side to chassis ground. Set sweep generator to sweep the sound IF pass band (20.25 to 22.25 MC).
4. Loosely couple marker generator high side to the sweep generator high side, low side to chassis ground.

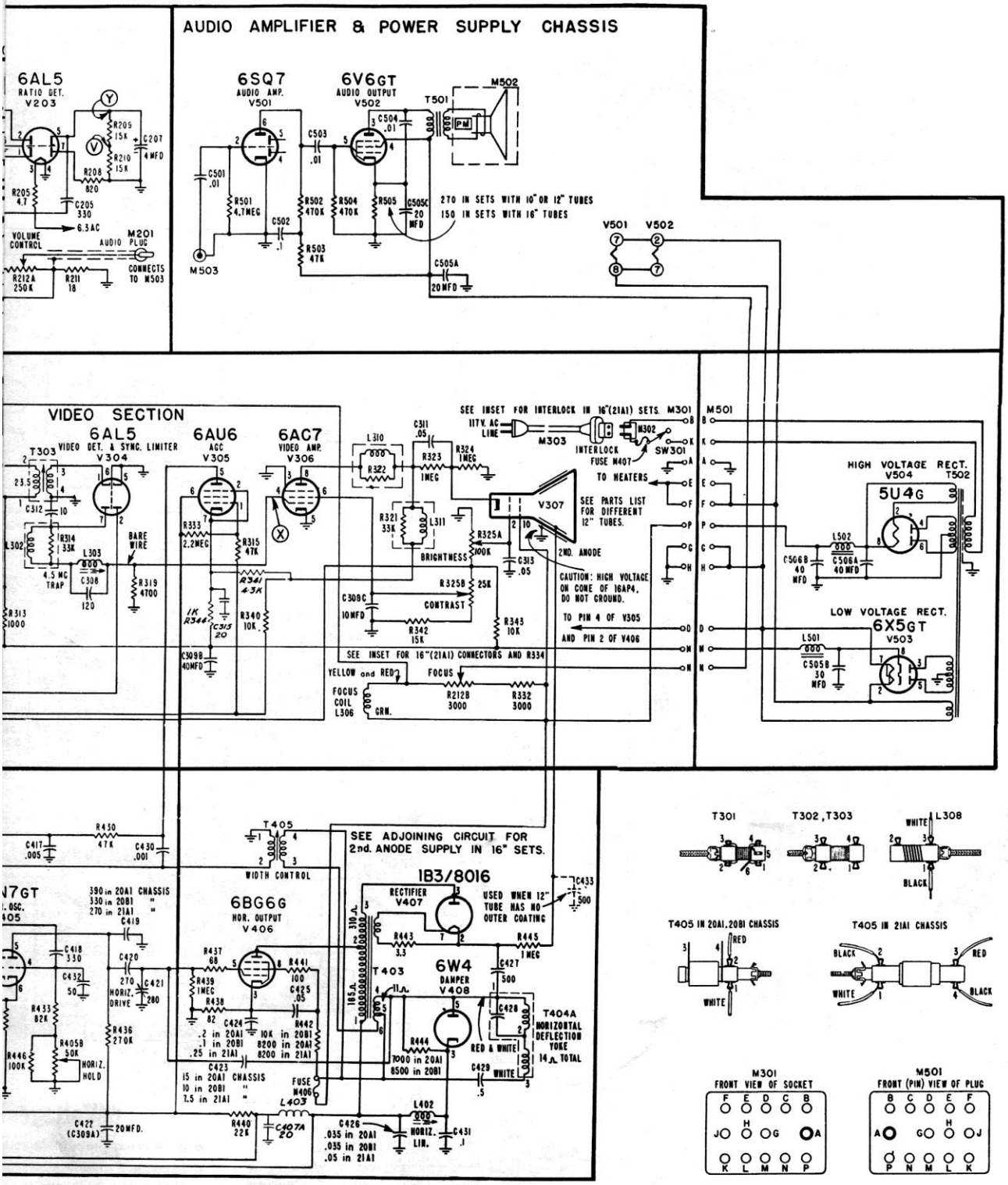
IMPORTANT

To avoid distortion of the response curve, keep the sweep generator and marker generator outputs at a very minimum. Marker pips should be kept just barely visible.

5. Observe ratio detector response (figure 29). Since the sweep signal is fed through the entire audio IF system for this check, misalignment of the audio IF's will affect this curve. This provides an overall audio IF response check. The shape of the curve should be such as to provide a minimum vertical voltage slope of 50 KC to each side of the 21.25 MC marker (cross over point). Maximum size and linearity of the straight portion of the curve is ideal. Note that the ratio detector circuit used gives a symmetrical "S" pattern. Check for linearity between the markers indicated on the curve. The response curves obtained may appear inverted and/or reversed (end for end) depending on the sweep generator and oscilloscope used.
6. If correct response is not obtained, repeat alignment steps for slugs A2, A3, A4 and A5 under "IF Amplifier and Trap Alignment." Re-check response curve.

