RCC TELEVISION Service Manual

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1950-51 Supplement No. 2

GORDON OLIVER TELEVISION
T. V. RADIO
YO 4815 923 CALVERHALL ST.
NORTH VANCOUVER, B. C.

INDEX

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PHILIPS

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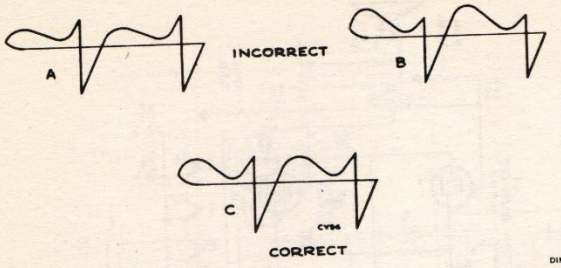


Fig. 10—Horizontal Oscillator Waveforms

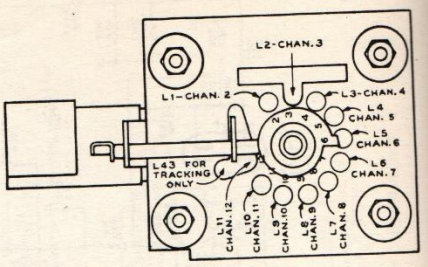
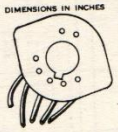


Fig. 9—R-F Oscillator Adj.



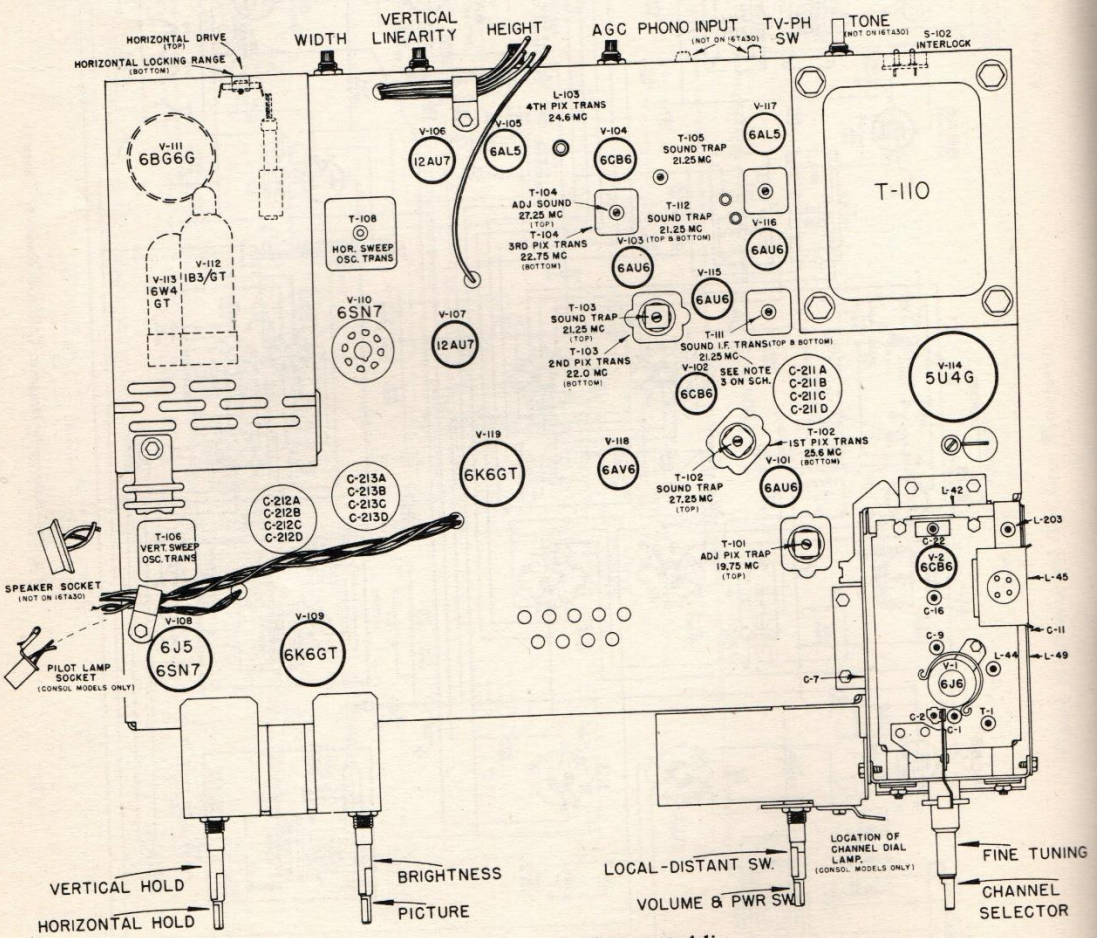


Fig. 5. Chassis Layout and Alignment Adj.

Alignment Procedure

SOUND DISCRIMINATOR ALIGNMENT.—Set the signal generator for approximately .1 volt output at 21.25 mc. and connect it to the second sound i-f grid, pin 1 of V116.

Detune T112 secondary (bottom) to the extreme counter-clockwise position.

Set the "VoltOhmyst" on the 3-volt scale.

Connect the meter, in series with a one-megohm resistor, to pin 7 of V117.

Adjust the primary of T112 (top) for maximum output on the meter.

Connect the "VoltOhmyst" to (Disc. output on 16TA30 only) the junction of R192 and S103. Adjust T112 secondary (bottom). It will be found that it is possible to produce a positive or negative voltage on the meter dependent upon this adjustment. Obviously to pass from a positive to a negative voltage, the voltage must go through zero. T112 (bottom) should be adjusted so that the meter indicates zero output as the voltage swings from positive to negative. This point will be called discriminator zero output.

Connect the sweep oscillator to the grid of the second sound i-f amplifier, pin 1 of V116.

Adjust the sweep band width to approximately 1 mc. with the center frequency at approximately 21.25 mc. and with an output of approximately .1 volt.

Connect the oscilloscope to (Disc. output on 16TA30 only) the junction of R192 and S103. The pattern obtained should be similar to that shown in Figure 11. If it is not, adjust T112 (top) until the wave form is symmetrical.

The peak-to-peak band width of the discriminator should be approximately 400 kc. and the trace should be linear from 21.175 mc. to 21.325 mc.

Note.—The bottom core and stud in the discriminator transformer are at plus B potential.

SOUND I-F ALIGNMENT.—Connect the sweep oscillator to the first sound i-f amplifier grid, pin 1 of V115.

Insert a 21.25 mc. marker signal from the signal generator into the first sound i-f grid.

With the oscilloscope connected as above, adjust T111 for maximum gain and symmetry about the 21.25 mc. marker on the discriminator pattern. The pattern obtained should be similar to that shown in Figure 11.

The output level from the sweep should be set to produce approximately 1 volt peak-to-peak at the junction of R192 and S103, when the final touches on the above adjustment are made. It is necessary that the sweep output voltage should not exceed the specified values otherwise the response curve will be broadened, permitting slight misadjustment to pass unnoticed and possibly causing distortion on weak signals.

The band width at 70% response from the first sound i-f grid to the second i-f grid should be approximately 530 kc.

PICTURE I-F TRAP ADJUSTMENT.—Connect the "VoltOhmyst" to the junction of R102 and R301.

Obtain a 4.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction of R102 and R301. Adjust the potentiometer for —3.0 volts indication on the "VoltOhmyst."

Set the channel switch to the blank position between channels number 2 and 13.

Connect the "VoltOhmyst" to pin 2 of V106 and to ground.

Connect the output of the signal generator to terminal D of T101.

Set the generator to each of the following frequencies and with a thin fiber screwdriver tune the specified adjustment for minimum indication on the "VoltOhmyst." In each instance the generator should be checked against a crystal calibrator to insure that the generator is exactly on frequency.

