

PHILCO



SERVICE

TELEVISION

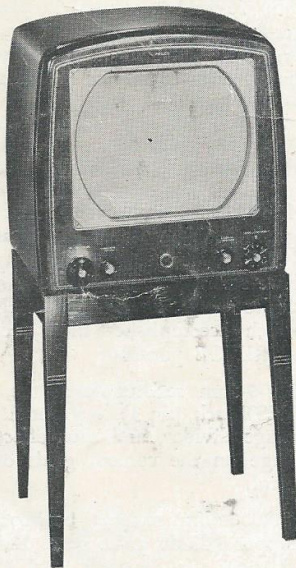
PHILCO TELEVISION RECEIVER MODELS

51-T1601, Codes 121 and 122;

51-T1601T, Codes 121 and 122;

51-T1602, Codes 121 and 122;

51-T1634, Codes 123 and 124



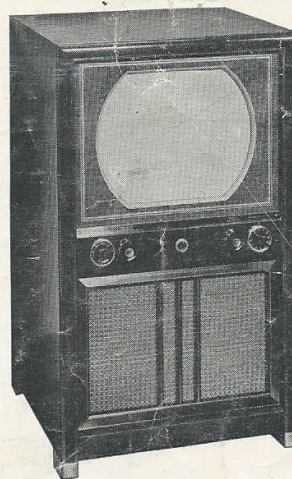
TP0-1437

MODEL 51-T1601T



TP0-1438

MODEL 51-T1602



TP0-1145

MODEL 51-T1634
Code 123

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MODELS 51-T1601, 51-T1601T, 51-T1602 and 51-T1634 SPECIFICATIONS AND TUBE COMPLEMENT

SPECIFICATIONS

CABINET

Models 51-T1601,
Codes 121 and 122 Table model

Model 51-T1602,
Codes 121 and 122 Table model

Model 51-T1601T,
Codes 121 and 122 Table model with built-in aerial
on back of cabinet; includes
table

Model 51-T1634,
Codes 123 and 124 Console model

TUNING Twelve-channel, wafer-switch
incremental tuner; fine tuning
of local oscillator

FREQUENCY RANGE Channels 2 through 13

AUDIO OUTPUT 2.5 watts

INTERMEDIATE FREQUENCIES

Video Carrier 26.6 mc.

Sound (Intercarrier) 4.5 mc.

AERIAL Built-in broad-band dipole (ex-
cept in Model 51-T1601); pro-
visions for external aerial, if
necessary

TRANSMISSION LINE 300-ohm, twin-wire leadin (bal-
anced), or 72-ohm coaxial cable
(unbalanced) in areas of exces-
sive interference

OPERATING VOLTAGE 110-120 volts, 60 cycles, a.c.

POWER CONSUMPTION 290 watts

TUBE COMPLEMENT

TUBE TYPE		FUNCTION
6CB6	miniature	R-f amplifier (76-5747 tuner)
6BC5	miniature	R-f amplifier (76-5411-1 tuner)
12AV7	miniature	Oscillator-mixer (76-5747 tuner)
6J8/S	miniature	Oscillator-mixer (76-5411-1 tuner)
6AU6 (3)	miniature	First, second, and third i-f amplifiers
6CB6	miniature	Fourth i-f amplifier
6AU6	miniature	Second sound i-f amplifier
12AU7	miniature	Video detector, a-g-c rectifier, and first sound i-f amplifier
6T8	miniature	FM detector and first audio amplifier
12AV7	miniature	First video amplifier and first sync separator
12AU7	miniature	Noise gate and 2nd sync separator
6AQ5	miniature	Video output
7C5	loktal	Audio output

TUBE COMPLEMENT (Cont.)

TUBE TYPE		FUNCTION
7N7	loktal	Sync inverter, and vertical oscillator and discharge
6S4	miniature	Vertical sweep output
6SN7GT	octal	Horizontal oscillator and phase comparer
6CD6G	octal	Horizontal sweep output
6BY5G	octal	Horizontal damping
1X2	miniature	High-voltage rectifier
1X2	miniature	Voltage doubler
5U4G (2)	octal	Low-voltage rectifier
16WP4A		Picture tube (70-degree deflection)

DIFFERENCES IN CODES

Code 122 of Models 51-T1601 and 51-T1602, and Code 124 of Model 51-T1634 are similar to Code 121 of Models 51-T1601 and 51-T1602, and Code 123 of Model 51-T1634 except that the Philco 12-Channel Turret Tuner, Part No. 76-5411-1, is used in place of the 12-Channel Wafer-Switch Incremental Tuner, Part No. 76-5747. For service information pertaining to the 12-Channel Invert Tuner, refer to service manuals PR-1803 and PR-1858.

FRINGE OPERATION

A kit, Part No. 45-1732, for improvement of sync performance in fringe areas is available. The use of this kit will improve the sync performance in those weak signal areas where strong electrical disturbance is present. The kit includes a switch called the FRINGE-NORMAL switch which accomplishes the following when thrown to the FRINGE position:

1. Connects a 68,000-ohm resistor from the a-g-c bus (at the ALIGN TEST jack, pin 3) to ground. This resistor acts as a voltage divider, and thus effectively lowers the a-g-c voltage on the control grids of the tubes under a-g-c control.

2. Connects an 80,000-ohm resistor between the plate of the diode clipper (diode noise gate, 12AU7) and ground. This changes the clipping level of the diode.

The kit is installed simply by plugging in the associated cable and plug into the ALIGN TEST jack, J200. Since the FRINGE-NORMAL switch is to be operated by the customer at times, it is advisable to mount the switch in a position which is readily accessible from the

front of the cabinet. In later productions a knock-out hole will be provided in the cabinet back for mounting purposes.

It should be noted that strong-signal reception is virtually impossible when the FRINGE NORMAL switch is in the FRINGE position, because of the fact that the receiver overloads and causes the picture to become washed out and distorted in shape. It will therefore be necessary for those customers who have both weak and strong signals to operate the switch when changing from station to station. Otherwise in complete fringe areas the switch may be left in the FRINGE position.

FUSE REPLACEMENT

B SUPPLY

The B supply protective fuse is located in the high-voltage cage, and is made accessible by removing the back cover of the cage. USE A 6/10-AMPERE DELAYED-ACTION TYPE FUSE, PHILCO PART NO. 45-2656-18.

CAUTION: Discharge the circuit before replacing the fuse.

FILAMENT

The filament protective fuse consists of a length of No. 26 copper wire. This fuse is in series with the grounded lead (black) of the power-transformer filament winding. It is important to use No. 26 copper wire when replacing this fuse.

BUILT-IN AERIAL

The built-in aerial consists of a broad-band dipole of metal foil, mounted inside the cabinet, at the top (except in the 51-T1601T where the dipole is mounted in an antenna assembly on the back) and a tuning and impedance-matching network. This aerial covers all channels, and is tuned for each channel by adjusting the AERIAL TUNING control, located on the front of the Receiver, near the top of the cabinet.

A 300-ohm line couples the tuning network to the aerial-input terminals on TB1. If an external aerial is required, this line must be disconnected from the aerial terminals.

CHECKING AND ADJUSTING THE BUILT-IN AERIAL TUNING NETWORK

By adjusting the AERIAL TUNING control, it should be possible to tune the built-in aerial system to resonance at the video-carrier frequency of each channel.

To check the built-in aerial system, follow the procedure given below:

1. Connect a dipole through a 72-ohm coaxial cable to the output of an AM signal generator which has a band range covering the television channels.
2. Connect a 20,000-ohms-per-volt voltmeter to pin 2 of the ALIGN TEST jack, J200.

3. Set the CHANNEL SELECTOR to Channel 2, and the FINE TUNING control to the middle of its range.

4. Place the dipole near the back of the Receiver, and set the signal generator for a modulated output at the video-carrier frequency of Channel 2. Adjust the signal-generator attenuator for an output that will just give an indication on the meter.

5. Adjust the AERIAL TUNING control for a maximum reading on the voltmeter. When maximum reading is obtained, the AERIAL TUNING control should not be in either its maximum clockwise or maximum counterclockwise position.

6. Repeat the above steps for Channels 3 through 13. For all channels, a maximum reading should be obtained on the meter when the AERIAL TUNING control is set at positions other than its maximum clockwise or maximum counterclockwise position.

If a peak reading cannot be obtained on each channel in the low-frequency band, the long section of the loop assembly, to which the 300-ohm line is attached, may be pushed together or bowed out, to obtain peaking. If a peak reading cannot be obtained on each channel in the high-frequency band, the two loops adjacent to the AERIAL TUNING condenser may be pushed toward each other or fanned out, to obtain peaking.

After the adjustments above have been made, it still may not be possible to obtain maximum meter readings when the AERIAL TUNING control is set at positions other than its maximum clockwise or maximum counterclockwise position. If this is the case, it is suggested that the AERIAL TUNING condenser be replaced.

HORIZONTAL-SWEEP ADJUSTMENT

The range of the horizontal-hold control potentiometer is sufficient to compensate for normal variations in the frequency of the horizontal oscillator, and no other adjustments are ordinarily required. However, if the tube or other components are replaced in the horizontal-oscillator circuit, it may be necessary to make the following adjustments, to obtain proper synchronism and deflection:

1. Preset the adjustments as follows:

- a. Lockin trimmer, C612, 1 turn counterclockwise from the maximum clockwise position. See figure 1.
- b. Stabilizing core, TC601, extending 5/8" above coil mount.
- c. Drive trimmer, C630, 1 turn counterclockwise from the maximum clockwise position.
- d. HORIZ. HOLD control, center of its range.

