SPECIFICATIONS

PICTURE TUBE: 7", Electrostatic Deflection.

INPUT IMPEDANCE: 300 Ohm.

INTERMEDIATE FREQUENCIES:

Video IF — 25.75 MC.
Audio IF — 21.25 MC.
Inter-carrier Beat Audio IF — 4.5 MC.

POWER CONSUMPTION: Approximately 100 Watts.

OPERATING VOLTAGE

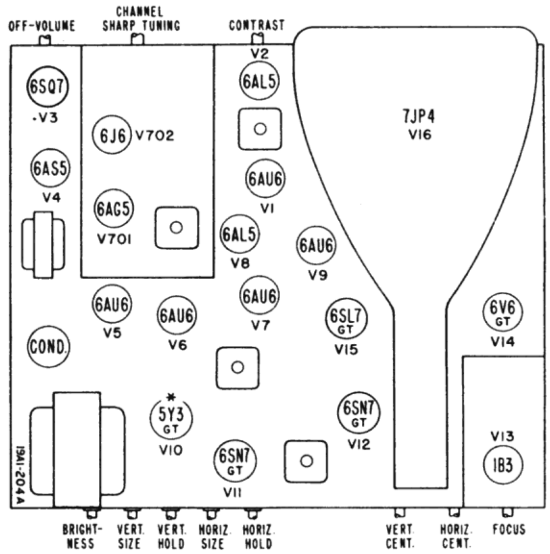
This receiver is designed to operate from a 117 volt, 60 cycle AC power outlet. DO NOT ATTEMPT TO OPERATE THIS RECEIVER ON DIRECT CURRENT (DC).

INTERLOCK PLUG

This set is provided with an interlock plug which disconnects AC line cord from chassis when cabinet back is removed.

TUBE COMPLEMENT

Symbol	Type	Circuit Function
V1	6AU6	Audio IF
V2	6AL5	Ratio Detector
V3	6SQ7	Audio Amplifier
V4	6AS5	Audio Output
V5	6AU6	1st IF
V6	6AU6	2nd IF
V7	6AU6	3rd IF
V8	6AL5	Video Detector and AGC
V9	6AU6	Video Amplifier
V10	*5Y3GT	Low Voltage Rectifier
V11A	6SN7GT	Sync Separator
V11B		Vertical Oscillator
V12A	6SN7GT	Sync Amplifier
V12B		Horizontal Oscillator
V13	1B3GT/8016	High Voltage Rectifier
V14	6V6GT	High Voltage Oscillator
V15A, V15B	6SL7GT	Balanced Vertical Output
V16	7JP4	7" Picture Tube
V701	6AG5	RF Amplifier
V702	6J6	Oscillator & Mixer



Tube Locations, Top View.

* Some sets used 5U4G. See production changes.

HIGH VOLTAGE WARNING

Operating or servicing this television receiver with cabinet removed involves shock hazard. Exercise normal High Voltage precautions while working with this set.

High voltages are present throughout the picture tube focusing and deflection circuits. No attempt should be made to make measurements from these points with ordinary test equipment.

Very carefully follow instructions given in this manual regarding location of test points for alignment, for taking voltage measurements, or in making oscilloscope waveform analysis. Do not connect test equipment across other points in the receiver unless you are thoroughly familiar with the circuit wiring and points at which high voltages are present.

TELEVISION FREQUENCY RANGES

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

OPERATION

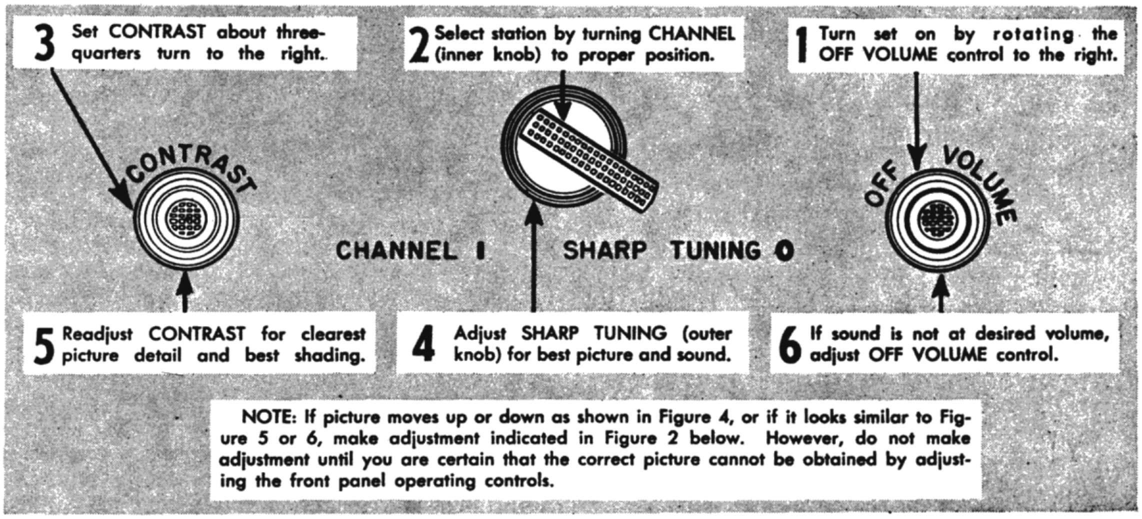


Fig. 1. Front Panel Controls showing complete tuning procedure.

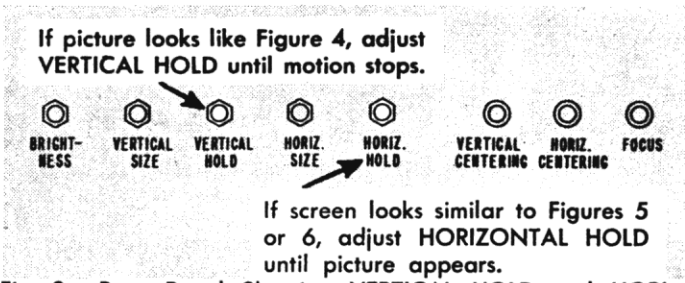


Fig. 2. Rear Panel Showing VERTICAL HOLD and HORIZONTAL HOLD adjustments.

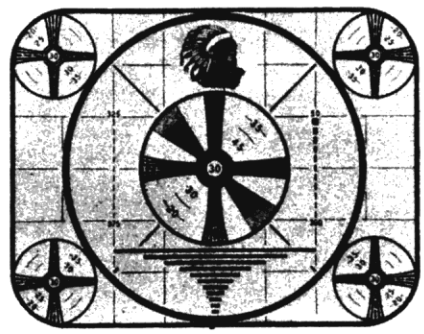


Fig. 3. Correct Picture.

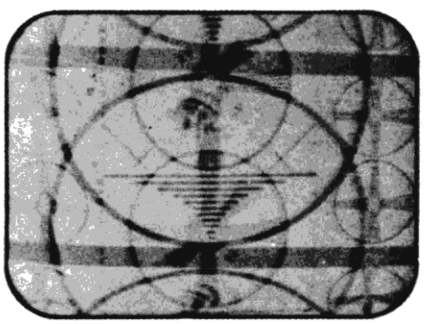


Fig. 4. Adjust VERTICAL HOLD.

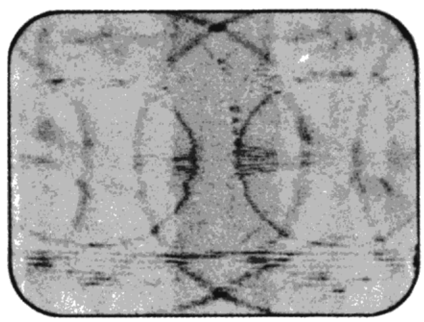


Fig. 5. Adjust HORIZONTAL HOLD.

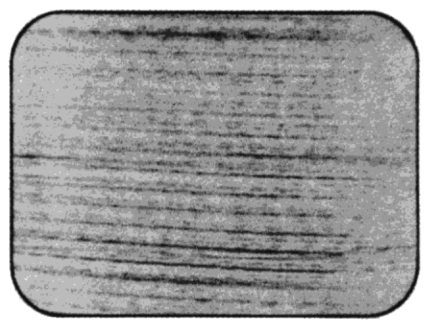


Fig. 6 Adjust HORIZONTAL HOLD.

Fig. 7. Sound bars and buzzing sound; adjust SHARP TUNING.

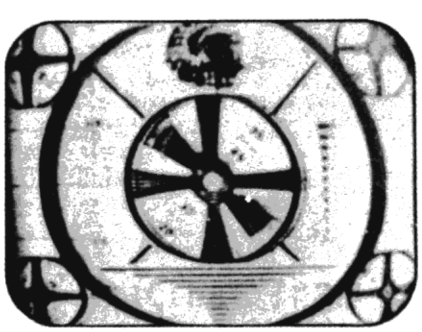


Fig. 8. Too much contrast; turn CONTRAST to left.

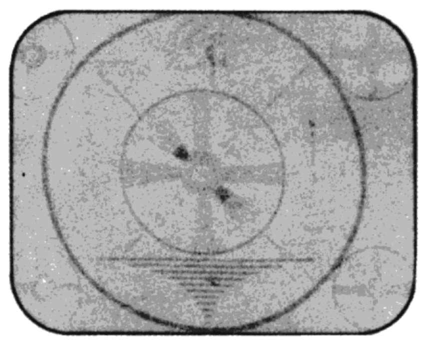


Fig. 9. Too little contrast; turn CONTRAST to right.

INTERFERENCE PATTERNS

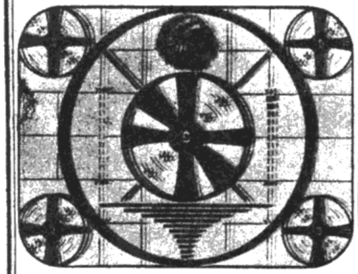


Fig. 10. "Ghosts" (multiple image).

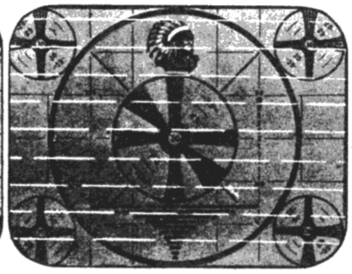


Fig. 11. Ignition interference.

Fig. 12. Medical Equipment interference.

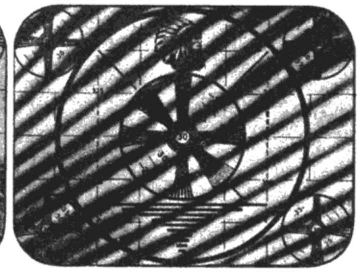


Fig. 13. Short wave transmitter interference.

INSTALLATION & SERVICE ADJUSTMENTS

The installation of this set is similar to the installation of other television receivers with regard to antenna installation, connection of transmission line, and placement of the receiver. The following information will be helpful in properly adjusting the receiver for best operation.

There are eight controls on the rear panel of this receiver. These controls are pre-set at the factory, but should be rechecked at the time of installation to insure best results.

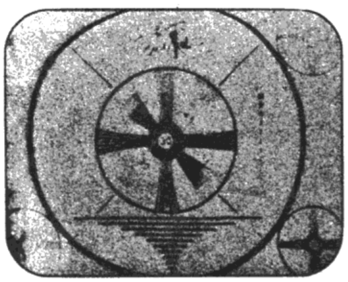
Before adjusting the rear panel controls, be sure that the SHARP TUNING control has been carefully set for the clearest picture and reasonably good sound.

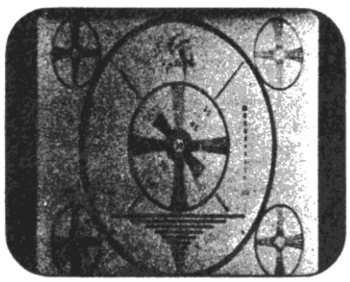
Better pictures may sometimes be obtained by changing the settings of the CONTRAST control (front panel) and BRIGHTNESS control (rear panel). See figures 9 and 14. If the picture seems to be too faint, adjust the BRIGHTNESS control (rear panel) for the desired screen illumination. The CONTRAST control should then be adjusted for clearest detail and best shading. Try several such settings to determine the ones giving the most satisfactory picture. The BRIGHTNESS control (rear panel) should not be set for maximun screen illumination because the picture will not be clearly defined.

Occasionally, picture detail may be improved by slightly readjusting the FOCUS control (rear panel). (See figure 19.)

AUDIO BUZZ

See page 16 for complete discussion of audio buzz.





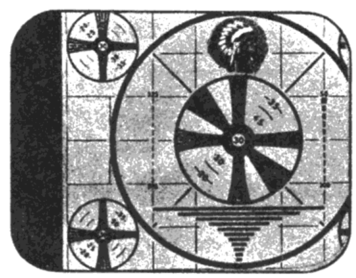


Fig. 14. Picture too bright or dim; adjust BRIGHTNESS.

Fig. 16. Picture too wide or narrow; adjust HORIZONTAL SIZE.

Fig. 18. Picture off to right or left; adjust HORIZONTAL CENTERING.

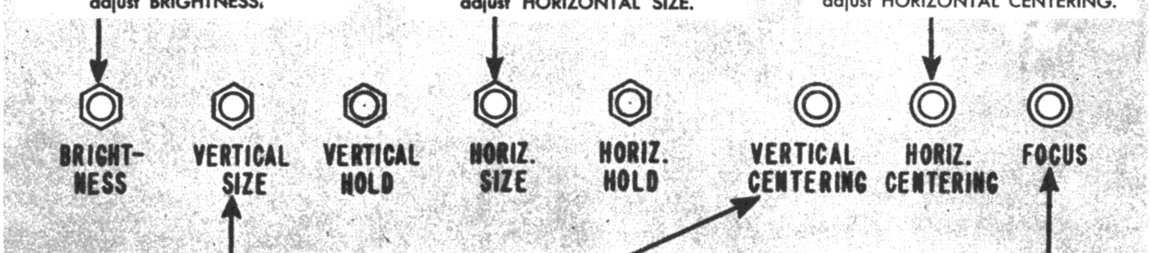
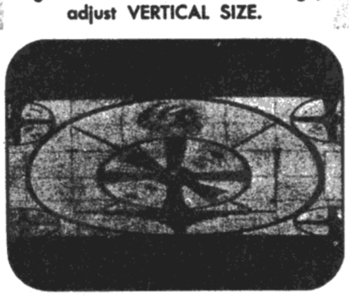
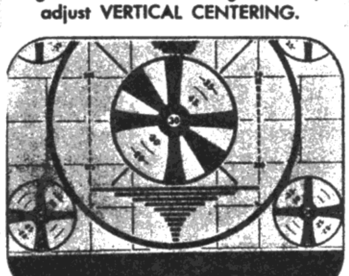


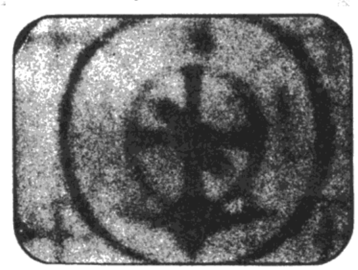
Fig. 15. Picture too small or large; adjust VERTICAL SIZE.

Fig. 17. Picture too high or low; adjust VERTICAL CENTERING.

Fig. 19. Picture detail poor; adjust FOCUS.







NOTE: See Figure 2 for VERTICAL HOLD and HORIZONTAL HOLD adjustments.

PICTURE TUBE

PICTURE TUBE HANDLING PRECAUTIONS: Use exceptional care and caution when handling or installing the picture tube (7JP4). It encloses a high vacuum and the large surface area is subject to considerable air pressure. Breakage of the tube and consequent shattering of glass may cause serious injury. It is recommended that safety goggles and heavy gloves be worn when handling tubes. Avoid nicking or scratching glass surface of tube from contact with other objects.

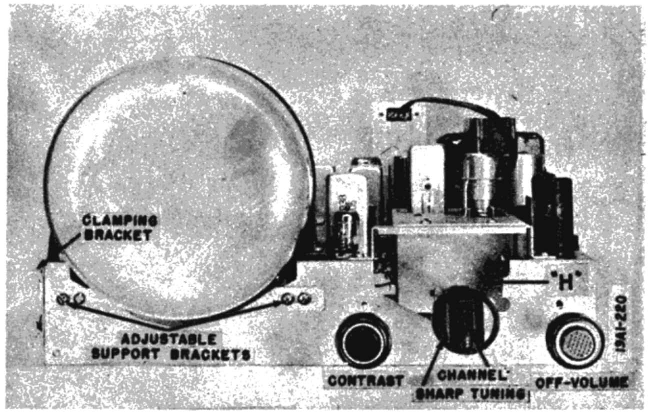


Figure 20. Chassis, Front View.

REPLACING PICTURE TUBE (7JP4)

Removing Picture Tube:

a. Remove tuning knobs by pulling off. Knobs used are push-on type.

b. Remove cabinet back with interlocking line cord connector attached.

c. Release the chassis by removing the four mounting screws at the bottom of the cabinet. Slide chassis out.

d. To remove the picture tube, slip socket and tube shield back from the base of the tube. Loosen the two screws which mount the webbing band clamping bracket at the side of the chassis. See figure 20.

Installing New Picture Tube:

The above procedure should be reversed, making sure that the metal tube shield fits snugly around the neck of the tube and tube clamping spring firmly supports the tube to the chassis tube support bracket. Note corrugated cardboard strip between tube and shield. Also note small sponge rubber pad used to keep the webbing band from slipping.

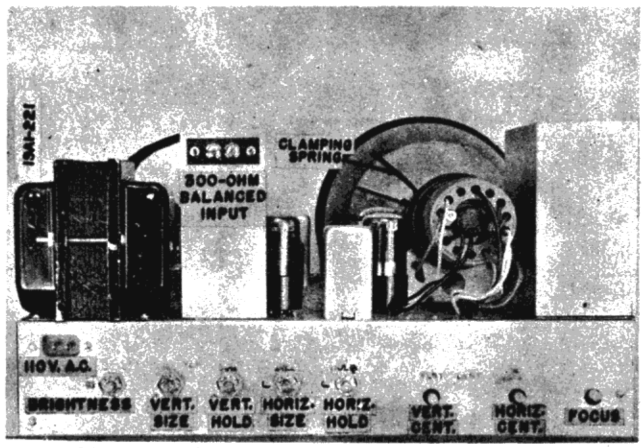


Figure 21. Chassis, Rear View.

Important

Before tightening the webbing band which holds down the front end of the picture tube, make sure that the tube is set in position for proper picture alignment and that the rubber bumpers of the adjustable support brackets contact the contour of the tube. Also, the front end of the picture tube (highest point on picture surface) must extend 1-15/16 inches out from the front edge of the chassis. This can best be measured with a 5 or 6 inch carpenters square.

