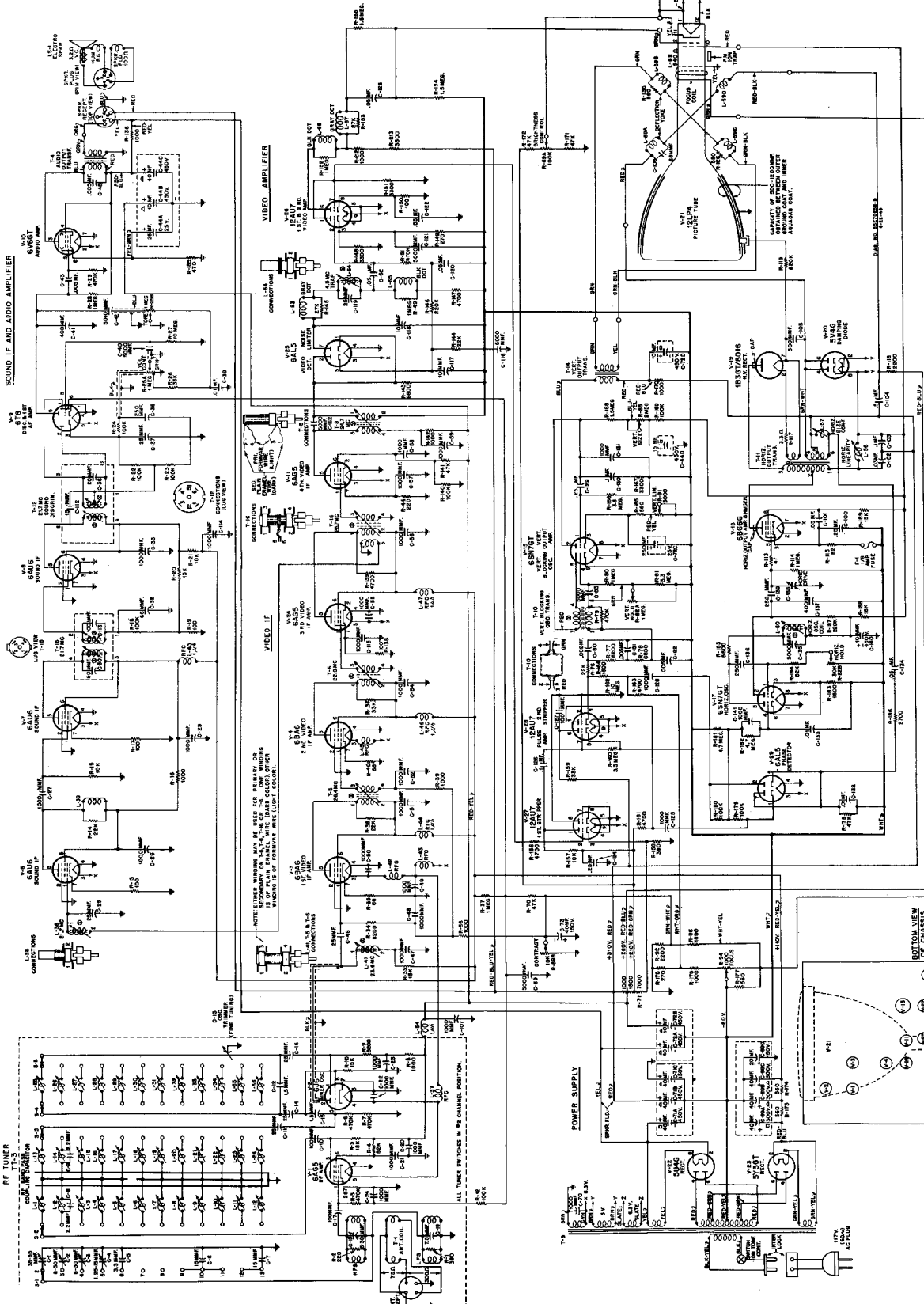


MODELS VT121, 12VK18, 12VTL6; Ch. TS-15, TS-15A, TS-15B, TS-15C, TS-15D1

Ref. No.	Part Number	Description	Part Number	Description	Part Number	Description	Part Number	Description
R-212	606327	1000 10% 1W	35A790085	Pad, felt (focus coil)	31A780523	Strip, terminal: 5 large insulated lugs, #4 ground, 1/2 spacing	31A780523	Strip, terminal: 5 large insulated lugs, #4 ground, 1/2 spacing
R-213	620069	3,300 10% 2W	74A84464	Bracket, chassis mounting (horizontal)	31A780374	Strip, terminal: 5 insulated lugs (#3 large)	31A780374	Strip, terminal: 5 insulated lugs (#3 large)
R-214	60476004	1000 20% 2W	78A89064	Bracket, coil mounting (horizontal)	31A780304	Strip, terminal: 5 insulated lugs, #2	31A780304	Strip, terminal: 5 insulated lugs, #2
Transformers								
T-1	14A70353	Antenna transformer: complete with antenna receptacle & trimmer	74A70376	Bracket, deflection yoke mounting	31A780373	Strip, terminal: 4 large insulated lugs, #3 ground, 1/2 spacing	31A780373	Strip, terminal: 4 large insulated lugs, #3 ground, 1/2 spacing
T-2	24A84086	IF transformer: 21.9 mc: complete but less shield can	74A84165	Bracket, focus coil mounting	31K37494	Strip, terminal: 4 insulated lugs, #3	31K37494	Strip, terminal: 4 insulated lugs, #3
T-3	24A471340	Discriminator transformer: 21.9 mc: complete, but less shield can	74A84111	Bracket, tuner chassis mounting	31K51511	Strip, terminal: 3 insulated lugs, #3	31K51511	Strip, terminal: 3 insulated lugs, #3
T-4	23A89030	Audio Output Transformer: complete with iron core	14A84981	Cable Assembly, speaker: includes receptacle	31K471504	Strip, terminal: 3 insulated lugs, #2	31K471504	Strip, terminal: 3 insulated lugs, #2
T-5	24A89071	Video IF transformer: complete with iron core	39A28036	Clip, chassis grounding (grounds front of chassis to bottom cover)	31K26235	Strip, terminal: 3 insulated lugs, #1	31K26235	Strip, terminal: 3 insulated lugs, #1
T-6	24A780406	Video IF & sound take-off transformer: complete with iron core	42F70721	Clip, coil (T-3 & T-12 sec. core)	31K34326	Strip, terminal: 2 insulated lugs, #3	31K34326	Strip, terminal: 2 insulated lugs, #3
T-7	24K780390	Video IF & sound take-off transformer: complete with iron core	42K470074	Clip, coil retainer (horizontal size and linearity, video IF & trap mtg)	31K30044	Strip, terminal: 2 insulated lugs, #2	31K30044	Strip, terminal: 2 insulated lugs, #2
T-8	24A845416	Vertical blocking oscillator transformer	42A780419	Clip, spring: black (V-2 shield grounding)	31K31251	Strip, terminal: 1 insulated lug, #1	31K31251	Strip, terminal: 1 insulated lug, #1
T-9	25C480095	Power Transformer: complete	30A482192	Conductor, shielded: single; black	46A484807	Stud, socket mounting (V-3 socket)	46A484807	Stud, socket mounting (V-3 socket)
T-10	24A845416	Vertical blocking oscillator transformer	30A49040	Conductor, shielded: single; blue	24A484862	Wafer, electrolytic mounting: bakelite: for 4 lug capacitors	24A484862	Wafer, electrolytic mounting: bakelite: for 4 lug capacitors
T-11	25C90052	Horizontal output transformer: complete, but less shield can	42A484844	Conductor, shielded: single; green	98471267	Washer, flat: 3/8 x .156 x .030; cad pl (tuner mtg)	98471267	Washer, flat: 3/8 x .156 x .030; cad pl (tuner mtg)
T-12	24A71340	Discriminator transformer: 21.7 mc: complete, but less shield can	39C17396	Contact, pin terminal (in speaker receptacle)	481720	TUNING UNIT IT-3 & IT-5	481720	TUNING UNIT IT-3 & IT-5
T-13	24K790440	Video IF & sound take-off transformer: complete with iron core	46A471143	Core, iron & screw (for L-55, L-56 & L-60)	14A484850	Tuner TT-3 (complete)	14A484850	Tuner TT-3 (complete)
T-14	25A489134	IF transformer, 21.7 mc: complete, but less shield can	46A780344	Core, iron-ceramic & screw (for L-57 & L-73)	14K790460	Tuner TT-5 (complete)	14K790460	Tuner TT-5 (complete)
T-15	24B780319	IF transformer, 21.7 mc: complete, but less shield can	46A70083	Core, iron & screw (for T-5, T-6, T-7, T-8, T-16, L-1, L-49 & L-64)	NOTE: Replaceable electrical parts are included in Television Chassis TS-15 Replacement Parts List. It is recommended that entire tuner be returned for exchange, if trouble develops in any of its major components.			
T-16	24A849073	Video IF & sound take-off transformer: complete with iron core	46A471337	Core, iron & screw (T-3, T-6, T-7, T-8, T-16, L-1, L-49 & L-64)	Replaceable Mechanical Parts			