2. Tune in a station, and adjust TC600 (figure 1) until the picture is brought into sync.

3. Connect an oscilloscope to pin 3 of the HOR. OSC. TEST socket, J600. The picture *must* be in sync; readjust TC600, if necessary adjust the scope sweep until two complete cycles of the pattern are stationary.

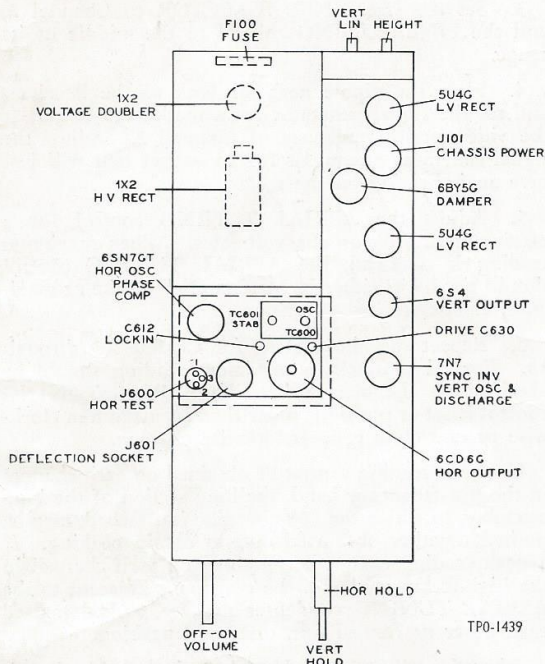


Figure 1. Power, Deflection Chassis, Top View

4. Adjust the stabilizing core, TC601, so that the 2 peaks (figure 2) are of equal amplitude, readjusting TC600, if necessary to keep the picture in sync.

5. Remove oscilloscope connections. Turn the HORIZ. HOLD control maximum clockwise, and adjust TC600 so that there are 4 blanking bars sloping to the right.

6. Turn the HORIZ. HOLD control counterclockwise until the picture comes in, then goes out of sync. Then turn the HORIZ. HOLD control slowly clockwise again, counting the number of black (blanking) bars, sloping down to the left, just before the picture pulls into sync. If there are more than $3\frac{1}{2}$ bars, turn the lock-in trimmer, C612, slightly clockwise; if there are less than $2\frac{1}{2}$ bars, turn C612 slightly counterclockwise. If the Receiver does not lose sync when the HORIZ. HOLD control is maximum counterclockwise, then re-

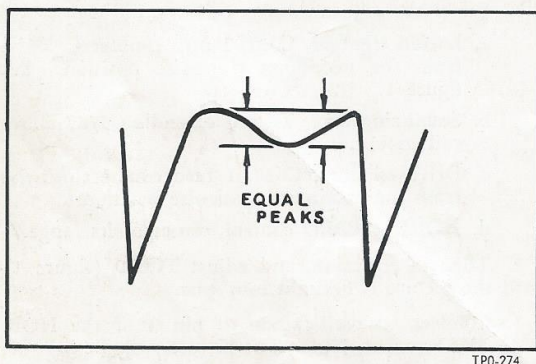


Figure 2. Horizontal Sweep — Horizontal Stabilizing Core Properly Adjusted

move the signal momentarily and proceed with the next step.

7. Repeat steps 5 and 6 until the picture pulls in after $2\frac{1}{2}$ to $3\frac{1}{2}$ bars, down to the left.

8. Turn the HORIZ. HOLD control maximum clockwise. Adjust TC600 to obtain 4 bars, sloping down to the right.

9. Turn the HORIZ. HOLD control slowly counterclockwise, and note whether the picture goes in and out of sync again. Now turn the HORIZ. HOLD control slowly clockwise until the picture comes into sync. If this sequence is not obtained, repeat steps 5, 6, 7, and 8.

HORIZONTAL-DRIVE ADJUSTMENT

The horizontal-drive condenser, C630, controls the amount of drive applied to the horizontal-output tube (6CD6G), and hence, the picture-tube second-anode voltage, picture width, and horizontal linearity. Turning C630 counterclockwise increases the drive; turning clockwise decreases it.

The drive should be as high as possible, consistent with good linearity, proper width, and the absence of black line due to Barkhausen oscillation.

The second-anode voltage should be at least 13,500 volts, under a 135-microampere load. The picture tube must be connected during this reading, to obtain the filtering provided by the tube aquadag-coating capacitance.

A practical method of adjusting the horizontal drive involves starting with the drive trimmer, C630, in the maximum clockwise position, and turning it counterclockwise until maximum picture width and best linearity are obtained. Turning the trimmer counterclockwise, past this point, will cause a reduction in picture width, and is an incorrect setting.

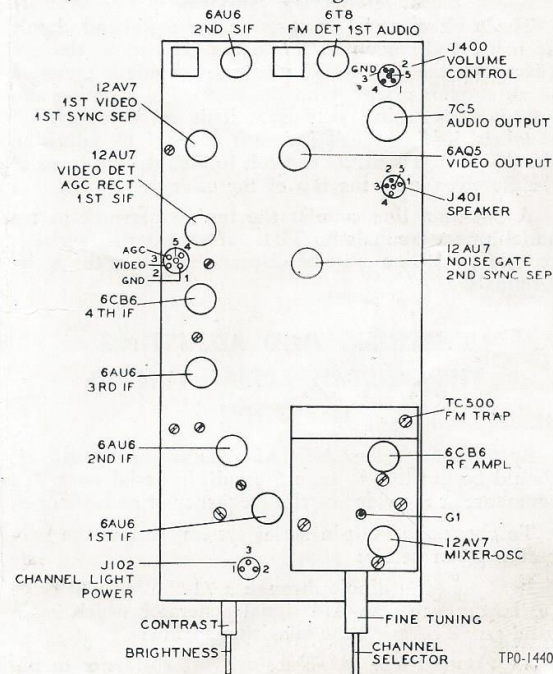


Figure 3. R-F, I-F Chassis, Top View

FM TRAP ADJUSTMENT (76-5747 TUNER)

The FM trap is adjusted at the factory to resonate at 100 mc., and normally requires no further adjustment unless an FM station with a frequency other than 100 mc. causes interference. In such case, the interference may be reduced by tuning in the television station on which the interference occurs, and adjusting TC500 for minimum interference. See figure 3.

If the FM station is not on the air, the FM trap may be adjusted as follows:

1. Connect the output of the AM signal generator

through the aerial-input matching network (figure 4) to TB500. Wire the tuner for 300-ohm input.

2. Connect an r-f probe or crystal detector (figure 5) to lead from the tapered line, Z500, to the wafer switch, WS500D (F). Connect the r-f probe or crystal detector to an oscilloscope vertical input. Use the highest possible oscilloscope gain.

3. Turn the CHANNEL SELECTOR to the channel with which the FM station is interfering.

4. Set the signal generator (modulated) to the station carrier frequency of the FM station causing the interference.

5. Adjust TC500 until the indication on the oscilloscope is minimum.

ALIGNMENT

GENERAL

The video carrier intermediate frequency is 26.6 mc., and the sound intermediate (intercarrier) frequency is 4.5 mc. Alignment of these circuits requires careful workmanship and good equipment. The following precautions must be observed:

1. There must be a good bond between the Receiver chassis and the test equipment. This is most easily obtained by having the top of the workbench metallic. The test equipment and television receiver chassis must make a good metal-to-metal contact with the bench top.
2. Never disconnect the picture tube, picture-tube yoke, or speaker, or remove the horizontal oscillator tube while the Receiver is turned on.
3. Allow the Receiver and test equipment to warm up for 15 minutes before starting the alignment.

TEST EQUIPMENT REQUIRED

The following test equipment is recommended for aligning the Receiver:

1. Philco Precision Visual Alignment Generator for Television and FM, Model 7008, or equivalent.
2. Vacuum-tube voltmeter, or 20,000-ohms-per-volt voltmeter.
3. R-f probe, Philco Part No. 76-3595 (for use with Model 7008 generator).

JIGS AND ADAPTERS REQUIRED

Connections to the grid of the mixer tube may be made through an alignment jack provided for that purpose. To connect the signal generator to this point, an alligator clip attached to the generator output cable may be used. The ground connection may also be made by the use of an alligator clip. Philco Alignment Cable, Part No. 45-1636, which consists of an output

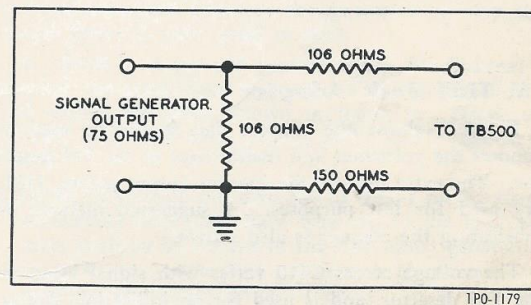


Figure 4. Aerial-Input Matching Network

cable for Model 7008 generator, with alligator clips, may be used for connections to this point.

Figure 4 shows an impedance-matching network for coupling the signal generator to the aerial-input terminals of the Receiver. This network, which is designed so that the input impedance is 75 ohms and the output impedance is 300 ohms, is used to match a 75-ohm generator to a 300-ohm aerial-input circuit. The resistors used in this network should be of carbon-composition construction, and should be chosen from a group to obtain values close to those indicated.