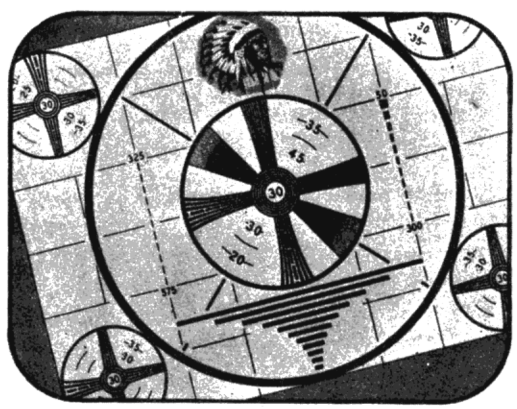


Figure 22. Picture Tilt.

Rotate picture tube for proper picture alignment.

19A1 CIRCUIT DISCUSSION

GENERAL NOTE: The IF circuit of this chassis utilizes a circuit development known at "Inter-carrier Sound System". It is well to remember the following:

The video and sound IF carriers are amplified as a unit (not separated). The video and sound signals remain together through the video IF stages and video amplifier up to the grid of the picture tube. However, the level of the sound signals is always kept considerably lower than the video signal level.

The sound and video IF carriers mix (converter action) at video detector V8 and produce a 4.5 MC FM IF carrier (difference frequency 25.75 minus 21.25 MC). Detection of this 4.5 MC FM IF carrier is the function of ratio detector V2 (6AL5). Since the 4.5 MC FM IF is an inter-carrier beat, loss of video signal will also result in loss of the 4.5 MC audio IF carrier. No sound will then be heard from the speaker.

The audio IF carrier level (21.25 MC) is dropped substantially below the video IF level (25.75 MC) in the video IF stages. This insures that the level of the amplitude modulation (present in the 4.5 MC beat FM IF carrier) will be low enough to permit complete removal by the FM ratio detector. If the required ratio in the relative levels of the video and sound IF carriers is materially changed, the level of amplitude modulation in the 4.5 MC FM IF carrier may be increased to such extent that it will be impossible for the ratio detector to remove it completely.

Amplitude modulation which is not removed by the ratio detector will result in spurious audio components heard as a buzzing sound in the speaker. For additional discussion of buzzing sound, see page 16.

RF SECTION: See separate tuner circuit discussion under heading "94C8-1 TUNER CIRCUIT DISCUSSION".

IF AMPLIFIER (VIDEO AND SOUND): Signal output from the mixer stage of the RF tuner is coupled to IF amplifier V5 (6AU6). The combined video and sound IF carriers are amplified as a unit through a three stage wide band IF amplifier, consisting of tubes V5 (6AU6), V6 (6AU6) and V7 (6AU6). The IF amplifier coils are stagger-tuned to obtain proper IF band width with adequate gain.

AGC controlled IF stages (V5 and V6); having unbypassed cathode resistors, provide for greater stability and uniform IF band width for all settings of the contrast (gain) control.

VIDEO DETECTOR AND AGC: Rectification of IF signal is achieved by one section of twin diode V8 (6AL5). The demodulated video signal appears at plate of the detector section of V8. The video IF carrier (25.75 MC) and the audio IF carrier (21.25 MC) also mix at this point (converter action), producing a 4.5 MC FM IF carrier (difference frequency). This beat carrier has the full 25 KC frequency deviation of the original FM signal.

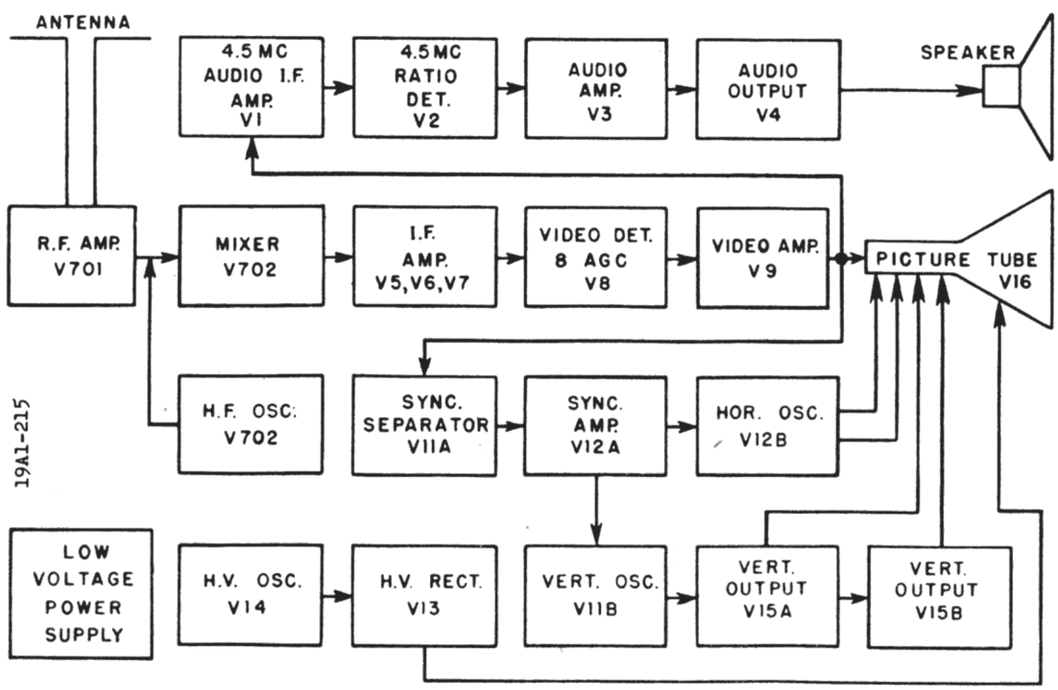


Figure 23. Functional Block Diagram.

Automatic gain control (AGC) bias is developed across diode load resistor R27. NOTE: Contrast control R33 varies the delay bias on V8.

VIDEO AMPLIFIER: Video amplifier V9 (6AU6) functions to amplify the composite video signal and the 4.5 MC audio IF signal.

The video amplifier also functions to some degree as a noise limiter, clipping impulse noise peaks from the composite video signal. Noise limiting action occurs by virtue of the negative direction of the signal from the video detector plate (V8), thus driving video amplifier V9 to beyond cut-off on noise peaks.

Video signal output from V9 is coupled to the cathode of picture tube V16 (7JP4). A portion of this signal is also coupled to sync separator V11A. The 4.5 MC audio IF signal from V9 is coupled to the tuned input of audio IF amplifier V1.

AUDIO SECTION: The 4.5 MC audio IF signal is amplified through V1 (6AU6) and applied to the ratio detector V2 (6AL5). Audio developed by the ratio detector is coupled to audio amplifier V3 (6SQ7) which in turn is coupled to V4 (6AS5). V4 functions as an output stage, voltage dropping, and voltage regulating tube. Conduction current through this tube is in series with the B plus voltage supply to other tubes.

SYNC SEPARATOR: Output from the video amplifier is coupled to sync separator V11A (½ 6SN7GT).

The sync separator V11A is self-biased by grid resistor R38, plate current flows only during positive pulse peaks, thus clipping away the rest of the video signal. Only amplified sync pulses appear at the plate of V11A sync separator.

SYNC AMPLIFIER: Sync pulse amplifier V12A (½ 6SN7GT) operates as a self-biased amplifier, and inverts the sync pulse, so that it has correct polarity to synchronize or lock in vertical and horizontal sweep oscillators.

The sync amplifier V12A (½ 6SN7GT) is capacity coupled to the horizontal oscillator (sweep generator) V12B (½ 6SN7GT).

Sync amplifier is also coupled to the vertical oscillator (sweep generator) through an integrating network. This network is a low pass filter which filters out the horizontal sync pulses and passes the vertical sync pulses on to the vertical oscillator V11B (½ 6SN7GT).

VERTICAL OSCILLATOR: The vertical blocking oscillator V11B (½ 6SN7GT) is synchronized by incoming sync pulses obtained through the integrating network.

A saw-tooth wave is formed by the RC network which is associated with the plate circuit of the vertical oscillator.

VERTICAL SWEEP OUTPUT: Saw-tooth output from V11B is coupled to both sections of V15 (6SL7GT), operating as a push-pull amplifier. Balanced output from V15 is coupled to the vertical deflecting plates of the picture tube.

HORIZONTAL OSCILLATOR: Sync pulse output from V12A is applied to the grid of the horizontal blocking oscillator V12B (½ 6SN7GT).

A differentiating network (high-pass filter) consisting of C35, grid coil of T3, R44, and R45 (horizontal hold control), filter out vertical pulses.

V12B is synchronized by incoming pulses. A saw-tooth wave is obtained through sweep output transformer T4. Output from V12B is coupled through T4, C38 and C40 to the horizontal deflecting plates of the picture tube.

HIGH VOLTAGE POWER SUPPLY: The high voltage power supply includes RF (high voltage) oscillator V14 (6V6GT), oscillator auto-transformer T5 and high voltage rectifier V13 (1B3GT/8016). RF voltage of plate coil of T5 is stepped up to a peak voltage of approximately 6000 volts. The secondary winding of T5 supplies a low RF voltage for the filament of high voltage rectifier V13.

The 6000 peak RF volts is applied to the plate (cap) of V13 high voltage rectifier. Rectified current is filtered by R68 and C56 to remove RF component.

Oscillation of V14 (6V6GT) is sustained by capacitive feedback accomplished by placement of a circular coil spring around the middle of V13 envelope and is connected to the grid of V14.

PICTURE TUBE: Picture tube V16 (7JP4) employs electrostatic deflection and focusing.

Video signal input from the video amplifier is applied through C43 to the cathode element. Grid #1 (signal grid) of the tube is grounded to chassis.

94C8-1 TUNER

CIRCUIT DISCUSSION

The 94C8-1 tuner is an individual sub-chassis consisting of an RF amplifier V701 (6AG5) and an RF mixer and oscillator V702 (6J6). Channel selection is accomplished with rotation of a turret assembly having separate matched snap-in coils for each of the 12 channels. An oscillator sharp tuning control C711 permits fine tuning adjustment.

Antenna coils L701 consist of a center-tapped coil (primary) and RF grid coil (secondary). Interstage coils L702 consist of an RF plate coil, mixer grid coil and oscillator coil. Coupling between the RF amplifier, mixer and oscillator is accomplished by locating all coils on the same coil form, in close proximity of each other.

Signal output from the mixer stage is coupled to IF amplifier through 1st IF coil T702.

94C8-1 TUNER SERVICE

See page 17 for production change in 94C8-1 Tuner.

GENERAL: The high frequencies used in television make it necessary that extreme care be exercised in handling or servicing RF tuners.

Location and lead dress of components and wiring are usually very critical. At high frequencies, wiring leads tend to act as small inductances or capacities and consequently may appreciably alter electrical characteristics of critical circuits.

Parts location and ground connections should be as originally made. When replacing components, it is important that they be replaced with parts of identical electrical characteristics and physical size. Refer to parts list for temperature coefficients, tolerances, and other essential description.

Note resemblance between some ceramic condensers and resistors. If in doubt, check call-out symbols in fig. 26 and 27.

Also note that replacement of tubes (especially V702(6J6) oscillator-mixer tube) may cause some slight detuning of tuner circuits. This is due to the inherent differences of interelectrode capacitances. When replacing V702(6J6) tube, it is recommended that several tubes be tried in order to select a tube which will cause least oscillator frequency shift. This is easily checked by noting whether the oscillator Sharp Tuning control C711 will tune in the picture carrier of the television signal at, or reasonably close to, the middle of its range.

Channel snap-in coils must be handled with care. Do not disturb coil windings. Also be sure the coils are properly paired for the indicated channel number, and that coils follow proper sequence when reassembled in the turret drum. For proper reference of tuner shaft in relation to coil position, refer to figure 33.

TUNER REPLACEMENT: Replacement of the complete tuner should generally never become necessary since all electrical and mechanical parts are easily replaceable.

Complete parts list and service data covering parts replacement and tuner alignment are given in this manual. Minor adjustments or repairs can easily be made in the field.

SHARP TUNING CONTROL C711: The normal electrical range of the sharp tuning control for high channels is plus or minus 3 MC, for low channels plus or minus 1.5 MC. Decreasing the spacing between the two stationary metal stator plates will increase the range of frequency.

To move the stator plates closer together or further apart, loosen the mounting screw (J, figure 25). Unsolder the metal strap K. (This strap was V-shaped in early production, and straight in later production.) Reposition stator plate. Resolder strap and tighten screw.

NOTE: Slight rubbing of the rotating dielectric disc against the grounded stator plate is intentional, in order to avoid vibration with resulting microphonics. However, the rotating dielectric disc should not be allowed to rub or contact the ungrounded plate attached to terminal #1 of the contact plate.

REMOVING CHANNEL COILS: Insert a screwdriver blade between the coil retainer spring and the turret end plate. Twist the blade away from the turret and lift the end of the coil upward and remove.

OSCILLATOR SLUGS IN TOO FAR: If HF oscillator slugs "fall into" coil form, remove the channel coil, move the slug retaining spring aside, and tap the coil assembly until the slug slips forward. Set the coil retaining spring into position; it should rest firmly against the slug. See figure 24.

REMOVING TUNER TURRET ASSEMBLY:

a. Remove stop screw "S", spring M706, and the retaining plate at the front of the tuner. See figure 33.

b. Remove the shaft retaining spring at the rear of the tuner by spreading it over the end of the shaft.

c. Using a screwdriver blade at the side of the tuner, press the detent spring M702 and roller M701 away from the turret detent plate.

d. Grasp tuner shaft and slip out of end plate bearings.

e. Reassemble in same manner.

REMOVING CONTACT PLATE ASSEMBLY M703:

a. Remove turret as indicated under "Removing Tuner Turret Assembly".

b. Remove the mounting screws at the front and rear of Contact Plate and Bracket Assembly M703.

c. Press outward the front and rear tuner chassis end plates.

d. To free M703, release the contact plate tabs by pushing them away from the slots in the end plates.

e. Unsolder all connections to contact plate. Unsolder the solder joint (L) holding contact plate to the center partition of the tuner chassis.

f. Reassemble in the same manner.

Note

When reassembling Contact Plate and Bracket Assembly M703, it will be necessary to reposition M703 as indicated in the next paragraph; it will also be necessary to reset the Detent Spring M702 as indicated under "Resetting The Detent Spring".

REPOSITIONING CONTACT PLATE ASSY. M703:

a. Loosen the contact plate mounting screws.

b. With thumb pressure of right and left hands, press the upper end of the contact plate toward the turret.

c. The contacts on the contact plate should clear the plastic surface of turret coils by a few thousands of an inch. Clearance can be observed by removing several sets of coils from the turret and slowly rotating turret.

d. After setting the contact plate for proper clearance, tighten the contact plate mounting screws.

e. Resolder wiring connections and solder joint (L).

RESETTING THE DETENT SPRING M702: When servicing the Detent Spring M702, the Detent Roller M701, or when replacing the Contact Plate and Bracket Assembly M703, the detent spring should be reset as follows:

a. Loosen the detent spring mounting screw.

b. Observing the contacts on the contact plate, grasp the turret and the roller end of the detent spring. Rotate the drum slightly in one direction and then the other, until a point is reached where the contacts appear to have the greatest rise.

c. Check to see that the detent roller is set in the center of the depression on the edge of the turret detent plate. If setting is correct, tighten the detent spring mounting screw.

d. Rotate the turret, checking contacts on all channels.

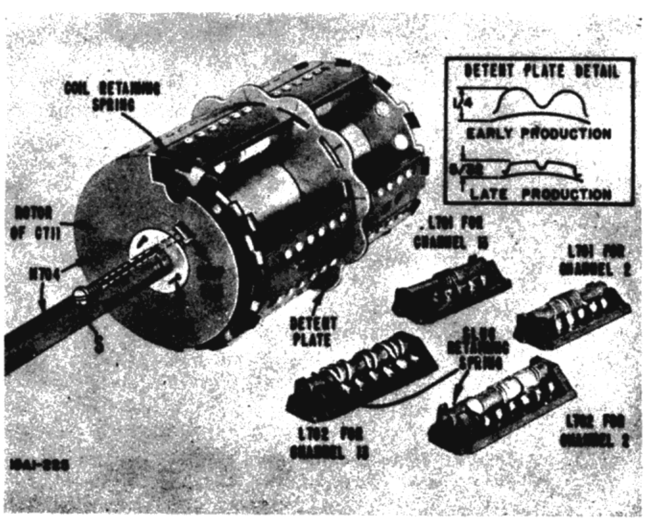


Figure 24. 94C8-1 Tuner Turret, Showing Snap-in Coils.

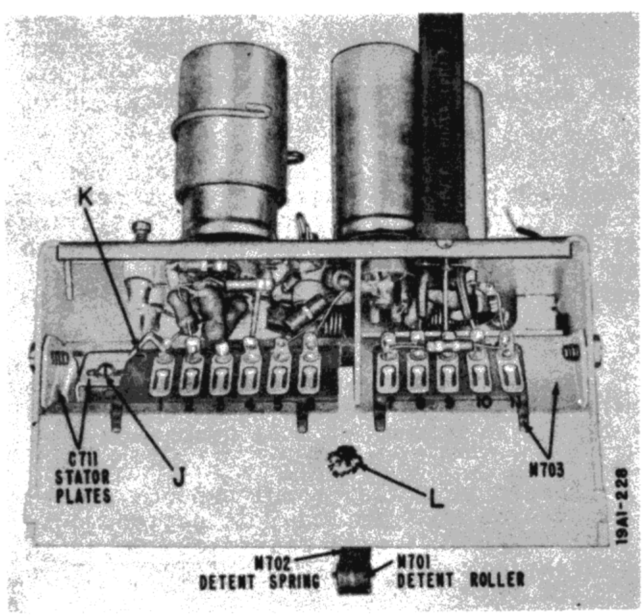


Figure 25. 94C8-1 Tuner, Side View.