(1) 21.25 mc.—T103 (top)
(2) 21.25 mc.—T105 (top)
(3) 27.25 mc.—T102 (top)
(4) 27.25 mc.—T104 (top)
(5) 19.75 mc.—T101 (top)

PICTURE I-F TRANSFORMER ADJUSTMENTS.—Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary to prevent overloading.

24.6 mc.—L103
22.75 mc.—T104 (bottom)
22.00 mc.—T103 (bottom)
25.6 mc.—T102 (bottom)

R-F UNIT ALIGNMENT.—Disconnect the co-ax link from terminal 2 of the r-f unit terminal board and connect a 39 ohm composition resistor between lugs 1 and 2.

Detune T1 by backing the core all the way out of the coil.

In early production units in which L44 is adjustable, back the L44 core all the way out.

In order to align the r-f tuner, it will first be necessary to set the channel 13 oscillator to frequency. The shield over the bottom of the r-f unit must be in place when making any adjustments.

The oscillator may be aligned by adjusting it to beat with a crystal-calibrated heterodyne frequency meter, or by feeding a signal into the receiver at the r-f sound carrier frequency and adjusting the oscillator for zero output from the sound discriminator. In this latter case the sound discriminator must first have been aligned to exact frequency. Either method of adjustment will produce the same results. The method used will depend upon the type of test equipment available. Regardless of which method of oscillator alignment is used, the frequency standard must be crystal controlled or calibrated.

If the receiver oscillator is to be adjusted by the heterodyne frequency meter method, couple the meter probe loosely to the receiver oscillator.

If the receiver oscillator is adjusted by feeding in the r-f sound carrier signal, connect the signal generator to the receiver antenna terminals. Connect the "VoltOhmyst" to the sound discriminator output (junction of R192 and S103). Also couple the link loosely to lug 2 of the r-f unit terminal board so as to permit measurement at sound discriminator.

Set the channel selector switch to 13.

Adjust the frequency standard to the correct frequency (236.75 mc. for heterodyne frequency meter or 215.75 mc. for the signal generator).

Set the fine tuning control to the middle of its range.

Adjust C1 for an audible beat on the heterodyne frequency meter or zero voltage from sound discriminator.

Now that the channel-13 oscillator is set to frequency, we may proceed with the r-f alignment.

Turn the Loc.-Dist. Switch to 'loc.' position.

Connect the bias box to terminal 3 of the r-f unit terminal board and adjust the bias box potentiometer for —3.5 volts.

Connect the oscilloscope to the test connection at R5 on top of the r-f unit.

Connect the r-f sweep oscillator to the receiver antenna terminals. The method of connection depends upon the output impedance of the sweep. The P300 connections for 300-ohm balanced or 72-ohm single-ended input are shown in the circuit diagram. If the sweep oscillator has a 50-ohm single-ended output, 300-ohm balanced output can be obtained by connecting as shown in Figure 4.

Connect the signal generator loosely to the receiver antenna terminals.

Set the sweep oscillator to cover channel 8.

Set the sweep oscillator to cover channel 8.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

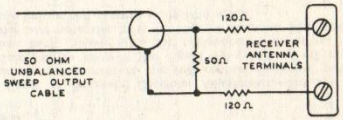


Figure 4—Unbalanced Sweep Cable Termination

Adjust C9, C11, C16 and C22 for approximately correct curve shape, frequency, and band width as shown in Figure 8.

The correct adjustment of C22 is indicated by maximum amplitude of the curve midway between the markers. C16 tunes the r-f amplifier plate circuit and affects the frequency of the curve most noticeably. C9 tunes the converter grid circuit and affects the tilt of the curve most noticeably (assuming that C22 has been properly adjusted). C11 is the coupling adjustment and hence primarily affects the response band width.

Set the receiver channel switch to channel 6.

Adjust the frequency standard to the correct frequency (108.75 mc. for heterodyne frequency meter or 87.75 mc. for the signal generator).

Set the fine tuning control to the middle of its range.

Adjust L5 for an audible beat on the heterodyne frequency meter or zero voltage from sound discriminator.

Set the sweep generator to channel 6.

From the signal generator, insert channel 6 sound and picture carrier markers, 83.25 mc. and 87.75 mc.

Adjust L42, L45 and L49 for proper response as shown in Figure 8.

L42 is adjusted to give maximum amplitude of the curve between the markers. L45 primarily affects the tilt of the curve. L49 primarily affects the frequency of response.

Connect the "VoltOhmyst" to the r-f unit test point at R5.

Adjust C7 for —3.0 volts at the test point.

Retouch L42, L45 and L49 for proper response if necessary. If necessary, retouch C11 for proper band width on channel 6. Continue these retouching adjustments until proper response is obtained and —3.0 volts of oscillator injection is present at the test point.

Set the receiver channel selector switch to channel 8 and readjust C1 for proper oscillator frequency.

Set the sweep oscillator and signal generator to channel 8.

Readjust C9, C16 and C22 for correct curve shape, frequency and band width. Readjust C11 only if necessary.

Switch the receiver, the sweep oscillator and signal generator to channel 13.

Adjust L52 for maximum amplitude of the curve midway between markers and then overshoot the adjustment by turning the slug in the same direction from the initial setting a little more than the amount of turning required to reach maximum amplitude of response.

Adjust C22 for maximum amplitude of response.

Turn off the sweep generator. Adjust the L43 core for correct channel 13 oscillator frequency, then overshoot the adjustment by turning the slug a little more in the same direction from the initial setting. Reset the oscillator to proper frequency by adjustment of C1.

Turn the sweep oscillator back on.

Check the response of channels 7 through 13 by switching the receiver channel switch, sweep oscillator and marker oscillator to each of these channels and observing the response and oscillator injection obtained. See Figure 8 for typical response curves. It should be found that all these channels have the proper shaped response with the markers above 80% response.

If the markers do not fall within this requirement, switch to channel 8 and readjust C9, C11, C16 and C22 as necessary. If C22 required adjustment, the adjustment should be overshot a small amount and corrected by adjustment of L52 to give maximum amplitude of response between the sound and picture carrier markers. The antenna circuit (L52, C22) is broad so that tracking is not particularly critical.

If the valley in the top of the selectivity curves for the high channels is deeper than normal, the curve can be flattened somewhat by decreasing the inductance of L44 by turning the core stud in. Be sure to check for undesirable resonant suckouts on channels 7 and 8 if this is done. In later production units, L44 may be fixed and not require adjustment.

Turn the sweep oscillator off and check the receiver r-f oscillator frequency. If the oscillator is off frequency overshoot the adjustment of C1 and correct by adjusting L43.

Turn the receiver channel selector switch to channel 6. Adjust L5 for correct oscillator frequency.

Turn the sweep oscillator on and to channel 6 and observe the response curve. If necessary readjust L42, L45 and L49. It should not be necessary to touch C11.

Check the oscillator injection voltage at the test point. If necessary adjust C7 to give —3 volts injection. If C7 is adjusted, switch to channel 8, and readjust C9 for proper curve shape, then recheck channel 6.

Switch the receiver through channel 6 down through channel 2 and check for normal response curve shapes and oscillator injection voltage.

Likewise check channels 7 through 13, stopping on 13 for the next step.

With the receiver on channel 13, check the receiver oscillator frequency. Correct by adjustment of C1 if necessary.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator trimmer for the specified indication. It should be possible to adjust the oscillator to the correct frequency on all channels with the fine tuning control in the middle third of its range.

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.	Channel Oscillator Adjustment
2	55.25	59.75	80.750	L1
3	61.25	65.75	86.750	L2
4	67.25	71.75	92.750	L3
5	77.25	81.75	102.750	L4
6	83.25	87.75	108.750	L5
7	175.25	179.75	200.750	L6
8	181.25	185.75	206.750	L7
9	187.25	191.75	212.750	L8
10	193.25	197.75	218.750	L9
11	199.25	203.75	224.750	L10
12	205.25	209.75	230.750	L11
13	211.25	215.75	236.750	C1

Switch to channel 8 and observe the response.