ALIGN TEST Jack Adapter

The ALIGN TEST jack adapter shown in figure 6 should be used during the i-f alignment to apply the proper bias to the a-g-c bias, and to provide a convenient oscilloscope connection. This adapter consists of a 5-prong plug, a 10,000-ohm potentiometer, a 2200-ohm isolating resistor, and a 3-volt battery. A suggested method of fabricating the adapter is also shown.

The potentiometer and switch are connected across the 3-volt battery. The switch is used to disconnect the potentiometer to prevent the discharge of the battery while not in use.

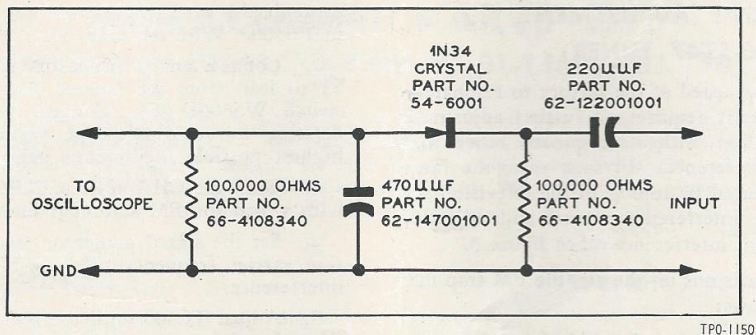


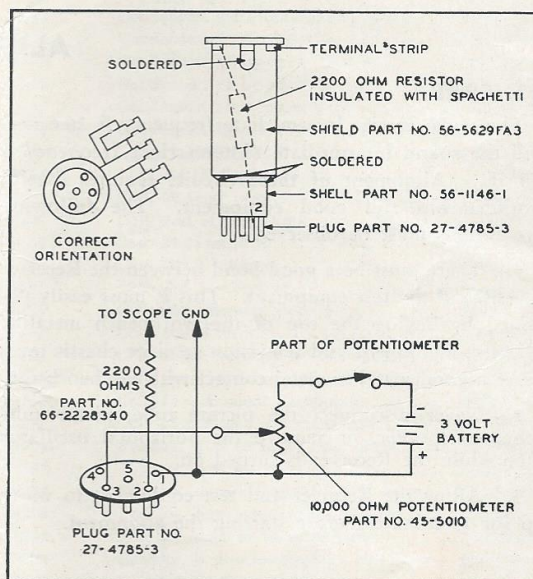
Figure 5. Wiring Diagram of Crystal Detector

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FM TEST Jack Adapter

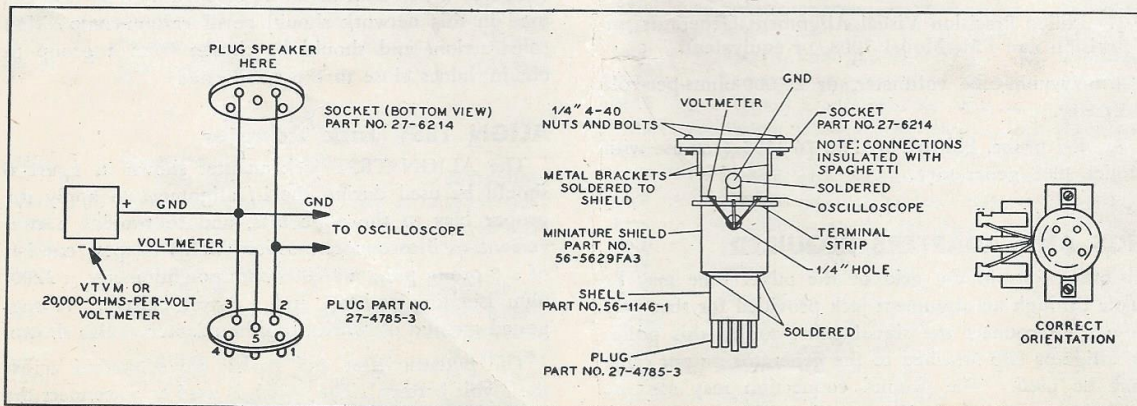
Figure 7 shows the adapter that should be used to connect the voltmeter and oscilloscope to the FM detector. The extra pins on the speaker output socket, J401, are used for test purposes. A suggested method of fabricating the adapter is also shown.

The voltage across C410 varies with signal input to the FM detector, and is used for an indication during sound i-f alignment. This adapter should be plugged into the speaker socket, J401, and the speaker, meter, and oscilloscope connected in place.



TP0-1441

Figure 6. ALIGN TEST Jack Adapter



TP0-1173

Figure 7. FM TEST Jack Adapter

I-F ALIGNMENT

PRELIMINARY

Before proceeding with i-f alignment or making an alignment check, the following preliminary instructions should be observed:

1. Connect the oscilloscope to the 2200-ohm resistor from the ALIGN TEST Jack Adapter.
2. If additional attenuation of the marker signal is required when using Visual Alignment Generator, Model 7008, insert a 10,000-ohm resistor in series with the output lead.

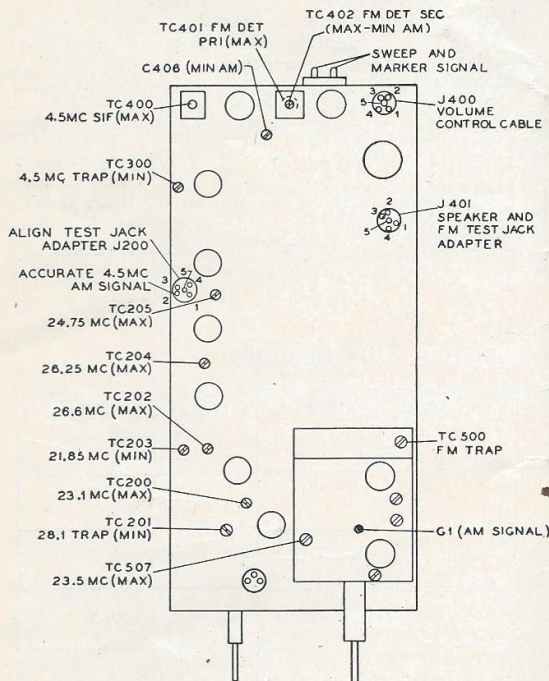


Figure 8. R-F, I-F Chassis, Top View, Showing Locations of Adjustments

3. The AM signal generator should be calibrated accurately to the frequencies used and to the sound and video r-f carriers of each channel used during alignment. If Model 7008 is used, the built-in crystal calibrator provides an excellent means of calibration. An alternate method of calibrating the signal generator to the sound and video r-f carrier frequencies is to zero beat the signal generator with the received signals. Refer to Philco Lesson PR-1745 entitled "Television Service in the Home," for further information regarding this procedure.

4. Preset the television controls as follows:
 - a. CONTRAST control fully counterclockwise.
 - b. BRIGHTNESS control to give a dim raster.
5. During the alignment, remove the cable and plug from J401 and insert the FM TEST jack adapter.
6. Inset the ALIGN TEST jack adapter into J200.

I-F ALIGNMENT PROCEDURE

1. Preset TC201 and TC203 fully counterclockwise. See figure 8. Preset TC200 and TC202 in the middle of their range.
2. Connect oscilloscope to J200, pin 2 through the 2200-ohm resistor from the ALIGN TEST jack adapter, and connect the AM generator to G1.
3. Feed in a 28.1-mc. AM signal, and tune TC201 for minimum output, (use first minimum). Use zero bias during this adjustment.
4. Feed in a 21.85-mc. AM signal and tune TC203 for minimum output (use first minimum). Use zero bias during this adjustment.
5. Tune TC205, TC204, TC202, TC200, and TC507 for maximum output at frequencies indicated. Use 3 volts of bias, and attenuate the generator to keep the output below 2 volts, peak to peak.
6. Feed in sweep and marker signals for Channel 2 through the aerial-input terminals. The response should fall within the limits shown in figure 9. Touch up TC205, TC204, TC202, TC200, and TC507. See note below.

IMPORTANT: Do not turn any of the i-f tuning cores excessively after they have been set to the approximate position by the use of the AM signal generator; to do so may cause poor transient or phase response, resulting in trailing whites or smear.

If a response within the limits shown cannot be obtained by a slight adjustment, carefully repeat the AM adjustments, and, if necessary, trouble-shoot the i-f system. It is preferable to get a response curve within the tolerance range **WITHOUT** touching the adjustments made with the AM signals at the specified frequencies, rather than to attempt to obtain the ideal curve.

NOTE: TC205 rocks top of curve.

TC202 controls level of carrier.

TC204 controls dip or peak on carrier side.

TC200 controls bandwidth (sound side).

TC507 controls dip or peak on sound side.

S.I.F. ALIGNMENT PROCEDURE

1. During s-i-f alignment, remove the first i-f tube, connect a v.t.v.m. or a 20,000-ohms-per-volt voltmeter to the FM TEST jack adapter. Adjust volume control for moderate speaker output.
2. Feed in an accurately calibrated 4.5-mc. AM signal to pin 2 of J200 through the 2200-ohm resistor in the ALIGN TEST jack adapter.
3. Tune TC400, TC401, and TC402 for maximum indications on the meter. The point of maximum meter indication for TC402 should also be the point of minimum speaker output.
4. Tune TC402 and C406 for minimum speaker output.