§ **In dealing with RF and IF response curves, it is well to remember that an inverted or mirror image may result, depending on the sweep generator and oscilloscope used. The general waveform should still be identical. When using a wide band oscilloscope for alignment, marker pips will be more distinct if condenser from 100 to 1,000 mmfd. is connected across the oscilloscope input. Caution: Use the lowest capacity condenser possible, since too high a capacity will affect the shape of the response curve.**


SOUND IF SECTION
6AU6
1ST SOUND IF
V201
6AU6
2ND SOUND IF
V202
6AL5
RATIO DET.
V203
VOLUME CONTROL
RF SECTION
TURRET SWITCH SETTING SELECTS PAIR OF COILS, L101 & L102, FOR CHANNEL DESIRED.
6AG5
R.F. AMP
V101
6J6
OSC. & MIXER
V102
300 OHM TRANS. LEAD IN
SHARP TUNING
THRU CHOKE L307 TO PIN #4 OF V404
GREEN
BLACK
RED
6AU6
VIDEO IF
V301
6AU6
VIDEO IF
V302
6AU6
VIDEO IF
V303
4.5 MC TRAP
TO TV TUNER HEATERS
TO PIN E OF M301
TO PIN D OF M301
TO PIN F OF M301
SWEEP SECTION
NOTE: T402 RESISTANCE
PART 79B24, PRI. 700Ω, SEC. 12Ω
PART 79B20, PRI. 521Ω, SEC 6.9Ω
1/2 6SN7GT
VERT. OSC.
V401A
6K6GT
VERT. OUTPUT
V402
M401, M402 USED IN 16"(21A1) CIRCUIT ONLY. SEE INSET.
T404B
VERT. DEFLECTION YOKE
68Ω TOTAL COILS ONLY
12AU7
SYNC. SEP. & CLIPPER
V403
1/2 6SN7GT
SYNC. INV.
V401B
6AL5
HOR. SYNC. DISC.
V404
6SN7GT
HOR. OSC.
V405
VERT. HOLD
HEIGHT
VERT. LIN.
HORIZ. LOCK
PRINTED - -49


AUDIO AMPLIFIER & POWER SUPPLY CHASSIS
6AL5
RATIO DET.
V203
6SQ7
AUDIO AMP.
V501
6V6GT
AUDIO OUTPUT
V502
T501
M502
M503
M201
VOLUME CONTROL
AUDIO PLUG
CONNECTS TO M503
270 IN SETS WITH 10" OR 12" TUBES
150 IN SETS WITH 16" TUBES
V501 V502
VIDEO SECTION
6AL5
VIDEO DET. & SYNC. LIMITER
V304
6AU6
AGC
V305
6AC7
VIDEO AMP.
V306
T303
V307
BARE WIRE
4.5 MC TRAP
BRIGHTNESS
CONTRAST
2ND. ANODE
CAUTION: HIGH VOLTAGE ON CONE OF 16AP4, DO NOT GROUND.
TO PIN 4 OF V305 AND PIN 2 OF V406
SEE INSET FOR 16"(21A1) CONNECTORS AND R334
YELLOW and RED
FOCUS
FOCUS COIL L306
GRN.
SEE INSET FOR INTERLOCK IN 16"(21A1) SETS. M301
117 V. AC LINE
M303
INTERLOCK
FUSE M407
M302
SW301
TO HEATERS
SEE PARTS LIST FOR DIFFERENT 12" TUBES.
M501
HIGH VOLTAGE RECT.
V504
T502
5U4G
LOW VOLTAGE RECT.
6X5GT
V503
SEE ADJOINING CIRCUIT FOR 2nd. ANODE SUPPLY IN 16" SETS.
T405
WIDTH CONTROL
6BG6G
HOR. OUTPUT
V406
1B3/8016
RECTIFIER
V407
USED WHEN 12" TUBE HAS NO OUTER COATING
T403
6W4
DAMPER
V408
T404A
HORIZONTAL DEFLECTION YOKE
14 Ω TOTAL
390 in 20A1 CHASSIS
330 in 20B1 "
270 in 21A1 "
HORIZ. DRIVE
HORIZ. HOLD
FUSE W406
L403
L402
HORIZ. LIN.
20MFD.
T301
T302, T303
L308
WHITE
BLACK
T405 IN 20A1, 20B1 CHASSIS
T405 IN 21A1 CHASSIS
RED
WHITE
BLACK
M301
FRONT VIEW OF SOCKET
M501
FRONT (PIN) VIEW OF PLUG

RCC TELEVISION Service Manual

PUBLISHED BY RADIO COLLEGE OF CANADA, TORONTO

1950-51 Supplement No.1

INDEX

NOTE: RE INDEXING

Since most TV circuits require fold pages for clear reproduction, it is necessary to bind them as a group in the middle of the book. As a result, related data such as alignment, voltages etc., may be widely separated in some cases. To avoid confusion, use your index to locate ALL data.

R.C.C. TELEVISION Supplement No.1