T-17	25T90035	Vertical output transformer: complete with antenna transformer	46A484196	Core, iron: threaded (T-2 & T-15 pri. sec.)	43A4326	Ball, steel: 1/8" (fine tuning assembly)	43A4326	Ball, steel: 1/8" (fine tuning assembly)
T-18	14T90492	Antenna transformer: complete with C-154, C-155, C-156 and tuning cores	35A780327	Cushion, picture tube: felt; 38" long (on top retainer brkt)	73A482263	Bracket, tuner support (rear end of tuner)	73A482263	Bracket, tuner support (rear end of tuner)
Tubes								
V-1	64C5	RF Amplifier	58T845	Eyebolt (V-17 socket mtg)	42A470100	Clip, coil mounting	42A470100	Clip, coil mounting
V-2	64C6	Mixer & IF Amplifier	58L35	Eyebolt: 3/64 x .593; brass; (focus coil adj screws)	42A484849	Clip, spring: ball retainer (fine tuning assembly)	42A484849	Clip, spring: ball retainer (fine tuning assembly)
V-3	64C6	1st Video IF Amplifier	37A24691	Grommet, rubber (cushions for V-17 socket)	34A70109	Core, coil adjusting screw: brass	34A70109	Core, coil adjusting screw: brass
V-4	64C6	2nd Video IF Amplifier	14A87179	Insulator, coil: 2-1/8 x 3-1/8 (T-3 & T-12)	46A790436	Core, coil adjusting screw: iron (low freq. ant. coil) (TT-5)	46A790436	Core, coil adjusting screw: iron (low freq. ant. coil) (TT-5)
V-5	64C6	3rd Video IF Amplifier	14A780088	Insulator, coil (T-2 & T-15)	46A70116	Form, coil	46A70116	Form, coil
V-6	64C6	Sound IF Amplifier	14A780371	Insulator, hi-voltage capacitor	46A70167	Lockwasher, split: #5; blk nkl pl (front of switch assembly)	46A70167	Lockwasher, split: #5; blk nkl pl (front of switch assembly)
V-7	64C6	Sound IF Amplifier	14A790661	Insulator, shield (2nd anode lead dress)	46A70167	Lockwasher, internal: #3; cad pl (end of tuner switch)	46A70167	Lockwasher, internal: #3; cad pl (end of tuner switch)
V-8	64C6	Discriminator & 1st AF Amplifier	48T686	Lockwasher, external: #5; cad pl (tuner mtg)	287010	Nut, hex: 5-40 x 1/4; cad pl (front of switch assembly)	287010	Nut, hex: 5-40 x 1/4; cad pl (front of switch assembly)
V-9	64C6	Audio Amplifier	48T666	Lockwasher, external: #6 (hi-volt. cap insulator)	287004	Nut, hex: 3/8-32 x 9/16; cad pl (end of tuner switch)	287004	Nut, hex: 3/8-32 x 9/16; cad pl (end of tuner switch)
V-10	64C5	4th Video IF Amplifier	48T657	Lockwasher, external: #8; cad pl (pwr trans mtg)	58A790647	Pad, rubber (inside low freq. ant. coil) (TT-5)	58A790647	Pad, rubber (inside low freq. ant. coil) (TT-5)
V-11	64C5	Video Detector, 1st Video Amplifier & Pulse Stripper	48T650	Lockwasher, internal: #6; cad pl (pwr trans mtg)	64A78890	Plate, shaft support (on front end) (receptacle) (TT-3)	64A78890	Plate, shaft support (on front end) (receptacle) (TT-3)
V-12	618	Video Detector, 2nd Video Amplifier & Pulse Stripper	48T750	Lockwasher, internal: #6; hot-timed (hi-volt. cap. insulator)	14K790493	Receptacle and Bracket Assembly: antenna	14K790493	Receptacle and Bracket Assembly: antenna
V-13	64C7	2nd Video Amplifier	48T750	Lug, soldering: #6; hot-timed (hi-volt. cap. insulator)	58A8497	Rivet: .088 x 1/8; nkl pl (socket mtg)	58A8497	Rivet: .088 x 1/8; nkl pl (socket mtg)
V-14	68T07	Pulse Amplifier & Pulse Stripper	29R3013	Lug, soldering: #6; hot-timed (hi-volt. cap. insulator)	58T707	Rivet: .122 x 5/32; steel; nkl pl (terminal strip mtg)	58T707	Rivet: .122 x 5/32; steel; nkl pl (terminal strip mtg)
V-15	68T07	Vertical Blocking Oscillator & Vertical Output Amplifier	29R3248	Lug, soldering: #6; hot-timed (hi-volt. cap. insulator)	58T701	Rivet: .122 x 3/16 steel; nkl pl (ant. receptacle)	58T701	Rivet: .122 x 3/16 steel; nkl pl (ant. receptacle)
V-16	64C7	Vertical Output Amplifier	24T80668	nut, coil tuning (soldered on L-60 tuning core)				
V-17	68T07	Horizontal Oscillator & Horizontal Oscillator Control	257019	Nut, hex: 4-40 x 1/4; cad pl (soldered on horizontal lin. & size core screws)				
V-18	656G	Horizontal Output Amplifier & H.V. Generator	24T90157	Nut, hex: 4-40 x 1/4 x 3/16 thick; brass (tuner mtg)				
V-19	1B37/8016	HY Rectifier	287003	Nut, hex: 8-32 x 5/16; cad pl (pwr trans mtg)				
V-20	12P4 or 12P4	Damping Diode	287051	Pl (control mtg)				
V-21	54G	Picture Tube						
V-22	50A6	LY Rectifier						
V-23	2139T	LY Rectifier						
V-24	64C5	3rd Video IF Amplifier						
V-25	64C5	Noise Limiter & Video Detector						
V-26	12A9T	1st & 2nd Video Amplifier						
V-27	12A9T	1st Pulse Stripper						
V-28	12A9T	2nd Pulse Stripper & Pulse Amplifier						
V-29	64C5	Phase Detector						



NOTE: RESISTORS ARE INDICATED IN OHMS.
 ALL VALUES ARE IN THOUSANDS UNLESS
 OTHERWISE SPECIFIED.
 * - BRASS TUNING CORES.