TELEVISION SERVICE MANUAL

5. Connect r-f probe or crystal detector to grid (pin 2) of picture tube. See note below.
6. Tune TC300 for minimum indication on oscilloscope.
7. Tune in a station and use speaker output as an indication.
8. Turn FINE TUNING control clockwise to obtain a slightly fuzzy picture.
9. Tune C406 and TC402 for minimum AM (noise) output.

NOTE: The r-f probe, Philco Part No. 76-3595, is used as a detector of the 4.5-mc. signal, and the oscilloscope as an indicating device. An alternate crystal detector may be made up as shown in figure 5.

TUNER TUBE REPLACEMENT

Whenever a tube is replaced, it is suggested that, if possible, several be tried to obtain a tube which has approximately the same interelectrode capacitance as that of the original tube to avoid changing the tuner alignment. The picture quality and oscillator fine-tuning range should be observed while selecting tubes.

TUNER ALIGNMENT (76-5747 Tuner)

After the tuner has been serviced, or if it is necessary to use a replacement tube that does not exactly meet the requirements described under TUNER TUBES REPLACEMENT, the tuner alignment should be checked. If realignment is necessary, it should be done according to the procedure given below.

BANDPASS ALIGNMENT

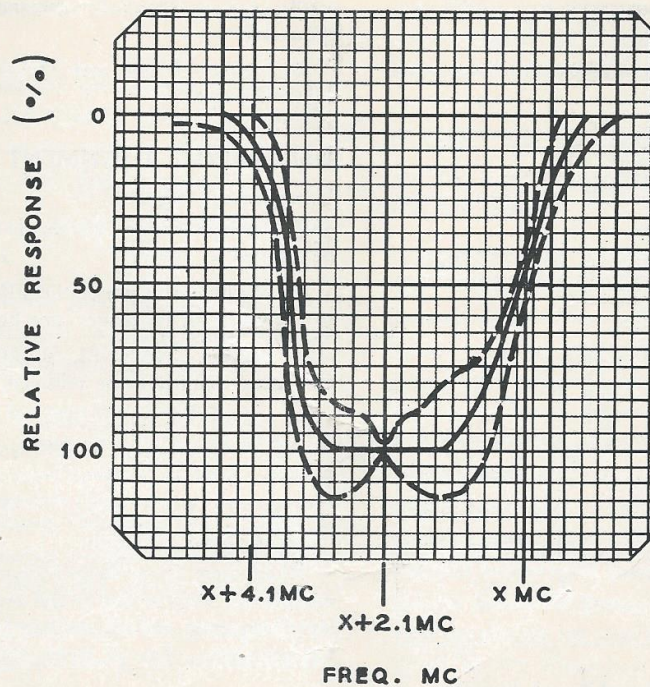
General

The bandpass alignment consists of aligning the tuner at Channels 13 and 6, and then making it track down to Channels 7 and 2, respectively.

During the alignment, a fixed bias of 1.5 volts is applied to the r-f amplifier tube. Sweep is applied to the aerial input, and an oscilloscope is connected in the mixer plate circuit. The oscilloscope gain should be as high as possible consistent with hum level and "bounce" conditions. Hum will cause distortion of the time base and response. "Bounce" will cause the response and time base to jump up and down, and is due to poor line regulation. Use of too high an oscilloscope gain aggravates these conditions, whereas the use of too low a gain necessitates increasing the generator output to a point where the tuner may be overloaded. The pres-

TELEVISION CARRIER AND OSCILLATOR FREQUENCIES

CHANNEL	CHANNEL LIMITS (mc.)	VIDEO CARRIER FREQUENCY (mc.)	SOUND CARRIER FREQUENCY (mc.)	LOCAL OSCILLATOR FREQUENCY (mc.)
2	54—60	55.25	59.75	81.85
3	60—66	61.25	65.75	87.85
4	66—72	67.25	71.75	93.85
5	76—82	77.25	81.75	103.85
6	82—88	83.25	87.75	109.85
7	174—180	175.25	179.75	201.85
8	180—186	181.25	185.75	207.85
9	186—192	187.25	191.75	213.85
10	192—198	193.25	197.75	219.85
11	198—204	199.25	203.75	225.85
12	204—210	205.25	209.75	231.85
13	210—216	211.25	215.75	237.85



XMC = PICTURE CARRIER FREQUENCY OF PARTICULAR CHANNEL

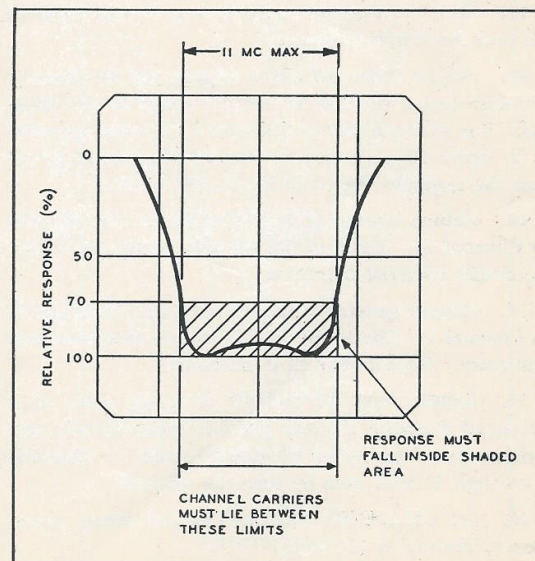
Figure 9. Over-all R-F, I-F Response Curve

TP0-1149

ence of detected overload may be detected by changing the generator output while observing the shape of the response curve. If the shape of the curve changes, the tuner is overloaded and a lower generator output and higher oscilloscope gain must be used. A 330-ohm resistor is shunted across the 1st i-f coil to eliminate the absorption effect of this coil on the response curve.

Bandpass Alignment Procedure

1. Disconnect the white (a-g-c) lead from the tuner and connect to the negative terminal of a 1.5-volt battery. Ground the positive terminal.
2. Connect a 3300-ohm resistor in series with the red lead from the tuner. Connect the "hot" lead of the oscilloscope to the junction of the red lead and the 3300-ohm resistor.
3. Connect a 330-ohm resistor from the green lead to ground.
4. Connect the sweep generator to the 300-ohm aerial input through the aerial matching network. See figure 4.
5. Set CHANNEL SELECTOR and sweep generator to Channel 13 (213 mc.). Adjust generator for sufficient sweep to see complete response curve.
6. Establish the channel limits (figure 10) by using the marker signal generator to produce marker pips on



TP9-512B-1

Figure 10. Tuner Response Curve, Showing Band-pass Limits

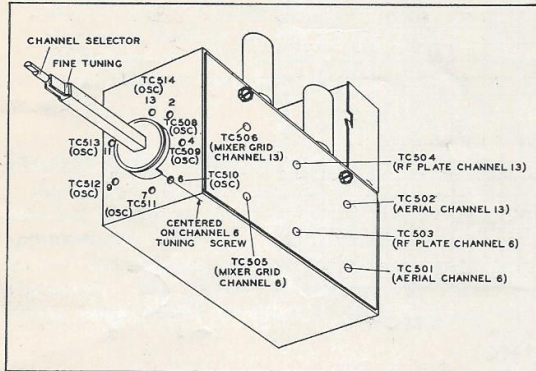
TELEVISION SERVICE MANUAL

the response curve; set the generator first to 210 mc., then to 216 mc.

7. Adjust TC502 (figure 11) for maximum curve height and symmetry.

8. Adjust TC504 and TC506 for a symmetrical response centered about 213 mc.

9. Set CHANNEL SELECTOR and sweep generator to Channel 7 (177 mc.).



TP0-1172

Figure 11. Oblique View of Tuner, Showing Locations of Adjustments

10. Establish the channel limits by using the marker signal generator to produce marker pips on the response curve; set the generator first to 174 mc., then to 180 mc.

11. Observe response curve noting the direction of tilt and the center frequency.

12. Adjust C503 and C511 (figure 12) to obtain a response curve which is the mirror image of the original. For example, if the Channel 7 response appeared as in figure 13a, the trimmer should be adjusted to obtain the response shown in figure 13b.

13. Retune generator and CHANNEL SELECTOR to Channel 13. Readjust TC504 and TC506 for a symmetrically centered bandpass.

14. Retune generator and CHANNEL SELECTOR to Channel 7. Check response for center frequency and symmetry. Repeat step 12 if necessary.

15. Repeat steps 12 and 13 as many times as is necessary to secure the best possible symmetrically centered response curves on Channels 13 and 7. Channels 8 through 12 will then be correctly aligned.

16. Set CHANNEL SELECTOR and sweep generator to channel 6 (85 mc.).

17. Establish the channel limits, using the marker generator to produce marker pips on the response curve; set the generator first to 82 mc., then to 88 mc.

