MODEL 180 UHF TUNER
(ALSO USED IN MODEL 2152)

ALIGNMENT PROCEDURE

PRELIMINARY NOTES:

VHF tuner and TV I-F strip must be in proper alignment before attempting alignment of UHF tuner.

Connect oscilloscope or VTVM across the 4.7K ohms video detector load, R-12, TV schematic.

EQUIPMENT REQUIRED—AM VHF signal generator with 12 Mc sweep; oscilloscope or VTVM; insulated screwdriver.

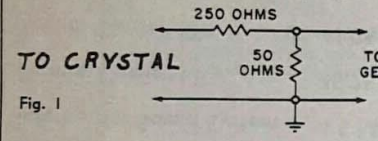


Fig. 1

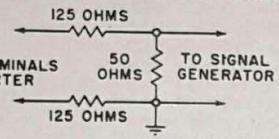


Fig. 2

SIG. GEN. CONNECTION	SIG GEN. FREQ.	ADJUST	REMARKS
I-F ALIGNMENT			
1—To crystal at junction of items 21, 29, 45, 51, UHF schematic, thru matching net. Fig. 1.	82 Mc	I-F transformers. Items 5 & 6, Figs. 3 & 4.	Adjust for maximum signal.
2—Same as 1.	82 Mc with 12 Mc sweep.	Item 6, Figs. 3 & 4.	Adjust for equal signal response at VHF channels 5 & 6. Maximum gain for minimum band-width of 12 Mc.
OSCILLATOR ALIGNMENT			
3—UHF antenna terminals thru matching net. See Fig. 2.	465 Mc (5th harmonic of 93 Mc)	Oscillator trimmer, item 48, Fig. 3.	Set pointer at extreme left of dial. Adjust for maximum.
4—Same as 3.	900 Mc (5th harmonic of 180 Mc)	Carefully spread or pinch legs of oscillator end-inductor, see Fig. 3.	Set pointer at extreme right of dial. Adjust for maximum.
5—Repeat steps 3 and 4 until no further improvement in signal is apparent. 465 Mc and 900 Mc are approximations and may not fall precisely at extreme left and right dial positions. However, oscillator alignment must be made so that both frequencies may be tuned within dial limits.			
6—Same as 3.	465 Mc	R-F trimmers, Item 72, Fig. 4.	Set pointer at extreme left of dial. Adjust for maximum.
7—Same as 3.	900 Mc	R-F end-inductors, Fig. 3.	Set pointer at extreme right of dial. Adjust for maximum.
8—Repeat steps 6 and 7 until no further improvement in signal is apparent.			
9—Same as 3.	465 Mc	Coupling trimmer, item 74, Fig. 4.	Set pointer at extreme left of dial. Adjust for maximum.

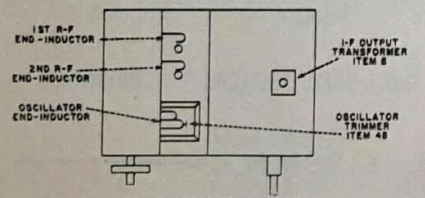


Fig. 3—BOTTOM VIEW

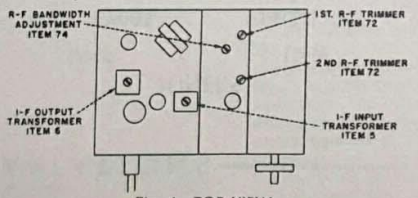


Fig. 4—TOP VIEW

VOLTAGE MEASUREMENTS

Notes: VTVM used. Measurements taken between terminals and chassis. Measurements within 20% of specified values are satisfactory. Values in DC volts unless otherwise noted. Switch in UHF position.

TUBE TYPE	FUNCTION	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
6X4	Rect.	170 AC	NC	0	6.3 AC	NC	170 AC	190	-----	-----
6BK7/ 6BQ7	I-F Amp.	120	0	.85	6.3 AC	0	125	0	1	0
6AF4	Osc.	85*	5.7	0	6.3 AC	0	5.7*	85	-----	-----

*Use 15K ohms isolating resistor in series with voltmeter probe.

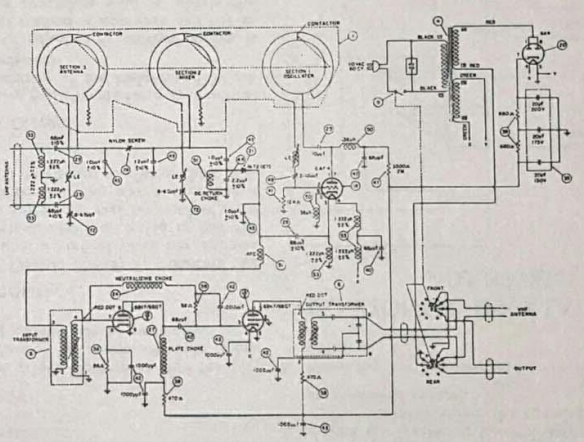
RESISTANCE MEASUREMENTS

Notes: VTVM used. Measurements taken between terminals and chassis. Measurements within 20% of specified values are satisfactroy. Switch in UHF position. AC cord disconnected.

TUBE TYPE	FUNCTION	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
6X4	Rect.	130	NC	0	.3	NC	130	50K*	-----	-----
6BK7/ 6BQ7	I-F Amp.	50K*	0	56	.3	0	50K*	0	56	0
6AF4	Osc.	50K*	12K	0	.3	0	12K	50K*	-----	-----

*Or more.

CIRCUIT DIAGRAM



REPAIR PARTS LIST

SCHEMATIC ITEM NO.		
PMA-65011-1	1	Inductuner, UHF
PMA-65011-4	4	Transformer, Power
PMA-65011-5	5	Transformer, I-F Input
PMA-65011-6	6	Transformer, I-F Output
PMA-65011-9	9	Switch AC & Antenna Changeover
PMA-65011-24	24	Choke, Neutralizing
PMA-65011-25	25	Capacitor, Ceramic Tubular, 10 UUF
PMA-65011-27	27	Choke, I-F Plate
PMA-65011-29	29	Capacitor, Ceramic Tubular, .68 UUF ± 10%
PMA-65011-35	35	Capacitor, Electrolytic Filter, 20-20-20/200-175-150 UUF
PMA-65011-36	36	Resistor, Carbon, 56 Ohms, ± 10%
PMA-65011-38	38	Resistor, Carbon, 470 Ohms
PMA-65011-39	39	Resistor, Carbon, 680 Ohms
PMA-65011-40	40	Capacitor, Ceramic Tubular, 68 UUF
PMA-65011-41	41	Resistor, Carbon, 12K Ohms
PMA-65011-42	42	Capacitor, Ceramic Disc, 1000 UUF
PMA-65011-44	44	Capacitor, Ceramic Tubular, 2.2 UUF
PMA-65011-45	45	Capacitor, Ceramic Tubular, 1.0 UUF
PMA-65011-46	46	Capacitor, Ceramic Tubular, 1.2 UUF
PMA-65011-47	47	Resistor, Carbon, 3300 Ohms, 2 Watt
PMA-65011-48	48	Capacitor, Ceramic Trimmer, 3-10 UUF
PMA-65011-50	50	Choke, Oscillator
PHA-65011-51	51	Choke, Oscillator
PMA-65011-53	53	Choke, Oscillator & R-F
PMA-65011-72	72	Capacitor, Ceramic Trimmer, .8-6.5 UUF
PMA-65011-74	74	Nylon Adjustment Screw