94C8-1 TUNER PARTS LIST

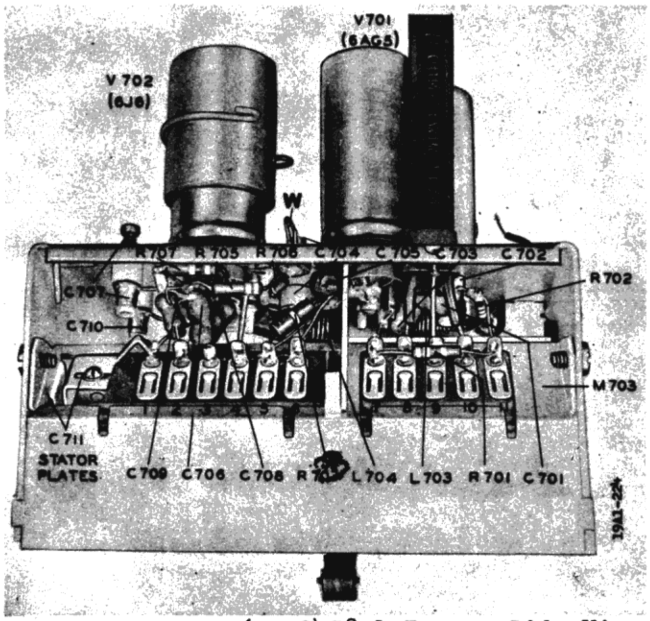


Figure 26. 94C8-1 Tuner, Side View

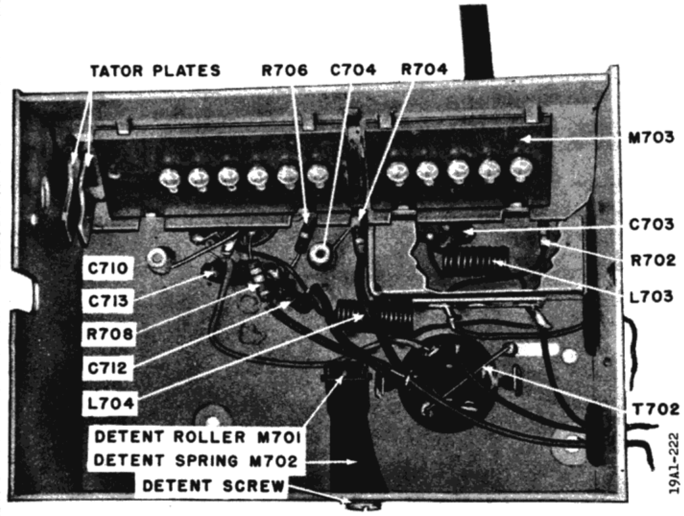


Figure 27. 94C8-1 Tuner, Bottom View (Turret removed)

Symbol	RESISTORS	Part No.
*R701	3,900 Ohms, 1/4 W.	98A 45-16
R702	47,000 Ohms, 1/4 W.	98A 45-17
R703	10,000 Ohms, 1/4 W.	98A 45-18
R704	2,200 Ohms, 1/2 W.	98A 45-19
*R705	4,700 Ohms, 1/2 W.	98A 45-20
R706	220,000 Ohms, 1/4 W.	98A 45-21
R707	10,000 Ohms, 1/4 W.	98A 45-18
*R708	4,700 Ohms, 1/2 W.	98A 45-20
R711	15,000 Ohms, 1/4 W.	98A 47-4

Symbol	COILS, TRANSFORMERS, ETC.	Part No.
L701	Antenna Coil	
L702	Mixer and Oscillator Coils	
	NOTE Coils L701 and L702 supplied only in matched pairs. Specify from list below.	
	for Channel #2	98A 45-2
	for Channel #3	98A 45-3
	for Channel #4	98A 45-4
	for Channel #5	98A 45-5
	for Channel #6	98A 45-6
	for Channel #7	98A 45-7
	for Channel #8	98A 45-8
	for Channel #9	98A 45-9
	for Channel #10	98A 45-10
	for Channel #11	98A 45-11
	for Channel #12	98A 45-12
	for Channel #13	98A 45-43
L703	Choke, Filament RF	98A 45-13
L704	Choke, Filament Oscillator	98A 45-14
L711	Coil, 1st IF	Part of T702
T702	1st IF Coil Assembly	98A 47-3

Symbol	CONDENSERS	Part No.
C701	5 mmfd., ±.5 mmfd., Zero Temp. Coeff.	98A 45-22
C702	.5 to 3 mmfd., Ceramic Trimmer	98A 45-23
C703	.001 mfd. min., Ceramic, Hi K.	98A 45-24
C704	.5 to 3 mmfd., Ceramic Trimmer	98A 45-23
C705	120 mmfd, Cer, -750 Temp. Coeff.	98A 45-25
C706	100 mmfd, Cer, -750 Temp. Coeff.	98A 45-26
C707	.5 to 3 mmfd., Ceramic Trimmer	98A 45-23
C708	20 mmfd, Cer, Zero Temp. Coeff.	98A 45-27
C709	10 mmfd, Cer, -300 Temp. Coeff.	98A 45-28
C710	.5 to 3 mmfd., Ceramic Trimmer	98A 45-23
C711	3 to 5 mmfd., Sharp Tuning	Part of M704
C712	.001 mfd. min., Ceramic, Hi K.	98A 45-24
C713	.001 mfd. min., Ceramic, Hi K.	98A 45-24
C721	10 mmfd., Silver Mica, ±1 mmfd. Zero Temp. Coeff.	98A 45-55
C722	130 mmfd., Silver Mica, ± 10% Zero Temp. Coeff.	98A 45-56

(If C721 and C722 are part of T702 wafer, replace with individual components listed above.)

Symbol	MISCELLANEOUS	Part No.
▲	Turret Assembly (less coils)	
	See Fig. 24 — Early production	98A 45-42
	See Fig. 24 — Late production	98A 45-51
▲M701	Roller, Detent	
	1/4" diameter (early prod.)	98A 45-32
	3/8" diameter (late prod.)	98A 45-50
▲M702	Spring, Detent	
	2-5/8" long (early prod.)	98A 45-37
	1-13/16" long (late prod.)	98A 45-45
M703	Contact Plate and Bracket Assy.	98A 45-30
M704	Shaft Shell & Rotor Assembly Sharp Tuning	98A 45-34
M705	Spring, Sharp Tuning Rotor Contact	98A 45-41
M706	Spring, Front Turret Shaft	98A 45-40
	Nut, Locking Spring (for trimmers)	98A 45-31
	Screw, Trimmer (#4-36x5/8")	98A 45-33
	Shield, Leaded Tube	98A 44-23
	Shield, Plain Tube	98A 45-36
	Spring, Tube Shield Clamping	98A 44-26
	Spring, Rear Turret Shaft	98A 45-39
	Spring, Slug Retaining (osc. coil)	98A 45-52

▲ Early and late production parts are not interchangeable. See "PRODUCTION CHANGES"

* Order exact replacement parts from Admiral distributor or use IRC metalized resistor only to secure proper high frequency characteristics.

ALIGNMENT

GENERAL: Complete alignment of model 19A1 television chassis consists of the following individual procedures. Alignment should be performed in this sequence.

a. IF Amplifier Alignment (Video and Audio IF).
b. 4.5 MC Audio IF Alignment.
c. Tuner RF and Mixer Alignment.
d. Tuner High Frequency Oscillator Alignment.

Under normal use or operating conditions, tuner misalignment with age will be slight. The RF and mixer stage components as well as coil assemblies have been designed for stable, band-pass operation and under normal conditions will seldom require realignment. The HF oscillator however, may require some slight readjustment, if the oscillator-mixer tube or individual channel snap-in coils have been replaced. See discussion under "94C8-1 Tuner Service".

Important

Do not attempt alignment of the tuner until all other possible causes of trouble have first been investigated. Also, tuner alignment should not be attempted unless suitable test equipment, as listed under "Test Equipment", is available.

TEST EQUIPMENT

To properly service this receiver, it is recommended that the following test equipment be available.

RF Sweep Generator

18 to 30 MC range: 10 MC sweep width.
50 to 90 MC range: 10 MC sweep width.
170 to 225 MC range: 10 MC sweep width.

Output: adjustable; one volt minimum.

Output impedance: 300 ohms balanced to ground for RF ranges.

Marker Generator

18 to 30 MC frequency range.
50 to 90 MC frequency range.
170 to 225 MC frequency range.

Must be extremely accurate or have built-in crystal calibrator for checking accuracy of calibration.

Crystal Calibrator

Check points from 18 to 225 MC. Not required if marker or sweep generators have built-in calibration crystals.

Signal Generator

Accurate signal generator, range 3 to 225 MC, with low impedance output and calibrated output attenuator.

Oscilloscope

Standard oscilloscope, preferably with a wide band vertical deflection, vertical sensitivity at least .5 volt peak-to-peak per inch, and input calibrator.

Vacuum-Tube Voltmeter

Vacuum-tube voltmeter or 20,000 ohms per volt DC meter. Preferably one with low range (3 volt) DC zero center scale.

TUNER ALIGNMENT REQUIREMENTS

RF and MIXER: General minimum requirements for proper RF and Mixer alignment are to provide correct band width and for the response curve (figure 31) to be centered within the limit frequencies shown for each individual channel. (See chart on page 12 for the marker generator frequencies.) Consistent with proper band width and response curve symmetry, it is also necessary that maximum amplitude and flat top appearance be maintained.

RF and mixer coil windings (L701A, L701B, L702A and L702B) are self-tuned by the distributed and tube capacities. Since the design of this tuner features replaceable channel snap-in coils, individual channel adjustments are not provided in RF and mixer alignment. Overall adjustment affecting all channels is made by screw adjustments A8, A9 and A10. See chart on page 12. This adjustment should be made on one of the high band channels, preferably channel 12. However, it can be made at any of the lower channels as a compromise adjustment in order to favor a particular channel having a weak signal.

If reasonable alignment cannot be effected on a particular channel, check with another set of coils marked for that particular channel. If coils are at fault, replace pair of coils (L701 and L702) for that channel (see Parts List). Before replacing coils, check to see that they have not been intermixed or have been located in wrong sequence in the turret. See figure 33 for correctly indexing coils. Coils are stamped with channel numbers or are RMA color coded.

IMPORTANT

Adjustments A8, A9 and A10 of step 1, "RF and Mixer Alignment", page 12, are overall adjustments affecting all channels.

HF Oscillator: The minimum requirement for correct high frequency oscillator alignment is that the oscillator frequency be adjusted so that the video RF carrier marker pip appears 6db (50%) below the peak of the Over-all RF, Mixer and IF Amplifier response curve. See figure 34. The sound RF carrier marker pip should appear at least 26db (95%) below the peak on the opposite side of the response curve. Ideal location of the sound marker pip is approximately 32db (97.5%) below the peak and may or may not be visible.

The need for oscillator adjustment of individual channels is determined by checking to see if the video carrier marker appears at the 50% point on the response curve (figure 34) when the Sharp Tuning Control C711 is tuned through the center of its range. If all or the majority of channels appear to be in need of oscillator alignment, adjustment may sometimes be made in a single operation, by means of the overall oscillator screw adjustment A-11. <u>Note that A-11 is an overall adjustment affecting all channels; do not use for alignment of an individual channel.</u> Oscillator slug adjustments A12 to A23 are to be used for alignment of individual channels.

IF AMPLIFIER ALIGNMENT

- Caution: To avoid contact with high voltage wiring, turn set off when attaching test leads.
- Disconnect antenna from receiver.
- Before starting alignment, allow 30 minutes for receiver and test equipment to warm up.
- Alignment adjustments, connection points, and response curves are shown in figs. 28, 29, 30.
- Point "W" is the junction of R705 and R706.
- Point "X" is the junction of L8 and R31.
- Point "R" is the junction of R15, R18, C16.

<table>
<tr><th>Step</th><th>Signal Gen. Frequency</th><th>Connections</th><th>Instructions</th><th>Adjust</th></tr>
<tr><td>1</td><td>25.3 MC unmodulated</td><td>Signal Generator high side to point "W" on tuner, low side to chassis.
VTVM (3 volt DC scale) between point "X" in chassis and chassis ground.</td><td>Remove one oscillator-mixer coil (6 terminal) section from turret of tuner. Rotate turret until open coil position is adjacent to contact points on tuner contact strip. Set contrast control full on.</td><td>A1 and A2 for maximum (keep reducing generator output to keep VTVM at approx. 1 volt)</td></tr>
<tr><td>2</td><td>23.1 MC unmodulated</td><td>Same as above</td><td>Same as above. Must use non-metallic screwdriver when adjusting A4.</td><td>A3 and A4 as in step 1.</td></tr>
<tr><td>3</td><td colspan="4">a. Disconnect Signal Generator and VTVM.
b. Connect Oscilloscope between point "X" in chassis and chassis ground. Keep leads away from receiver.
c. Connect Sweep Generator high side to point "W" on tuner, low side to chassis ground. Set Sweep Generator to sweep the IF pass band (20 to 30 MC).
d. Loosely couple Marker Generator high side to the Sweep Generator lead connected to point "W" on tuner, low side to chassis ground.
e. Check curve obtained against the ideal overall IF amplifier response curve shown in figure 28. If necessary, retouch (stagger tune) A1, A2, A3, and or A4 as required.
IMPORTANT
To avoid distortion of the response curve (overloading the video detector) keep the sweep generator and marker generator outputs at a very minimum. Marker pips should be just kept barely visible. Connecting a 3 volt bias battery (negative to point R, positive to chassis) will allow greater signal input without distorting response curve.
It is important that marker pips be in the proper location on the response curve as shown in figure 28. Correct location of 25.75 MC marker, should be 6db below peak (50% point on slope of curve). The 22 MC marker should be at the opposite side of the response curve, located approximately 18db (85%) below the peak. The 21.25 MC marker should be located at least 26db (95%) below the peak. The ideal location of the 2.25 MC marker is approximately 32db (97%) below the peak and may or may not be visible.
Consistent with proper band width and correct location of markers, the response curve must have maximum amplitude, symmetry, and flat top appearance.</td></tr>
<tr><td>4</td><td colspan="4">Replace oscillator-mixer coil removed in step 1.</td></tr>
</table>

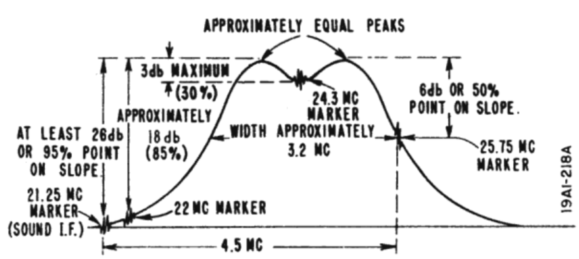


Figure 28. Overall IF Amplifier Response Curve.

4.5 MC AUDIO IF ALIGNMENT

- Caution: To avoid contact with high voltage wiring, turn set off when attaching test leads.
- Disconnect antenna from receiver.
- Before starting alignment, allow 30 minutes for receiver and test equipment to warm up.
- Alignment adjustments and connection points are shown in figures 29 and 30.
- Point "V" is pin #1 of V9, video amplifier.
- Point "Y" is pin #2 of V2, ratio detector.
- Point "Z" is junction of R8, R4 and C6 in ratio detector stage.

Step	Signal Gen. Frequency	Connections	Instructions	Adjust
	Before proceeding, be sure to check the signal generator used in alignment against a crystal calibrator or other frequency standard for absolute frequency calibration at the 4.5 MC alignment point required for this operation. Accuracy required within one kilocycle. If a frequency standard is not available for a 4.5 MC frequency check, it is recommended that touchup of zero setting adjustment A7 in step 2 be made using a television signal rather than the 4.5 MC signal from a signal generator. This touchup adjustment should be made after checking (and aligning where necessary) the IF Amplifier, Tuner RF and Mixer, and HF oscillator.			
1	4.5 MC unmodulated	Signal generator high side to point "V" thru .01 cond. VTVM (3 volt DC scale) to point "Y".	Use 3 volt scale on VTVM. Keep VTVM leads well separated from signal generator and chassis wiring. A non-metalic screwdriver will be required for aligning slug adjustment A5.	A5 and A6 for maximum (keep reducing generator output to keep VTVM at approx. 1 volt)
2	4.5 MC unmodulated	Signal generator high side to point "V" thru .01 cond. VTVM to point "Z".	Use 3 volt zero center scale on VTVM, if available. Keep VTVM leads well separated from signal generator and chassis wiring. A non-metallic screwdriver will be required for aligning slug adjustment A7.	A7 for zero voltage on VTVM (the correct zero point is located between a positive and a negative maximum)

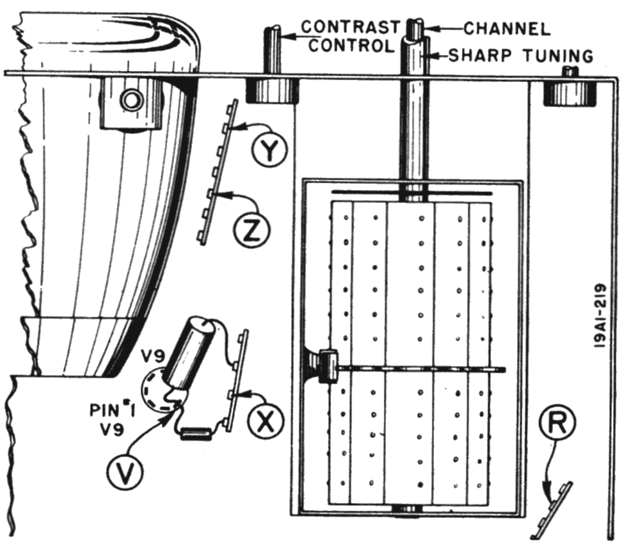


Figure 29. Bottom View Chassis Showing Alignment Connection Points.

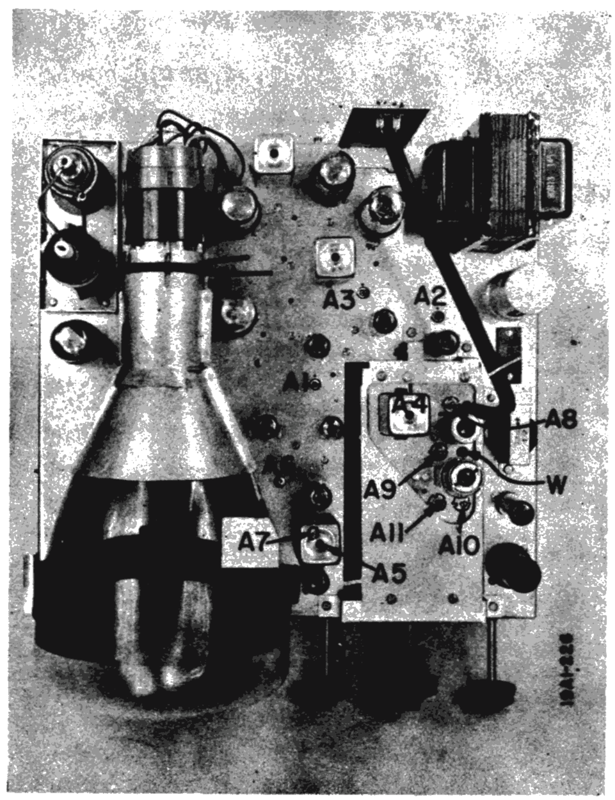


Figure 30. Top View of Chassis Showing Alignment Adjustment Locations.