18. Adjust TC501 for maximum curve height and symmetry.

19. Adjust TC503 and TC505 for a symmetrically centered response.

OSCILLATOR ALIGNMENT

Using Station Signal:

If television stations are on the air, the oscillator may be aligned as follows:

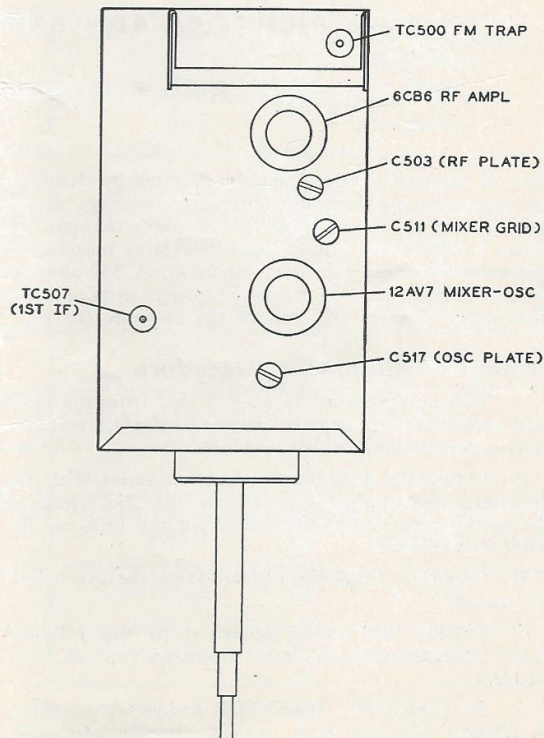
1. Mechanically preset the FINE TUNING control to the center of its range. See figure 11.

2. Set the CHANNEL SELECTOR to the highest frequency channel to be received.

3. Adjust the tuning core of the channel selected, or of the next highest frequency channel, for the best picture. That is, starting with sound in the picture, turn the tuning core until the sound disappears.

Using a Signal Generator:

When there is no station signal, an r-f signal (unmodulated) may be fed in the aerial input at the oscillator frequency, and the oscillator tuning cores adjusted for zero beat. The r-f signal should be accurate, pre-



TP0-1152

Figure 12. Top View of Tuner, Showing Locations of Adjustments

ferably from a crystal source, or calibrated against the television station.

1. Connect r-f generator and tuner as in steps 1 and 4 of BANDPASS ALIGNMENT. (It may be necessary to increase the oscilloscope gain to see the beat. In this instance, base-line hum may be ignored.)

2. Mechanically preset the FINE TUNING control as shown in figure 11.

3. Feed in an r-f signal (unmodulated) at the oscillator frequency for Channel 13 (237.85 mc.) with the CHANNEL SELECTOR turned to Channel 13.

4. Adjust TC514 for zero-beat indication.

5. Adjust TC513 and TC512 for Channels 11 and 9, respectively.

6. Check the oscillator frequency on Channel 8. If the oscillator frequency is high, turn C517 several turns clockwise; low, turn C517 counterclockwise.

7. Repeat steps 3, 4, 5, and 6 until Channels 13, 11, 9, and 8 are within +500 kc. of the correct frequency.

8. Feed in an r-f (unmodulated) signal at the oscillator frequency for Channels 7, 6, 4, and 2, in the order given, and adjust TC511, TC510, TC509, and TC508, respectively.

NOTE: All the oscillator inductances are in series, and any adjustment on one channel will affect all other channels below it.

Beginning with Channel 13 every other coil is tunable, so that by adjusting the tuning cores, it is possible to place either of two adjacent channels exactly on frequency; that is, either Channels 13 or 12, 11 or 10, 9 or 8, etc. The foregoing is based on the assumption that the oscillator has previously been tracked and that it is desired to compensate for small tracking errors on several different channels. It is also apparent that this adjustment procedure should be carried out with the highest channel first, since each channel will affect the channels below it in frequency. The FINE TUNING control should be preset for all adjustments. This is done by placing the stop on the fine-tuning cam at the center of the Channel 6 oscillator tuning core. See figure 11.

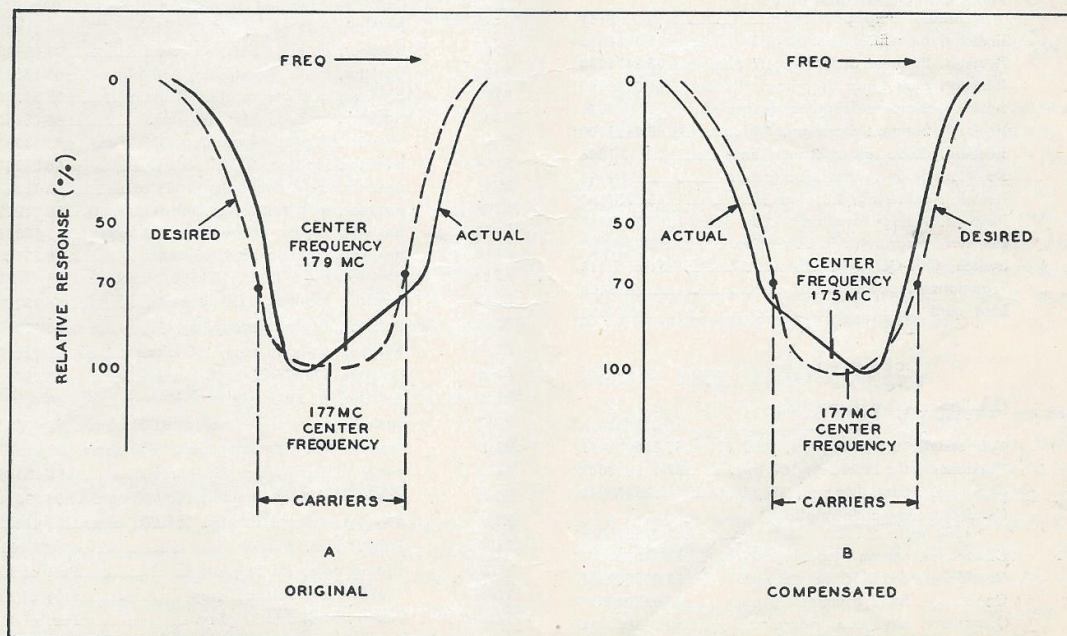


Figure 13. Tuner Response, Showing Tracking Compensation

REPLACEMENT PARTS LIST

MODELS 51-T1601, 51-T1601T, 51-T1602, 51-T1634

NOTE: Part numbers identified by an asterisk (*) are general replacement items. These numbers may not be identical with those on factory parts. Also, the electrical values of some replacement items may differ from the values indicated in the schematic diagram and parts list. The values substituted in any case are so chosen that the operation of the radio will be either unchanged or improved. When ordering replacements, use only the "Service Part No."

SECTION 1

Reference Symbol	Description	Service Part No.
C100	Condenser, input filter, 40 μ f., 450v	30-2568-5
C101	Condenser, 4-section, filter	30-2570-62
C101A	Condenser, filter, 50 μ f., 350v	Part of C101
C101B	Condenser, filter, 30 μ f., 350v	Part of C101
C102	Condenser, bias filter, 10 μ f., 25v	30-2417-8
C103	Condenser, high-voltage d-c blocking, 500 μ f.	30-1229-4
C104	Condenser, high-voltage filter, 500 μ f.	30-1229-4
F100	Fuse, B supply, 6/10 amp., delayed action	45-2656-18
F101	Fuse, filament supply	(Length of #26 copper wire)
I100	Lamp, channel lighting	34-2068
J100	Socket, a-c power	27-6240-1
J101	Socket, chassis power	27-6174
J102	Socket, channel-lamp power	27-6126
L100	Coil, filter choke, 1.5 henries	32-8430
L101	Coil, filter choke, 2.25 henries	32-8435
PL100	Plug, a-c power	Part of W100
PL101	Plug and cable, chassis power	41-3975-4
PL102	Plug, socket and cable assy., channel-lamp power	76-6184
R100	Resistor, bias filter, 10,000 ohms	66-3108340*
R101	Resistor, filament dropping, 4.7 ohms	66-9474360*
R102	Resistor, pilot lamp dropping, 10 ohms	66-0104340*
R103	Resistor, filament dropping (length of wire)	41-4025
R104	Resistor, filament dropping, 4.7 ohms	66-9474360*
R105	Resistor, diode return, 2 megohms	33-1346
R106	Resistor, diode return, 2 megohms	33-1346
R107	Resistor, centering, 3.3 ohms	66-9334360*
R108	Resistor, voltage divider, 18,000 ohms	66-3188340*
R109	Resistor, dropping, 650 ohms, 8w.	33-3445-2
S100	Switch, OFF-ON	Part of R413
T100	Transformer, power	32-8429
W100	Line cord	41-3865

SECTION 2

C200	Condenser, a-g-c decoupling, 1500 μ f.	62-215001011*
C201	Condenser, screen by-pass, 1500 μ f.	62-215001011*
C202	Condenser, d-c blocking, 100 μ f.	62-110009001*
C203	Condenser, fixed trimmer, 39 μ f.	62-039409011*
C204	Condenser, a-g-c decoupling, 1500 μ f.	62-215001011*
C205	Condenser, screen by-pass, 1500 μ f.	62-215001011*
C206	Condenser, d-c blocking, 33 μ f.	62-033009001*
C207	Condenser, fixed trimmer, 22 μ f.	62-022009001*
C208	Condenser, a-g-c decoupling, 1500 μ f.	62-215001011*
C209	Condenser, screen by-pass, 1500 μ f.	62-215001011*
C210	Condenser, a-g-c filter, .22 μ f.	45-3505-49*
C211	Condenser, by-pass, .22 μ f.	45-3505-49*

SECTION 2 (Cont.)