CHASSIS VARIATIONS

NUMBER	PICTURE TUBE TYPE	TUNERS	
		VHF	UHF
200-1	17HP4	PMC-57006	PMC-57007
200-2	17HP4	PMC-57006	PMC-57008
200-3	17HP4	PMC-57006	PMC-57009
200-4	17HP4	PMC-57006	None
200-5	17HP4	PMC-57011	None
200-11	21MP4	PMC-57006	PMC-57007
200-12	21MP4	PMC-57006	PMC-57008
200-13	21MP4	PMC-57006	PMC-57009
200-14	21MP4	PMC-57006	None
200-15	21MP4	PMC-57011	None

GENERAL SPECIFICATIONS

Antenna	Built-in with Provisions for External 300 Ohms Antenna
Intercarrier Sound System	4.5 Megacycles
Picture Carrier I-F	45.75 Megacycles
Sound Carrier I-F	41.25 Megacycles
Power Supply	110-120 Volts, 60 Cycle, AC.
Power Consumption	215 Watts
Speaker	PM Type 3.2 Ohms Voice Coil

ADJUSTMENTS

WARNING — OPERATION OF THE RECEIVER CHASSIS OUTSIDE OF THE CABINET INVOLVES THE DANGER OF WORKING WITH HIGH VOLTAGES. EXTREME CAUTION SHOULD BE EXERCISED AT ALL TIMES.

Occasional minor adjustments will be needed if any circuit work or tube replacement is required. A test pattern, generated locally or from a broadcast station, is recommended for best results. The operating and auxiliary controls, located on the front panel and rear apron, should be set for as good a pattern as possible before making the following adjustments:

CENTERING

Rotate each of the Centering Rings separately until the picture is properly centered.

HEIGHT AND WIDTH

Adjust the Height and Width Controls so that the picture fills out the dimensions of the screen. A slight re-adjustment of the centering control may be necessary.

HORIZONTAL DRIVE CONTROL

The Horizontal Drive Control (C51B) is adjustetd by backing off the control until a vertical white bar appears in the middle of the picture, and then going in one full turn from this point. This adjustment may be reached from the underside of the chassis mounting board. See below for detailed description of Horizontal Oscillator Sync Adjustment.

VERTICAL LINEARITY CONTROL

Set the Vertical Linearity Adjustments for a symmetrical pattern. A slight re-adjustment of the Height and Width Controls may then be necessary.

Note: The sequence of adjustments outlined above is suggested as a convenient method of approach and not an arbitrary procedure. The procedure used to obtain the final results may be varied to fit the circumstances.

NOISE BALANCE CONTROL

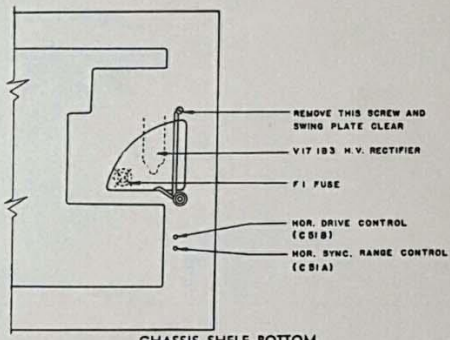
Turn the Channel Selector to the strongest station signal on the air. Slowly turn the Noise Balance Control from full clockwise position counterclockwise until the picture just starts to show a distorted shape. Then turn the control slightly in the opposite direction so that the picture shape is normal. Check all channels. If the picture shape is distorted on any channel, advance the control slightly clockwise to restore normal shape. (NOTE: WHENEVER THE PICTURE IS DISTORTED, OR SLANTING BARS ARE ENCOUNTERED WHICH CANNOT BE ADJUSTED CORRECTLY WITH THE HORIZONTAL LOCK OR FINE TUNING CONTROLS, ALWAYS SET THE NOISE BALANCE CONTROL FULLY CLOCKWISE BEFORE MAKING ANY OTHER ADJUSTMENT.)

PICTURE TUBE ADJUSTMENTS

WARNING: THE PICTURE TUBE ENVELOPE ENCLOSES A HIGH VACUUM. ANY ACCIDENTAL BLOW OR ROUGH HANDLING MAY CAUSE THE TUBE TO IMPLODE WITH DANGEROUS AND DESTRUCTIVE FORCE. THE WEARING OF HEAVY GLOVES AND SHATTER-PROOF GOGGLES IS ADVISED WHEN HANDLING THE PICTURE TUBE.

1. Turn the Brightness Control to maximum (clockwise) and the Picture Control to minimum (Counterclockwise).
2. Rotate the Ion Trap Magnet and at the same time move it backward and forward to obtain the brightest raster.
3. Reduce the Brightness Control so that the raster is slightly over normal brilliance and re-adjust the Ion Trap Magnet for maximum brightness.
4. Loosen the Deflection Yoke adjusting screws and rotate the Deflection Yoke so that the top and bottom edges of the raster are parallel to the top of the chassis. When this adjustment is made, tighten screws.
5. Adjust the Centering Control until the entire raster is visible, centered within the opening of the mask, with no shadowed corners.
6. Move the Ion Trap Magnet as in step 2 for final adjustment.

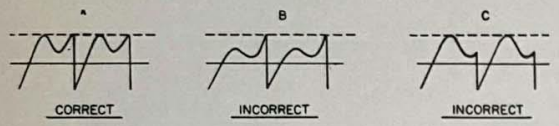
HORIZONTAL OSCILLATOR SYNC ADJUSTMENT



CHASSIS SHELF BOTTOM

1. Set the Noise Balance control to maximum clockwise.
2. Connect an oscilloscope to terminal "C' on the Synchroguide transformer (T-8) through a small capacitor, from 10 to 50 UUF.
3. Connect a DC VTMV from the grid of the type 6AU5 Horizontal Output tube (V-15) to the chassis. Use a high impedance probe.
4. Set the trimming capacitor adjustment screws in tight for the Horizontal Locking Range (C-51a) and the Horizontal Drive (C-51b).
5. Back off the trimmer for the Horizontal Locking Range 1/4 turn.
6. Back of the trimmer for the Horizontal Drive until the VTVM registers —9 volts (approximately one full turn).
7. Adjust front screw of Synchroguide to lock-in picture horizontally.

8. Adjust inside core of Synchroguide to give correct wave form. Re-adjust front screw simultaneously to keep in sync. Use non-metallic screw driver on inside core.



9. Trim front screw to get approximately three bars break-out when switching channels, with Horizontal Lock control in maximum clockwise position.

THE HORIZONTAL LOCK CONTROL SHOULD PRODUCE THE FOLLOWING CONDITIONS:

A. Sync should hold with control in maximum counterclockwise position.

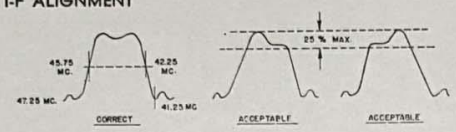
B. Sync should pull in when switching channels over at least half of the rotation range of the control.