Adjust T1 clockwise while watching the change in response. When T1 is properly adjusted, the selectivity curve will be slightly wider with a slightly deeper valley in its top.

Switch through all channels and observe response, oscillator injection and r-f oscillator frequency. Minor touch-ups of adjustments may be made at this time. However, if C7 or C9 are changed appreciably, then a recheck of the oscillator frequency on all channels should be made.

Remove the 39 ohm resistor and reconnect the link from T101 to terminal 2 of the r-f unit terminal board.

Since T1 was adjusted during the r-f unit alignment it will be necessary to sweep the overall i-f response.

R-F UNIT TUBE CHANGES.—Since most of the circuits are low capacitance circuits the r-f unit may require readjustments when the tubes are changed.

If the 6CB6 r-f amplifier tube is changed, it may be necessary to readjust C16 and C22.

If the 6J6 oscillator and mixer tube is changed, then more extensive adjustments are required.

For good conversion efficiency, the oscillator injection to a triode mixer must be held reasonably close to the optimum value. Although there is some latitude in this level, it is nearly expended in the normal variation in injection from channel to channel. Consequently, the adjustment of C7 is limited primarily to establishing the conditions for good conversion. Since changes in oscillator injection affect conversion gain, it also affects the input capacity of the mixer, thus also affecting tracking of the mixer grid circuit. These tube variations with their consequent effect on circuit alignment thereby require readjustment of the r-f unit if maximum conversion efficiency is to be retained after the 6J6 tube is changed. It may be possible, however, to try several 6J6 tubes and select one which gives satisfactory performance without realignment.

SWEEP ALIGNMENT OF PIX I-F.—Set the r-f unit bias to —3.5 volts.

Connect a 47 ohm resistor across the link circuit at T101 terminals C and D.

Remove the second picture i-f amplifier tube, V102.

With the oscilloscope connected to the r-f unit test connection and the sweep oscillator connected to the antenna terminals, set the sweep output to give 0.1 volts peak-to-peak on the oscilloscope.

Switch through the channels and select one that is essentially flat and with the two carriers at 90% response or higher. Channel 6 is usually the most desirable for this test.

Remove the 47 ohm resistor and replace V102.

Connect the oscilloscope to terminal 2 of V106 socket.

Clip 330 ohm resistors across R106, R108, R113 and R119. (See Service Letter T-31 dated Dec. 27, 1949 for alternate procedure.)

Connect the bias box to the junction of R201 and R301. Adjust the box for —1 volt.

Adjust the sweep oscillator output to give 0.5 volts peak-to-peak on the oscilloscope.

Connect the signal generator loosely to the i-f amplifier.

Adjust T1 and T101 bottom core to obtain the response curve shown in Figure 13.

Remove the 330 ohm resistors across R106, R108, R113 and R119.

Set the i-f bias to —4.5 volts.

Adjust the sweep output to give 3 volts peak-to-peak on the oscilloscope.

Retouch T1, T101 bottom, T102 bottom, T103 bottom, T104 bottom and L103 to obtain the response curve shown in Figure 14.

HORIZONTAL OSCILLATOR ADJUSTMENT.—Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator wave form adjustment requires the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment.—With a clip lead, short circuit the coil between terminals C and D of the horizontal oscillator transformer T108. Tune in a television station and sync the picture if possible.

A.—Turn the horizontal hold control R166 to the extreme clockwise position. Adjust the T108 Frequency Adjustment (atop the chassis) so that the picture is just out of sync and the horizontal blanking appears in the picture as a vertical bar. The position of the bar is unimportant.

B.—Turn the hold control approximately one quarter of a turn from the extreme clockwise position and examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C147B, the width control R177 and the linearity control L110 until the picture is correct. If C147B, R177 or L110 were adjusted, repeat step A above.

Horizontal Locking Range Adjustment.—Turn the horizontal hold control fully counter-clockwise. The picture may remain in sync. If so, turn the T108 top core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Momentarily remove the signal by switching off channel then back. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 9 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C147A slightly clockwise. If less than 7 bars are present, adjust C147A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 7 to 9 bars are present.

Horizontal Oscillator Waveform Adjustment.—Remove the shorting clip from terminals C and D of T108. Turn the horizontal hold control to the extreme clockwise position. With a thin fibre screwdriver, adjust the Oscillator Waveform Adjustment Core of T108 (under the chassis) until the horizontal blanking bar appears in the raster.

A.—Connect the low capacity probe of an oscilloscope to terminal C of T108. Turn the horizontal hold control one quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 10. Adjust the Oscillator Waveform Adjustment Core of T103 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Check of Horizontal Oscillator Adjustments.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 2 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C147A slightly clockwise. If less than 2 bars are present, adjust C147A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 bars are present.

Turn the horizontal hold control to the maximum clockwise position. The picture should be just out of sync to the extent that the horizontal blanking bar appears as a single vertical or diagonal bar in the picture. Adjust the T108 Frequency Adjustment until this condition is fulfilled.

SENSITIVITY CHECK.—A comparative sensitivity check can be made by operating the receiver on a weak signal from a television station and comparing the picture and sound obtained to that obtained on other receivers under the same conditions.

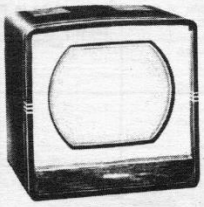
This weak signal can be obtained by connecting the shop antenna to the receiver through a ladder type attenuator pad. The number of stages in the pad depends upon the signal strength available at the antenna. A sufficient number of stages should be inserted so that a somewhat less than normal contrast picture is obtained when the picture control is at the maximum clockwise position. Only carbon type resistors should be used to construct the pad.

RESPONSE CURVES.—The response curves shown on page 12 and referred to throughout the alignment procedure were taken from a production set. Although these curves are typical, some variations can be expected.

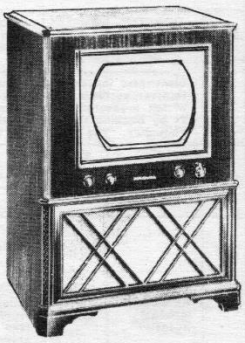
The response curves are shown in the classical manner of presentation, that is with "response up" and low frequency to the left. The manner in which they will be seen in a given test set-up will depend upon the characteristics of the oscilloscope and the sweep generator. The curves may be seen inverted and/or switched from left to right depending on the deflection polarity of the oscilloscope and the phasing of the sweep generator.

NOTES ON R-F UNIT ALIGNMENT.—Because of the frequency spectrum involved and the nature of the device, many of the r-f unit leads and components are critical in some respects. Even the power supply leads form loops which couple to the tuned circuits, and if resonant at any of the frequencies involved in the performance of the tuner, may cause serious departures from the desired characteristics. In the design of the receiver these undesirable resonant loops have been shifted far enough away in frequency to allow reasonable latitude in their components and physical arrangement without being troublesome. When the r-f unit is aligned in the receiver, no trouble from resonant loops should be experienced. However, if the unit is aligned in a jig separate from the receiver, attention should be paid to insure that unwanted resonances do not exist which might present a faulty representation of r-f unit alignment.

A resonant circuit exists between the r-f tuner chassis and the outer shield box, which couples into the antenna and r-f plate circuits. The frequency of this resonance depends on the physical structure of the shield box, and the capacitance between the tuner chassis and the front plate. In the 75194 tuner units, this resonance should fall between 120 and 135 mc. and is controlled in the design by using insulating washers of different thicknesses (in the front plate to tuner chassis mounting) to compensate for differences in the shield boxes of different models of receivers. The performance of the tuner, particularly on channels 7 and 8 will be impaired if the proper washers for the particular shield box involved are not used. Obviously then, if the r-f unit is removed for service, the washers should be replaced in the correct order when the unit is replaced.