C212	Condenser, cathode by-pass, 1500 μ f.	62-215001011*
C213	Condenser, d-c blocking, 470 μ f.	62-147001001
C214	Condenser, screen by-pass, 1500 μ f.	62-215001011
C215	Condenser, r-f by-pass, 1500 μ f.	62-215001011
C216	Condenser, r-f by-pass, 56 μ f.	62-056409001
C217	Condenser, i-f by-pass, 5 μ f.	30-1224-5*
C218	Condenser, by-pass, .1 μ f.	45-3505-47*
J200	Socket, ALIGN TEST	27-6214
L200	Coil, 1st i-f plate tank	32-4486
L201	Coil, 28.1-mc. trap	32-4303-3
L202	Coil, 2nd i-f plate tank	32-4486
L203	Coil, 21.85-mc. trap	32-4486
L204	Coil, 3rd i-f primary	Part of T200
L205	Coil, 3rd i-f secondary	Part of T200
L206	Coil, r-f-c, filament decoupling	32-4112-15
L207	Coil, 4th i-f tank	32-4486
L208	Coil, series peaking, 40 microhenries	32-4143-16
L209	Coil, shunt peaking, 100 microhenries	32-4480-3
L210	Coil, r-f-c, filament decoupling	32-4112-15
L211	Coil, r-f-c, filament decoupling	32-4112-15
R200	Resistor, grid return, 15,000 ohms	66-3158340*
R201	Resistor, cathode bias, 68 ohms	66-0688340*
R202	Resistor, a-g-c decoupling, 330 ohms	66-1338340*
R203	Resistor, grid return, 12,000 ohms	66-3128340*
R204	Resistor, cathode bias, 68 ohms	66-0688340*
R205	Resistor, B plus decoupling, 330 ohms	66-1338340*
R206	Resistor, loading, 33,000 ohms	66-3338340*
R207	Resistor, a-g-c decoupling, 330 ohms	66-1338340*
R208	Resistor, grid return, 12,000 ohms	66-3128340*
R209	Resistor, B plus decoupling, 330 ohms	66-1338340*
R210	Resistor, cathode bias, 68 ohms	66-0688340*
R211	Resistor, a-g-c filter, 100,000 ohms	66-4108340*
R212	Resistor, loading, 8200 ohms	66-2828340*
R213	Resistor, B plus decoupling, 330 ohms	66-1338340*
R214	Resistor, cathode bias, 150 ohms	66-1154340*
R215	Resistor, platefeed, 6800 ohms	66-2688340*
R216	Resistor, r-f filter, 100,000 ohms	66-4108340*
R217	Resistor, a-g-c diode load, 330,000 ohms	66-4338340*
R218	Resistor, video-detector load, 3300 ohms	66-2338340*
R219	Resistor, decoupling, 330 ohms	66-1338340*
R220	Resistor, voltage divider, 1000 ohms	66-2108340*
R221	Resistor, voltage divider, 150,000 ohms	66-4158340*
T200	Transformer, 3rd i-f	32-4486-6
TC200	Tuning core, 1st i-f plate	Part of L200
TC201	Tuning core, 28.1-mc. trap	Part of L201
TC202	Tuning core, 2nd i-f plate	Part of L202
TC203	Tuning core, 21.85-mc. trap	Part of L203
TC204	Tuning core, 3rd i-f transformer	Part of T200
TC205	Tuning core, 4th i-f tank	Part of L207

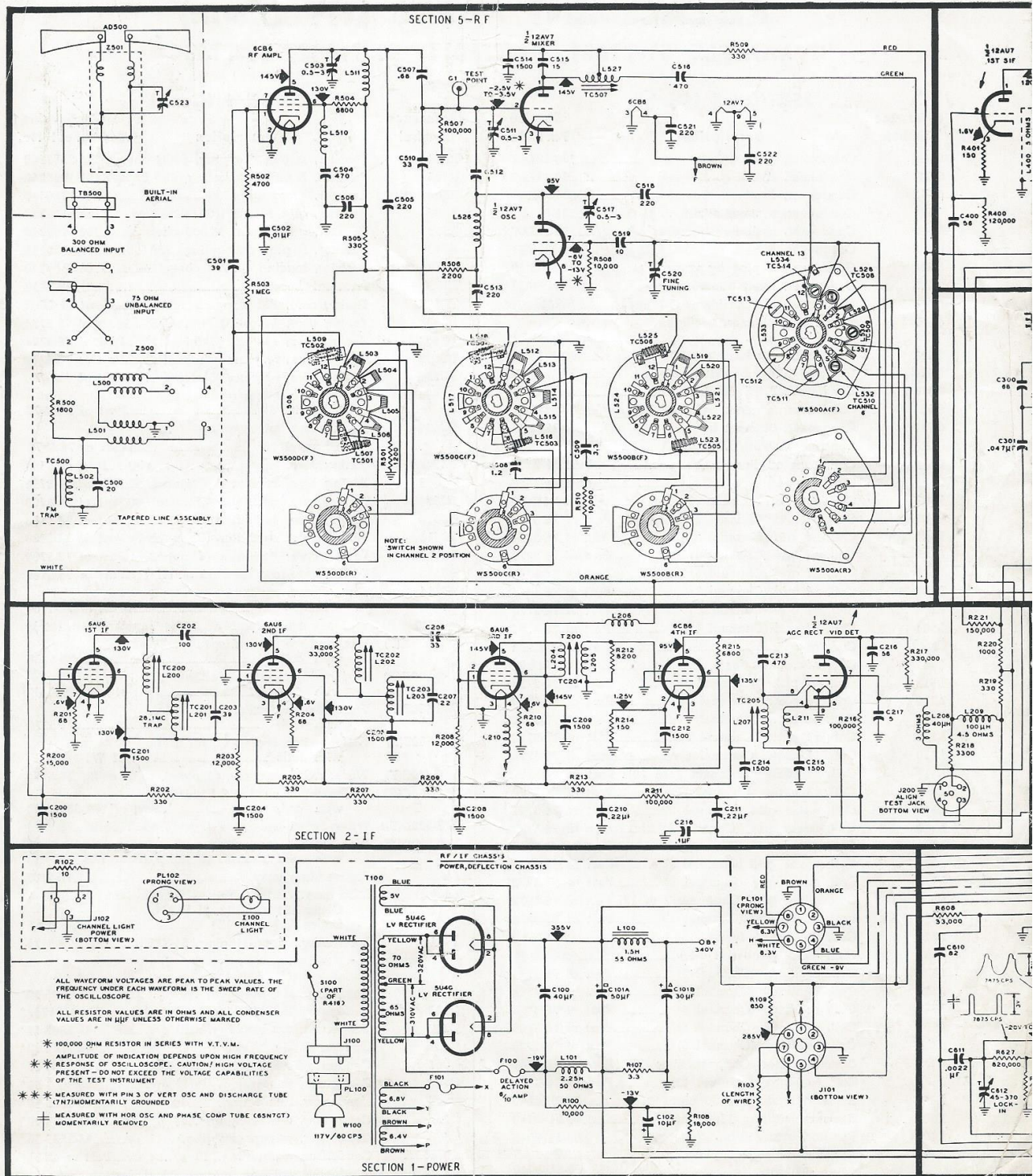
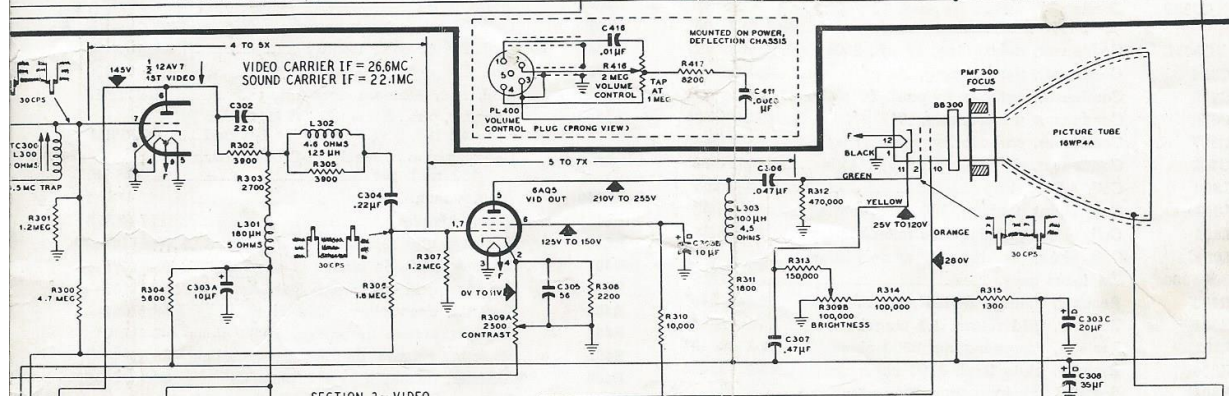
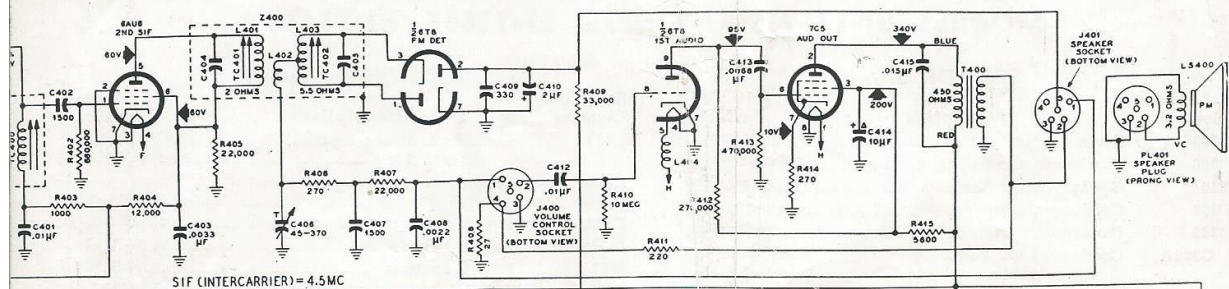
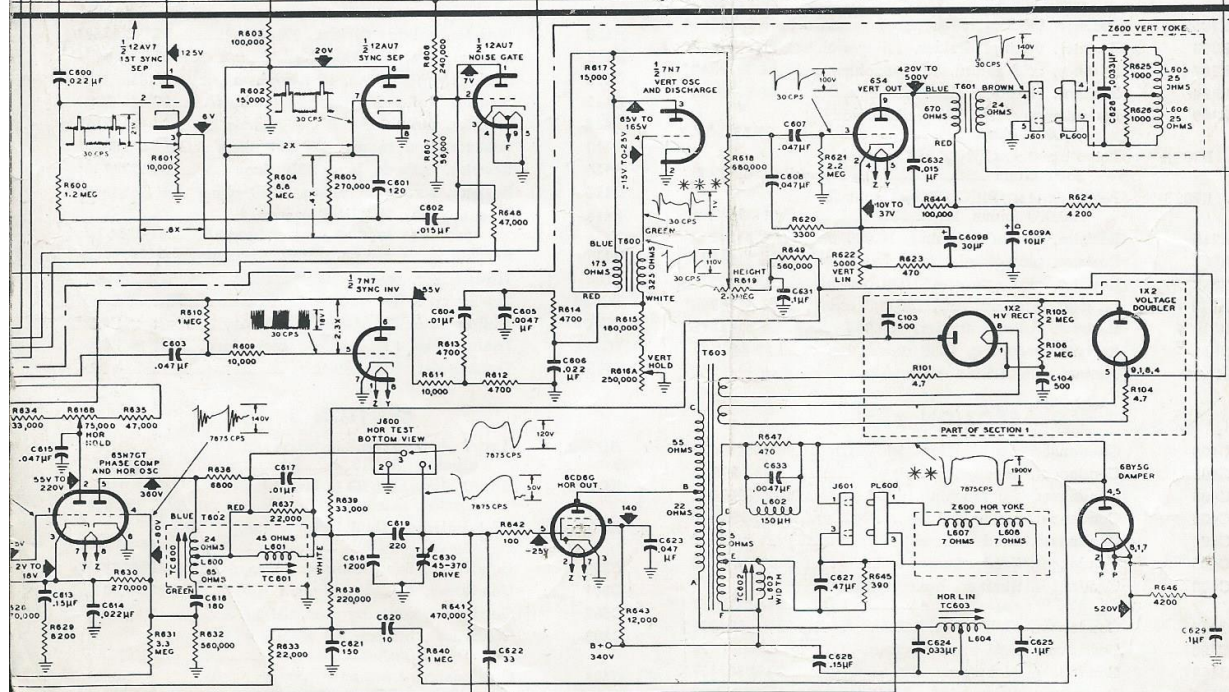