C. Picture should not jitter at any position of the control.
   a. If sync does not hold in maximum counterclockwise position, back off front screw of Synchroguide. Retain correct wave form by adjustment of inside core.
   b. If sync does not pull in when switching channels over half of rotation range, back off C-51a, 1/4 turn at a time, until correct lock-in range is established.
   c. If the picture jitters at any position of the Horizontal Lock control, advance the control in a clockwise direction to the position that produces the greatest amount of jitter and adjust the front screw of the Synchroguide in a clockwise direction until the jitter stops. If jitter is not eliminated, advance C-51a trimmer adjustment. If jitter persists, shunt a 100 UUF capacitor across C-51a. Re-check break-out on clockwise end when switching channels. Back off C-51a if sync does not pull in over at least half of rotation range of Horizontal Lock control.

ALIGNMENT

NOTE: ALWAYS SET NOISE BALANCE CONTROL FULLY CLOCKWISE BEFORE MAKING ANY ALIGNMENT TESTS OR ADJUSTMENTS.

I-F ALIGNMENT



Lift the top section of the shield on the R-F oscillator-mixer tube so that it does not make electrical contact with its base. Connect one side of the output of an A-M signal generator to the shield, the other side to the chassis.

Connect a VTVM across the 4.7K video detector load. Use the lowest scale reading on the meter. Always attenuate the signal generator output for a reading below the limits of the meter, approximately —1 to —1.5 volts.

Set the Volume and Contrast controls to minimum. Set the Channel Selector to channel 7 or 13, depending on local conditions or interference.

PROCEDURE

	SIG. GEN FREQUENCY	ADJUST	METER READING	REMARKS
1.	43.90 Mc	T-11	Maximum	
2.	44 Mc	I-F Adjustment on Tuner	Maximum	Connect a 1K resistor from grid of V-1 to AGC line for this step only.
3.	44.0 Mc	Bottom of T-1	Maximum	
4.	42.50 Mc	Bottom of T2	Maximum	
5.	45.35 Mc	Bottom of T-10	Maximum	
6.	41.25 Mc	top of T-1	Minimum	
7.	41.25 Mc	Top of T-2	Minimum	
8.	47.25 Mc	Top of T-10	Minimum	
9.	Repeat steps 3, 4, and 5			
10.	Repeat step 1.			

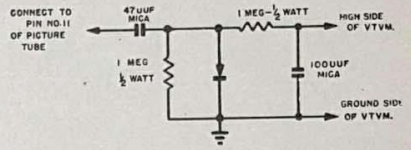
The I-F passband may be observed by substituting a sweep generator for the A-M signal generator and substituting an oscilloscope for the VTVM. Connect a 3 volt battery so that its positive terminal is connected to the chassis and the negative terminal is connected to the AGC lead. The sweep generator should be set to approximately 44 Mc and then adjusted to center the wave form on the scope face. To avoid overload and to assure a true view of the wave shape, the output of the sweep generator should be attenuated until further attenuation has a minimum effect on the wave shape. If necessary, a slight adjustment of the I-F transformers may be made to obtain a close approximation to the ideal curve. Adjustment of T-2 or T-10 affects the band width. Adjustment of T-1 or T-11 affects the slope of the top. However, T-1 should be preferred for slope adjustment.

SOUND ALIGNMENT

1. Connect an A-M signal generator tuned to 4.5 Mc between the grid of V5 and ground. Connect the alignment test circuit shown below and tune L8 for a minimum reading on a VTVM.

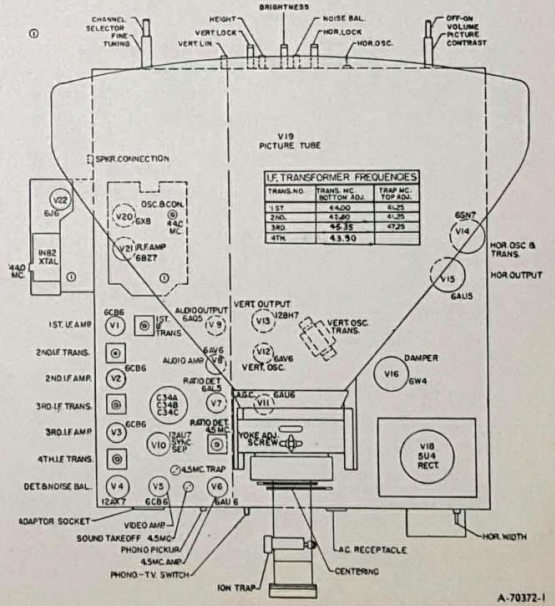
2. Disconnect the alignment test circuit and connect the VTVM to ground and Pin 5 of V7. Adjust L9 and primary of T3 (Bottom) for maximum indication.

3. Remove the VTVM and re-connect it to ground and junction of R27 and R28. Adjust secondary of T3 (Top) for zero. (Note: When tuning through the proper setting, the meter should swing negative on one side and positive on the other side.)



USE IN34 CRYSTAL

SOUND ALIGNMENT TEST CIRCUIT



TUBE LOCATION CHART FOR CHASSIS NO. S

200-1

200-11

TV REPAIR PARTS LIST

PART NO.	SCHEMATIC LOCATION	DESCRIPTION
		COMPOSITION CAPACITORS
PMB-40519-3	C22	2 UUF
		CERAMIC CAPACITORS
PMB-40518-1	C11	5 UUF 500 DCWV
	C14, C23	47 UUF† (Part of L8 & L9) 500 DCWV
PMB-40518-14	C47	100 UUF 500 DCWV
PMA-40523-23	C19	100 UUF 2000 DCWV
PMB-40518-17	C36	150 UUF 500 DCWV
PMB-40518-19	C13, C73	220 UUF 500 DCWV
PMA-40520-23	C72	470UUF 1000 DCWV
PMA-40521-42	C4, C7, C10	620 UUF† 500 DCWV
PMB-40518-24	C1, C2, C3, C5, C6, C8, C9, C25, C38, C39, C40, C67, C75, C76, C77, C78	1500 UUF 500 DCWV
PMA-40517-2	C24, C26, C37, C42, C68, C69	1500 UUF 500 DCWV
PMA-40517-4	C30a, C30b	1500 UUF Dual 500 DCWV
PMB-40518-32	C27	5000 UUF† 500 DCWV
PMA-40517-3	C12, C31	5000 UUF 500 DCWV
		MOLDED PAPER CAPACITORS
PMB-41007-74	C15, C35	.02 MFD 400 DCWV
PMB-41007-75	C62	.03 MFD 400 DCWV
PMB-41007-30	C21	.05 MFD 400 DCWV
PMB-41007-51	C16	.1 MFD 600 DCWV
PMB-41007-53	C66	.25 MFD 600 DCWV
PMB-41007-17	C17	.5 MFD 200 DCWV
		ELECTROLYTIC CAPACITORS (Continued)
PMA-42000	C33a	10 MFD 400 DCWV
	C33b	80 MFD 450 DCWV
PMA-42005	C46	100 MFD Paper Case 50 DCWV
		MICA TRIMMER CAPACITORS
PMA-43001	C51a, C51b	25 to 280 & 80 to 480 UUF
		COILS
PMB-52053	L1, L2, L3, L14	Filament Choke Coils
PMA-52023	L4	100 UH Peaking Coil