MODEL 16T11



MODEL 16TC21

ALIGNMENT TABLE

THE DETAILED ALIGNMENT PROCEDURE SHOULD BE READ BEFORE ALIGNMENT BY USE OF THE TABLE IS ATTEMPTED

STEP No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT OSCILLOSCOPE TO	CONNECT "VOLTOHMYST" TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
				DISCRIMINATOR AND SOUND I-F ALIGNMENT					
1	2nd sound i-f grid (pin 1, VII6)	21.25 .1 volt output	Not used	—	Not used.	In series with 1 meg. to pin 7 of V117	Meter on 3 volt scale	Detune T112 (bot.) Adjust T112 (top) for max. on meter	Fig. 11 Fig. 5
2	"	"	"	—	"	Junction of R192 & S103	Meter on 3 volt scale	T112 (bottom) for zero on meter	Fig. 11 Fig. 5
3	"	"	2nd sound i-f grid (pin 1, V116)	21.25 center 1 mc. wide .1 v. out	Junction of R192 & S103	Not used	Check for symmetrical response waveform (positive & negative). If not equal adjust T112 (top) until they are equal		Fig. 11 Fig. 5
4	1st sound i-f grid (pin, 1, VII5)	21.25 reduced output	1st sound i-f grid (pin 1, V115)	21.25 reduced output	"	"	Sweep output reduced to provide 1.0 volt p-to-p on scope	T111 for max. gain and symmetry at 21.25 mc.	Fig. 11 Fig. 5
5	Not used		Not used	—	Not used	Junction of R201 and R301	Connect bias box to junction of R201 & R301 and to ground	Adjust potentiometer for −3.0 volts on meter	

PICTURE I-F AND TRAP ADJUSTMENT

STEP No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT OSCILLOSCOPE TO	CONNECT "VOLTOHMYST" TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
6	Terminal D of T101	21.25	"	—	"	Pin 2 of V106 and to ground	Meter on 3 volt scale. Receiver between 2 & 13	T103 (top) for min. on meter	Fig. 5
								T105 (top) for min.	Fig. 5
7	"	21.25	"	—	"	"	"	T102 (top) for min.	"
8	"	27.25	"	—	"	"	"	T104 (top) for min.	"
9	"	27.25	"	—	"	"	"	T101 (top) for min.	"
10	"	19.75	"	—	"	"	"	L103 (top) for max.	"
11	"	24.6	"	—	"	"	"	T104 (bot.) for max.	Fig. 5
12	"	22.75	"	—	"	"	"	T103 (bot.) for max.	"
13	"	22.00	"	—	"	"	"	T102 (bot.) for max.	
14	"	25.6	"		"	"	"		

R-F UNIT ALIGNMENT

STEP No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT HETERODYNE FREQ. METER TO	HET. METER FREQ. MC.	CONNECT "VOLTOHMYST" TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
15	Disconnect the co-ax link from terminal 2 of the r-f unit terminal board and connect a 39 ohm composition resistor between lugs 1 and 2. If the receiver oscillator is adjusted by feeding in the r-f sound carrier signal, couple the link loosely to lug 2 of the r-f unit terminal board so as to permit measurement at sound discriminator. In early production units in which L44 is adjustable, back the L44 core all the way out. Detune T1 by backing the core all the way out of the coil. In order to align the r-f tuner, it will first be necessary to set the channel 13 oscillator to frequency. The shield over the bottom of the r-f unit must be in place when making any adjustments.									
16	Antenna terminals	215.75 MC.	Not used		Loosely coupled to r-f oscillator	236.75 MC.	Junction of R192 & S103 for signal gen. method only	Fine tuning centered. Receiver on channel 13. Het. freq. meter coupled to osc. if used.	C1 for zero on meter or beat on het. freq. meter	Fig. 5
17			"				Connect "Volt-Ohmyst" to terminal 3 of the r-f unit terminal board	Turn AGC control counter-clockwise. Connect bias box to terminal 3 of r-f unit term. board	Adjust the bias box potentiometer for −3.5 volts.	
18	Antenna terminal (loosely)	181.25 185.75	Antenna terminals (see text for precaution)	Sweeping channel 8	Not used	—	Not used	Rec. on chan. 8. Connect oscilloscope to test connection at R5 on top the r-f unit. Adjust C9, C11, C16 and C22. Correct curve shape, frequency, and band width. C22 is adjusted to give max. amplitude between markers. C9 primarily affects tilt and C16 primarily affects the frequency of response. C11 affects the response band width.		Fig. 8 (8)
19	"	87.75	"	Not used	Loosely coupled to r-f oscillator	108.75	Junction of R192 & S103 for signal gen. method only	Rec. on channel 6	L5 for zero on meter or beat on het. freq. meter	Fig. 5 Fig. 9
20	"	83.25 87.75	"	Channel 6	Not used	—		Rec. on chan. 6. Adjust L42, L45 and L49 for proper response. L42 is adjusted to give max. amplitude between markers. L45 primarily affects tilt and L49 primarily affects freq. of response. If necessary, retouch C11 for proper width.		Fig. 8 (6)
21	Not used	—	Not used	—	Not used	—	Connect "Volt-Ohmyst" to r-f unit test point R5	Rec. on channel 6	Adjust C7 for −3.0 volts at the test point	Fig. 5
22	Repeat steps 18, 19 and 20 until the specified conditions are obtained.									
23	Antenna terminal (loosely)	185.75	Not used	—	Loosely coupled to r-f oscillator	206.75	Junction of R192 & S103 for sig. gen. method only	Rec. on chan. 8	C1 for zero on meter or beat on het. freq. meter	Fig. 5
24	Antenna terminal (loosely)	181.25 185.75	Antenna terminals (see text for precaution)	Sweeping channel 8	Not used	—	Not used	Rec. on chan. 8. Readjust C9, C16 and C22 for correct curve shape, frequency and band width. Readjust C11 only if necessary.		Fig. 5 Fig. 8 (8)
25	"	211.25 215.75	"	Sweeping channel 13	Not used	—	Not used	Rec. on chan. 13. Adjust L52 for max. amplitude between markers and then overshoot a little more than the amount of turning required to reach max. response. Adjust C22 to regain max. amplitude of response.		Fig. 5 Fig. 8 (13)
26	"	215.75	Not used	—	Loosely coupled to r-f oscillator	236.75	Junction of R192 & S103 for signal gen. method only	Fine tuning centered. Receiver on chan. 13. Adjust L43 for correct channel 13 osc. freq. then overshoot. Reset the osc. to proper freq. by adjustment of C1.		Fig. 9 Fig. 5
27	"	205.25 209.75	Antenna terminals (see text for precaution)	channel 12	Not used	—	Connect "Volt-Ohmyst" to r-f unit test point at R5	Rec. on chan. 12	Check to see that response is correct and −3.0 volts of osc. injection is present	Fig. 5 Fig. 8