RF AND MIXER ALIGNMENT

See discussion under "TUNER ALIGNMENT REQUIREMENTS"

- Caution: To avoid contact with high voltage wiring, turn set off when attaching test leads.
- Disconnect antenna from receiver.
- Before starting alignment, allow 30 minutes for receiver and test equipment to warm up.
- Alignment adjustments, connection points, and response curve are shown in figs. 29, 31, 32.
- Point "W" is the junction of R705 and R706.
- 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". Keep oscilloscope leads away from chassis.
- Set contrast control full on (clockwise).
- Connect wire jumper across R15 (grid resistor of V5).

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 31. If necessary, adjust A8, A9 and A10 as required. Curve must have maximum amplitude, symmetry, flat top, and be centered within marker limit frequencies.
2	211.25 215.75	13	Check each channel for curve resembling RF response curve shown in figure 31. In general, the adjustment performed in step 1 is sufficient to give satisfactory response curves on all channels. (See discussion under "TUNER ALIGNMENT REQUIREMENTS" on page 9 of this manual. 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	
13	Remove wire jumper from across R15 (grid resistor of V5).		

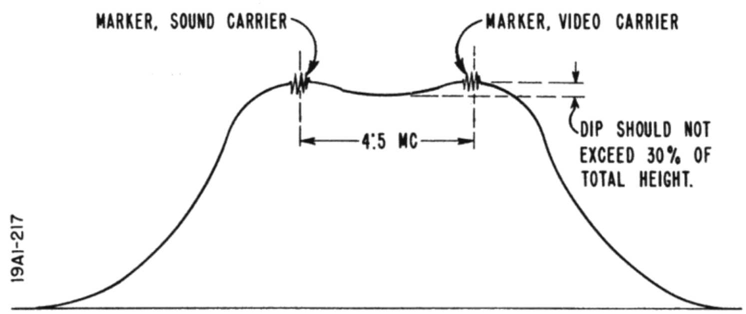


Figure 31. RF Response Curve.

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

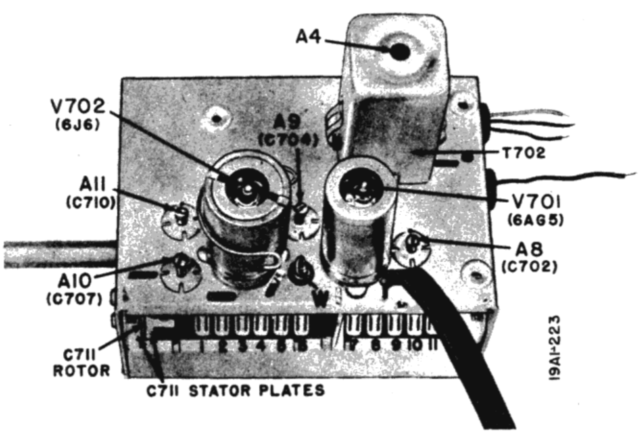


Figure 32. 94C8-1 Tuner, Top View.

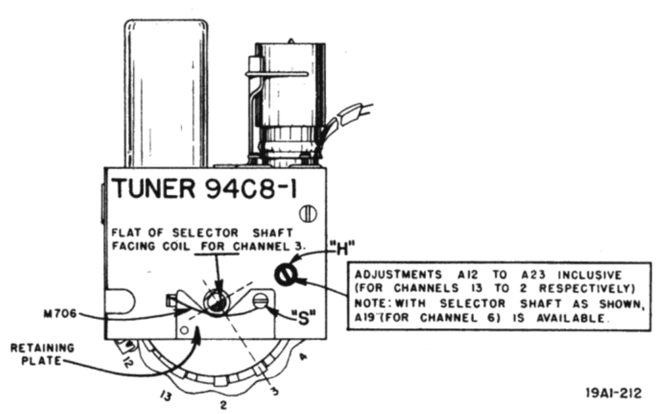


Figure 33. 94C8-1 Tuner, Front View.

HF OSCILLATOR ALIGNMENT

See discussion under "TUNER ALIGNMENT REQUIREMENTS" on page 9.

- **Caution: To avoid contact with high voltage wiring, turn set off when attaching test leads.**
- **Disconnect antenna from receiver.**
- **Before starting alignment, allow 30 minutes for receiver and test equipment to warm up.**
- Alignment adjustments, connection points, and response curve shown in figs. 29, 32, 33, 34.
- **Connect sweep generator to antenna terminals.**
- **Loosely couple marker generator to antenna terminals (to obtain marker pips of video and sound RF carriers). To avoid distorting response curve (overloading the video detector), keep the sweep generator output and the marker generator output at a very minimum. The marker pips should just be barely visible.** Connecting a 3 volt bias battery (negative to point R, positive to chass) will allow greater signal input without distorting response curve.
- Connect oscilloscope between point "X" in chassis and chassis ground. Keep oscilloscope **leads away from chassis.**
- **Point "X" is the junction of L8 and R31 in video detector stage.**
- **Set Contrast control full on (clockwise).**
- **Set Sharp Tuning Control C711 for electrical center as follows: Turn Sharp Tuning Control counter-clockwise until the stop tab of rotor of C711 engages stop screw "S". At this setting the Sharp Tuning Control is at electrical center and the cut-out in the rotor dielectric disc will make slug adjustments A12 to A23 individually accessible by rotating the turret.**
- Use a NON-METALLIC alignment screwdriver with a 1/8 inch blade.
- If HF oscillator slugs "fall into" coil form, remove the channel coil, move the slug retaining spring aside, and tap the coil assembly until the slug slips forward. Set the coil retaining spring into position; it should rest firmly against the slug. See figure 24.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Frequency	Instruction
1	Before aligning the HF oscillator, check the IF response curve (figure 28) as indicated in step 3 of the IF Amplifier Alignment. The IF's must be accurately aligned before correct oscillator adjustment can be made. Retouch IF adjustments if necessary.		
2	*211.25 **215.75	Sweeping Channel 13	Check to see if the video carrier marker appears at the 50% point on the response curve (figure 34) when the Sharp Tuning Control C711 is tuned through the center of its range. If adjustment is needed, check to see whether mis-alignment is apparent on channel 13 only or also exists on other channels. If overall adjustment is required, adjust A-11. Otherwise adjust A12.
3	205.25 209.75	12	Check all channels individually for proper marker location. If overall adjustment has been made, it may not be necessary to make any further adjustments. If necessary, however, make individual HF oscillator adjustments (A12 to A23) for individual channels by adjusting the slug in the HF oscillator section (L702C) of coil L702 for the particular channel.
4	199.25 203.75	11	
5	193.25 197.75	10	
6	187.25 191.75	9	
7	181.25 185.75	8	
8	175.25 179.75	7	
9	83.25 87.75	6	
10	77.25 81.75	5	
11	67.25 71.75	4	
12	61.25 65.75	3	
13	55.25 59.75	2	

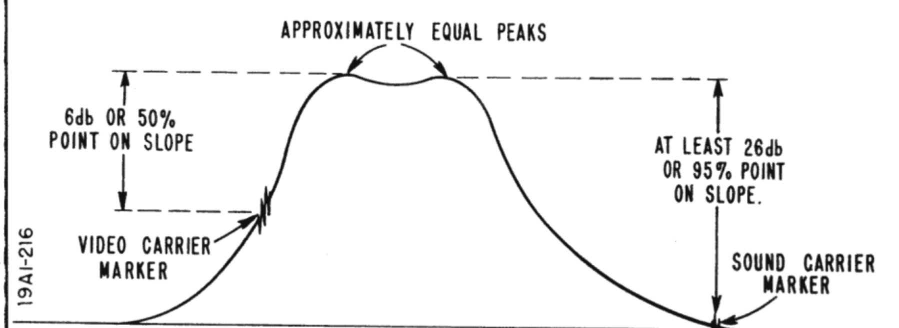


Figure 34. Overall RF Mixer and IF Amplifier Response Curve.

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

WAVEFORM ANALYSIS

SERVICING BY WAVEFORM ANALYSIS: After a circuit defect has been localized to the video or sweep sections, localization to a single stage can be accomplished by use of the waveforms shown in figures 35 to 53.

The waveforms shown in figures 35, 36, 37, 38, 39, 40, 41, 42, 43, 47 and 48, are obtained with a standard RMA television signal applied to the receiver input. A television signal is not necessary for obtaining the waveforms shown in figures 44, 45, 46, 49, 50, 51, 52 and 53, since these are taken from sweep circuits. The contrast control is set so that a voltage of 1.5 volts peak-to-peak (approximately 1 volt average DC) is obtained at TP1 (test point "V", grid of video amplifier), thus providing a standard of comparison for measuring stage gain.

Two separate waveforms are shown for the first four test points. Two different oscilloscope sweep frequencies were used in order to show up the vertical and horizontal pulses at each test point (both cannot be viewed at the same time because of the great difference in, and non-integral relationship of, the vertical and horizontal pulse frequencies).

The peak-to-peak voltages indicated for the various test points were measured by calibrating the oscilloscope used to observe the waveforms. Such peak-to-peak voltage measurements provide a check on the voltage gain per stage. For example: the peak-to-peak voltage readings at test points TP1 and TP2 are 1.5 and 48 volts, respectively. A voltage gain of 32 is indicated for the video amplifier stage V9 (6AU6).

A change in waveform may be noticed at the first two test points when the receiver is switched to a different television station. This is true since some variations in the transmitted waveform are tolerated at the television transmitter.

All waveforms and peak-to-peak voltage readings are subject to slight modification due to the response of the particular oscilloscope used for test. Due to component and manufacturing tolorances, variations in peak-to-peak voltages between television receivers are a normal condition. Hence, when using waveforms and peak-to-peak voltage readings for quick trouble shooting, these variations should be kept in mind to avoid erroneous conclusions.

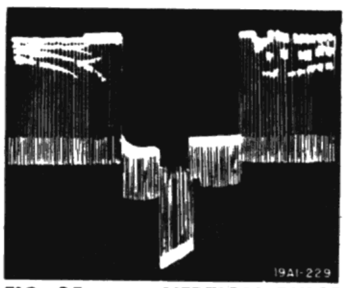


FIG. 35 VERTICAL PULSE

TP1
Input to Video Amplifier
Pin 1 of V9 (6AU6)
1.5 Volts PP

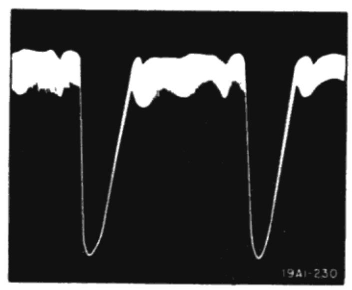


FIG. 36 HORIZONTAL PULSE

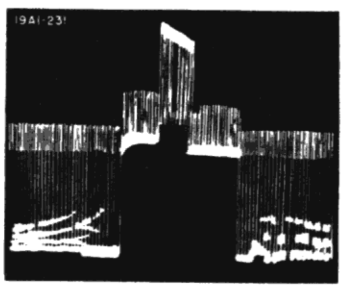


FIG. 37 VERTICAL PULSE

TP2
Output of Video Amplifier
Pin 5 of V9 (6AU6)
48 Volts PP

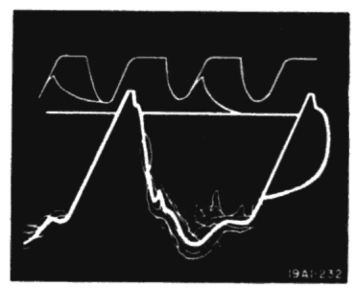


FIG. 38 HORIZONTAL PULSE

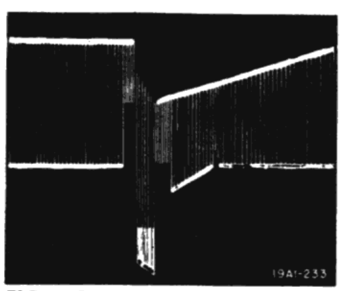


FIG. 39 VERTICAL PULSE

TP3
Output of Sync Separator
Pin 2 of V11 (6SN7GT)
25 Volts PP

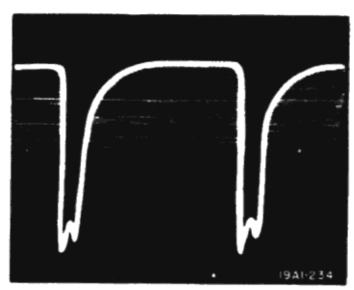


FIG. 40 HORIZONTAL PULSE

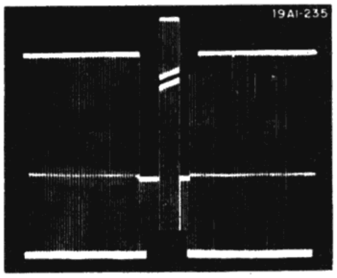


FIG. 41 **VERTICAL PULSE**

TP4
Output of Sync Amplifier
Pin 2 of V12 (6SN7GT)
100 Volts PP

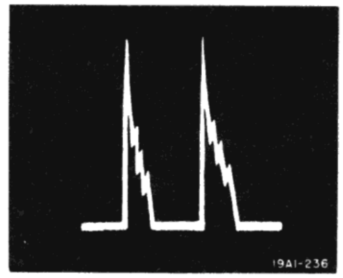


FIG. 42 **HORIZONTAL PULSE**

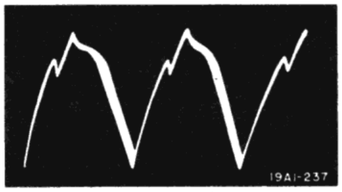


FIG. 43 **TP5** **HORIZ. PULSE**
Input to Horizontal Oscillator
Pin 4 of V12 (6SN7GT)
448 Volts PP

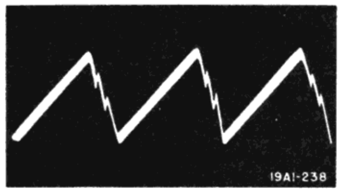


FIG. 44 **TP6** **HORIZ. PULSE**
Output of Horizontal Oscillator
Pin 5 of V12 (6SN7GT)
448 Volts PP

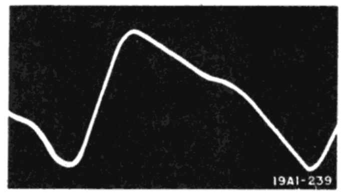


FIG. 45 **TP7** **HORIZ. PULSE**
Yellow Wire Lead from T4
650 Volts PP

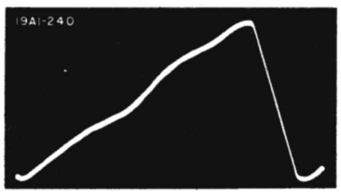


FIG. 46 **TP8** **HORIZ. PULSE**
Blue Wire Lead from T4
650 Volts PP

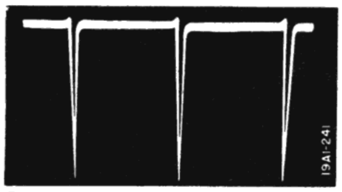


FIG. 47 **TP9** **VERT. PULSE**
Terminal 4 of T7
9 Volts PP

FIG. 48 **TP10** **VERT. PULSE**
Input to Vertical Oscillator
Pin 4 of V11 (6SN7GT)
76 Volts PP

FIG. 49 **TP11** **VERT. PULSE**
Output of Vertical Oscillator
Pin 5 of VII (6SN7GT)
22 Volts PP

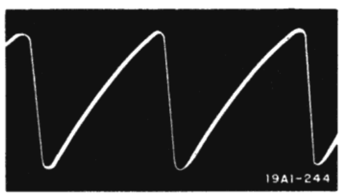


FIG. 50 **TP 12** **VERT. PULSE**
Grid of Vertical Output
Pin 1 of V15 (6SL7GT)
7 Volts PP

FIG. 51 **TP13** **VERT. PULSE**
Plate of Vertical Output
Pin 2 of V15 (6SL7GT)
286 Volts PP

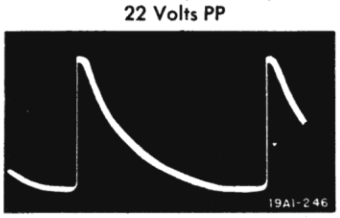


FIG. 52 **TP14** **VERT. PULSE**
Grid of Vertical Output
Pin 4 of V15 (6SL7GT)
7 Volts PP

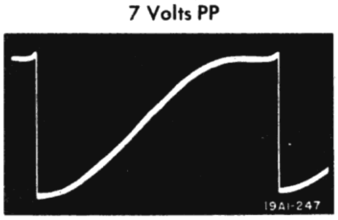
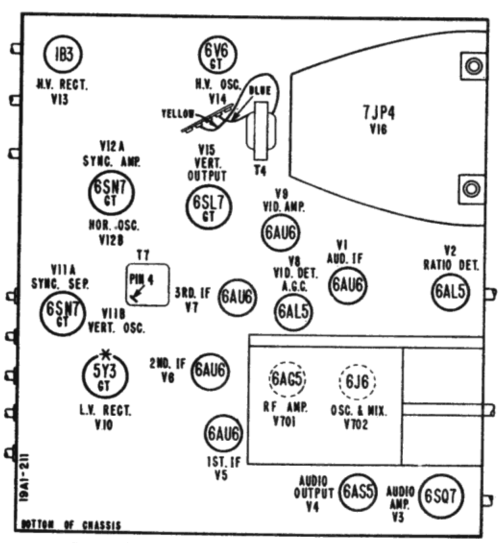


FIG. 53 **TP15** **VERT. PULSE**
Plate of Vertical Output
Pin 5 of V15 (6SL7GT)
286 Volts PP



Bottom View of Chassis.

TROUBLE SHOOTING

The logical procedure in trouble shooting is to (1) localize the trouble to a particular functional section or circuit group, (2) isolate the particular circuit or stage at fault, (3) locate the circuit defect or component at fault.

If circumstances permit, and if possible, analyze trouble by an operational check. Test patterns shown on page 1 and 2 will be of help in checking for possible operational difficulties.

Since this chassis uses an Inter-carrier Sound System and a 7" electrostatic deflection picture tube, the following circuit characteristics should be kept in mind when trouble shooting.

A. The sound and video IF carriers are amplified as a unit. The video and sound signals remain together through the video IF stages and the video amplifier. At the video detector V8, the sound and video IF carriers mix (converter action) producing a 4.5 MC FM IF carrier.

B. Blocking type oscillators are used for vertical and horizontal deflection circuits. High voltages for the cathode ray tube anodes are furnished by an RF (high voltage) oscillator V14 (6V6GT) and rectified by a high voltage rectifier V13 (1B3GT/8016).

C. The audio output stage, V4 (6AS5) functions as an output stage, voltage dropping, and voltage regulating tube. Conduction current through this tube is in series with B plus voltage supply to other tubes.

The section on "Waveform Analysis" in this (19A1) manual will also be helpful.