RF TUNER
 TL3

POWER SUPPLY

BOTTOM VIEW
 OF CHASSIS

MODELS V121, 12V18, 12V16
CH. 1S-15, 1S-15A, 1S-15B, 1S-15C, 1S-15D

DESCRIPTION OF CHASSIS

Chassis 1S-15 - This television chassis contains 25 tubes, plus a 12" type 12A12, picture tube. The circuit differs from that fed directly from a 600V output amplifier tube.

Chassis 1S-15A - Except that the 600V vertical output amplifier tube was eliminated, and a vertical output transformer was added. In addition, provision is made to either a 12A12 or 12V18 picture tube. As the two types are interchangeable, the chassis is not furnished in any of the receiver, but may be provided by the customer if he so desires.

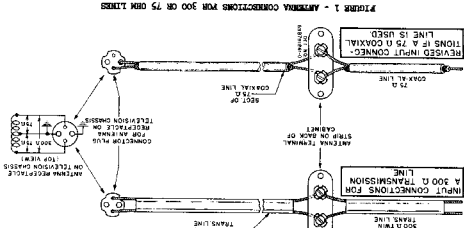
Chassis 1S-15B - New noise limiting, video amplifier, plus amplifier and horizontal sync were incorporated in this chassis. The video IF amplifier tube, a 6A6, was replaced by a 6AV6 type for greater IF gain. The transformer and horizontal sync were eliminated from the 1S-15 chassis. Two transformer adjustments, horizontal lock-in, and horizontal sync frequency were eliminated from the 1S-15 chassis. The transformer adjustments were re-routed to make the adjustment accessible from the rear. The tube total in this chassis is 23, plus a 12A12 picture tube.

Chassis 1S-15C - Similar to chassis 1S-15B, except that a new 20" tuner with variable antenna terminals and new antenna coils is used, to improve overall sensitivity.

Chassis 1S-15D - Similar to chassis 1S-15C, except that 2" 20, the 2" 20 damping diode tube was replaced with a 6AV6 type, the 5 volt 2" 20 tubes, plus a 12" picture tube.

By means of the four connection antenna receptacles, either a 75 ohm unbalanced, or 300 ohm balanced input is available. The input circuit is shown in Figure 1. If the receiver is to be used with a 75 ohm line, the 300 ohm balanced input is used.

ANTENNA CONNECTIONS



OPERATING CONTROLS

There are 9 controls on the front panel of your receiver. See Figure 2. Note that each front panel control is a dual control, consisting of a small knob and a large knob, the functions of each control is indicated by markings on the front panel. The "dot" indicates the large knob while the "dot" indicates the small knob. See Figure 2 for front panel control functions.

The receiver is completely adjusted at the factory, so normally none other than the front panel controls operate. However, to provide for any readjustment of the service controls, due to handling, the following instructions are in order. See Figures 3 & 4 for location of service adjustment controls.

SERVICE ADJUSTMENT CONTROLS

Complete alignment of horizontal oscillation (chassis 1S-15 & 1S-15A) (chassis 1S-15 & 1S-15A) should be aligned as follows:

If, in the above check, the receiver failed to align the proper range of the horizontal hold control, the horizontal oscillation control should be aligned as follows:

1. Leave the horizontal hold control in the extreme counterclockwise position.
2. Adjust the horizontal frequency control to give the picture a normal horizontal lock-in.
3. Rotate the horizontal hold control clockwise until the picture falls into sync, then rotate an additional 10-15 degrees clockwise and leave in that position.

When the receiver has been adjusted in this manner, it should be possible to switch the receiver on and off or to readjust. It is possible to switch the receiver on and off or to readjust.

MODELS V121, 12V18, 12V16
CH. 1S-15, 1S-15A, 1S-15B, 1S-15C, 1S-15D

To insure the proper range of the hold control to give synchronization under all conditions, it is necessary to adjust the hold control to give synchronization under all conditions. If picture fails to show this tendency to align.

1. Leave the horizontal hold control in the extreme counterclockwise position.
2. Adjust the horizontal frequency control to give the picture a normal horizontal lock-in.
3. Rotate the horizontal hold control clockwise until the picture falls into sync, then rotate an additional 10-15 degrees clockwise and leave in that position.

Complete alignment of horizontal oscillation (chassis 1S-15 & 1S-15A) (chassis 1S-15 & 1S-15A) should be aligned as follows:

If, in the above check, the receiver failed to align the proper range of the horizontal hold control, the horizontal oscillation control should be aligned as follows:

1. Turn oscillator control for about normal picture contrast.
2. Turn horizontal lock-in control to about 2 turns from right.
3. Adjust horizontal frequency control to give the picture a normal horizontal lock-in.
4. Turn horizontal frequency control clockwise until the picture falls into sync, then rotate an additional 10-15 degrees clockwise and leave in that position.
5. If it is not possible to obtain proper picture quality, step 4, back off on horizontal lock-in control an additional 1/2 turn.
6. Turn the horizontal hold control to the extreme counterclockwise position.
7. Rotate the horizontal hold control clockwise 10-15 degrees past the point at which the picture falls into sync, and leave it in that position.
8. Rotate the horizontal hold control clockwise 10-15 degrees past the point at which the picture falls into sync, and leave it in that position.

It should now be possible to change stations without losing synchronization.

Alignment of horizontal oscillation (chassis 1S-15, 1S-15C & 1S-15D) (chassis 1S-15, 1S-15C & 1S-15D) should be aligned as follows:

With normal contrast, adjust the horizontal hold control on the rear of the chassis until the picture remains in sync throughout the entire range of the horizontal hold control.

Alignment of the fine tune and synchronization controls:

Under conditions of rough alignment, it is possible for these parts to become misaligned. The following instructions will enable the service man to bring the parts to their normal setting.

See Figure 5 for alignment locations. A marker placed in front of the receiver will aid in making these adjustments.

Four types of permanent magnets for traps are used on the 1S-15 service chassis. They are as follows:

1. One is held in place with two clamps, colored black and blue, and fastened onto the back of the tube with two screws.
2. A large rod is held in place with two clamps, colored black and blue, and fastened onto the back of the tube with two screws.
3. Two square bar magnets are fastened to the back of the tube.
4. Another type consisting of black and blue clamps, but which also wrap around the neck of the tube.