STEP No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT HETERODYNE FREQ. METER	HET. FREQ. METER MC.	CONNECT "VOLTOHMYST" TO	MISCELLLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
28	"	199.25 203.75		channel 11	"	—	"	Rec. on chan. 11	"	Fig. 8 (11)
29	"	193.25 197.75	"	channel 10	"	—	"	Rec. on chan. 10	"	Fig. 8 (10)
30	"	187.25 191.75	"	channel 9	"	—	"	Rec. on chan. 9	"	Fig. 8 (9)
31	"	181.25 185.75	"	channel 8	"	—	"	Rec. on chan. 8	"	Fig. 8 (8)
32	"	175.25 179.75	"	channel 7	"	—	"	Rec. on chan. 7	"	Fig. 8 (7)
33	If the response of any channel (steps 26 through 31) is below 80% at either marker, repeat step 23 and adjust C9, C11, C16 and C22 as necessary to pull respdnse up on the low channel yet maintain correct response on channel 8. If C22 required adjustment, the adjustment should be overshot a small amount and corrected by adjustment of L52 to give maximum amplitude of response between the sound and picture carrier markers.									
34	Repeat step 22. If the oscillator is off frequency overshoot the adjustment of C1 and correct by adjusting L43.									
35	Repeat steps 26 through 33 until all requirements are obtained.									
36	Antenna terminals (loosely)	87.75	Not used	—	Loosely coupled to r-f oscillator	108.75	Junction of R192 & S103 for sig. gen. method only	Rec. on chan. 6	L5 for zero on meter or beat on het. freq. meter	
37	"	83.25 87.75	Ant. terminals (see text for precaution)	Sweeping channel 6	Not used	—	Not used	Observe response. If necessary readjust L42, L45 and L49. It should not be necessary to touch C11.		Fig. 5 Fig. 8
38	Not used	—	Not used	—	Not used	—	Connect "Volt-Ohmyst" to the r-f unit test point at R5	Check osc. injection. If necessary adjust C7 to give −3 volts. If C7 is adjusted, switch to channel 8, and readjust C9 for proper response then repeat step 36.		Fig. 5
39	Antenna terminals (loosely)	77.25 81.75	Ant. terminals (see text for precaution)	channel 5	"	—	"	Rec. on chan. 5	Check to see that response is correct and −3.0 volts of osc. injection is present	Fig. 8 (5)
40	"	67.25 71.75	"	channel 4	"	—	"	Rec. on chan. 4		Fig. 8 (9)
41	"	61.25 65.75	"	channel 3	"	—	"	Rec. on chan. 3	"	Fig. 8 (3)
42	"	55.25 59.75	"	channel 2	"	—	"	Rec. on chan. 2	"	Fig. 8 (2)
43	Likewise check channels 7 through 13, as outlined in steps 31 back through 26, stopping on channel 13 for next step.									
44	Antenna terminals	215.75	Not used	—	Loosely coupled to r-f oscillator	236.75	Junction of R192 & S103 for sig. gen. method only	Fine tuning centered. Receiver on channel 13	C1 for zero on meter or beat on het. freq. meter	Fig. 5
45	"	209.75	"	—	"	230.75	"	Rec. on chan. 12	L11 as above	Fig. 9
46	"	203.75	"	—	"	224.75	"	Rec. on chan. 11	L10 as above	Fig. 9
47	"	197.75	"	—	"	218.75	"	Rec. on chan. 10	L9 as above	Fig. 9
48	"	191.75	"	—	"	212.75	"	Rec. on chan. 9	L8 as above	Fig. 9
49	"	185.75	"	—	"	206.75	"	Rec. on chan. 8	L7 as above	Fig. 9
50	"	179.75	"	—	"	200.75	"	Rec. on chan. 7	L6 as above	Fig. 9
51	"	87.75	"	—	"	108.75	"	Rec. on chan. 6	L5 as above	Fig. 9
52	"	81.75	"	—	"	102.75	"	Rec. on chan. 5	L4 as above	Fig. 9
53	"	71.75	"	—	"	92.75	"	Rec. on chan. 4	L3 as above	Fig. 9
54	"	65.75	"	—	"	86.75	"	Rec. on chan. 3	L2 as above	Fig. 9
55	"	59.75	"	—	"	80.75	"	Rec. on chan. 2	L1 as above	Fig. 9
56	Repeat steps 43 through 54 as a check.									
57	Antenna terminals	181.25 185.75	Antenna terminals	Sweeping channel 8	Not used	—		Rec. on chan. 8. Oscilloscope at R5 test point. Adjust T1 clockwise. When properly adjusted, curve will be slightly wider with a slightly deeper valley in top.		Fig. 8 (8)
58	Switch through all channels and observe response, oscillator injection and r-f oscillator frequency. Minor touch-ups of adjustments may be made at this time. However, if C7 or C9 are changed appreciably, then a recheck of the oscillator frequency on all channels should be made.									
59	Remove 39 ohm resistor and reconnect link from T101 to terminal 2 of r-f unit terminal board. Proceed with sweep alignment of Pix I-F.									
	SWEEP ALIGNMENT OF PICTURE I-F AMPLIFIER									
60	Loosely coupled to i-f amplifier	22.3 25.4	Antenna terminals	Sweeping selected channel	Terminal 2 of V106 socket		Junction of R201 & R301	Select channel known to have good r-f response. Clip 330 ohm resistors across R106 R108, R113, R119. Connect bias box to junction R201, R301.	Adjust bias box for −1.0 v. Set sweep to give 0.5 v. p-p on oscilloscope. Adjust T1 and T101 for correct response.	Fig 5
61	"	21.85 24.75 25.50 26.25	"	"	"		"	Remove 330 ohm resistors. Set bias box for −4.5 v.	Set sweep to give 3.0 v. p-p on oscilloscope. Adjust T1, T101 bot., T102 bot., T103 bot., T104 bot. and L103 for desired response	Fig. 14

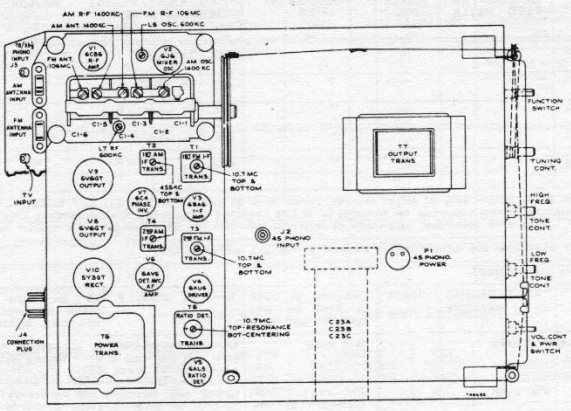


Fig. 15—Chassis, Top View, Showing Adjustments

CRITICAL LEAD DRESS:

1. The 2.2 meg. mixer grid resistor should have a minimum practicable amount of lead extending on the grid end.
2. The first AM and first FM i-f plate leads should be dressed away from the range switch wafer.
3. The ground strap between the r-f shelf and the main chassis should be well soldered and kept as short as practicable.
4. Arrange wiring to prevent the filament wire between mixer and 1st i-f tubes from passing near the mixer grid, or the AVC wiring.
5. Dress filament wires away from 1st audio and inverter coupling condensers.
6. Dress ac power switch wires away from the audio coupling condenser which is wired to the volume control.
7. Dress the mixer grid coupling condenser away from the lugs on the front range switch wafer.
8. The 1st i-f tube AVC and screen bypass condensers should ground at same point as cathode neutralizing loop.
9. The mixer plate by-pass should ground as close to the r-f shelf ground strap as practicable.

ALIGNMENT PROCEDURE (16TA30 RECEIVER CHASSIS)

If any lead dressing is necessary, it should be done before aligning the receiver. When making a complete alignment follow the table below in sequence. If only a portion of the circuit is to be aligned select the portion required and follow with the remaining steps in the section. Any adjustments made on the 455 kc. I-F's make it necessary to adjust the 10.7 mc. I-F's.

"AM" R-F—I-F ALIGNMENT

Test-Oscillator.—For all alignment operations, connect low side of the test-osc. to the receiver chassis, and keep the osc. output as low as possible to avoid a-v-c action. **Output Meter.**—Connect the meter across the speaker voice coil, and turn the receiver volume control to max. Turn tone controls for maximum highs and maximum lows. Before aligning set, completely mesh the gang and set the dial pointer to the mechanical max. calibration point at extreme left end of dial.

Steps	Connect the High Side of the Test. Osc. to—	Tune Test Osc. to—	Function Switch	Turn Radio Dial to—	Adjust the following
1	Stator of C1-4	455 kc. Modulated	AM	Low Freq. end of Dial	†Top and bot. cores of T4 and T2. (For max. voltage across voice coil.)
2	Ant. terminal through dummy ant. of 200 mmfs.	1,620 kc.	AM	Min. capacity	Osc. C1-2T for maximum output.
3		1,400 kc.	AM	Tune to signal	C1-4T and C1-5T for max. output.
4		600 kc.	AM	600 kc.	‡Osc. L5 and R-FL7.
5	Repeat steps 2, 3 and 4 for maximum output at 600 kc. and 1,400 kc.				