ELIMINATION OF AUDIO BUZZ

The "Inter-carrier Sound System" used in the 19A1 circuit may cause a buzzing sound (not HUM) under certain conditions. Buzzing sound is the result of amplitude modulation (picture modulation) being superimposed on the 4.5 MC beat FM IF carrier to such an extent that it is impossible for the ratio detector to remove this amplitude modulation completely.

Some of the conditions which may produce a buzzing sound are given below. Corrective measures which may be applied in the customers home are also listed below.

The most common causes of buzzing sound are improper setting of the Sharp Tuning control, and the Contrast control being too far advanced (clockwise). Merely turn down the contrast or tune the Sharp Tuning control for best picture definition. Under normal conditions, the sound will be free of audio buzz at this point.

Audio buzz can also be caused by slight misalignment of the oscillator coils for a particular channel. Oscillator adjustment (for individual channels) can easily be made without removing the chassis from the cabinet. This adjustment must be made while receiving a transmitted television station test pattern or program, and should be performed as follows:

Touch-up of Oscillator Slug Adjustments (for individual channels).

a. Allow 30 minutes for set to warm up.

b. Remove Channel and Sharp Tuning knobs.

c. Remove channel-indicating escutcheon: For plastic cabinets, pry the channel-indicating escutcheon away evenly (with fingernails or screwdriver) being careful not to break off the plastic mounting pins from the escutcheon. For wood cabinets, slide the escutcheon to the left, and pry the right side away from the cabinet.

d. Replace knobs after removing escutcheon. Set channel switch on station with test pattern or program. Set Contrast control for normal picture. Turn Sharp Tuning control completely to the left.

e. Insert NON-METALLIC screwdriver (1/8" blade and 7" length) in the 3/8" hole in cabinet at right of Sharp Tuning control. Tune oscillator slug for best defined picture with minimum buzz. Do this carefully as only a slight rotation in either direction of slug will be required.

If station buzz will not tune out completely with this adjustment, remaining buzz may be due to misalignment of ratio detector secondary. This adjustment can easily be made without removing the chassis from the cabinet. This adjustment must be made while receiving a transmitted television station test pattern or program, and should be performed as follows:

Touch-up of Ratio Detector Secondary.

NOTE: This adjustment needed on one channel only.

a. Tune station for normal picture or test pattern. Advance Contrast control until buzz is audible (full on or almost full on).

b. Insert NON-METALLIC screwdriver in 3/8" hole in center of cabinet bottom.

c. Adjust ratio detector secondary slug for maximum volume with minimum buzz. Do this carefully as only a slight rotation of the slug in either direction will be required. Correct point of adjustment is between the two maximum buzz peaks that can be noticed when turning the slug back and forth slightly in either direction.

d. If necessary, repeat 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 retune the ratio detector secondary after once correctly adjusting it as indicated above.

Buzzing sound may also be caused by misalignment of the IF coils. It may be necessary to perform the "IF Amplifier Alignment".

CLEANING PICTURE WINDOW: The picture window should be cleaned only with a dampened chamois or a soft, lint-free cloth, with as little rubbing as possible.

Do not use cleaners or solvents of any kind. Cleaners and solvents such as kerosene, carbon tetrachloride and most of the kitchen-type cleaners may be injurious.

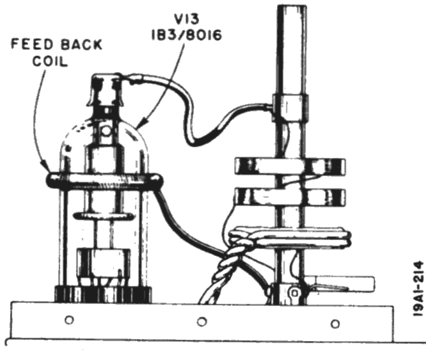


Figure 55. High Voltage Rectifier, Showing Feed Back Coil.

If electrolytic condenser C5 opens or its capacity decreases substantially, audio buzz may be apparent.

Buzzing sound (usually momentary) can also be caused by a drop in transmission level of the video carrier at the transmitter. Naturally, this can not be compensated for by adjustment of the receiver.

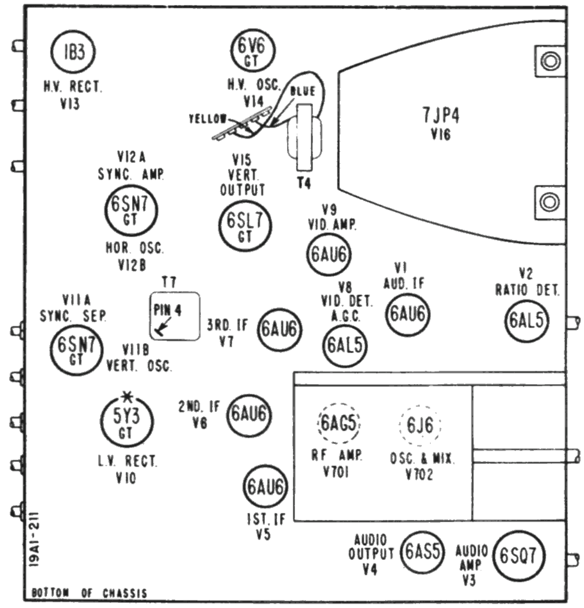


Figure 56. Bottom View of Chassis.

PRODUCTION CHANGES

VERTICAL OSCILLATOR CIRCUIT

Changes have been made in the vertical oscillator circuit in later production. The late production circuit is shown in the schematic, figure 59. The parts list on pages 18 and 19 also show the late production components. The adjoining illustration, figure 54, shows the early production circuit.

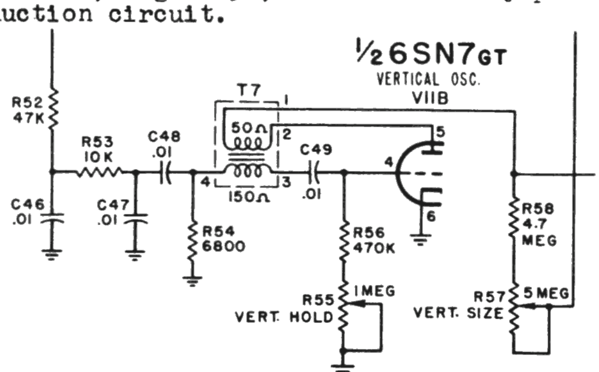


Figure 54. Vertical Oscillator Circuit, Early Production.

94C8-1 TUNER DETENT CHANGE

The mechanical dimensions of parts in the detent mechanism of the 94C8-1 Tuner have been changed slightly in later production. See figure 33 and "94C8-1 Tuner Parts List". In addition to the differences indicated in the parts list, the detent cut-out (left side of tuner chassis) is 1-1/16" longer than the cut-out in the early production tuner chassis.

LOW VOLTAGE RECTIFIER

A small quantity of 5U4G rectifier tubes have been used instead of the 5Y3GT rectifier originally specified for the 19A1 chassis. These tubes were used because some of the power transformers (supplied by several sources) were slightly different electrically. However, these transformers are carried under the same part number 80B13. The transformer used with the 5U4G rectifier has a red dot on the laminations. (A very small number of these transformers were first used without the identifying red dot.) The transformer used with the 5Y3GT rectifier has no red dot.

When servicing power transformer T6 or the low voltage rectifier tube, be sure to use the correct tube for the transformer used. If a 5Y3GT rectifier tube is substituted for the 5U4G normally used with the "red dot" power transformer, the DC output voltage on pin #8 of the rectifier will be approximately 220 volts. This is approximately 30 volts below the normal operating voltage. For this reason, a 5Y3GT tube should not be used with a transformer designed for use with a 5U4G. Also, a 5U4G tube should not be used with a transformer designed for use with a 5Y3GT.

Since it may sometimes be impossible to recognize transformers from the original markings, the above voltage check will identify the transformer. A second check is a resistance check, across the high voltage winding, made between pin #4 and pin #6 of the rectifier tube. A resistance reading of approximately 175 ohms indicates a transformer designed for use with a 5Y3GT rectifier tube. A resistance reading of approximately 150 ohms indicates a transformer designed for use with a 5U4G rectifier tube.

19A1 CHASSIS PARTS LIST

Symbol	RESISTORS	Part No.
R1	82 Ohms, 1/2 Watt	60B 28-31
R2	6,800 Ohms, 2 Watt	60B 28-27
R3	4,700 Ohms, 2 Watt	60B 28-26
R4	390 Ohms, 1/2 Watt	60B 8-391
R5	10,000 Ohms, 1/2 Watt, 5%	60B 7-103
R6	10,000 Ohms, 1/2 Watt, 5%	60B 7-103
R7	Volume Control & Switch, 1 Megohm	75B 1-27
R8	33,000 Ohms, 1/2 Watt	60B 8-333
R9	4.7 Megohms, 1/2 Watt	60B 8-475
R10	270,000 Ohms, 1/2 Watt	60B 8-274
R11	220,000 Ohms, 1/2 Watt	60B 8-224
R12	470,000 Ohms, 1/2 Watt, 5%	60B 7-474
R13	560,000 Ohms, 1/2 Watt, 5%	60B 7-564
R14	180 Ohms, 1 Watt	60B 14-181
R15	10,000 Ohms, 1/2 Watt, 5%	60B 7-103
R16	82 Ohms, 1/2 Watt	60B 28-31
R17	220 Ohms, 1/2 Watt	60B 8-221
R18	220 Ohms, 1/2 Watt	60B 8-221
R19	10,000 Ohms, 1/2 Watt, 5%	60B 7-103
R20	1,000 Ohms, 1/2 Watt	60B 8-102
R21	82 Ohms, 1/2 Watt	60B 28-31
R22	1,000 Ohms, 1/2 Watt	60B 8-102
R23	10,000 Ohms, 1/2 Watt, 5% (Was 27,000 in early production)	60B 28-40
R24	150 Ohms, 1/2 Watt	60B 8-151
R25	1,000 Ohms, 1/2 Watt	60B 8-102
R26	560,000 Ohms, 1/2 Watt	60B 8-564
R27	680,000 Ohms, 1/2 Watt	60B 8-684
R28	39,000 Ohms, 1/2 Watt	60B 8-393
R29	33,000 Ohms, 1/2 Watt	Part of L7
R30	8,200 Ohms, 1/2 Watt	Part of L8
R31	8,200 Ohms, 1/2 Watt	60B 8-822
R32	1 Megohm, 1/2 Watt	60B 8-105
R33	Contrast Control, 1,000 Ohms	75A 14-1
R34	33 Ohms, 1/2 Watt	60B 28-30
R35	33,000 Ohms, 1/2 Watt	Part of L9
R36	8,200 Ohms, 2 Watt	60B 28-28
R37	10,000 Ohms, 1/2 Watt	60B 8-103
R38	2.7 Megohms, 1/2 Watt	60B 8-275
R39	1 Megohm, 1/2 Watt	60B 8-105
R40	10,000 Ohms, 1/2 Watt	60B 8-103
R41	12,000 Ohms, 2 Watt	60B 20-123
R42	39,000 Ohms, 1 Watt	60B 14-393
R43	39,000 Ohms, 1/2 Watt	60B 8-393
R44	10,000 Ohms, 1/2 Watt	60B 8-103
R45	Horizontal Hold, 20,000 Ohms	75A 13-5
R46	Horizontal Size Control, 20,000 Ohms	75A 13-5
R47	1 Megohm, 1/2 Watt	60B 8-105
R48	Brightness Control, 1 Megohm	75A 13-6
R49	180,000 Ohms, 1/2 Watt	60B 8-184
R50	100 Ohms, 1 Watt	60B 14-101
R51	5,600 Ohms, 1/2 Watt	60B 8-562
*R52	100,000 Ohms, 1/2 Watt	60B 8-104
R53	10,000 Ohms, 1/2 Watt	60B 8-103
*R54	6,800 Ohms, 1/2 Watt	60B 8-682
R55	Vertical Hold Control, 1 Megohm	75A 13-6
*R56	680,000 Ohms, 1/2 Watt	60B 8-684
R57	Vertical Size Control, 5 Megohms	75A 13-4
*R58	2.7 Megohms, 1/2 Watt	60B 8-275
R59	10 Megohms, 1/2 Watt, 10%	60B 8-106
R60	10 Megohms, 1/2 Watt	60B 8-106
R61	10 Megohms, 1/2 Watt, 10%	60B 8-106
R62	100,000 Ohms, 1/2 Watt	60B 8-104
R63	10 Megohms, 1/2 Watt	60B 8-106
R64	4.7 Megohms, 1 Watt	60B 14-475
R65	4.7 Megohms, 1 Watt	60B 14-475
R66	4.7 Megohms, 1/2 Watt	60B 28-29
R67	4.7 Megohms, 1/2 Watt	60B 28-29
R68	10,000 Ohms, 1/2 Watt	60B 8-103
R69	Vertical Centering Control, 2 Megohms (tapped at 1 Megohm)	75B 2-11
R70	Horizontal Centering Control, 2 Megohms (tapped at 1 Megohm)	75B 2-11
R71	4.7 Megohms, 1/2 Watt	60B 28-29
R72	4.7 Megohms, 1/2 Watt	60B 28-29
R73	2.2 Megohms, 1 Watt	60B 28-25
R74	2.2 Megohms, 1 Watt	60B 28-25
R75	2.2 Megohms, 1 Watt	60B 28-25
R76	2.2 Megohms, 1 Watt	60B 28-25
R77	1 Megohm, 1 Watt	60B 28-24
R78	Focus Control, 2.5 Megohms	75B 1-28
R79	1 Megohm, 1 Watt	60B 28-24
*R80	2.7 Megohms, 1/2 Watt	60B 8-275
*R81	47,000 Ohms, 1/2 Watt	60B 8-473

* See "PRODUCTION CHANGES"

Symbol	CONDENSERS	Part No.
C1	75 mmfd. -150 Temp. Coeff., Silver Ceramic	98A 47-1
C2	.005 mfd., min., Ceramic	65A 10-1
C3	.005 mfd., min., Ceramic	65A 10-1
C4	180 mmfd., ±5%, ±.00003 Temp. Coeff., Ceramic	65B 6-59
C5	4 mfd., 150 Volts, Elect.	67A 4-2
C6	500 mmfd., Ceramic	65B 6-6
C7	.005 mfd., 600 Volts, Paper	64B 5-12
C8	.005 mfd., 600 Volts. Paper	64B 5-12

C9	.002 mfd., 600 Volts, Paper	64B 5-14
C10	.05 mfd., 400 Volts, Paper	64B 5-22
C11	.001 mfd. min., Ceramic	65B 6-41
C12	.005 mfd., 600 Volts, Paper	64B 5-12
C13a	30 mfd., 150 Volts) Elect.	67A 10
C13b	50 mfd., 150 Volts)	
C14	.02 mfd., 600 Volts, Paper	64B 5-9
C15	.001 mfd. min., Ceramic	65B 6-41
C16	.001 mfd. min., Ceramic	65B 6-41
C17	.001 mfd. min., Ceramic	65B 6-41
C18	.001 mfd. min., Ceramic	65B 6-41
C19	.001 mfd. min., Ceramic	65B 6-41
C20	.001 mfd. min., Ceramic	65B 6-41
C21	.001 mfd. min., Ceramic	65B 6-41
C22	.005 mfd. min., Ceramic	65A 10-1
C23	.001 mfd. min., Ceramic	65B 6-41
C24	.001 mfd. min., Ceramic	65B 6-41
C25	120 mmfd., Ceramic	65B 6-66
C26	.25 mfd., 200 Volts, Paper	64B 5-28
C27	5 mmfd., Ceramic	65B 6-61
C28	.001 mfd. min., Ceramic	65B 6-41
C29	.1 mfd., 200 Volts, Paper	64B 5-30
C30	2 mmfd. ±.5 mmfd. Zero Temp. Coeff., Ceramic	65B 6-58
C31	.005 mfd. min., Ceramic	65A 10-1
C32a	20 mfd., 350 Volts)	
C32b	30 mfd., 350 Volts) Elect.	67C 7-13
C32c	30 mfd., 350 Volts)	
C33	.05 mfd., 400 Volts, Paper	64B 5-22
C34	.05 mfd., 400 Volts, Paper	64B 5-22
C35	50 mmfd., Ceramic	65B 6-4
C36	.01 mfd., 400 Volts, Paper	64B 5-25
C37	.001 mfd., 1,000 Volts, Mica	65B 1-56
C38	.001 mfd., 6,000 Volts, Oil Impreg.	64A 7-2
C39	.001 mfd., 1,000 Volts, Mica	65B 1-56
C40	.001 mfd., 6,000 Volts, Oil Impreg.	64A 7-2
C41	.001 mfd. min., Ceramic	65B 6-41
C42	.001 mfd. min., Ceramic	65B 6-41
C43	.05 mfd., 400 Volts, Paper	64B 5-22
C44	.05 mfd., 400 Volts, Paper	64B 5-22
C45	.0013 mfd., 1,000 Volts Silver Mica ±2%	98A 47-2
C46	.01 mfd., 400 Volts, Paper, 10%	64B 5-25
C47	.01 mfd., 400 Volts, Paper, 10%	64B 5-25
*C48	.01 mfd., 400 Volts, Paper, 10%	64B 5-25
C49	.01 mfd., 400 Volts, Paper	64B 5-25
C50	.05 mfd., 400 Volts, Paper	64B 5-22
C51	.1 mfd., 600 Volts, Paper, 20%	64B 5-5
C52	100 mmfd., Ceramic, 10%	65B 6-60
C53	.004 mfd., 600 Volts, Paper	65A 13-2
C54	.005 mfd, 6000 V, Oil Impreg.	64A7-1
C55	.005 mfd, 6000 V, Oil Impreg.	64A7-1
C56	.005 mfd, 6000 V, Oil Impreg.	64A7-1

Symbol	COILS, TRANSFORMERS, ETC.	Part No.
L1	Coil, Sound IF	72A 60-1
L2	Coil, Video IF	72A 59-1
L3	Coil, Video IF	72A 59-1
L4	Coil, IF Grid (Yellow dot)	AA139-4
L5	Coil, IF Plate (Yellow dot)	AA139-4
L6	Coil, Video IF	72A 59-1
L7	Coil, Peaking (145 millihenrys wound on R29) Blue dot	AA139-7
L8	Coil, Peaking (516 millihenrys wound on R30) Violet dot	AA139-8
L9	Coil, Peaking (520 millihenrys wound on R35) Gray dot	AA139-9
L10	Coil, Peaking (Green dot)	AA139-6
L11	Choke, Filter	74A 13
L12	Choke, RF	AB103-1
L13	Choke, Filament	73A 2-2
T1	Transformer, Ratio Detector	72B 68
T2	Transformer, Audio Output	79A 13
T3	Transformer, Blocking Oscillator	69B 70
T4	Transformer, Hor. Sweep Output	79B 15
T5	Transformer, H. V. Oscillator	69B 64
*T6	Transformer, Power	80B 13
T7	Transformer, Blocking Oscillator	69B 70
SW1	On-Off Switch	Part of R7