PART NO.	SCHEMATIC LOCATION	DESCRIPTION
		PAPER CAPACITORS
PMB-41006-39	C58	.001 MFD 600 DCWV
PMA-41009	C56	.01 MFD (Oil Filled) 200 DCWV
PMB-41006-7	C28	.01 MFD 200 DCWV
PMB-41006-45	C32	.01 MFD 600 DCWV
PMB-41006-28	C53	.02 MFD 400 DCWV
PMB-41006-47	C60	.025 MFD 600 DCWV
PMB-41006-49	C44	.05 MFD 600 OCWV
PMB-41006-30	C54	.05 MFD 400 DCWV
PMB-41006-51	C45	.1 MFD 600 DCWV
PMB-41006-15	C52, C59	.25 MFD 200 DCWV
		MICA CAPACITORS
PMB-40003-15	C18, C50	47 UUF† 500 DCWV
PMB-40002-15	C65	47 UUF* 1000 DCWV
PMB-40003-29	C48	180 UUF† 500 DCWV
PMA-40005-1	C20	220 UUF† 1500 DCWV
PMB-40003-37	C55	390 UUF† 500 DCWV
PMA-40004	C64	500 UUF 20,000 DCWV
PMB-40003-47	C57	1000 UUF† 500 DCWV
PMB-40003-55	C49	2200 UUF† 500 DCWV
PMB-40003-63	C41	4700 UUF† 500 DCWV
		ELECTROLYTIC CAPACITORS
PMA-42002	C29	1 MFD 50 DCWV
PMA-42006	C61, C43	20 MFD Paper Case 300 DCWV
PMA-42001	C34a	40 MFD 450 DCWV
	C34b	50 MFD 350 DCWV
	C34c	50 MFD 300 DCWV
PMA-45017-50	R64	120K OHMS 1 WATT
PMA-45015-51	R48, R62	150K OHMS ½ WATT
PMA-45017-51	R69, R70	150K OHMS 1 WATT
PMA-45015-53	R51, R87	220K OHMS ½ WATT
PMA-45015-54	R24, R52	270K OHMS ½ WATT
PMA-45015-56	R19	390K OHMS ½ WATT
PMA-45015-57	R41, R42, R75	470K OHMS ½ WATT
PMA-45017-57	R80	470K OHMS 1 WATT
PMA-45015-60	R50, R67	820K OHMS ½ WATT
PMA-45015-61	R14, R32, R56	1 MEGOHM ½ WATT
PMA-45017-66	R72	2.7 MEGOHMS 1 WATT

PART NO.	SCHEMATIC LOCATION	DESCRIPTION
PMA-52024	L5, L6	450 UH Peaking Coil
PMA-52025	L7 & R15	200 UH Peaking Coil Wound on 22K Resistor
PMA-52028-2	L8 & C14, L9 & C23	4.5 MC Take Off Trap
PMA-56000	L10	Yoke
PMA-56003	L12	Width Coil
		PRINTED CIRCUITS
PMA-95000	N1	Vertical Integrating Network
PMA-95001	N2	Audio Couplate
		COMPOSITION RESISTORS
PMA-45013-1	R81	3.3 OHMS ½ WATT
PMA-45015-9	R3, R7, R88	47 OHMS ½ WATT
PMA-45015-12	R25	82 OHMS ½ WATT
PMA-45015-15	R1, R10	150 OHMS ½ WATT
PMA-45015-18	R27	270 OHMS ½ WATT
PMA-45015-19	R2, R4, R11	330 OHMS ½ WATT
PMA-45017-19	R33	330 OHMS 1 WATT
PMA-45015-21	R57	470 OHMS ½ WATT
PMA-45015-22	R59, R60	560 OHMS ½ WATT
PMA-45019-24	R34	820 OHMS 2 WATT
PMA-45015-25	R5, R8, R26, R79	1K OHMS ½ WATT
PMA-45017-25	R78	1K OHMS 1 WATT
PMA-45015-28	R44	1.8K OHMS ½ WATT
PMA-45015-29	R45, R84, R85	2.2K OHMS ½ WATT
PMA-45015-30	R43	2.7K OHMS ½ WATT
PMA-45015-33	R2, R12	4.7K OHMS ½ WATT
PMA-45019-35	R17, R77	6.8K OHMS ½ WATT
PMA-45015-36	R55, R68, R73	8.2K OHMS ½ WATT
PMA-45015-37	R30, R31, R61, R83	10K OHMS ½ WATT
PMA-45015-42	R46	27K OHMS ½ WATT
PMA-45017-42	R39	27K OHMS 1 WATT
PMA-45015-44	R16, R18	39K OHMS ½ WATT
PMA-45015-45	R28, R54	47K OHMS ½ WATT
PMA-45017-47	R66, R74	68K OHMS 1 WATT
PMA-45015-49	R20, R21, R22, R63, R82, R86	100K OHMS ½ WATT
PMA-45017-49	R71	100K OHMS 1 WATT