† First peak T2 and T4 then starting with T4, use alternate loading. Connect a 47,000-ohm resistor across the primary to load the plate winding while the grid winding of the same transformer is being peaked. Then load the grid winding with the 47,000-ohm resistor while the plate winding is being peaked.

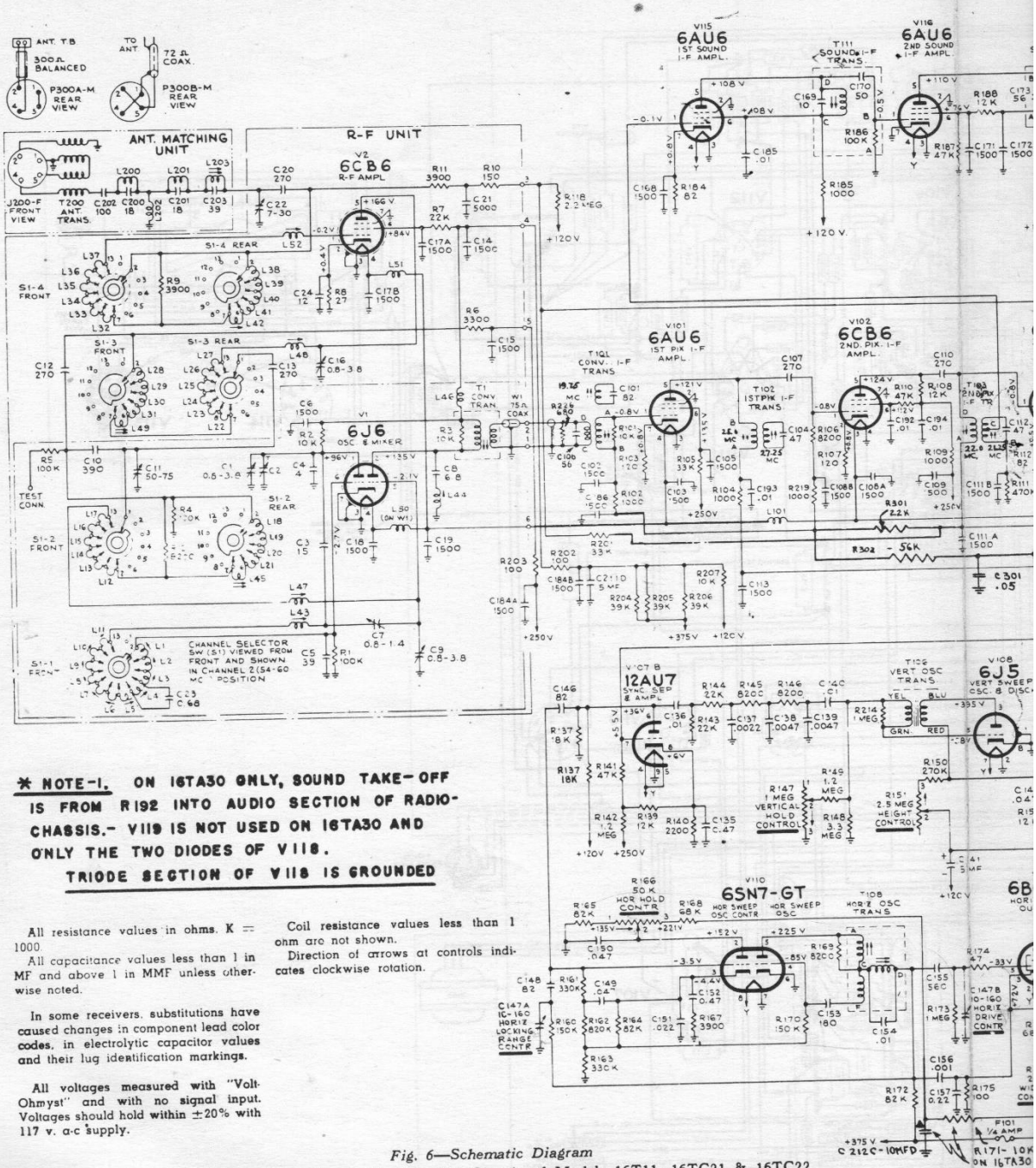
‡ With a 10,000-ohm resistor clipped across C1-4, peak the oscillator core L5, simultaneously "rocking" the gang condenser for maximum output. Then, remove the 10,000-ohm shunt resistor and peak L7 for maximum output.

FM ALIGNMENT PROCEDURE

Connect probe of "VoltOhmyst" to negative side of C40 and low side to chassis. Connect output meter across speaker voice coil. Turn the tone controls for maximum highs and lows.

Steps	Connect the High side of the Test. Osc. to—	Tune Test Osc. to—	Function Switch	Radio Dial Tuned to—	Adjust
6	Pin No. 1 of 6AU6 (V4) in series with .01 mfd.	10.7 mc. 30% AM Modulated	FM	———	Top of Driver Trans. T5 for maximum DC on "VoltOhmyst."
7	Pin No. 1 of 6AU6 (V4) in series with .01 mfd.		FM	———	Bottom of Driver Trans. T5 for minimum audio output on meter.
8	Repeat steps 6 and 7 as necessary making final adjustment with r-f input level set to give approximately –4.0 volts d-c on "VoltOhmyst."				
9	Through 470 ohms to stator of C1-3, gang at max. Connect gnd. of cable close to V2 cathode ground on r-f shelf.	10.7 mc.	FM	88 mc.	*T3 then T1 for max. with r-f input set to give –3 volts on "VoltOhmyst" connected across C40.
10	Connect cable to antenna terminals through 120 ohms in each side of line.	90 mc.	FM	90 mc.	OSC. L8 for max. voltage across C40.
11		106 mc.	FM	Tune to signal	ANT. C1-3 and R-F C1-6 for max. voltage across C40.
12		90 mc.	FM	Tune to signal	ANT. L1 and R-F L2 for max. voltage across C40.
13	Repeat steps 10, 11 and 12 as required.				
14	Connect a sweep generator to the antenna terminals through 120 ohms in each side of line. Connect an oscilloscope to Junction of R44 and C1 and check response and linearity of FM band. Peak to peak separation should not be less than 180 kc.				

* Use a 680-ohm resistor to load the plate winding while the grid winding of the same transformer is being peaked. Then the grid winding is loaded with 680-ohm resistor while the plate winding is being peaked. When windings are loaded, it is necessary to increase the 10.7 mc. input, since gain will decrease and voltage across C40 will be less.



*** NOTE-1. ON 16TA30 ONLY, SOUND TAKE-OFF IS FROM R192 INTO AUDIO SECTION OF RADIO-CHASSIS.- V119 IS NOT USED ON 16TA30 AND ONLY THE TWO DIODES OF V118. TRIODE SECTION OF V118 IS GROUNDED**

All resistance values in ohms. K = 1000.

All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted.

In some receivers, substitutions have caused changes in component lead color codes, in electrolytic capacitor values and their lug identification markings.