The function of each trap is the same, and the setting will result in poor definition or misalignment of the contrast.

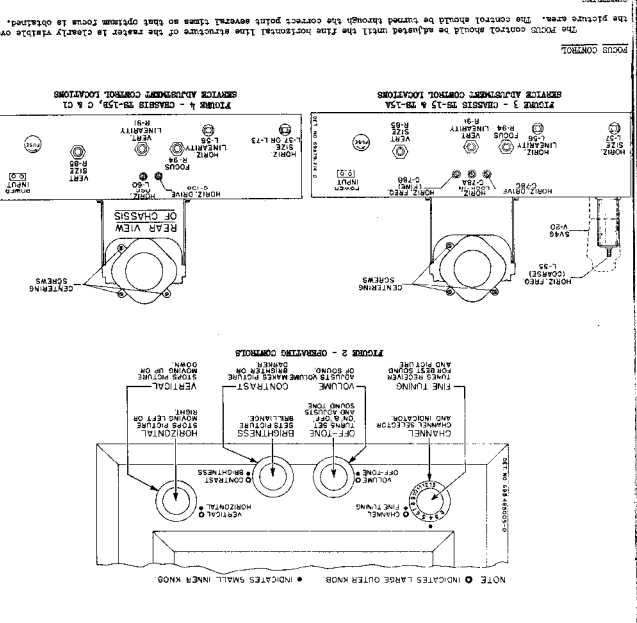


FIGURE 2 - OPERATING CONTROLS

FIGURE 3 - CHASSIS 1S-15 & 1S-15A

FIGURE 4 - CHASSIS 1S-15C & 1S-15D

FIGURE 5 - FRONT VIEW OF CHASSIS

FIGURE 6 - REAR VIEW OF CHASSIS

The diagrams show the front and rear views of the TV chassis, highlighting the locations of various adjustment controls. Figure 2 shows the front panel controls: CHANNEL, CONTRAST, BRIGHTNESS, HORIZONTAL, VERTICAL, OFF-TONE, BALANCE, CHANNEL, CONTRAST, BRIGHTNESS, HORIZONTAL, VERTICAL, OFF-TONE, BALANCE. Figure 3 shows the chassis 1S-15 & 1S-15A with controls for HORIZONTAL LINEARITY, VERTICAL LINEARITY, HORIZONTAL HOLD, VERTICAL HOLD, CONTRAST, BRIGHTNESS, HORIZONTAL, VERTICAL, OFF-TONE, BALANCE. Figure 4 shows the chassis 1S-15C & 1S-15D with controls for HORIZONTAL LINEARITY, VERTICAL LINEARITY, HORIZONTAL HOLD, VERTICAL HOLD, CONTRAST, BRIGHTNESS, HORIZONTAL, VERTICAL, OFF-TONE, BALANCE. Figure 5 shows the front view of the chassis with controls for CHANNEL, CONTRAST, BRIGHTNESS, HORIZONTAL, VERTICAL, OFF-TONE, BALANCE. Figure 6 shows the rear view of the chassis with controls for HORIZONTAL HOLD, VERTICAL HOLD, CONTRAST, BRIGHTNESS, HORIZONTAL, VERTICAL, OFF-TONE, BALANCE.

FIGURE 5 - FRONT VIEW OF CHASSIS

FIGURE 6 - REAR VIEW OF CHASSIS

The diagrams show the front and rear views of the TV chassis, highlighting the locations of various adjustment controls. Figure 5 shows the front view of the chassis with controls for CHANNEL, CONTRAST, BRIGHTNESS, HORIZONTAL, VERTICAL, OFF-TONE, BALANCE. Figure 6 shows the rear view of the chassis with controls for HORIZONTAL HOLD, VERTICAL HOLD, CONTRAST, BRIGHTNESS, HORIZONTAL, VERTICAL, OFF-TONE, BALANCE.

FIGURE 5 - FRONT VIEW OF CHASSIS

FIGURE 6 - REAR VIEW OF CHASSIS

The diagrams show the front and rear views of the TV chassis, highlighting the locations of various adjustment controls. Figure 5 shows the front view of the chassis with controls for CHANNEL, CONTRAST, BRIGHTNESS, HORIZONTAL, VERTICAL, OFF-TONE, BALANCE. Figure 6 shows the rear view of the chassis with controls for HORIZONTAL HOLD, VERTICAL HOLD, CONTRAST, BRIGHTNESS, HORIZONTAL, VERTICAL, OFF-TONE, BALANCE.

**MODELS VT121, 12VK18, 12VT16;
Ch. TS-15, TS-15A, TS-15B, TS-15C, TS-15D1**

STEP	SIG. GEN. FREQ., Mc.			REMARKS
	TS-15	TS-15A, B, C	TS-15D1	
1.	23.6	23.6	23.4	L-41 L-41 Adjust for maximum.
2.	26.4	26.4	22.9	T-5 T-5 Adjust for maximum.
3.	22.9	22.9	26.7	T-6 T-6 Adjust for maximum.
4.	25.7	25.7	25.5	T-7 T-7 Adjust for maximum.
5.	21.9	21.7	21.7	L-38 L-38 Increase generator output about 10 times and adjust for minimum. (Sound trap adjustment).
6.	25.7	25.7	25.7	T-13 T-13 Readjust for maximum, as in Step 4.
7.	24.7	24.7	24.7	T-8 T-8 Adjust for maximum.

7. Refer to Figures 6, 7, 8 & 9 for location of alignment adjustments and to the following chart for procedure.

While observing the raster on the screen, move the ion trap slightly backward or forward, simultaneously turning it slightly to end fro until the brightest raster is obtained, and one in which none of the four corners are cut off or shadowed. These adjustments should be made with the brightest picture obtainable, consistent with good line focus and a full, square raster. When adjustment is completed, make certain that the ion trap is held tightly in position.

DEFLECTION YOKE

If the deflection yoke shifts, the picture will be tilted. To correct, loosen the wing nut on top of the deflection yoke and rotate yoke till picture is straight. Before tightening wing nut, make certain that the deflection yoke is as far forward as possible.

ALIGNMENT

NOTE: The alignment procedure covers all chassis, through TS-15D1.

GENERAL

The chassis should be mounted on angle iron brackets (Motorola Part Number 7P484018) so that all connections and adjustments may be made easily. Spurious response trouble may be reduced to a minimum by bonding the chassis and all instruments together with braided metal straps.

A metal screwdriver may be used for making video IF adjustments, but a plastic or fibre screwdriver is required for RF or sound IF alignment.

EQUIPMENT NECESSARY FOR ALIGNMENT

AM Signal Generator: Frequency Range 4.5-220 mc
Output 0-100,000 microvolts

Electronic Voltmeter

Oscilloscope

Sweep Frequency Generator: Frequency Range 20-30 mc
Sweep Width: 10 mc minimum

VIDEO IF ALIGNMENT PROCEDURE

It will be necessary to remove the picture tube to expose two video IF tuning cores. A short screwdriver of 2 to 3 inches in length is convenient for making the adjustments.