Description	CABINET PARTS	Part No.
Cabinet		
19A11, Plastic Mahogany		34D 23
19A12, Plastic Ebony		34D 23-1
19A15, Wood Walnut		35E 94
Cartons and Fillers		
for Plastic Cabinet		44B 119
for Wood Cabinet		44B 128
Escutcheon, Plastic (Picture Tube)		23C 34
Escutcheon, Tuner		
for 19A11 with 94C8-1 Tuner		23B 38
for 19A12 with 94C8-1 Tuner		23B 38-1
for 19A15 with 94C8-1 Tuner		23B 43
Knob, Contrast or Volume		
for 19A11, 19A15		33A 13-4
for 19A12		33A 13-5
Knob, Channel		
for 19A11, 19A15		33C 28-13
for 19A12		33C 28-31
Knob, Sharp Tuning		
for 19A11		33C 28-33
for 19A12		33C 28-34
for 19A15		33C 28-14
Mask, Tube (Sponge Rubber)		12C 19
Ring, Compression (for Channel Knob)		18A 5-3
Spring, Tuner Escutcheon (19A15)		18A 48
Spring, Tuner Escutcheon (19A11, 19A12)		18A 18-1
Strip, Escutcheon Retaining		15A 352
Washer, Felt (for knobs)		5A 4-2

Description	MISCELLANEOUS	Part No.
M1	Socket, Speaker	88A 5-6
M2	Plug, Speaker	88A 5-4
M3	Speaker, 5" PM, less output trans.	78B 40
M4	Linecord and Socket, Interlock	89A 22-1
M5	Plug, AC Interlock	89A 22-2
M6	Spring, Feedback (for V13)	19A 36
Back, Cabinet (includes linecord)		A1783
Baffle Board, Speaker		43B 56
Bracket, L.H. Picture Tube Support		15A 351-1
Bracket, R.H. Picture Tube Support		15A 351-2
Bracket, Tube Mounting		15A 350
Bumper, Picture Tube Rubber		12A 7-1
Clamp, Picture Tube Mounting		15A410
Cover Assembly, Shield (for H.V. Osc.)		A1326
Nut, Speed (Baffle Board Mounting)		2B 10-21-68
Plate, H.V. Mounting		A1804
Plate, Insulating (for H.V. Osc.)		32A 77
Plate, RF Tuner Adapter (for 94C8-1 Tuner)		15B 360
Shield Assembly, Picture Tube		AB151
Socket, Miniature Tube		87A 3-7
Socket, Octal Tube		87A 5-1
Socket, Tube (for 7JP4)		87B 26-1
Socket, Ring Mount Octal Tube (for 1B3)		87A 20-1
Spring, Shield Clamping (for Picture Tube)		19A 43-1
Strap, Webbing (for Picture Tube)		50A 3-2
Rubber Strip (top of Picture Tube)		12A 5-6
Tab, Webbing End (for Picture Tube)		15A 361
Terminal Strip, Antenna		10A 6-2
Tuner, RF (Turret type complete)		94C 8-1

VOLTAGE DATA

- All measurements made with vacuum tube voltmeter.
- Contrast control full on. All rear controls set at approximately half rotation (usual setting for normal picture).
- Transmission line disconnected from set receiver.
- Channel switch on channel 2.
- Line voltage 117 volts, 60 cycles.
- Proper filament voltage check of V13 (1B3/8016) tube can be made by observing filament brilliancy as compared with that obtained with a 1.5 volt dry cell battery.

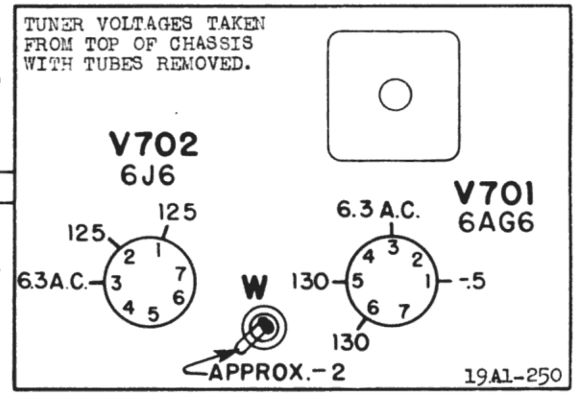
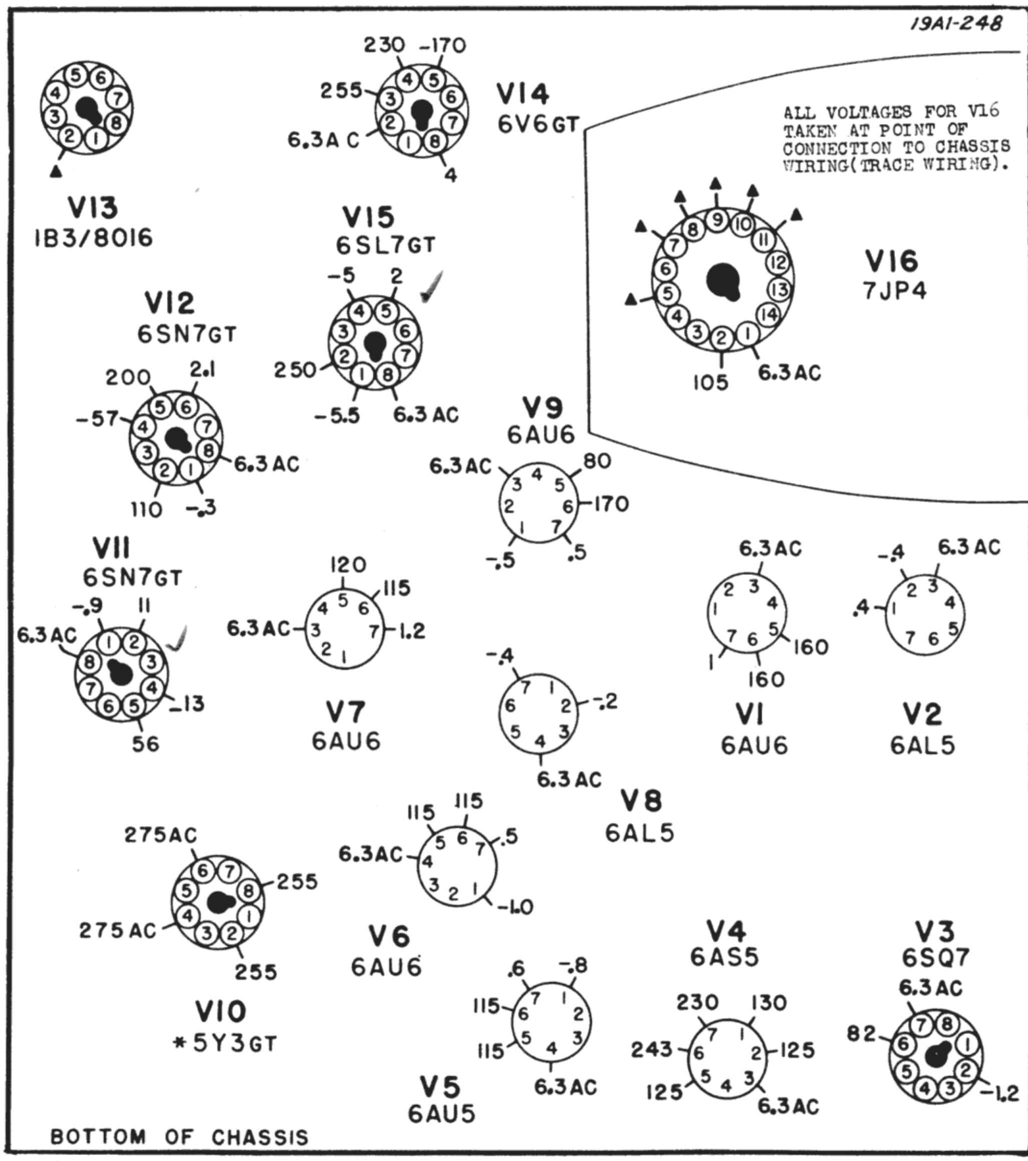


Figure 57. 9408-1 Tuner Voltage Diagram.



* 5U4G ALSO USED: SEE PRODUCTION CHANGES, PAGE 17.

▲ HIGH VOLTAGES: DO NOT USE ORDINARY TEST EQUIPMENT. 6500 VOLTS AT PIN 2 OF V13. 2000 VOLTS AT PIN 5 OF V16. 6000 VOLTS AT PINS 7, 8, 9, 10 AND 11 OF V16.

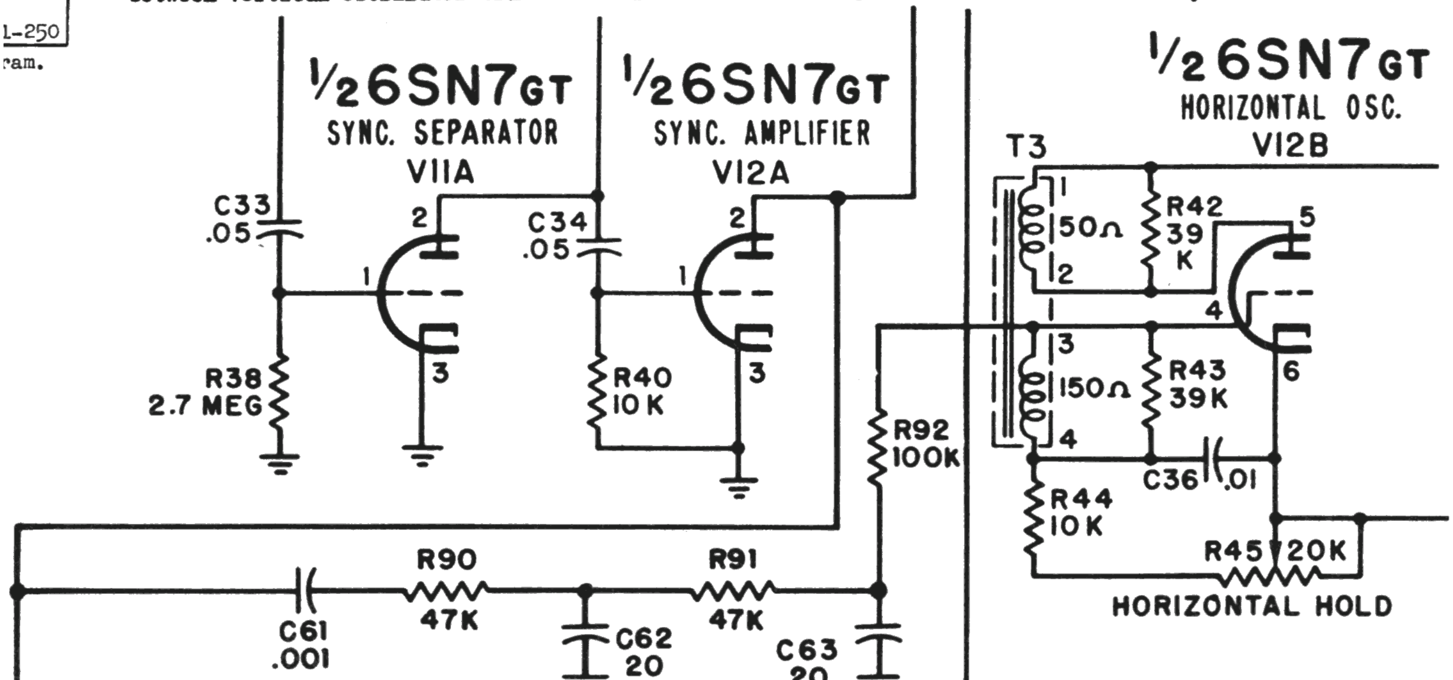
Figure 58. Chassis Voltage Diagram.

19A1 CHASSIS PRODUCTION CHANGE

Vertical lines in the picture appear jagged or broken if high frequency noise signals reach the Horizontal Oscillator. This interference appears in areas having low signal strength and a high noise level. This condition can be corrected by insertion of a noise filter between the Sync Amplifier and Horizontal Oscillator. Production has been changed to include such a filter in the 19A1 chassis.

If this interference condition is encountered in a chassis, a horizontal sync filter can be installed after removing capacitor C35. All parts, with the exception of C61, must be mounted on a tie strip. The tie-strip can best be mounted under the chassis between vertical oscillator transformer T7 and third IF amplifier V7. See Figure 56, Bottom View of Chassis, page 17 in the 19A1 service manual for physical placement. The lead dress and placement of a few small parts will have to be altered slightly to permit mounting the tie-strip. C61 should be connected between terminal 2 of V12 and the tie-strip. Dress the leads from C61 to avoid shorts.

NOTE: When the above circuit modification is incorporated in the 19A1 chassis, adjustment of the Horizontal Hold control is critical. This adjustment must be carefully made and checked on all channels currently in use. However, once set, readjustment is seldom necessary.



HORIZONTAL SYNC FILTER CIRCUIT

PARTS REQUIRED FOR HORIZONTAL SYNC FILTER

Symbol	Description	Part No.
R90	47,000 ohms, 1/2 Watt...	60B 8-473
R91	47,000 ohms, 1/2 Watt...	60B 8-473
R92	100,000 ohms, 1/2 Watt...	60B 8-104
C61	.001 mfd., Ceramic....	65B 6-41
C62	20 mmfd., Ceramic....	65B 6-26
C63	20 mmfd., Ceramic.....	65B 6-26
	Tie-strip, 5 terminal.	10B 1-55

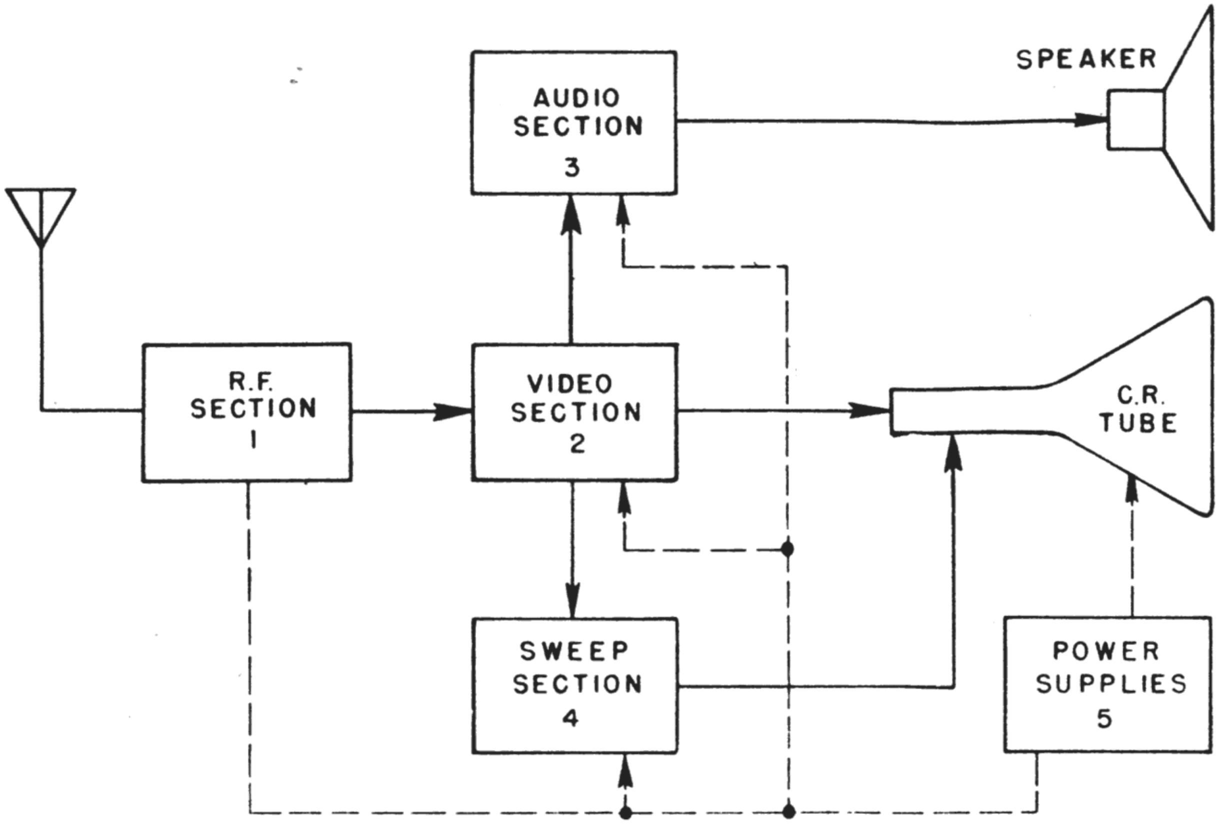
19A1 CIRCUIT DESCRIPTION AND TROUBLE SHOOTING CHARTS.

SECTIONAL CIRCUIT FUNCTION. A block diagram of the five major sections in the Admiral 19A1 television receiver is shown below. The RF section (Section 1) amplifies the audio and video carriers, and converts them to their respective intermediate frequencies. The video section (Section 2) consists of a broad band IF amplifier, video detector and video amplifier circuit. The audio section (Section 3) consists of an IF amplifier, FM ratio detector and an audio amplifier circuit. The sweep section (Section 4) contains the horizontal and vertical sweep and sync circuits. The power supply section (Section 5) supplies the necessary voltages for operation of the various tubes and circuits in the other sections of the receiver. Figure 23 (19A1 Manual) is a functional block diagram of the Admiral 19A1.

RF SECTION 1.

RF Amplifier. Center-tapped primary winding L701A (See schematic, Figure 59) provides for a balanced 300 ohm input to the receiver. Loading resistor R701 is connected across secondary L701B to obtain the required bandpass. L701B is tuned by V701 input capacity in series with the parallel combination of C701 and C702. Trimmer C702 is used for alignment. Primary coil L702A is the plate load of RF Amplifier V701. R703 is used to broaden the response of the circuit. The parallel combination of C704 and tube output capacity acts in series with C705 to tune L702A. Trimmer C704 is used for alignment.

A different set of coils (L701 and L702) is switched into the circuit for each television channel by means of a turret assembly.



19A1 SECTIONAL BLOCK DIAGRAM

Mixer. Secondary coil L702B feeds the RF and oscillator injection voltages to the grid of the mixer, one triode section of V702. C706, R705 and R706 develop grid-leak bias for the mixer. Two resistors are used in this circuit to permit bringing out the junction as an alignment test point. A test scope c can be connected to this point ("W") without materially affecting the operation of the circuit. C707 is used for alignment of the mixer.

Mixer plate load resistor R711 is by-passed by C721 in order to limit regenerative feedback in the mixer. L711 and C722 form a series resonant coupling circuit between the mixer and the first Video and sound IF amplifier (V5).