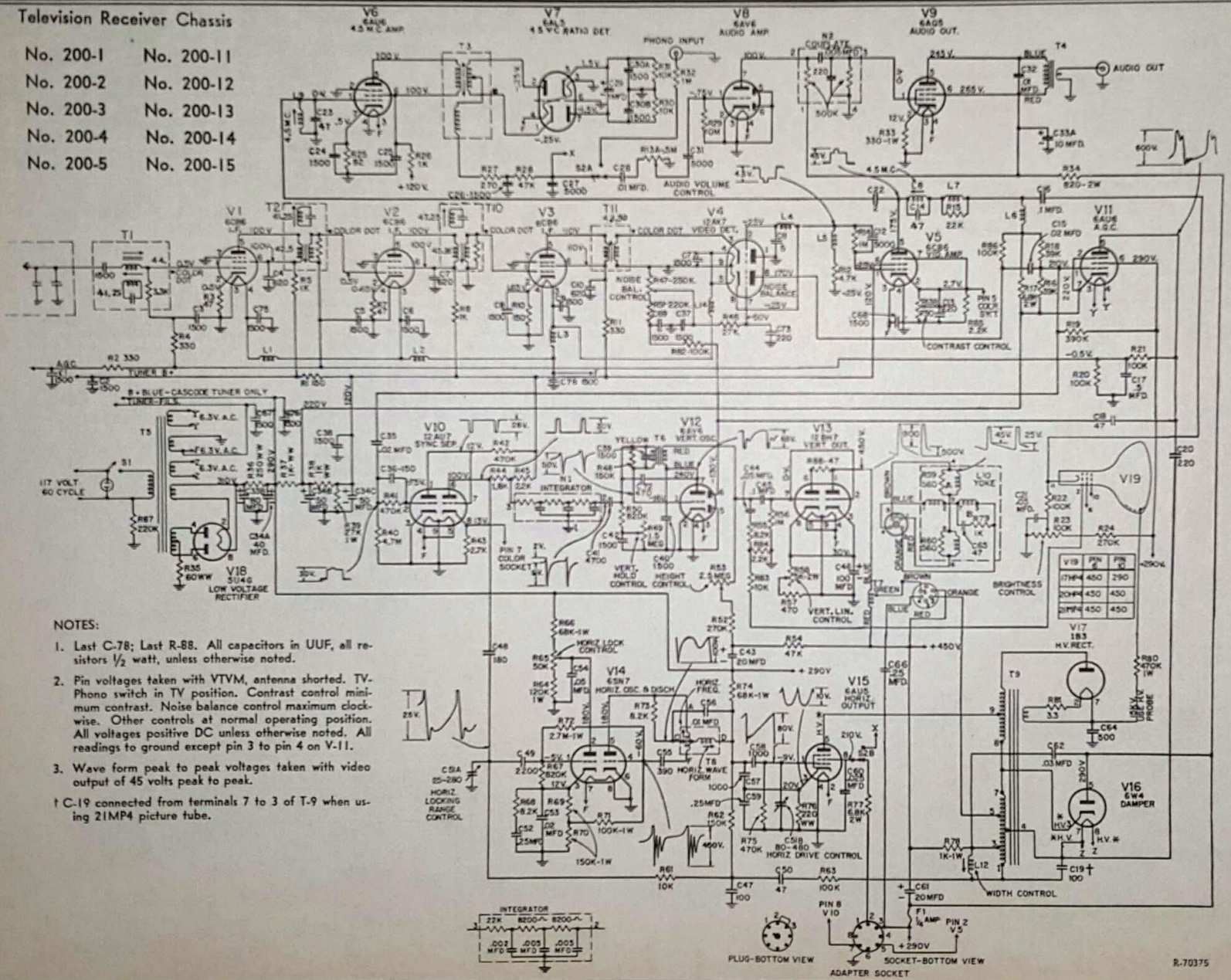
PART NO.	SCHEMATIC LOCATION	DESCRIPTION
PMA-45015-69	R40	4.7 MEGOHMS ½ WATT
PMA-45015-73	R29	10 MEGOHMS ½ WATT
		WIRE WOUND RESISTORS
PMB-47007-4	R35	60 OHMS 6 WATT
PMB-47007-3	R76	220 OHMS 4 WATT
PMB-47007-5	R36	250 OHMS 15 WATT
PMB-47007-1	R37, R38	1K OHMS 7.5 WATT
		VARIABLE RESISTORS
PMA-48016	R58	5K Ohms, Vertical Linearity Control
PMB-48014-1	R65	50K Ohms, Horizontal Hold Control
PMB-48014-2	R23	100K, Brightness Control
PMB-48014-3	R47	250K, Noise Balance Control
PMB-48015	R13a, R13b, S1	.5 Megohm & 750 Ohms, Volume & Contrast Control and On-Off Switch
PMB-48014-7	R49	1.5 Megohm, Vertical Hold Control
PMB-48014-5	R53	2.5 Megohms, Height Control
		TRANSFORMERS
PMB-52051	T1	1st I-F
PMB-52050	T2	2nd I-F
PMB-52049	T10	3rd I-F
PMB-52052	T11	I-F Output
PMA-52027	T3	4.5 MC Ratio Detector
PMB-51005	T4	Audio Output
PMB-50003	T5	Power
PMA-56005	T6	Vertical Oscillator
PMA-56004	T7	Vertical Output
PMB-52019	T8	Synchrouigde
PMC-56002	T9	Horizontal Output

ALL CAPACITOR TOLERANCES ± 20%, EXCEPT: * ± 5%; † ± 10%
ALL RESISTORS ± 10%.

C-70373-1

Television Receiver Chassis

No. 200-1	No. 200-11
No. 200-2	No. 200-12
No. 200-3	No. 200-13
No. 200-4	No. 200-14
No. 200-5	No. 200-15



NOTES:

1. Last C-78; Last R-88. All capacitors in UUF, all resistors ½ watt, unless otherwise noted.
2. Pin voltages taken with VTVM, antenna shorted. TV-Phono switch in TV position. Contrast control minimum contrast. Noise balance control maximum clockwise. Other controls at normal operating position. All voltages positive DC unless otherwise noted. All readings to ground except pin 3 to pin 4 on V-11.
3. Wave form peak to peak voltages taken with video output of 45 volts peak to peak.

† C-19 connected from terminals 7 to 3 of T-9 when using 21MP4 picture tube.

CHASSIS	RADIO CHASSIS	NO. OF TUBES	PICTURE TUBE	TUNER	
150-4	155	21 2	20CP4	PMB-57001	Turret Pentode
150-5		21	24AP4	PMB-57001	
150-7		20	17HP4	PMB-57003	Rotary Switch
150-9		21	17HP4	PMB-57001	
150-10	160	21 2	21MP4	PMB-57002-1	Turret Cascode
150-12		21	17HP4	PMB-57001	
150-16		21	17HP4	PMB-57002-1	
150-31	155	21 2	21AP4	PMB-57002-1	
150-51		21	24AP4	PMB-57002-1	
150-61	155	21 2	21MP4	PMB-57002-1	

CABINET MODELS AND CORRESPONDING CHASSIS NUMBERS

CABINET MODEL NO.	STYLE	CHASSIS MODEL NUMBER TV	RADIO	PHONO
2081	Console Comb.	150-4	155	90023
2181	Console Comb.	150-31	155	90023
		150-61		90025
2184	Console Comb.	150-61	155-1	90023
2192	Consolette Comb.	150-10	160	90026
2193	Consolette Comb.	150-10	160	90026
2194	Console Comb.	150-10	160	90023
2401	Console	150-5		
		150-51		
4317	Table Model	150-7		
		150-9		
		150-12		
4721	Table Model Comb.	150-10	160	
5517	Table Model	150-16	160	

Power consumption of combination sets is 240 watt.

DESCRIPTION

COMBINATION RECEIVERS USING CHASSIS 155 & 155-1 A-M RADIO TUNER TV CHASSS 150-4, 150-31, & 150-61

Chassis model 155 is a two tube A-M radio tuner with built-in loop antenna, a type 6BE6 converter tube, a type 6BA6, 455 Kc, I-F amplifier, tube, and a crystal diode detector, type 1N65. This A-M radio tuner has a control panel separate from the television controls. The audio amplifying and audio output circuits of the television receiver provide these functions for radio reception. A three position function switch on the radio control panel (S1a, 1b, 1c radio schematic) permits changing the source of the audio signal voltage across the volume control potentiometer (R-13a, TV schematic) from TV to radio or phonograph, as desired. The 155 A-M radio tuner is connected to the television circuit through an adapter socket on the back of the TV chassis. The phono motor is also plugged into the back of the TV chassis, but the phono pick-up lead is plugged into the A-M radio tuner.

Chassis 155-1 is the same as 155 except for length of control shafts.

COMBINATION RECEIVERS USING CHASSIS 160 AM RADIO TUNER TV CHASSIS 150-10

Chassis model 160 is also a two tube A-M radio tuner with the same type of converter, I-F amplifier, and detector as chassis 155. The function of the two tuners is also the same. However, a single set of controls is used to provide both television and radio reception on receivers with the 160 chassis. The radio dial is attached to the TV Fine Tuning control, which gives this control a dual capacity, depending on the position of the TV-RADIO-PHONO function switch. The 160 chassis is mounted on the underside of the TV chassis directly behind the front panel auxiliary controls. Its tuning gang is driven off the fine tune shaft with a pulley and stringing arrangement. The function switch (S-1a, 1b, 1c radio schematic) is connected directly into the TV audio circuit between the high frequency de-emphasis net, R-28 - C27, and the coupling capacitor C-28, to the volume control potentiometer, R-13a (TV schematic).