- Turn the channel selector switch to a blank channel, e.g., the position which would correspond to channel 14 or 15 if there were such marking on the switch. This disables the local oscillator and prevents spurious responses in the IF amplifier.
- Turn the receiver on, and adjust the contrast control R-699, for -5 volts bias, as measured from the variable tap of the control to chassis.
- Apply a -3 volt bias to the mixer grid by means of a dry battery. Connect the positive terminal of the battery to ground and the -3 volt terminal to the point at which the two 470,000 ohm resistors (R-6 & R-7) in the mixer grid are connected.
- Connect the signal generator output lead, through a blocking capacitor of 100 mmf to .01 mf, to the grid of the mixer tube V-2 (6J6, pin 5). The low side of the signal generator should be connected to the oscillator coil mounting plate near the mixer tube socket. To avoid regeneration, keep the grid and ground leads to the signal generator as short as possible.
- Connect the electronic voltmeter across the video detector load resistor*. With zero output from the generator the meter should read less than 1 volt negative contact potential. A voltage appreciably greater than this indicates oscillation in the IF strip; and the generator lead connections, groundings, etc., should be checked.
- Adjust the output of the signal generator throughout alignment for no more than 1 volt increase across the detector load resistor to prevent overdriving the IF amplifier. Use the 3 volt range on the electronic voltmeter.

* R-50 (1800 ohms) in chassis TS-15 & TS-15A.
R-147 (4700 ohms) in chassis TS-15B, TS-15C & TS-15D1.

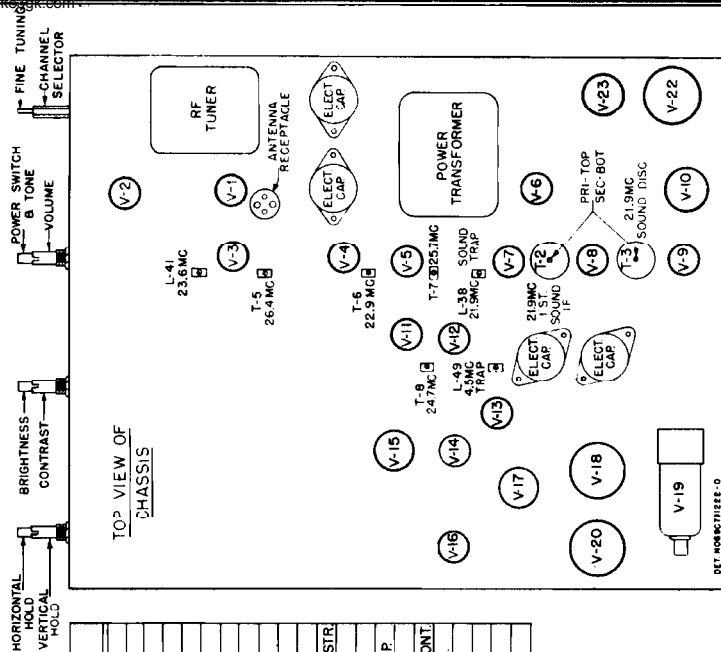
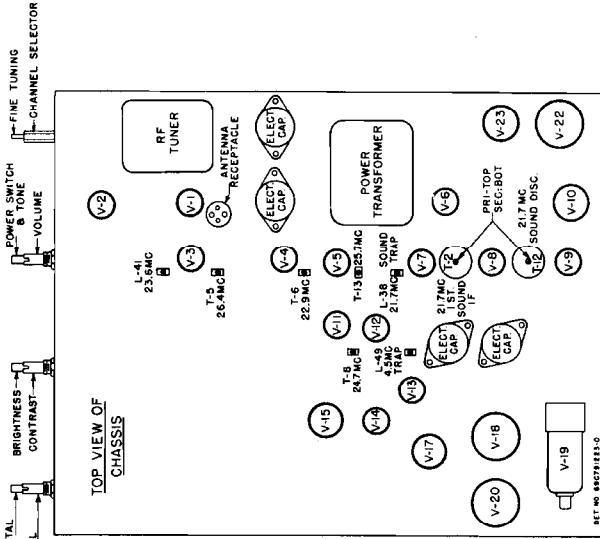


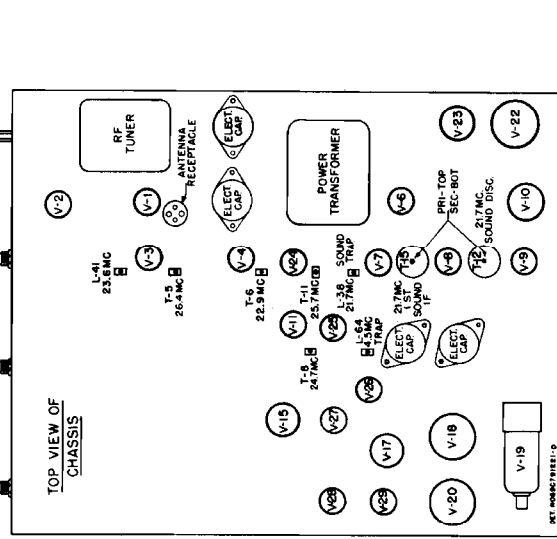
FIGURE 6 - CHASSIS TS-15 TUBE & IF ALIGNMENT LOCATIONS

MODELS VT121, 12VK18, 12VT16;
Ch. TS-15, TS-15A, TS-15B, TS-15C, TS-15D, TS-15G1



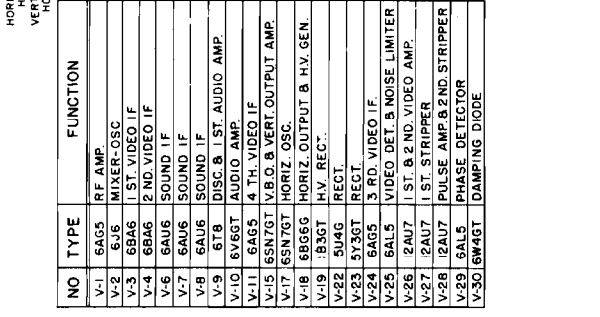
NO	TYPE	FUNCTION
V-1	6AG5	RF AMP
V-2	6AJ6	MIXER-OSC
V-3	6BA6	1 ST. VIDEO IF
V-4	6BA6	2 ND. VIDEO IF
V-5	6BA6	3 RD. VIDEO IF
V-6	6AU6	1 ST. AUDIO AMP
V-7	6AU6	2 ND. AUDIO AMP
V-8	6AV6	1 ST. VIDEO DET. & VERT. OUTPUT AMP
V-9	6AV6	2 ND. VIDEO DET. & VERT. OUTPUT AMP
V-10	6AV6	1 ST. AUDIO AMP
V-11	6AG5	4 TH. VIDEO IF
V-12	6T8	VIDEO DET. & VERT. OUTPUT AMP
V-13	6AC7	2 ND. VIDEO AMP
V-14	6SN76T	PULSE AMP & STRIPPER
V-15	6SN76T	V.B.O. & H.V. GEN.
V-16	6SN76T	HORIZ. OSC. & H.V. GEN.
V-17	6SN76T	HORIZ. OSC. & H.V. GEN.
V-18	6B06G	HORIZ. OUTPUT & H.V. GEN.
V-19	183GT	H.V. RECT.
V-20	5V4G	DAMPING DIODE
V-21	5U4G	RECT.
V-22	5Y3GT	RECT.
V-23	5Y3GT	RECT.