Figure 14. Schematic Diagram, Models 51-T1601, Code 121, 51-T

SECTION 4-SOUND



SECTION 3-VIDEO



SECTION 6 - SYNC AND DEFLECTION

1601T, Code 121, 51-T1602, Code 121 and 51-T1634, Code 123

TP0-1443

REPLACEMENT PARTS LIST (Cont.)

MODELS 51-T1601, 51-T1601T, 51-T1602, 51-T1634

SECTION 3

Reference Symbol	Description	Service Part No.
BB300	Beam bender, p-m	76-6077
C300	Condenser, fixed trimmer, 68 μ f.	62-068409011*
C301	Condenser, d-c blocking, .047 μ f.	45-3505-62*
C302	Condenser, compensating, 220 μ f.	30-1224-20*
C303	Condenser, 4-section, filter	30-2570-65
C303A	Condenser, low-frequency compensating, 10 μ f., 350v	Part of C303
C303B	Condenser, screen by-pass, 10 μ f., 350v	Part of C303
C303C	Condenser, decoupling, 20 μ f., 350v	Part of C303
C304	Condenser, d-c blocking, .22 μ f.	45-3505-48*
C305	Condenser, cathode by-pass, 56 μ f.	62-056409001*
C306	Condenser, d-c blocking, .047 μ f.	45-3505-62*
C307	Condenser, cathode by-pass, .47 μ f.	45-3500-4*
C308	Condenser, decoupling 35 μ f., 450v	30-2570-25
L300	Coil, 4.5-mc. trap	32-4483-5
L301	Coil, shunt peaking, 180 microhenries	32-4480-9
L302	Coil, series peaking, 125 microhenries	32-4480-8
L303	Coil, shunt peaking, 100 microhenries	32-4480-3
PM-F300	PM focus assy.	76-5725
R300	Resistor, voltage divider, 4.7 megohms	66-5478340*
R301	Resistor, grid return, 1.2 megohms	66-5128340*
R302	Resistor, compensating, 3900 ohms	66-2398340*
R303	Resistor, plate load, 2700 ohms	66-2278340*
R304	Resistor, low-frequency compensating, 5600 ohms	66-2568340*
R305	Resistor, loading, 3900 ohms	66-2398340*
R306	Resistor, voltage divider, 1.8 megohms	66-5128340*
R307	Resistor, grid return, 1.2 megohms	66-5128340*
R308	Resistor, shunting, 2200 ohms	66-2228340*
R309	Potentiometer, dual, 2500 ohms and 100,000 ohms	33-5563-27
R309A	Potentiometer, CONTRAST control, 2500 ohms	Part of R309
R309B	Potentiometer, BRIGHTNESS control, 100,000 ohms	Part of R309
R310	Resistor, screen dropping, 10,000 ohms	66-3104340
R311	Resistor, plate load, 1800 ohms, 2w.	66-2185340*
R312	Resistor, grid return, 470,000 ohms	66-4478340*
R313	Resistor, cathode bias, 150,000 ohms	66-4118340*
R314	Resistor, voltage divider, 100,000 ohms	66-4104340*
R315	Resistor, dropping, 1300 ohms, 9w.	33-3435-31
TC300	Tuning core, 4.5-mc. trap	Part of L300

SECTION 4

C400	Condenser, d-c blocking, 56 μ f.	62-056409001*
C401	Condenser, decoupling, .01 μ f.	45-3505-58*
C402	Condenser, d-c blocking, 1500 μ f.	62-215001011*
C403	Condenser, screen by-pass, .0033 μ f.	45-3505-55*
C404	Condenser, fixed trimmer	Part of Z400
C405	Condenser, fixed trimmer	Part of Z400
C406	Condenser, trimmer, balancing 45-370 μ f.	31-6473-18
C407	Condenser, r-f by-pass, 1500 μ f.	62-215001001*
C408	Condenser, tone compensating, .0022 μ f.	45-3505-54*
C409	Condenser, r-f by-pass, 330 μ f.	60-10335407*
C410	Condenser, filter, 2 μ f., 50v	30-2417-7
C411	Condenser, tone compensating, .0068 μ f.	45-3505-40*
C412	Condenser, d-c blocking, .01 μ f.	45-3505-58*
C413	Condenser, d-c blocking, .0068 μ f.	45-3505-40*

SECTION 4 (Cont.)

Reference Symbol	Description	Service Part No.
C414	Condenser, screen by-pass, 10 μ f., 350v	Part of C303
C415	Condenser, tone compensating, .015 μ f.	45-3509-59*
C416	Condenser, d-c blocking, .01 μ f.	45-3505-58*
J400	Socket, volume control	27-6214
J401	Socket, speaker	27-6214
L400	Coil, 1st s-i-f	32-4449A
L401	Coil, FM detector primary	Part of Z400
L402	Coil, FM detector tertiary	Part of Z400
L403	Coil, FM detector secondary	Part of Z400
L404	Coil, r-f-c, filament decoupling	32-4112-15
LS400	Speaker, p.m., 6-inch, 51-T1601, Codes 121 and 122, 51-T1602, Codes 121 and 122, 36-1638-1	
LS400	Speaker, p.m., 10-inch, 51-T1634, Codes 123 and 124	36-1640*
PL400	Plug, volume control	27-4785-3
PL401	Plug, speaker	27-4785-3
R400	Resistor, grid return, 120,000 ohms	66-4128340*
R401	Resistor, cathode bias, 150 ohms	66-1158340*
R402	Resistor, grid return, 680,000 ohms	66-4688340*
R403	Resistor, decoupling, 1000 ohms	66-2104340*
R404	Resistor, screen dropping, 12,000 ohms	66-4124340*
R405	Resistor, voltage divider, 22,000 ohms	66-3224340*
R406	Resistor, decoupling, 270 ohms	66-1278340*
R407	Resistor, tone compensating, 22,000 ohms	66-3228340*
R408	Resistor, voltage divider, 27 ohms	66-0273340*
R409	Resistor, filter, 33,000 ohms	66-3338340*
R410	Resistor, grid return, 10 megohms	66-6108340*
R411	Resistor, voltage divider, 220 ohms	66-1223340*
R412	Resistor, plate load, 270,000 ohms	66-4278340*
R413	Resistor, grid return, 470,000 ohms	66-4478340*
R414	Resistor, cathode bias, 270 ohms	66-1274340*
R415	Resistor, screen dropping, 5600 ohms	66-2564340*
R416	Potentiometer, VOLUME control, 2 megohms tapped at 1 megohm	33-5564-10
R417	Resistor, tone compensating, 8200 ohms	66-2828340*
T400	Transformer, audio output	32-8242-9
TC400	Tuning core, 1st s-i-f	Part of L400
TC401	Tuning core, FM detector, primary	Part of Z400
TC402	Tuning core, FM detector, secondary	Part of Z400
Z400	Transformer, FM detector	32-4450