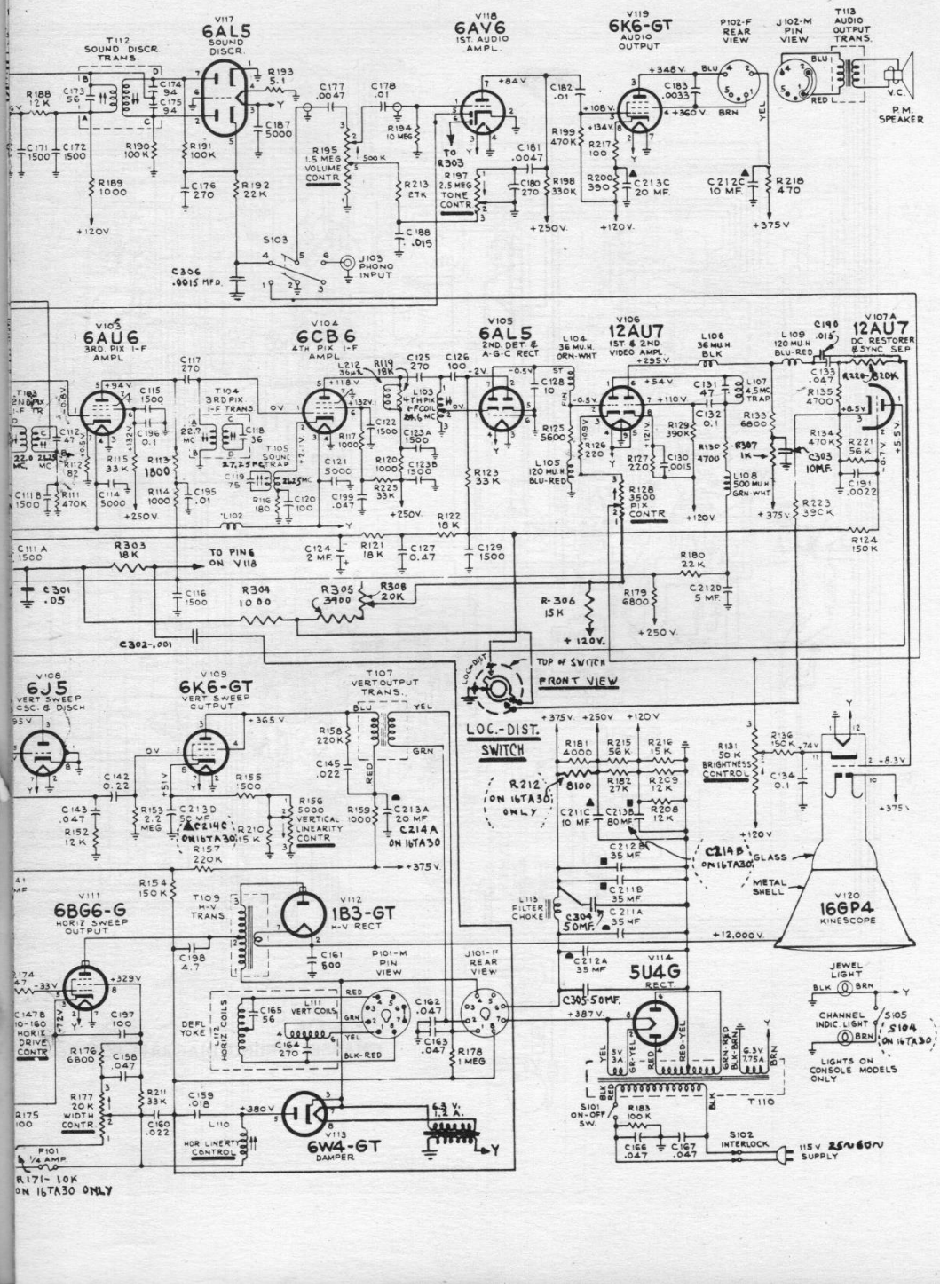
All voltages measured with "Volt-Ohmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Coil resistance values less than 1 ohm are not shown.

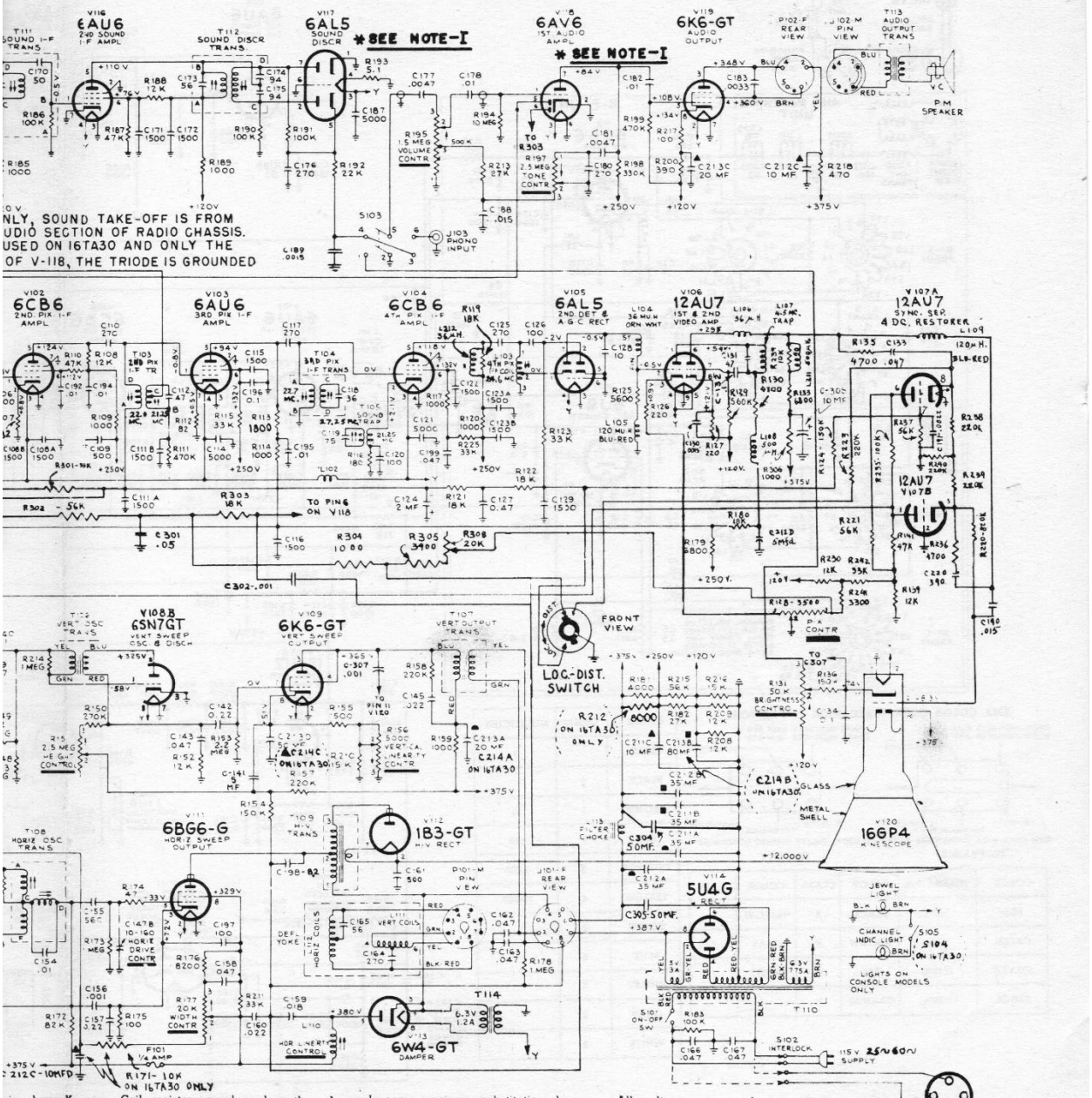
Direction of arrows at controls indicates clockwise rotation.

Fig. 6—Schematic Diagram

This Schematic applies to the Uncoded Chassis of Models 16T11, 16TC21 & 16TC22.