H. F. Oscillator. Oscillator coil L702C is inductively coupled to the mixer grid for oscillator injection. Condenser C709 is in series with the parallel combination of C710 and C711 to form the split condenser of a Colpitts Oscillator. C710 permits oscillator alignment. C711 is a variable dielectric type of condenser used as a Sharp Tuning Control. R707 and C708 develop grid-leak bias for the oscillator tube, half of a 6J6. (The functions of an oscillator and a mixer are combined in a single type 6j6 dual triode tube). R708 is used to shunt-feed the Colpitts oscillator plate.

VIDEO SECTION 2.

Video and Sound IF Amplifiers. The first IF stage is a conventional impedance-capacity coupled circuit. R15 is the grid return resistor. This stage as well as the RF amplifier and second IF stage, has AGC voltage applied to its grid. Cathode bias resistor R16 is left unbypassed to prevent circuit instability. L2 is the plate load and is one of the tuned circuits in the stagger-tuned IF system. Tube, stray circuit and distributed capacity result in resonance at the desired frequency.

The second IF stage is essentially the same as the first. Plate load L3 is tuned to a different frequency than was L2.

Due to greater signal amplitude, grid current is probable in the third IF stage. L4 is used as a DC grid return for this reason. R23 is used to broaden the response of the stage (a high peak in the IF responsecurve would otherwise result due to the high circuit "Q".) Grid return resistors serve to broaden the response in preceding stages. Plate load L5 is untuned since a tuned circuit is used in the Video Detector. No loading resistor is required in this coupling circuit since loading is provided by the Video Detector. A resistor might have been used as a plate load for the third IF stage except that it would reduce the plate voltage and gain of the stage.

Video Detector and AGC. One section of a 6AL5 duodiode is used as a Video Detector. C27 is the IF bypass for the frequency compensated load circuit. A "constant K filter" consisting of L7, L8, R29, R30 and R31 is used as a frequency compensated load for the Video Detector. Series-peaking coil L7 separates the Video Detector output and Video Amplifier input capacities. The load resistance R31 can then be increased without loss of high frequency response. Increased video gain results. High frequency response is also improved by the use of shunt-peaking coil L8. Reduction in load impedance due to tube and circuit capacity is compensated for by the increase in impedance resulting from the presence of L8 in the load circuit. Resistor shunts are used across the peaking coils to eliminate self-resonance effects. While high frequency compensation might be accomplished by the use of one type of peaking coil, the use of both series and shunt peaking results in a minimum of phase distortion.

Phase distortion and poor low frequency response have been kept at a minimum by the use of large values of coupling capacity and grid return resistance. C29 and R32 are sufficiently large for this purpose.

Although the IF amplifier gain is quite low at 21.25 mc., both the audio and video IF carriers appear at the Video Detector. The Video Detector acts as a diode mixer for these two signal frequencies. Dual conversion is actually used for audio reception since a 4.5 mc. audio IF signal is obtained from this mixer action in the Video Detector. The Video Detector then serves as a Video Detector and Audio mixer. Both the detected video signal and the 4.5 mc. audio IF signal are fed to the input of the Video Amplifier.

The second section of the 6AL5 duo-diode is used as an AGC rectifier. Coupling condenser C25 and load resistor R27 have been so chosen that the AGC voltage developed is proportional to the peak RF signal input. The sync pulses represent peak or 100% carrier power in a television transmitter. Since the sync pulse level is a constant at the transmitter, it must represent a peak RF signal at the receiver that is proportional to signal strength. The AGC voltage developed must then be proportional to signal strength. (Average carrier level is not indicative of signal strength since it is controlled by background illumination in the scene being televised).

Contrast control is accomplished by adjustment of the delay voltage applied to the cathode of the cathode of the AGC diode. A positive delay voltage is obtained from a voltage divider consisting of R28, and Contrast Control R33. The greater the delay voltage applied to the AGC diode, the greater the signal required to develop an appreciable AGC voltage. Fur her contrast control range is obtained by using the Contrast Control as a rheostat in the cathode of the Video Amplifier stage as well as in the AGC delay voltage divider. C28 is the cathode bypass for the AGC diode.

Video Amplifier. Contrast control R33 is connected in the cathode circuit of the Video Amplifier in order to permit some adjustment of the video gain. (Since grid return resistor R32 is not returned to ground, no bias variation on the grid of the Video Amplifier results due to changes in the Contrast control setting). Inverse feedback is obtained by omission of the bypass condenser which would otherwise be connected across R34. A constant K filter is used as a plate load, the values being only slightly different from the one in the Video Detector. Slight differences are necessary due to the difference in coupling condenser C43 (smaller capacity than C29) and the effects of the 4.5 mc. Audio IF coupling circuit.

The Video Amplifier output is coupled to the cathode of picture tube V16 instead of the grid since the output of the Video Amplifier is negative picture phase. (While positive picture phase is required to feed the grid of a picture tube, negative picture phase must be used to feed the cathode).

AUDIO SECTION 3..

Audio IF Amplifier. Condenser C30 is the coupling condenser between the Video Amplifier plate and the grid of the 4.5 mc. Audio IF Amplifier. The tuned circuit consisting of L1 and C1 tunes the grid of the Audio IF Amplifier and also acts as 4.5 mc. absorbtion trap for the Video Amplifier. The Audio IF amplifier stage is a conventional cathode-biased circuit and feeds the primary of Ratio Detector transformer T1.

Ratio Detector. Although the ratio detector in the 19A1 chassis is only slightly modified from those used in previous Admiral FM and television circuits, its function is quite different.

The de-emphasis filter consists of R8 and C9. DC blocking condenser C8 couples the audio output of the ratio detector to volume control R7. This network serves as the output load for the ratio detector and is connected between point Z and ground. C6 is the IF bypass for this load.

Ratio Detector transformer T1 developes equal voltages at pins 7 and 5 (with respect to point Z) when the IF input signal is exactly 4.5 mc. The conduction path for the lower diode of V2 (during one half of the Audio IF input cycle) is from cathode (pin 5) to plate (pin 2), through R6 to ground, through the load circuit to point Z, through R4, through T1 from terminal 5 to terminal 4 and back to the cathode of V2. Since conduction was from ground to point Z, this conduction current will tend to cause point Z to become positive.

Tracing the conduction path for the upper diode of V2, conduction is from cathode (pin 1) to plate (pin 7), through T1 from terminal 3 to terminal 5, through R4, through the load circuit from Point Z to ground, through R5 and back to the cathode of V2. Since conduction was from point Z to ground, this conduction current will tend to cause point Z to become negative.

Since the applied voltages to the two diode sections of V2 are equal and their conduction currents flow through the load (between point Z and ground) in opposite directions, the conduction currents will cancel and point Z will assume ground potential.

If the Audio IF signal swings to a higher frequency (above 4.5mc.), the Audio IF voltage at pin 5 of V2 will increase while the voltage at pin 7 will decrease (this is the normal function of a discriminator or ratio detector transformer. The explanation of this action will not be presented here since it involves the use of vector analysis and can be found in several texts on FM). Conduction current of the lower section of V2 will be greater than that of the other section and will cause Point Z to swing positive. Conversely, if the Audio IF signal swings lower in frequency (below 4.5 mc.), the Audio IF voltage at pin 7 of V2 will increase while the voltage at pin 5 will decrease. Point Z will now swing negative. Successive increases and decreases in Audio IF signal frequency (above and below 4.5 mc.) cause Point Z to swing alternately positive and negative. Frequency modulation of the Audio IF signal is then converted into Audio.

With the preceding description of FM detection, our next concern is the method of obtaining limiter action (and AM noise rejection) in a ratio detector. The Audio IF signal voltage appears across C4 in the tuned secondary of ratio detector transformer T1. A conduction current will flow through V2 during positive half cycles of the Audio IF signal (from cathode pin 5 to plate pin 2, through R6 and R5, from cathode pin 1 to plate pin 7 and back to the other side of C4). This conduction current represents the normal load on T1 and is determined by average Audio-IF signal strength.

The voltage developed across R5 and R6 due to diode conduction current (as described in the preceding paragraph) is filtered by C5 and maintained at a value proportional to average Audio IF signal strength. The voltage across C5, plus the voltages across the two diode sections of V2, is equal to the voltage across C4 (during the time that diode conduction is taking place). If an amplitude noise pulse causes a momentary increase in the Audio IF signal voltage across C4, this added voltage must appear across the diodes of V2 since the voltage across C5 is unable to follow such rapid variations (The time constant of R5, R6 and C5 is 0.08 seconds). An increased conduction current flows and results in an increased load on T1. This increase in loading tends to reduce the Audio IF signal voltage to its average value.

Similarly, a momentary reduction in Audio IF signal voltage results in reduced voltages across the diodes of V2, reduced conduction current, reduced loading and tendency for the Audio IF signal voltage to come up to its average value.

This amplitude limiter action of a ratio detector may be summarized as follows: Audio IF signal amplitude variations are removed by connecting C5 across the tuned secondary of T1 through the diodes of V2.

A change in average signal amplitude, such as might take place when switching from one station to another, will cause the charge on C5 to assume a value proportional to the new average signal amplitude. The signal across C4 will now be limited at a new average amplitude and the audio output level from the Ratio Detector will change accordingly. (The audio output of the Ratio Detector is greater for strong signal inputs than it is for weaker signal inputs). However, AM noise rejection is obtained at all levels since the Ratio Detector automatically adjusts itself to the average signal amplitude and then rejects amplitude noise pulse variations.

Audio Amplifier. Audio amplifier V3 used a conventional circuit with the possible exception of the method of developing bias. Under static (no-signal) conditions, plate current is limited by plate load resistor R10 and contact bias developed across grid return resistor R9. With normal audio input voltages, operating bias is developed by the grid-leak action of C7 and R9. High frequencies above the useful audio range are removed by plate bypass C11.

Operation of 19A1 television chassis in the field. indicated a susceptibility to short wave interferance in the audio system. This was traced to signal rectification in the first audio grid (V3). A 50 mmfd. ceramic condenser (Part #65B6-4) was added to by-pass the first audio grid to ground This eliminated the interference. In order to restore the frequency response of the audio system, the value of C11 was reduced to 250 mmfd. (Part #65B6-5). This change has been made in production.

Audio Output. The plate and screen connections of Audio Output V4 are conventional. The cathode and grid connections are modified due to a special power supply arrangement. The plate voltage requirement of V4 is much less than the power supply output voltage. Tubes V701, V702, V5, V6, V7, V11A and voltage divider R28 and R33 require the same power supply current as V4 while also requiring a lower voltage than delivered by the power supply. V4 is connected in series with this parallel combination and the series-parallel circuit connected across the power supply. Thus, all these tubes are supplied with the proper current and voltage.

Since V4 is in series with the other tubes previously mentioned, a filter must be used to prevent interaction between circuits. This isolating filter consists of C13A, C13B and R14. C13A also serves as the cathode by-pass for V4.

Due to the supply connections previously described, the cathode of V4 is positive with respect to ground by a rather large amount. In order to maintain normal bias voltage on V4, a voltage divider across the power supply keeps the grid at a positive value with respect to ground . R12 and R13 form this divider. R13 also functions as a grid return resistor. Since the grid voltage is fixed by a voltage divider, any variation in cathode voltage will result in a change in bias on V4. This change in bias tends to bring the cathode voltage back to its original value by changing the conduction through V4. This provides voltage regulation for those tubes supplied from the cathode of V4. Coupling to the grid of V4 is accomplished by C12 in the usual manner.

SWEEP SECTION 4

Sync Separator. Coupling from Video Amplifier load resistor R36 to the grid of Sync Separator V11A is provided by R37, R89, C60 and C33. R37 prevents Sync Separator grid current from causing distortion of the video signal in the Video Amplifier load circuit. R89 and C60 form a high-pass filter to prevent low frequency noise pulses from triggering the Vertical Oscillator. C33 serves the normal function of a coupling condenser.

Since a negative picture phase signal is fed to the grid of the Sync Separator, the sync pulses are positive. These positive pulses cause grid current and develop grid-leak bias across R38.

The value of R38 is relatively high and a large bias voltage is developed. The positive sync pulses cause plate current flow in V11A while the picture signal is in the grid cut-off region. Only the sync pulses are passed on by the Sync Separator. This can be accomplished with relatively low signal input to the Sync Separator since low plate voltage supply and high plate load resistance are used.

Sync Amplifier. The Sync Amplifier is a conventional RC-Coupled Circuit with the exception that it has low operating bias. Approximately 0.8 volts of grid-leak bias is developeddacross R40 with a normal sync input signal. Since V12A is a pulse amplifier, this low value of bias is sufficient.

Horizontal Oscillator. The windings of oscillation transformer T3 are connected in a conventional manner in the grid and plate circuits of Horizontal Oscillator V12B. Damping Resistors R42 and R43 are connected across the plate and grid windings of T3. Grid-leak bias is developed by C36, R44 and Horizontal Hold Control R45. Horizontal Hold Control R45 adjusts the frequency of the Horizontal Oscillator by changing the time constant of the grid-leak bias circuit (as is done in most blocking oscillator circuits).

Horizontal sync pulses are coupled to a filter network by C61. The filter consisting of R90, R91, C62 and C63 is used to prevent high frequency (short duration) noise pulses from triggering the Horizontal Oscillator. Isolation resistor R92 prevents the filter network from affecting the operation of the Horizontal Oscillator. Differentiation is unnecessary at this point due to the peaked wave-form of the Sync Amplifier output.

Horizontal Size control R46 is in series with the plate supply of the oscillator and controls the charging rate of C39. Two windings are provided on horizontal output transformer T4 in order to obtain a balanced output for the horizontal deflector plates in the picture tube. One winding is in series with the primary of oscillation transformer T3 and is one section of the plate load. The other winding is in series with the cathode circuit and is also a section of the Horizontal Oscillator plate load. The output voltages across the two windings of T4 are of opposite phase and are coupled to the picture tube deflector plates by C38 and C40. C37 is required for symmetry and wave form correction.

Vertical Oscillator. Sync Amplifier V12A feeds an integrator filter as well as the filter in the grid circuit of Horizontal Oscillator V12B. The three-section integrator is made up of R52, R53, R54, C46, C47 and C48. R52 also prevents the integrator from severely attenuating the horizontal pulse output of the Sync Amplifier. The output of the integrator is coupled to the grid of the vertical blocking oscillator through the secondary of T7 and Condenser C49.

T7 is the Vertical Oscillator Oscillation Transformer. Resistor R81 provides damping for T7. Grid leak-bias is developed by R55, R56 and C49. Vertical Hold Control R55 adjusts the time constant of this bias circuit and the frequency of the oscillator. R57 and R58 form the plate load of the Vertical Oscillator. C51 is the wave forming condenser. Vertical Size Control R57 adjusts the charging rate of C51, and therefore, the peak voltage.

Vertical Output. A 6SL7 dual triode tube is used in the Vertical Output circuit in order to obtain a balanced vertical output to the picture tube vertical deflector plates. Due to its application, rather unusual component values are used in order to obtain the desired results.
Grid-leak bias is developed for V15A and V15B by R60 and R63, respectively..The use of R82 as a bias bleeder stabilizes the cathode bias voltage developed for V15A by R83.
The plate circuit of the Vertical Output amplifier is in series with the bleeder of the picture tube second anode supply. This results in very high peak plate voltages when the grid signal swings negative and provides the high sweep voltages required by the picture tube. Due to the limited plate current supply, plate load resistors R64 and R65 must be very high in value to develop the required sweep voltage output.
Vertical output amplifier V15A amplifies the sweep voltage and feeds it to one of the vertical deflector plates in the picture tube. A capacitive voltage divider consisting of C52 and C53 provides a portion of the output from V15A for driving the grid of phase inverter V15B. The attenuation of this divider system is equal to the voltage gain that can be obtained between grid and plate of V15B. Phase inverter V15B then feeds a sweep voltage of equal amplitude and opposite phase to the second vertical deflector plate in the picture tube The two sections of V15 thus provide a balanced sweep voltage feed to the vertical deflector plates of the picture tube.
Resistors R86, R87 and R88 form a voltage divider across the output of V15B. Vertical linearity control R88 adjusts the amount of feedback voltage used for waveform correction. Resistors R84 and R85 and the grid circuit input capacity form a filter that changes the waveform of the feedback voltage. The resultant of the normal input and feedback voltage waveforms can be adjusted by changing the amplitude of the feedback voltage. Adjustment of the feedback voltage by R88 provides linearity control in this manner. Condenser C58 is a DC blocking condenser.

POWER SUPPLY SECTION 5.

Low Voltage Rectifier. This power supply unit consists of a conventional full-wave rectifier and pi-type LC filter. RC decoupling filters are used where necessary to isolate various stages from the common power supply circuit. Due to the large load current, LC filtering is used for isolation purposes in the heater supply. L13, C41 and C42 are used in such a filter arrangement.

V701, V702, V4, V5, V6, V7 and V11A all require a supply voltage of about half that delivered by the Low Voltage Rectifier. It so happens that the current required by V4 is equal to the combined load currents of these other tubes, By connecting V4 in series with the parallel combination of these other tubes, they can be connected across the output of the Low Voltage Rectifier and filter system. This arrangement makes the most efficient use of th the line power consumed by the receiver and results in a lower AC power requirement.

High Voltage Rectifier. In order to get maximum output voltage from this circuit, the primary of oscillation transformer T5 is tuned to the same frequency as the self-resonant frequency of the secondary. The oscillator is therefore a tuned-grid, tuned-plate type of circuit. A "gimmick" provides capacitive coupling between the secondary of T5 and the grid of V14. The gimmick is in the form of a piano-wire clip around the bulb of V13.

The voltage dropping and negative feedback effects of R51 keep the plate current of V14 down without reducing the output of the High Voltage Rectifier below the required value. Oscillator voltage is kept out of other sections of the receiver by means of shielding and decoupling filter consisting of L12 and C44.

R68 and C56 are the High Voltage Rectifier output filter. R69, R70 and resistors R73 through R79 are all part of the bleeder circuit. The ground or return end of this bleeder is through the plate circuit of V15.

Picture Tube Connections. Focus Control R78 is used for adjustment of the picture tube first anode potential.

Brightness Control R48 is a voltage divider across the plate supply (Low Voltage Rectifier supply) and permits adjustment of the cathode bias on the picture tube. This cathode bias voltage is applied to the tube through R47 to permit coupling the video s signal to the cathode circuit.

C54 and R67 form the coupling circuit to one of the picture tube vertical deflector plates. The return end of R67 is connected to the center of Vertical Centering control R69. The return circuit of the other vertical deflector plate (R66) is connected to the arm of R69. The voltage on this plate can then be adjusted positive or negative with respect to the voltage on the other vertical deflector plate and vertical centering accomplished. The horizontal sweep and centering arrangement is the same as the vertical. The picture tube second anode is returned to the center of Vertical Centering control R69 in order that it may be at the same potential as the deflector plates. This eliminates stray Electrostatic fields between the second anode and the deflection system. Such stray fields would result in unwanted deflection and improper focus.