The phono motor and phono pick-up leads are plugged into the back of the TV chassis.

COMBINATION RECEIVERS USING CHASSIS 113 RADIO, TV CHASSIS 150-2, MODEL 2080

Chassis model 113 is a 5 tube superheterodyne A-M radio receiver with built-in loop antenna. The radio and TV chassis are complete within themselves, with separate power supplies and control panels. One speaker is used, with the secondaries of the two voice coils wired to the speaker in parallel through the PHONO-RADIO-TV function switch on the radio panel. On some sets the audio output transformer of the TV is mounted on the radio chassis.

RECORD CHANGERS

There are three types of record changers used in Pacific Mercury combination receivers.

Pacific Mercury model 90023 is a V-M, model 950, record changer. Pacific Mercury model 90025 is a Webster-Chicago, model 114 record changer.

Pacific Mercury model 90026 is a General Instrument & Appliance Corp., model 700F-33/45, record changer.

All three record changers operate on 117 volts AC, 60 cycle power.

CHASSIS 150-9 & 150-16

Chassis 150-9 and 150-16 use a 17HP4 type picture tube. The 17HP4 has electrostatic focus with 450 volts on Pin No. 6, and 290 volts on Pin No. 10. See installation and adjustment instructions of electrostatic focus picture tubes.

CHASSIS 150-7 & 150-12

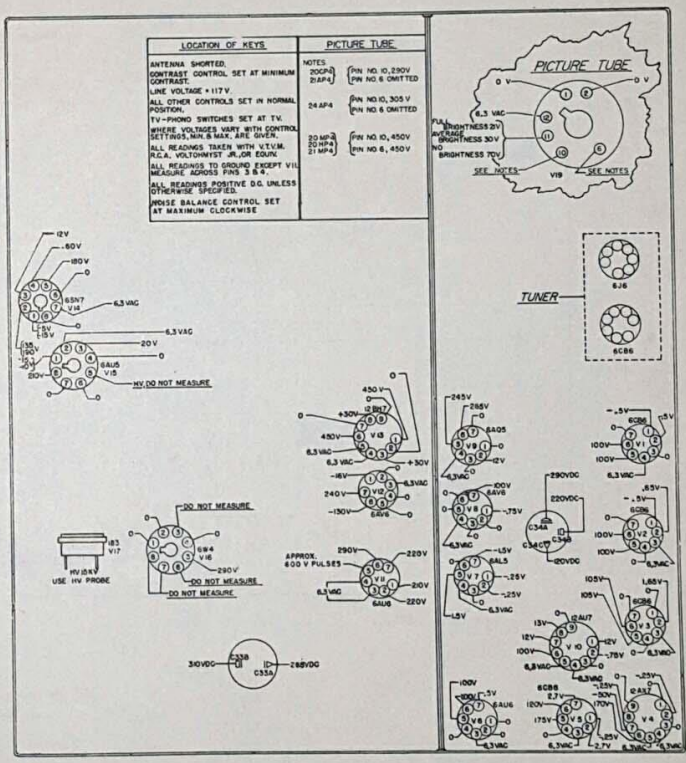
Chassis 150-7 and 150-12 also use a type 17HP4 picture tube. These two models are 20 tube chassis, similar to the basic chassis 150-Series except for the omission of the Noise Balance circuit.

The second half of V-4 (Type 12AX7), which formerly functioned as the Noise Balance Control, is used as the audio amplifier in these models, and V-8, the type 6AV6 tube, which was formerly used for audio amplification, is omitted.

There is no coupling between the two halves of the twin triode V-4, in the twenty tube receivers even though they are in the same envelope. The output from the first half, the video detector, is coupled to the video amplifier (V-5) only. The signal input to the second half of V-4 is taken off the pontentiometer, R-13A (Volume Control), across which is developed the audio signal voltage from the 4.5 Mc ratio detector, V-7. There is no phono jack on the twenty tube chassis. The voltage readings on the pins of V-4 are as follows:

VIDEO DETECTOR PIN NO.	VOLTAGE	FUNCTION	AUDIO AMPLIFIER PIN NO.	VOLTAGE
1	0	Plate	6	100
2	—.25	Control Grid	7	—.75
3	0	Cathode	8	0
4	6.3 AC	Filament	5	6.3 AC

Pin No. 9 is a common ground for both halves of the filament. The voltage readings on the pins of the other tubes in the twenty tube chassis are the same as for the twenty-one tube chassis, 150-Series.



150-SERIES CHASSIS.

ROTARY SWITCH TUNER—PMB-57003

Chassis 150-7 only, uses a rotary switch R-F tuner. This R-F selector is electrically equivalent to a tapped coil whose inductance is reduced from its maximum value by means of a rotary switch. The switch progressively shorts additional taps to ground as the selector knob is rotated and the oscillator coils are switched in and out of the circuit from channel 2 to channel 13.

The R-F amplifier tube is a type 6AG5, 6BC5, or 6CB6. A twin triode, type 6J6, is used for the combination mixer and oscillator.

CHASSIS 150-5 & 150-51

Chassis models 150-5 and 150-51 use a 24 inch, magnetic focus, metal picture tube, type 24AP4. The use of this tube requires changing the circuit of the basic 150-Series chassis as follows:

Resistor R-36 in the low voltage rectifier filter circuit has been replaced by a choke coil, L-13. A filter network (R-89, C-43, and R-90, C-73) is used to increase stability of the vertical sweep circuit with line voltage variations.

The capacity of C-66 has been reduced from .25 mfd. to .1 mfd. to provide the additional linearity and width control necessary for the larger raster.

ADJUSTMENTS

The chassis listed in this supplement require the same type of adjustments as described in the 150-Series Service Manual.

INSTALLING AND ADJUSTING PICTURE TUBES

17HP4

Rotate each of the Centering Rings separately until the picture is properly centered.

24AP4

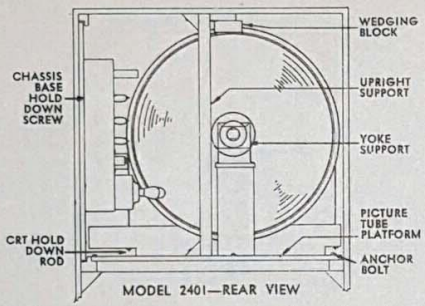
The 24 inch picture tube is mounted on a triangular wooden platform, and this platform is bolted to the cabinet at each of its three corners. The chassis is mounted separately on a flat wooden base which in turn is fastened to the side of the cabinet with four wood screws.

REMOVING THE PICTURE TUBE

To remove the picture tube, it is first necessary, to remove the chassis.