FIGURE 7 - CHASSIS TS-15A TUBE & IF ADJUSTMENT LOCATIONS



NO	TYPE	FUNCTION
V-1	6AG5	RF AMP
V-2	6AJ6	MIXER-OSC
V-3	6BA6	1 ST. VIDEO IF
V-4	6BA6	2 ND. VIDEO IF
V-5	6BA6	3 RD. VIDEO IF
V-6	6AU6	1 ST. AUDIO AMP
V-7	6AU6	2 ND. AUDIO AMP
V-8	6AU6	1 ST. VIDEO DET. & VERT. OUTPUT AMP
V-9	6T8	VIDEO DET. & VERT. OUTPUT AMP
V-10	6V6GT	AUDIO AMP
V-11	6AG5	4 TH. VIDEO IF
V-12	6T8	VIDEO DET. & VERT. OUTPUT AMP
V-13	6SN76T	PULSE AMP & STRIPPER
V-14	6SN76T	V.B.O. & H.V. GEN.
V-15	6SN76T	HORIZ. OSC. & H.V. GEN.
V-16	6B06G	HORIZ. OUTPUT & H.V. GEN.
V-17	183GT	H.V. RECT.
V-18	5V4G	DAMPING DIODE
V-19	5U4G	RECT.
V-20	5Y3GT	RECT.
V-21	6AG5	3 RD. VIDEO IF
V-22	6AJ6	1 ST. & 2 ND. VIDEO AMP
V-23	12AU7	1 ST. STRIPPER
V-24	12AU7	PULSE AMP & 2 ND. STRIPPER
V-25	6AL5	PHASE DETECTOR

FIGURE 8 - CHASSIS TS-15B & TS-15C TUBE & IF ADJUSTMENT LOCATIONS



NO	TYPE	FUNCTION
V-1	6AG5	RF AMP
V-2	6AJ6	MIXER-OSC
V-3	6BA6	1 ST. VIDEO IF
V-4	6BA6	2 ND. VIDEO IF
V-5	6BA6	3 RD. VIDEO IF
V-6	6AU6	1 ST. AUDIO AMP
V-7	6AU6	2 ND. AUDIO AMP
V-8	6AV6	1 ST. VIDEO DET. & VERT. OUTPUT AMP
V-9	6AV6	2 ND. VIDEO DET. & VERT. OUTPUT AMP
V-10	6V6GT	AUDIO AMP
V-11	6AG5	4 TH. VIDEO IF
V-12	6T8	VIDEO DET. & VERT. OUTPUT AMP
V-13	6AC7	2 ND. VIDEO AMP
V-14	6SN76T	PULSE AMP & STRIPPER
V-15	6SN76T	V.B.O. & H.V. GEN.
V-16	6SN76T	HORIZ. OSC. & H.V. GEN.
V-17	6SN76T	HORIZ. OSC. & H.V. GEN.
V-18	6B06G	HORIZ. OUTPUT & H.V. GEN.
V-19	183GT	H.V. RECT.
V-20	5V4G	DAMPING DIODE
V-21	5U4G	RECT.
V-22	5Y3GT	RECT.
V-23	5Y3GT	RECT.

FIGURE 9 - CHASSIS TS-15D TUBE & IF ADJUSTMENT LOCATIONS

The video IF amplifier response curve is shown in Figure 10. The bandwidth at the 3 db points should be approximately 3.5 mc. To check this with an AM generator, note the signal strength in microvolts necessary to produce an increase of approximately 1 volt above contact potential at 24.5 mc. Increase the generator input by 1.4 times and shift the generator frequency both sides of 24.5 mc until the original detector voltage reading is again obtained. These two new frequencies thus obtained are the 3db skirt frequencies and should correspond with the points shown in Figure 10. This measurement should be made with the -3 volt mixer bias and a -5 volt contrast bias.

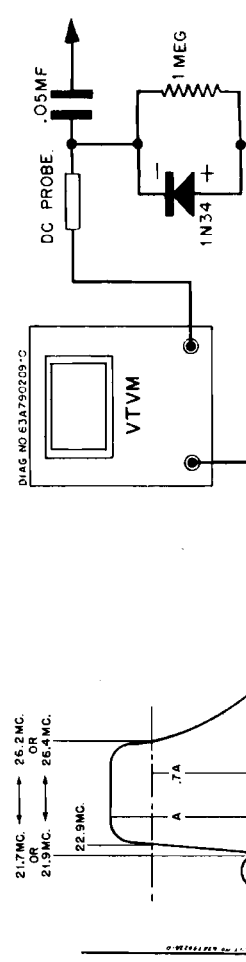


FIGURE 10 - VIDEO IF RESPONSE WAVEFORM

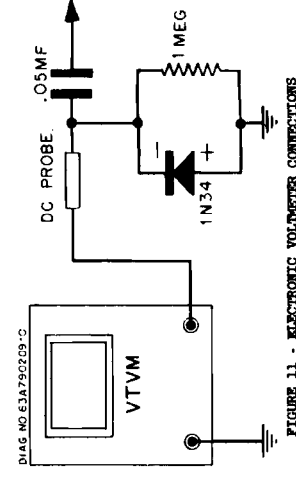


FIGURE 11 - ELECTRONIC VOLTMETER CONNECTIONS

4.5 MC TRAP ADJUSTMENT

1. Connect the signal generator to the plate of the video detector tube**.

** Pin 2, V-12 (6T8) in chassis TS-15 & TS-15A.
Pin 7, V-25 (6AL5) in chassis TS-15B, TS-15C & TS-15G1.

**MODELS VT121, 12VK18, 12VT16;
Ch. TS-15, TS-15A, TS-15B, TS-15C, TS-15D1**

STEP	SU. GEN. FREQ. -MC	ELECT. VOLT. CONN. TO	ADJUST	REMARKS
1	TS-15 TS-15A, R.C.C.1 21.9	TS-15 & TS-15A TS-15B, C.C.1 R-50	TS-15 L-38	TS-15B, C.C.1 L-38 Adjust for minimum. (This step not necessary if performed during video IF alignment.)
2	21.9	Across R-18 & R-19	T-2 Pri. & Sec.	T-15 Adjust for maximum.
3	--	--	T-3 Sec. (bottom)	T-12 Detune 2 turns counter-clockwise.
4	21.9	High side of volume control	T-3 Pri. (top)	T-12 Adjust for maximum.
5	21.9	High side of volume control	T-3 Sec. (bottom)	T-12 Adjust so that the meter indicates zero output at the voltage range from the polarity to the other.

2. Connect the electronic voltmeter and germanium crystal rectifier, as shown in Figure 11 to the plate of the 2nd video amplifier tube***. Use the lowest voltage scale on the meter.

3. With the signal generator set at 4.5 mc and maximum output, adjust the 4.5 mc. trap coil**** for minimum reading on the meter.

An alternate method is to tune in a normal picture and adjust the trap coil so that the stripped or half-tone effect in the picture is minimized or eliminated. Make sure the fine tuning control is set on center audio peak while this adjustment is being made. The RF portion of the receiver must, of course, be aligned first before this method of adjusting the sound trap is attempted.