Note that the grid of the picture tube is grounded. This is done since cathode bias and an inverted input circuit are employed. The input signal can be applied between cathode and ground just as well as bias can be developed between cathode and ground. This is an adaptation of an "inverted amplifier" circuit.

19A1 TROUBLE SHOOTING

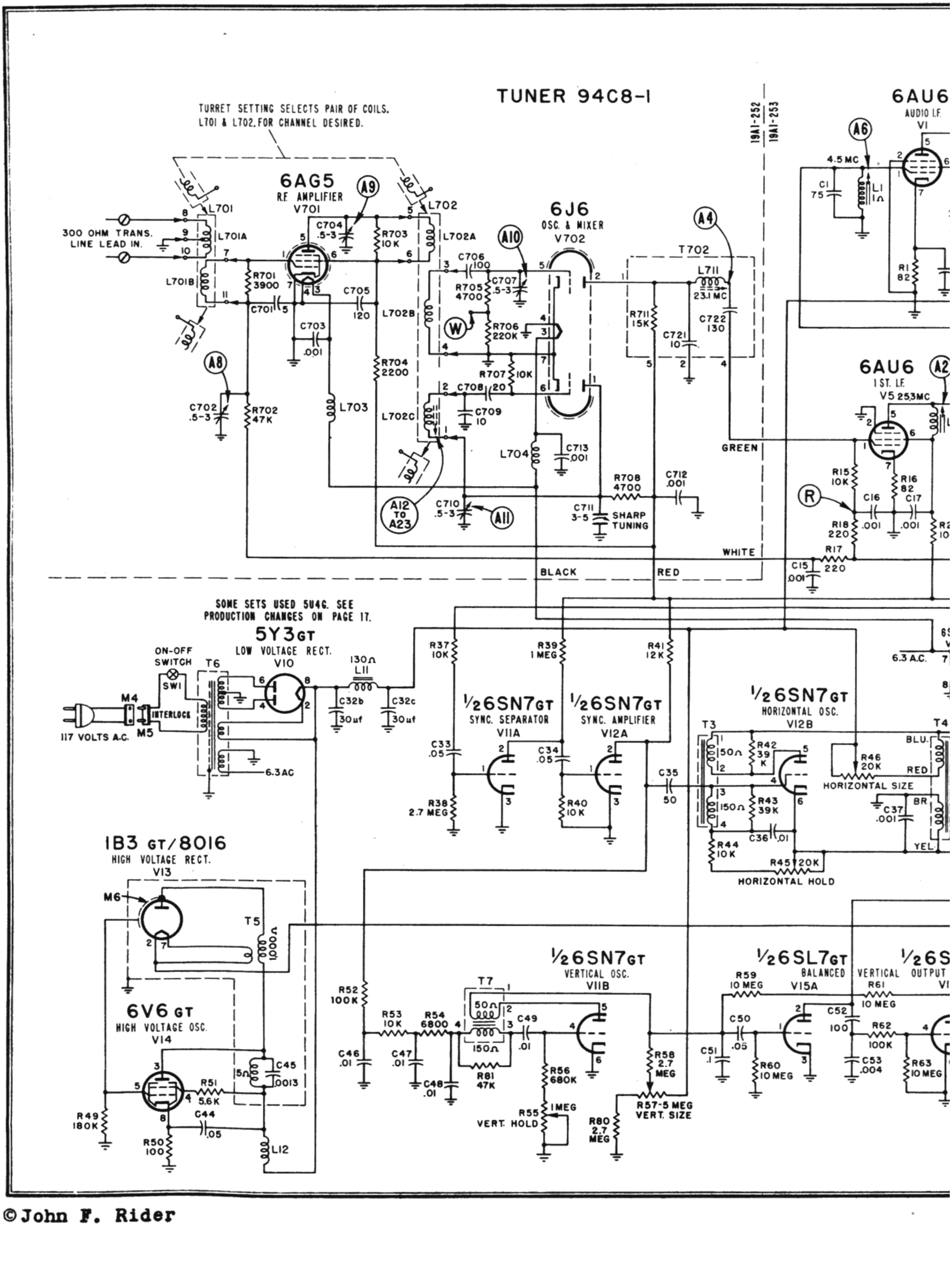
The following is a trouble shooting chart of possible troubles and the circuit sections most likely at fault. No attempt is made to cover all possible troubles. The chart is intended to be used in becoming familiar with the 19A1 chassis and formulating a logical trouble shooting procedure.

Symptoms	Check	Remarks
Dead receiver	a. Power line circuit. b. low voltage rectifier circuit (V10).	
No sound or picture. Raster OK.	a. RF tuner circuit (V701, V702). b. IF stages (V5 - V7). c. Video detector circuit (V8). d. Video amplifier circuit (V9). e. Audio output circuit (V4).	e. Dead tube or open circuit component.
No sound. Weak Video (insufficient contrast).	a. RF tuner circuit (V701, V702) b. IF stages (V5 - V7). c. Video detector circuit (V8). d. Video amplifier circuit (V9).	a. Alignment possible cause. b. Alignment possible cause. c. Open peaking coil. d. Open peaking coil.
No sound. Picture OK.	a. Audio IF stage (V1). b. Ratio detector circuit (V2). c. Audio amplifier circuit(V3). d. Audio output circuit (V4). e. Speaker	e. Open speaker voice coil.
Weak sound. Picture OK.	a. Audio IF stage (V1). b. Ratio detector circuit (V2). c. Audiio amplifier circuit (V3). d. Audio output circuit (V4). e. Speaker	a. Alignment. b. Alignment. e. Open voice coil.
Noisy sound. Picture OK.	a. Audio IF stage (V1). b. Ratio detector circuit (V2). c. Audio amplifier circuit (V3) d. Audio output circuit (V4). e. Speaker	a. Tube b. Tube, alignment. c. Tube. d. Tube. e. Intermittent speaker voice coil.
Station buzz in sound.	a. See page 16 of 19A1 Service Manual.	
Intermittent sound. Picture OK.	a. Audio IF stage (V1). b. Ratio detector circuit (V2). c. Audio amplifier circuit (V3). d. Audio output circuit (V4). e. Speaker	a. Tube b. Tube c. Tube d. Tube e. Intermittent speaker voice coil.
No raster. Sound OK.	a. Picture tube (V16). b. Brightness control circuit. c. 6 kv bleeder and centering circuit d. High voltage oscillator circuit (V14). e. High voltage rectifier circuit (V13).	a. Check by substitution. b. R47 or R48 open.

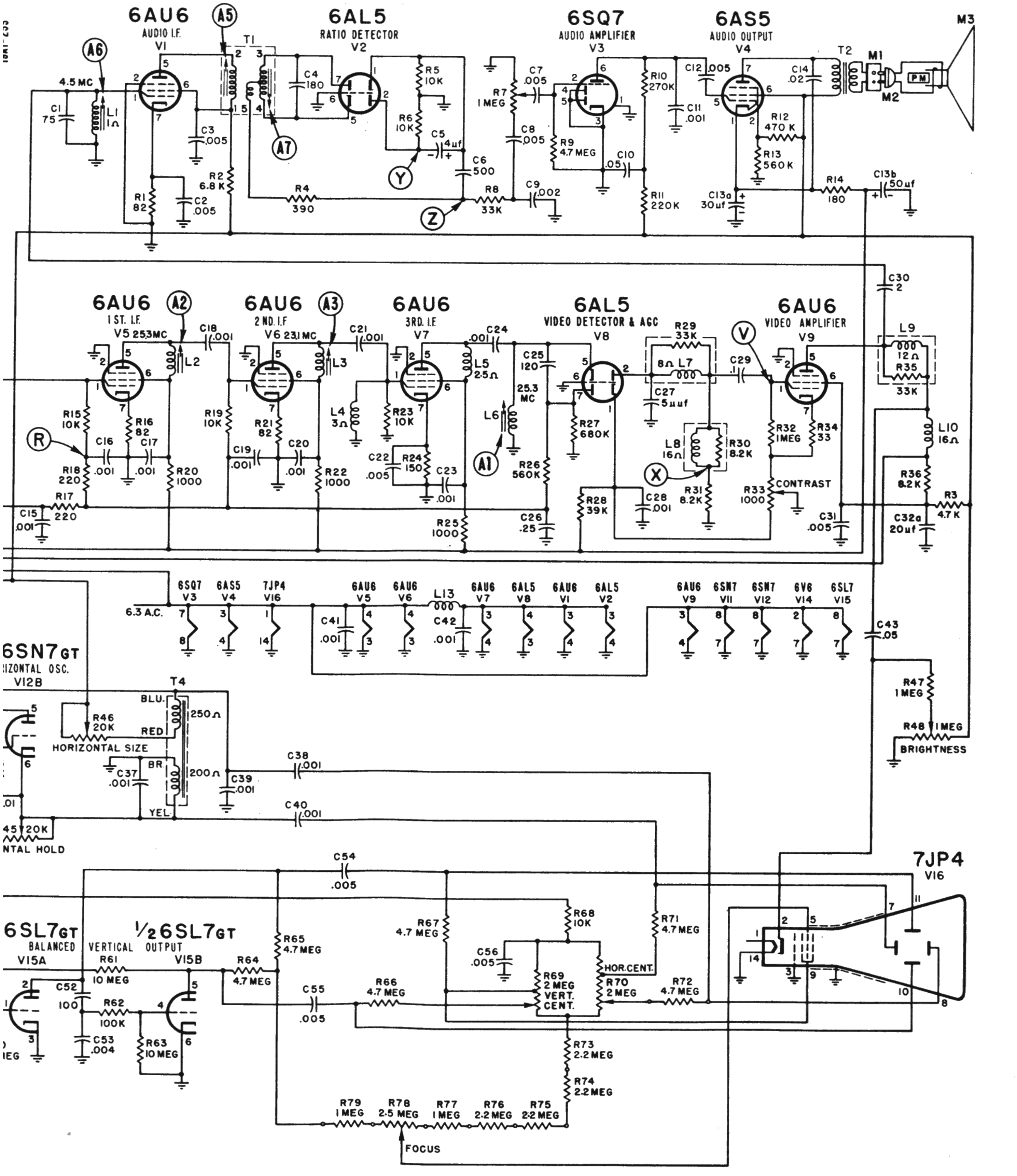
Symptoms	Check	Remarks
Intermittent raster. Sound OK.	a. Picture tube (V16). b. Brightness control circuit. c. 6 kv bleeder and centering circuit. d. High voltage oscillator circuit (V14). e. High voltage rectifier circuit (V13).	a. Check by substitution b. R47 or R48 intermittenly open.
Insufficient raster brilliance.	a. For low AC line voltage. b. Picture tube (V16). c. High voltage oscillator circuit (V14). d. High voltage rectifier circuit (V13). e. Low voltage rectifier circuit (V10).	b. Check by substitution c. Weak tube. Check feedback clip. (See figure 55 in 19A1 Manual). Check T5 for shorted turns. d. Weak tube. e. Weak tube. Wrong replacement (5Y3GT in set designed for a 5U4G. See page 17 of manual).
Tilted Raster	a. Picture tube position (V16).	a. Rotate tube axially.
Raster not centered.	a. Centering controls. b. Horizontal hold control adjustment. c. Condensers C38, C40, C54 and C55.	b. Improper sync can result in horizontal displacement. c. May be leaky.
Excessive raster size.	a. Height and width adjustments. b. 6 kv rectifier circuit (V13). c. High voltage oscillator circuit (V14).	b. and c. Check for low voltage output from 6kv supply.
Horizontal line. No raster.	a. Vertical oscillator circuit (V11B). b. Vertical output circuit (V15)	b. C50 may break off in shipment.
Insufficient raster width.	a. Horizontal oscillator circuit (V12B). b. Excessive high voltage (6 kv).	a. Replace V12 with RCA brand 6SN7. b. Adjust feedback clip. (see figure 55 in 19A1 Manual).
Vertical line. No raster.	a. Horizontal oscillator circuit (V12B).	a. Terminals on T3 shorted to chassis.
Insufficient raster height.	a. Vertical oscillator circuit (V11B). b. Vertical output circuit (V15A, V15B).	a. Change R58 to 2.2 meg. if no other cure can be effected.
Raster too small (insufficient height & width)	a. Height and width adjustments. b. Picture tube (V16).	b. May be gassy (also recognized by improper focus.
Excessive raster brilliance Brightness control has no effect.	a. Picture tube (V16). b. Picture tube cathode circuit.	a. Open or shorted cathode. No picture detail on raster. b. Open brightness control (R48).

Symptoms	Check	Remarks
No picture, Raster and sound OK.	a. Coupling condenser(C43 to picture tube grid.) b. Open peaking coil (L10).	a. C43 may break off in shipment
Intermittent Video. Raster and sound OK.	a. Coupling condenser C45 intermittently open.	
Intermittent video and sound. Raster OK.	a. RF tuner circuit (V701, V702) b. IF amplifiers (V5 - V7). c. Video detector circuit (V8). d. Video amplifier circuit (V9).	a. Poor contact in turret assembly.
Weak video (insufficient contrast Sound and raster OK.)	a. Brightness control setting too high. b. Alignment, RF and IF. c. RF tuner circuit (V701, V702) d. IF amplifiers stages (V5-V7). e. Video detector circuit (V8). f. Video amplifier circuit (V9).	c. Weak tube. d. Weak tube. e. Weak tube. f. Weak tube. Peaking coils.
Snow in picture.	a. Weak signal input to tuner. b. Noisy tubes in tuner (V701 and V702). c. Corona discharge in 6 kv supply circuit (V13, V14).	a. Beyond normal service area of a station. check antenna and trans mission line. b. V702 most likely cause.
No vertical sync. Horizontal sync OK.	a. Integrator network. b. Blocking oscillator transformer T7.	b. Terminals shorted to chassis.
No Horizontal sync. Vertical sync OK.	a. Coupling Condenser C61. b. Filter network. c. Isoltation resistor R92.	a. May be open. b. R90, R91, C62 & C63. c. May be open.
No horizontal or vertical sync.	a Sync separator circuit (V11A). b. Sync amplifier circuit (V12A).	a. C33 and /or C34 may break off in shipment.
Picture jitter.	a. Vertical hold control adjustment. b. Contrast control set too high. c. Noisy tubes in RF, IF, video and sweep circuits.	
Vertical nonlinearity.	a. Vertical output (V15A, V15B).	a. Adjust Vertical Lin. Control R88. b. Replace 6SL7 Vertical Output tube.
Improper focus.	a. Focus control adjustment. b. Picture tube (V16).	b. May be gassy.

Symptoms	Check	Remarks
Blurred picture. Smeared effect in picture.	a. Ghosts, multipath reception. b. Improper focus. c. Video detector circuit (V8). d. Video amplifier circuit (V9).	a. Multiple images having only small amounts of displacement produce a blurred image. c. Open peaking coil (L7 or L8). d. Open peaking coil (L9).
Poor picture detail.	a. Sharp tuning adjustment. b. Alignment, RF adn IF. c. Video detector circuit (V8). d. Video amplifier circuit (V9).	c. Check peaking coils. d. Check peaking coils. (May have shorted turns)
Picture "tear-out."	a. Sharp tuning adjustment. b. RF interference. c. Excessive video signal. (May be due to strength of the television station).	b. Prevalent in receiver installation location. c. Readjust contrast control. Check for same trouble on other channels before circuit checking.
Sound bars in picture.	a. Sharp tuning adjustment. b. Volume control setting too high. c. Alignment, RF and IF. d. Oscillation in the IF system. e. Condenser C13A, C13B or C32C. f. Microphonic tube in RF or video circuits.	d. Caused by open C20, 22 or 23. e. Low capacity or open. f. Tube V702 probable cause.
Horizontal bar in picture, sides of picture curved.	a. Low voltage power supply.	a. Defective filter condensers.
Sides of picture curved.	a. Check ground on C26.	a. Make sure it isn't grounded at common point with heaters.
Herringbone pattern super-imposed on picture.	a. FM, diathermy or other forms of RF interference. b. Oscillation in the IF system.	a. Can best be cured at source. Traps may also be used at the receiver. b. Caused by open C20, 22 or 23.
Cogwheel effect or excessive interference in picture at high volume levels.	a. Microphonic tube.	a. 6J6 oscillator-mixer tube (V702) most probable cause. Replace.



TUNER 94C8-1
TURRET SETTING SELECTS PAIR OF COILS.
L701 & L702, FOR CHANNEL DESIRED.
300 OHM TRANS. LINE LEAD IN.
6AG5
R.F. AMPLIFIER
V701
6J6
OSC. & MIXER
V702
T702
L711
23.1 MC
GREEN
SHARP TUNING
WHITE
BLACK
RED
19A1-252
19A1-253
6AU6
AUDIO I.F.
V1
4.5 MC
6AU6
1 ST. I.F.
V5 25.3MC
SOME SETS USED 5U4G. SEE PRODUCTION CHANGES ON PAGE 17.
5Y3GT
LOW VOLTAGE RECT.
V10
ON-OFF SWITCH
SW1
INTERLOCK
117 VOLTS A.C.
6.3AC
6.3 A.C.
1/2 6SN7GT
SYNC. SEPARATOR
V11A
1/2 6SN7GT
SYNC. AMPLIFIER
V12A
1/2 6SN7GT
HORIZONTAL OSC.
V12B
HORIZONTAL SIZE
HORIZONTAL HOLD
1B3 GT/8016
HIGH VOLTAGE RECT.
V13
6V6 GT
HIGH VOLTAGE OSC.
V14
1/2 6SN7GT
VERTICAL OSC.
V11B
VERT. HOLD
R57-5 MEG VERT. SIZE
1/2 6SL7GT
BALANCED
V15A
VERTICAL OUTPUT


6AU6
AUDIO I.F.
V1
6AL5
RATIO DETECTOR
V2
6SQ7
AUDIO AMPLIFIER
V3
6AS5
AUDIO OUTPUT
V4
6AU6
1 ST. I.F.
V5 25.3 MC
6AU6
2 ND. I.F
V6 23.1 MC
6AU6
3RD. I.F
V7
6AL5
VIDEO DETECTOR & AGC
V8
6AU6
VIDEO AMPLIFIER
V9
CONTRAST
BRIGHTNESS
6.3 A.C.
6SN7GT
HORIZONTAL SIZE
HORIZONTAL HOLD
6SL7GT
BALANCED
VERTICAL OUTPUT
V15A
1/2 6SL7GT
V15B
7JP4
V16
HOR. CENT.
VERT. CENT.
FOCUS