WARNING: OBSERVE ALL HIGH VOLTAGE AND PICTURE TUBE HANDLING PRECAUTIONS

1. Remove the push-on type control knobs on the front panel and remove the back of the cabinet.
2. Remove the upright support (Held in place by two wood screws) located in the rear of the cabinet to the left of the neck of the picture tube.
3. Disconnect:
   a. Speaker plug.
   b. Antenna.
   c. Anode lead of picture tube.
   d. Picture tube socket.
   e. Ion trap.
   f. Deflection yoke (Some models have plug-in yoke leads).
   g. Focusing assembly.
   h. Wire or spring that is used to ground the deflection yoke support and tube mounting strap to the chassis.



MODEL 2401—REAR VIEW

4. Remove the four screws on the side of the cabinet that hold the wooden base of the chassis in place and slide the chassis and base out of the cabinet.

Note: The chassis may be operated for servicing without removing the picture tube from the cabinet by taking the chassis off its base and placing it next to the cabinet in such a position that all necessary connections can be made.

5. Remove the wooden block that acts as a wedge support for the top of the rim of the picture tube.
6. Remove the three anchor bolts that fasten the platform support to the cabinet and slide the platform and picture tube out of the cabinet.
7. Unfasten the mounting strap from the rim of the tube.

INSTALLING THE PICTURE TUBE

1. Set the picture tube on its supporting platform, with its rim resting in the cradle, and attach the mounting strap. Position the tube so that the key-way for the tube socket will be toward the chassis. Place the rubber collar and deflection yoke support as far forward on the neck of the tube as possible.
2. Slide the supporting platform inside the cabinet and bolt it in the proper position. The supporting platform has elongated holes for the three bolts that anchor it to the cabinet. This allows adjustment of the platform's position so that the face of the tube can be made to fit properly against the mask, regardless of variations in dimensions or shapes of new tubes.
3. Replace the wooden block that acts as a wedge support for the top of the rim of the picture tube.
4. Slide the chassis, mounted on its base, into the grooved track on the side of the cabinet and fasten it in place with the four wood screws. The holes through which the chassis is bolted to its base are large enough to shift the chassis to the position that will allow the control shafts to fit properly.
5. Connect:
   a. Focusing assembly.
   b. Deflection yoke (or plug).
   c. Ion trap.
   d. Picture tube socket.
   e. Anode lead.
   f. Wire or spring that is used to ground the deflection yoke support and tube mounting strap to the chassis.
   g. Speaker plug.
   h. Antenna.
6. If the picture is not properly centered, move the Centering Control Lever on the rear of the receiver a short distance in any direction necessary for correction. Do not use force in making this adjustment as excessive strain may be exerted on the neck of the picture tube. If proper centering cannot be restored in this manner, a slight adjustment of the deflection yoke or focus magnet mountings may be necessary.
7. Replace the upright support.
8. Replace the back of the cabinet and the push-on control knobs.

ALIGNMENT

NOTE: ALWAYS SET NOISE BALANCE CONTROL FULLY CLOCKWISE BEFORE MAKING ANY ALIGNMENT TESTS OR ADJUSTMENTS.

I-F SWEEP PATTERNS AND ALIGNMENT CHART

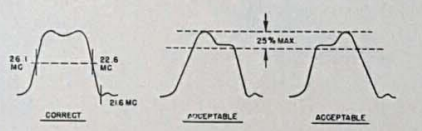


FIG. 8

SIGNAL GENERATOR FREQUENCY	ADJUSTMENT	VTVM INDICATION
24.35 Mc	T2, 1st I-F coil on tuner, and L1	Maximum
23.2 Mc	L3	Maximum
25.2 Mc	T1	Maximum
21.6 Mc	L2	Minimum

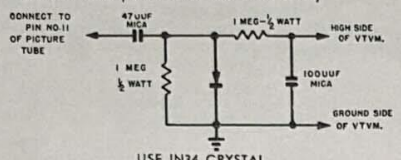
I-F ALIGNMENT

1. Lift the top section of the shield on the 6J6 mixer so that the shield does not make electrical contact with its base. Connect the output of an A-M signal generator to the shield and ground to the chassis.
2. Connect a VTVM across R12, the 4,700 ohm video detector load.
3. Set the Volume and Contrast Controls to minimum.
4. Tune the signal generator to 24.35 Mc and attenuate the signal generator output for a reading of —1 to —1.5 volts to avoid overload and consequent inaccurate alignment.
5. Peak the fourth I-F transformer (T2) to 24.35 Mc keeping the VTVM reading at —1 to —1.5 volts by adjustment of the attenuator on the signal generator.
6. Connect a 1,000 ohm resistor from the grid of V1 to the junction of R2 and R4. Adjust the first I-F coil located on the tuner for a maximum reading on the VTVM of between —1 and —1.5 volts (L9, Fig. 10). Remove the 1,000 ohm resistor.
7. Place the tuner turret so that it is between any two channels and adjust L1 for maximum indication on the VTVM. (Note: on sets below serial number 10525, L1 is fixed and step 7 should be disregarded.)
8. Peak the third I-F coil (L3) to 23.2 Mc keeping the VTVM reading at —1 to —1.5 volts.

9. Tune the signal generator to 25.2 Mc and adjust the second I-F transformer (T1) for maximum, keeping the VTVM reading at —1 to —1.5 volts.
10. Adjust the signal generator to 21.6 Mc and tune the trap L2 for a minimum reading.
11. The I-F passband may be observed by connecting a sweep generator across the terminals of the A-M signal generator and substituting an oscilloscope for the VTVM. Place a 3 volt battery so that its positive terminal is connected to the chassis and its negative terminal is connected to the junction of R2 and R4. The sweep generator should be set to approximately 24.35 Mc and then adjusted to center the waveform on the scope face. To avoid overload, and to assure a true view of the wave shape, the output of the sweep generator should be attenuated until further attenuation has a minimum effect on the wave shape. If necessary, a slight adjustment of the I-F transformers may be made to obtain a close approximation to the ideal curve. Adjustment of L3 or T1 affects the bandwidth. Adjustment of T2 affects the slope of the top.

SOUND ALIGNMENT

1. Connect an A-M signal generator tuned to 4.5 Mc between the grid of V5 and ground. Connect the alignment test circuit shown below and tune L8 for a minimum reading on a VTVM.
2. Disconnect the alignment test circuit and connect the VTVM to ground and Pin 5 of V7. Adjust L9 and primary of T3 (Bottom) for maximum indication.
3. Remove the VTVM and re-connect it to ground and junction of R27 and R28. Adjust secondary of T3 (Top) for zero. (Note: When tuning through the proper setting, the meter should swing negative on one side and positive on the other side.)