CHECK OF VIDEO IF ALIGNMENT WITH SWEEP GENERATOR

Since variations in tube gain and component values cannot be taken into consideration in the single frequency alignment technique, whereas they can be compensated for in a sweep alignment, it is very desirable after AM alignment to check the shape of the IF response curve and to touch up the adjustments by using a sweep generator and an oscilloscope.

1. Turn the channel selector switch to a blank channel (a position corresponding to channels 14 or 15) to disable the local oscillator.

2. Adjust the contrast control for -5 volts bias.

3. Apply a -3V bias to the mixer grid, at the junction of the two 470,000 ohm resistors, R-6 & R-7.

4. Connect the sweep generator output lead, through a blocking capacitor of 100 muf to .01 mf, to the grid of the mixer tube V-2 (606, pin 5). Ground the generator to the oscillator coil mounting plate, again keeping the leads as short as possible.

5. Connect the oscilloscope vertical input to the grid of the 1st video amplifier tube****, or to the grid of the 2nd video amplifier tube***** if more gain is needed. Run a lead from the scope terminal on the sweep generator to the horizontal input on the oscilloscope; or use the built-in sawtooth, synchronized internally, which-ever is preferred.

6. Set the sweep generator for a center frequency of about 24.0 mc, with a deviation of about 10 mc. At all times keep the output below the level at which the IF strip is over-driven, the point at which the response curve begins to change shape as the generator output is increased.

7. Turn on the marker in the sweep generator. If there is no built-in marker in the sweep generator, loosely couple the output of the AM generator to the IF strip, or feed the output to the mixer tube through a small capacitor. At all times, keep the marker output low enough to prevent the marker from distorting the response curve. If a wide band scope is used, the marker output will be more distinct if a capacitor of 100 muf to 1000 muf is placed across the scope input. Use the smallest size possible, since too large a value will affect the shape of the curve.

8. Adjust the sweep and scope until one complete response curve appears on the screen.

9. Compare the curve with the ideal curve in Figure 10, using the marker to locate specific frequencies on the wave. If it is necessary to alter the shape of the curve, readjust the core closest in frequency to the point requiring correction.

SOUND IF ALIGNMENT

1. Make adjustments and connections as described for video IF alignment.

a. Turn the channel selector switch to a blank channel.

b. Adjust the contrast control for -5 volts bias.

c. Apply -3 volts bias to the mixer grid.

d. Connect the AM generator output lead, through a blocking capacitor, to the grid of V-2 (606, pin 5).

2. Refer to Figures 6, 7, 8 & 9 for location of alignment adjustments and to the following chart for procedure.

3. Except in step 1, keep the output of the signal generator low enough to prevent limiting during alignment.

*** Pin 8, V-13 (6AC7) in chassis TS-15 & TS-15A.
Pin 6, V-26 (12AU7) in chassis TS-15B, TS-15C & TS-15D1.

**** L-49 in chassis TS-15 & TS-15A.
L-64 in chassis TS-15B, TS-15C & TS-15D1.

***** Pin 8, V-12 (606) in chassis TS-15 & TS-15A.

Pin 2, V-26 (12AU7) in chassis TS-15B, TS-15C & TS-15D1.

***** Pin 4, V-13 (6AC7) in chassis TS-15 & TS-15A.
Pin 7, V-26 (12AU7) in chassis TS-15B, TS-15C & TS-15D1.

With -3 V. mixer bias and zero contrast bias, the normal audio sensitivity is as follows:

Chassis TS-15: 100 microvolts for 1 V. across R-18 & R-19 (terminal #1 of T-2 to ground).

Chassis TS-15A: 100 microvolts for 1 V. across R-18 & R-19 (terminal #1 of T-2 to ground).

Chassis TS-15B: 200 microvolts for 1 V. across R-18 & R-19 (terminal #1 of T-15 to ground).

Chassis TS-15C: 200 microvolts for 1 V. across R-18 & R-19 (terminal #1 of T-15 to ground).

Chassis TS-15D1: 200 microvolts for 1 V. across R-18 & R-19 (terminal #1 of T-15 to ground).

RF ALIGNMENT PROCEDURE

NOTE: Chassis TS-15, TS-15A and TS-15B use the type TT-3 tuner assembly. Chassis TS-15C and TS-15D1 use a type TT-5 tuner which contains antenna trimmers for the high channels and two tunable antenna coils.

The locations of the various adjustments are given in Figures 12 & 13. It will be noted that the oscillator adjustments are arranged in a counterclockwise sequence on the front side of the chassis, starting with the #2 channel as the first adjustment at the top.

The RF amplifier adjustments are located in a similar manner, starting at the top of the chassis and going around to the bottom. Both coils for each channel are placed together and then apart, alternately, in the channel sequence.

The antenna trimmers are also located in a counterclockwise manner, starting at the top of the chassis with #2 channel and going around to below the chassis.

TELEVISION FREQUENCY CHANNELS

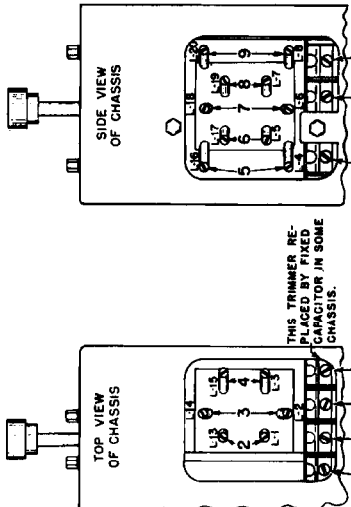
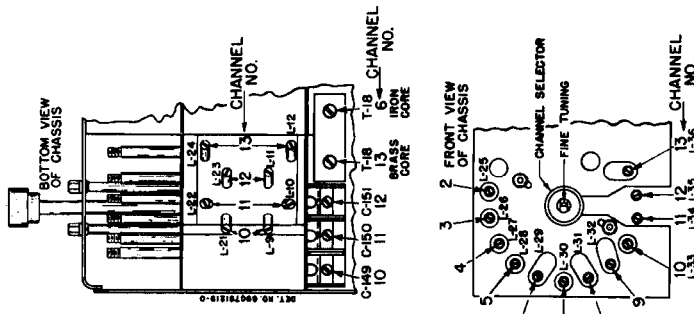
CHANNEL	FREQ. BAND MC	PICTURE CARRIER	SOUND CARRIER	RECEIVER OSCILLATOR*
2	54-60	59.25	59.75	81.55
3	60-66	61.25	61.75	83.55
4	66-72	67.25	67.75	89.55
5	76-82	77.25	77.75	95.55
6	82-88	83.25	83.75	101.55
7	174-180	179.25	179.75	201.55
8	180-186	181.25	181.75	203.55
9	186-192	187.25	187.75	209.55
10	192-198	193.25	193.75	215.55
11	198-204	199.25	199.75	221.55
12	204-210	205.25	205.75	227.55
13	210-216	211.25	211.75	233.55

* In TS-15A, B, C & D1 chassis, reduce osc frequencies by 0.2 mc.