SECTION 5

AD500	Aerial element (built-in broad-band dipole), 51-T1634	56-7635
AD500	Aerial element (built-in broad-band dipole), notched 51-T1602	56-8435
AD500	Aerial element (built-in broad-band dipole), 51-T1601	56-8512-1
C500	Condenser, fixed trimmer, 20 μ f.	62-020309011
C501	Condenser, d-c blocking, 39 μ f.	62-039409011
C502	Condenser, a-g-c by-pass, .01 μ f.	30-1238-2
C503	Condenser, trimmer, r-f plate, .5 to 3 μ f.	31-6520-1
C504	Condenser, r-f screen by-pass, 470 μ f.	62-147001011*
C505	Condenser, d-c blocking, 220 μ f.	30-1225-11
C506	Condenser, B plus decoupling, 220 μ f.	30-1225-11
C507	Condenser, coupling, .68 μ f.	30-1221-11

REPLACEMENT PARTS LIST (Cont.)

MODELS 51-T1601, 51-T1601T, 51-T1602, 51-T1634

SECTION 5 (Cont.)

Reference Symbol	Description	Service Part No.
C508	Condenser, coupling, 1.2 μ f.	30-1221-7
C509	Condenser, coupling, 3.3 μ f.	30-1221-9
C510	Condenser, fixed padder, 33 μ f.	62-033009001*
C511	Condenser, trimmer mixer, .5 to 3 μ f.	31-6520-1
C512	Condenser, oscillator injection 1.0 μ f.	30-1224-7
C513	Condenser, B plus by-pass, 220 μ f.	30-1225-11
C514	Condenser, B plus by-pass, 1500 μ f.	30-1225-19
C515	Condenser, fixed trimmer, 15 μ f.	62-015409011*
C516	Condenser, d-c blocking, 470 μ f.	62-147001001*
C517	Condenser, trimmer, oscillator, .5 to 3 μ f.	31-6520-1
C518	Condenser, d-c blocking, 220 μ f.	30-1225-11
C519	Condenser, d-c blocking, 10 μ f.	30-1224-48
C520	Condenser, FINE TUNING	76-5755
C521	Condenser, filament by-pass, 220 μ f.	30-1225-11
C522	Condenser, filament by-pass, 220 μ f.	30-1225-11
C523	Condenser, AERIAL TUNING	31-6523
L500	Coil, tapered line	Part of Z500
L501	Coil, tapered line	Part of Z500
L502	Coil, FM trap	32-4438-1
L503	Coil, r-f grid (Channel 2)	Part of 76-5774
L504	Coil, r-f grid (Channel 3)	Part of 76-5774
L505	Coil, r-f grid (Channel 4)	Part of 76-5774
L506	Coil, r-f grid (Channel 5)	Part of 76-5774
L507	Coil, r-f grid (Channel 6)	Part of 76-5774
L508	Coil, r-f grid (Channels 7 to 12)	Part of 76-5774
L509	Coil, r-f grid (Channel 13)	Part of 76-5774
L510*	Coil, r-f-c	Part of C504
L511	Coil, r-f-c, plate feed	32-4112-22
L512	Coil, r-f plate (Channel 2)	Part of 76-5770
L513	Coil, r-f plate (Channel 3)	Part of 76-5770
L514	Coil, r-f plate (Channel 4)	Part of 76-5770
L515	Coil, r-f plate (Channel 5)	Part of 76-5770
L516	Coil, r-f plate (Channel 6)	Part of 76-5770
L517	Coil, r-f plate (Channels 7 to 12)	Part of 76-5770
L518	Coil, r-f plate, (Channel 13)	Part of 76-5770
L519	Coil, mixer grid (Channel 2)	Part of 76-5772
L520	Coil, mixer grid, (Channel 3)	Part of 76-5772
L521	Coil, mixer grid (Channel 4)	Part of 76-5772
L522	Coil, mixer grid (Channel 5)	Part of 76-5772
L523	Coil, mixer grid (Channel 6)	Part of 76-5772
L524	Coil, mixer grid (Channels 7 to 12)	Part of 76-5772
L525	Coil, mixer grid (Channel 13)	Part of 76-5772
L526	Coil, r-f-c, plate feed	32-4112-2
L527	Coil, mixer plate (1st v-i-f)	32-4359-10
L528	Coil, oscillator (Channel 2)	Part of 76-5768
L529	Coil, oscillator (Channel 3)	Part of 76-5768
L530	Coil, oscillator (Channel 4)	Part of 76-5768
L531	Coil, oscillator (Channel 5)	Part of 76-5768
L532	Coil, oscillator (Channel 6)	Part of 76-5768
L533	Coil, oscillator (Channels 7 to 12)	Part of 76-5768
L534	Coil, oscillator (Channel 13)	Part of 76-5768
R500	Resistor, loading, 1800 ohms	66-2188340
R501	Resistor, loading, 1200 ohms	66-2128340
R502	Resistor, grid return, 4700 ohms	66-2478340
R503	Resistor, a-g-c decoupling, 1 megohm	66-5108340

*NOTE: Consists of 1-1/4 turns of the condenser lead, wrapped around itself.

SECTION 5 (Cont.)

Reference Symbol	Description	Service Part No.
R504	Resistor, screen dropping, 6800 ohms	66-2688340
R505	Resistor, B plus decoupling, 330 ohms	66-1338340
R506	Resistor, dropping, 2200 ohms	66-2228340
R507	Resistor, grid return, 100,000 ohms	66-4108340
R508	Resistor, grid return, 10,000 ohms	66-3108340
R509	Resistor, B plus decoupling, 330 ohms	66-1338340
R510	Resistor, loading, 10,000 ohms	66-3108340
TB500	Terminal board	38-8689
TC500	Tuning core, FM trap	Part of L502
TC501	Tuning core, r-f grid (Channel 6)	Part of 76-5774
TC502	Tuning core, r-f grid (Channel 13)	Part of 76-5774
TC503	Tuning core, r-f plate (Channel 6)	Part of 76-5770
TC504	Tuning core, r-f plate (Channel 13)	Part of 76-5770
TC505	Tuning core, mixer grid (Channel 6)	Part of 76-5772
TC506	Tuning core, mixer grid (Channel 13)	Part of 76-5772
TC507	Tuning core, mixer plate (1st v-i-f)	Part of L527
TC508	Tuning core, oscillator (Channel 2)	Part of 76-5768
TC509	Tuning core, oscillator (Channel 4)	Part of 76-5768
TC510	Tuning core, oscillator (Channel 6)	Part of 76-5768
TC511	Tuning core, oscillator (Channel 7)	Part of 76-5768
TC512	Tuning core, oscillator (Channel 9)	Part of 76-5768
TC513	Tuning core, oscillator (Channel 11)	Part of 76-5768
TC514	Tuning core, oscillator (Channel 13)	Part of 76-5768
WS500	Wafer-switch assembly	Not Supplied separately
WS-500A(F)	Wafer-switch section (oscillator), with coils	76-5768
WS-500A(R)	Wafer-switch section (oscillator), with coils	Part of WS-500A (F)
WS-500B(F)	Wafer-switch section (mixer grid), with coils	76-5772
WS-500B(R)	Wafer-switch section (mixer grid), with coils	Part of WS-500B (F)
WS-500C(F)	Wafer-switch section (r-f plate), with coils	76-5770
WS-500C(R)	Wafer-switch section (r-f plate), with coils	Part of WS-500C (F)
WS-500D(F)	Wafer-switch section (r-f grid), with coils	76-5774
WS-500D(R)	Wafer-switch section (r-f grid), with coils	Part of WS-500D (F)
Z500	Tapered-line assy.	76-5767
Z501	Loop assy., aerial tuning, 51-T1602, Codes 121 and 122, 51-T1634, Codes 123 and 124	76-6220-1
Z501	Loop assy., aerial tuning, 51-T1601T	76-6471

SECTION 6

C600	Condenser, d-c blocking, .02 μ f.	45-3505-60*
C601	Condenser, d-c blocking, 120 μ f.	60-10135237*
C602	Condenser, d-c blocking, .015 μ f.	45-3505-59*
C603	Condenser, d-c blocking, .047 μ f.	45-3505-62*
C604	Condenser, d-c blocking, .01 μ f.	45-3505-58*
C605	Condenser, integrating, .0047 μ f.	45-3505-56*
C606	Condenser, integrating, .22 μ f.	45-3505-60*
C607	Condenser, d-c blocking, .047 μ f.	45-3505-62*
C608	Condenser, sweep charging, .047 μ f.	45-3505-62*
C609A	Condenser, decoupling, 10 μ f., 400v.	Part of C101
C609B	Condenser, cathode by-pass, 30 μ f., 25v	Part of C101
C610	Condenser, voltage divider, 82 μ f.	60-00825237