V117 6AL5 SOUND DISCR.
T112 SOUND DISCR. TRANS.
V118 6AV6 1ST. AUDIO AMPL.
V119 6K6-GT AUDIO OUTPUT
P102-F REAR VIEW
J102-M PIN VIEW
T113 AUDIO OUTPUT TRANS.
P.M. SPEAKER
V.C.
R195 1.5 MEG VOLUME CONTR
R197 2.5 MEG TONE CONTR
R213 27K
R217 100
R218 470
C212C 10 MF.
C213C 20 MF.
C306 .0015 MFD.
S103
J103 PHONO INPUT
+120V.
+250V.
+375V
V103 6AU6 3RD. PIX I-F AMPL.
V104 6CB6 4TH PIX I-F AMPL.
V105 6AL5 2ND. DET. & A.G.C. RECT.
V106 12AU7 1ST. & 2ND VIDEO AMPL.
V107A 12AU7 DC RESTORER & SYNC. SEP.
T104 3RD PIX I-F TRANS.
T105 SOUND TRAP
L102
L103 4TH PIX I-F COIL
L104 36 MU.H. ORN-WHT
L105 120 MU.H BLU-RED
L106 36 MU.H BLK
L107 4.5 MC TRAP
L108 500 MU.H GRN-WHT
L109 120 MU.H BLU-RED
R128 3500 PIX CONTR
R135 4700
R303 18K
TO PIN 6 ON V118
R304 10 000
R305 3900
R306 15K
R308 20K
R179 6800
R180 22K
C2120 5 MF.
C303 10MF.
C301 .05
C302-.001
TOP OF SWITCH FRONT VIEW
LOC.-DIST. SWITCH
V108 6J5 VERT SWEEP OSC. & DISCH
V109 6K6-GT VERT SWEEP OUTPUT
T107 VERT OUTPUT TRANS.
R212 ON 16TA30 ONLY
C214C ON 16TA30
C214A ON 16TA30
C214B ON 16TA30
GLASS
METAL SHELL
V120 16GP4 KINESCOPE
+12,000V.
V111 6BG6-G HORIZ SWEEP OUTPUT
T109 H.V. TRANS.
V112 1B3-GT H.V. RECT
V114 5U4G RECT.
C305-50MF.
V113 6W4-GT DAMPER
DEFL YOKE
L111 VERT COILS
L112 HORIZ COILS
HOR LINERTY CONTROL
R171- 10K ON 16TA30 ONLY
F101 1/4 AMP
S101 ON-OFF SW.
S102 INTERLOCK
115 V 25~60~ SUPPLY
JEWEL LIGHT
CHANNEL INDIC. LIGHT
S105 S104 ON 16TA30
LIGHTS ON CONSOLE MODELS ONLY
T110
R131 50 K BRIGHTNESS CONTROL
R183 100 K
C166 .047
C167 .047

RCA-VICTOR
16T11, TC21,2, 16TA30



in ohms. K =

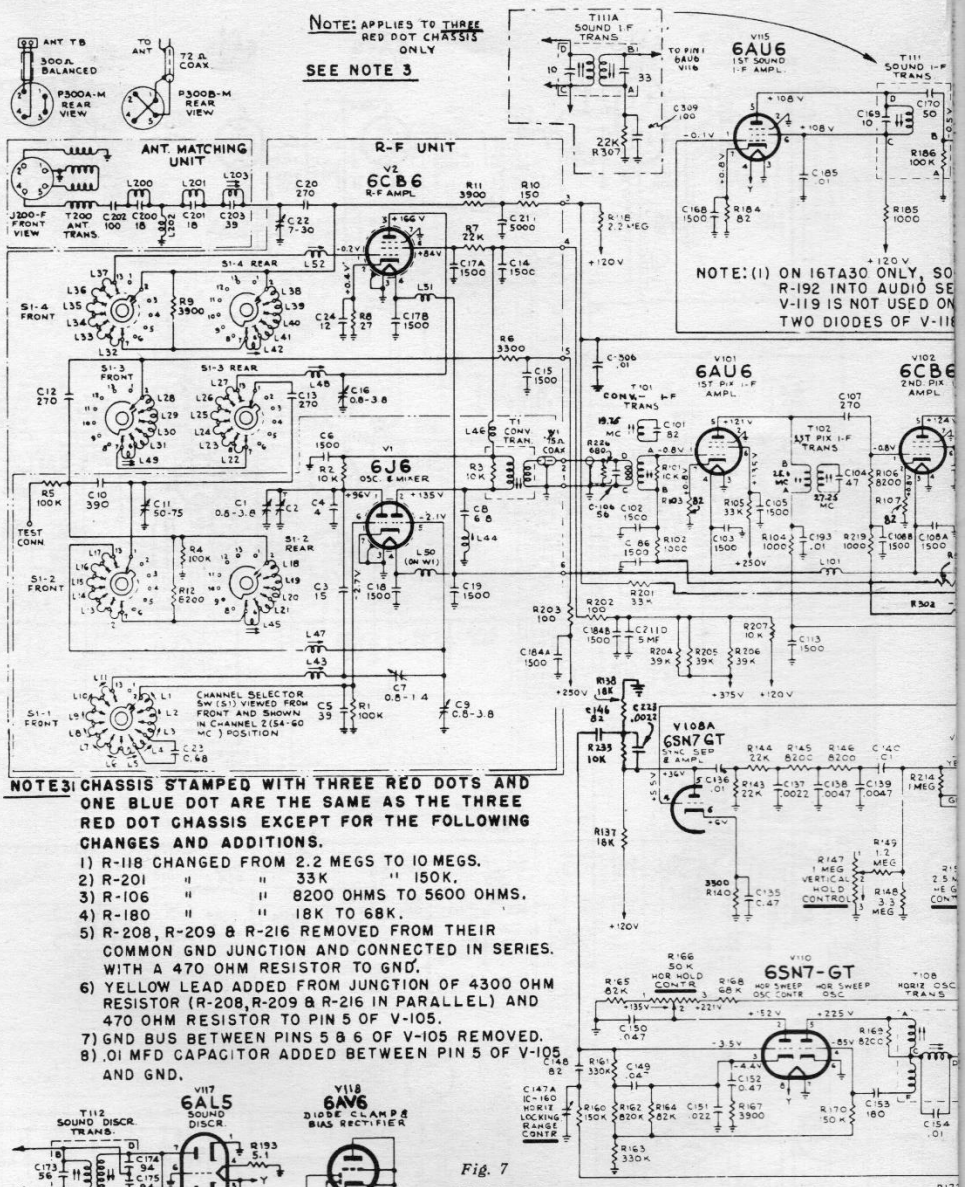
s less than 1 in
IF unless other-

Coil resistance values less than 1 ohm are not shown.

Direction of arrows at controls indicates clockwise rotation.

In some receivers substitutions have caused changes in component lead color codes, in electrolytic capacitor values and their lug identification markings.

All voltages measured with "Volt Ohmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.



NOTE 3: CHASSIS STAMPED WITH THREE RED DOTS AND ONE BLUE DOT ARE THE SAME AS THE THREE RED DOT CHASSIS EXCEPT FOR THE FOLLOWING CHANGES AND ADDITIONS.

1) R-118 CHANGED FROM 2.2 MEGS TO 10 MEGS.
2) R-201 " " 33K " 150K.
3) R-106 " " 8200 OHMS TO 5600 OHMS.
4) R-180 " " 18K TO 68K.
5) R-208, R-209 & R-216 REMOVED FROM THEIR COMMON GND JUNCTION AND CONNECTED IN SERIES. WITH A 470 OHM RESISTOR TO GND.
6) YELLOW LEAD ADDED FROM JUNCTION OF 4300 OHM RESISTOR (R-208, R-209 & R-216 IN PARALLEL) AND 470 OHM RESISTOR TO PIN 5 OF V-105.
7) GND BUS BETWEEN PINS 5 & 6 OF V-105 REMOVED.
8) .01 MFD CAPACITOR ADDED BETWEEN PIN 5 OF V-105 AND GND.

SOUND DISCR.-16TA30 CHASSIS ONLY.

Fig. 7

Models 16T11, 16TC21, 16TC22 and 16TA30.

This Schematic applies to all Coded Chassis of

NOTE 2 ON 'TW' & 'X' SETS R103 AND R107 WERE 120 OHMS.

All resistance values in ohms. 1000.

All capacitance values less than MF and above 1 in MMF unless o wise noted.