Procedure:

1. Connect the AM signal generator output cable to the antenna terminals of the receiver. Match the generator to the 300 ohm input impedance of the receiver by using a 100 ohm resistor in series with the output terminal of the generator cable and a 150 ohm resistor in series with the ground terminal. This arrangement is for a 50 ohm generator. If the generator impedance is 30 ohms, use a 120 ohm resistor on the output terminal and 150 ohms in series with the ground terminal.

MODELS VT121, 12VK18, 12VT16;
Ch. TS-15, TS-15A, TS-15B, TS-15C, TS-15C1



CHANNEL	OSC. ADJUSTMENTS		RF ADJUSTMENTS		ANT. ADJUSTMENTS	
	COILS	FREQ.	COILS	FREQ.	TRIMMER OR COIL	FREQ.
2	L-25	59.75MC	L-18L-13	58MC	C-142	58MC
3	L-26	65.75MC	L-28L-14	64MC	C-143	64MC
4	L-27	71.75MC	L-38L-15	70MC	C-144	70MC
5	L-28	81.75MC	L-48L-16	80MC	C-145	80MC
6	L-29	87.75MC	L-58L-17	86MC	IRON	86MC
7	L-30	179.75MC	L-68L-18	178MC	C-146	178MC
8	L-31	185.75MC	L-78L-19	184MC	C-147	184MC
9	L-32	191.75MC	L-88L-20	190MC	C-148	190MC
10	L-33	197.75MC	L-98L-21	196MC	C-149	196MC
11	L-34	203.75MC	L-108L-22	202MC	C-150	202MC
12	L-35	209.75MC	L-118L-23	208MC	C-151	208MC
13	L-36	215.75MC	L-128L-24	214MC	BRASS	214MC

FIGURE 13 - CHASSIS TS-15C & TS-15C1 OSCILLATOR, RF & ANTENNA ADJUSTMENT LOCATIONS

This will not give a proper bandpass characteristic. Always keep the generator output low enough to prevent saturation.

Chassis TS-15, TS-15A & TS-15B (Tuner TT-3)

- Align the remaining low frequency RF coils to their proper frequencies, and then proceed to the high channels.
- Antenna coil trimmers are provided for channels 2 through 6. See Figure 12 for locations. They are peaked for maximum output on the meter at the same frequencies used for aligning the RF coils.
- Capacitor C-18 is tuned at 195 mc and has enough bandwidth to work effectively over the high frequency channels.

Chassis TS-15C & TS-15C1 (Tuner TT-5)

- Peak the low frequency antenna coil (iron core) at 86 mc.
- Repeat steps 11 and 12 on channels 2 to 5, peaking the antenna trimmers to the same frequencies as the RF coils. See Figure 13 for locations.
- Tune the Channel 13 RF coils and antenna coil (brass core) at 214 mc.
- Tune the Channels 7 to 12 RF coils and antenna trimmers to their proper frequencies.

- Set the contrast control for -5 volts bias. (Measured from arm of contrast control to chassis).
- When aligning the oscillator, connect the electronic voltmeter across the volume control.
- Turn the channel switch to the channel to be aligned.
- Set the fine tuning capacitor C-13 to half-capacity position.
- Set the signal generator at the sound carrier frequency of the channel (see above chart) and adjust the signal generator output until a voltage reading is obtained on the electronic voltmeter, connected as in Step 3.
- Locate the oscillator tuning adjustment belonging to the channel being aligned. See Figures 12 & 13. With a non-metallic screwdriver, adjust the oscillator frequency until the reading on the meter is zero. The meter reading will change rapidly from one polarity, through zero, to the opposite polarity as the oscillator frequency is adjusted to produce the correct sound IF of 21.9 mc.*
- Proceed as above for each channel; and, if the fine frequency trimmer is left in the same position for each channel when the oscillator adjustments are made, very little retuning of the fine tuning control will be required in changing from one television station to the next.
- With the oscillator correctly set, the next step is the alignment of the RF and antenna sections. The RF coils and the antenna trimmers are tuned at a frequency 1 mc higher than the center frequency of the channel under test; that is, 4 mc above the lower channel limit, or 2 mc below the upper limit. See chart above for channels and Figures 12 & 13 for alignment locations and frequencies.
- Connect electronic voltmeter across the video detector load resistor**.
- Set the signal generator to 86 mc., the RF alignment frequency for Channel 6, and adjust the output for a reading on the voltmeter.
- There are two coils for each RF channel. Using a non-metallic screwdriver, detune one core considerably in a counter-clockwise direction. Then tune the other for maximum output on the meter at 86 mc. Now, return the first coil for maximum output, and the RF amplifier is aligned. Do not return the other coil for maximum, as

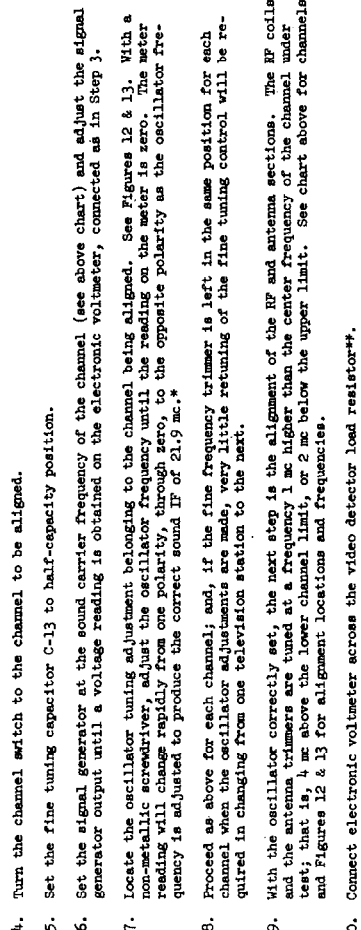


FIGURE 12 - CHASSIS TS-15, TS-15A & TS-15B OSCILLATOR, RF & ANTENNA ADJUSTMENT LOCATIONS

* 21.7 mc in TS-15A, TS-15B, TS-15C & TS-15C1.
** R-50 in chassis TS-15 & TS-15A.
R-147 in chassis TS-15B, TS-15C & TS-15C1.

CHANNEL	OSC. ADJUSTMENTS		RF ADJUSTMENTS		ANT. ADJUSTMENTS	
	COILS	FREQ.	COILS	FREQ.	TRIMMER	FREQ.
2	L-25	59.75MC	L-18L-13	58MC	C-1	58MC
3	L-26	65.75MC	L-28L-14	64MC	C-2	64MC
4	L-27	71.75MC	L-38L-15	70MC	C-3	70MC
5	L-28	81.75MC	L-48L-16	80MC	C-4	80MC
6	L-29	87.75MC	L-58L-17	86MC	C-5	86MC
7	L-30	179.75MC	L-68L-18	178MC	—	—
8	L-31	185.75MC	L-78L-19	184MC	—	—
9	L-32	191.75MC	L-88L-20	190MC	—	—
10	L-33	197.75MC	L-98L-21	196MC	C-18	195MC
11	L-34	203.75MC	L-108L-22	202MC	—	—
12	L-35	209.75MC	L-118L-23	208MC	—	—
13	L-36	215.75MC	L-128L-24	214MC	—	—