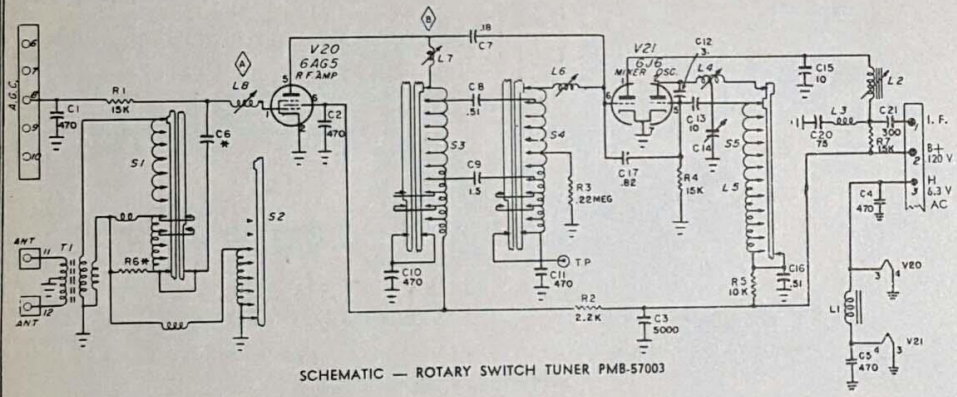


USE IN34 CRYSTAL

FIG. 9—SOUND ALIGNMENT TEST CIRCUIT

ALIGNMENT OF THE ROTARY SWITCH TUNER PMB-57003

Note: This tuner has been carefully checked and aligned at the factory to give the best possible performance. Alignment should not be necessary in the field unless tubes or other components are replaced.



SCHEMATIC — ROTARY SWITCH TUNER PMB-57003

OSCILLATOR ADJUSTMENT

1. Turn station selector to channel 13.
2. Connect signal generator, adjusted to correct channel 13 oscillator frequency, to the antenna.
3. Connect oscilloscope to test point through 10,000 ohms.
4. Set fine tuning in center of range. Check channel 13 and 6 for zero beat on scope.

If it is necessary to make adjustments to the oscillator, the following steps should be followed:

A. Align high channels for correct frequency with channel 13 oscillator screw (See illustration, Adjustment D). A non-metallic screwdriver is advisable.

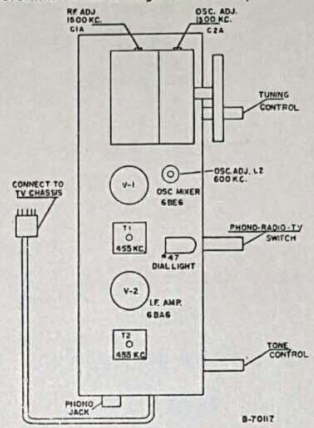
B. Align low channels for correct frequency with channel 6 oscillator screw (Adjustment E).

C. Adjustment of channel 13 and channel 6 oscillator brings all other channels in adjustment. Do not back up the screws more than 8 turns from tight. At that point the electrical effect has ceased. Further backing up will cause the screw to drop out.

Notes: Cover and tube shields to be on. Have rated supply voltages fed to tuner. Allow at least 3 minutes warm up. When replacing oscillator tube, select one which requires minimum touch-up. Clockwise rotation of screws increases frequency.

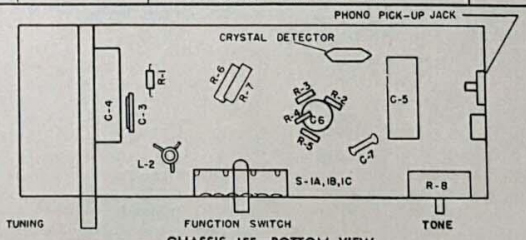
BAND PASS ALIGNMENT

1. Use R-F sweep to antenna and oscilloscope to the test point through 10,000 ohms.
2. The oscillator must be operating for each channel at nearly the correct frequency.
3. Align channel 13 R-F plate (Adjustment B) and R-F grid (Adjustment A) end inductances. Align channel 13 mixer grid end inductances by spreading or pushing together the turns. The band pass should include both carriers, have steep sides, and maximum gain.
4. Align the incremental loops of the R-F plate, R-F grid, and mixer grid from 12 to 7, in that order. Pushing the loops inwards increases the frequency.
5. Align channel 6 R-F plate, R-F grid, and mixer grid to obtain a flat response with maximum gain. Spreading the coils increases the frequency. Band pass should include both carriers and have steep sides.
6. Align incremental coils of R-F plate, R-F grid, and mixer grid from 5 to 2 in that order. Spreading coils increases the frequency. A tuning wand may be used to determine what change is necessary.

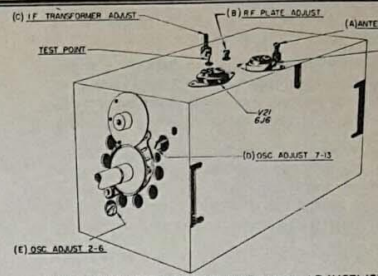


CHASSIS 155—TOP VIEW

DUMMY ANTENNA	SIG. GEN. COUPLING	SIG. GEN. FREQUENCY	DIAL SETTING	ADJUST	REMARKS
1.) .1 mfd.	High side to Pin No. 7, V-1 Radio, through .05 mfd. Low side to ground.	455 Kc	Tuning gang fully open.	Top & Bottom T1. 1st I-F Top & Bottom T2 2nd I-F	Adjust for max.
2.) None	To loop (form from a few turns of wire). Place in proximity of built-in antenna.	1500 Kc	Adjust gang to bring pointer 4⅛" from left edge of dial panel background.	C-2a Osc. trimmer.	Adjust for max.
3.) None	Same as (2).	600 Kc	1½" from left edge.	L-2 Osc. Slug Rock Gang.	Adjust for max.
4.) None	Same as (2).	1500 Kc	4⅛" from left edge.	C-1a R-F.	Adjust for max.
		Repeat (2), (3) and (4) if necessary.			



CHASSIS 155—BOTTOM VIEW



ROTARY SWITCH TUNER PMB-57003 ADJUSTMENTS

CAUTION: Band pass alignment is carefully made at the factory. Attempt this alignment only with proper equipment and set-up.

CONDITIONS OF MEASUREMENT:

"B" Supply	120 Volts
Heater Supply	6.3 Volts AC
Grid Bias	—.5 Volts

ALIGNMENT OF THE A-M RADIO TUNER, CHASSIS 155

Set RADIO-PHONO-TV function switch to RADIO position.

Set Volume and Tone controls at full clockwise position. With tuning gang fully closed, align dial pointer exactly ⅝" from left edge of dial panel background.

Connect output meter across voice coil.

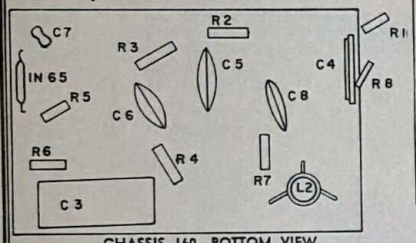
Notes: Use an insulated alignment screwdriver. Use signal generator having 30% modulation at 400 cycles. Attenuate signal generator to keep output meter reading below 1.25 volts.

ALIGNMENT OF THE A-M RADIO TUNER, CHASSIS 160

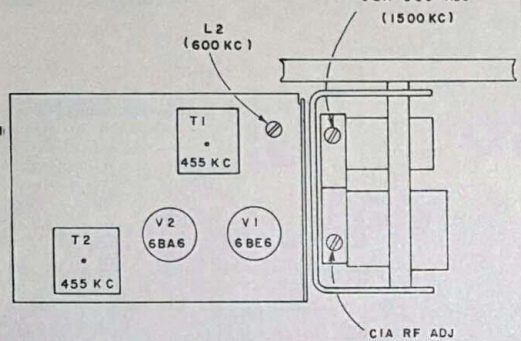
The alignment procedure for this tuner is basically the same as for chassis 155, except for dial setting. The radio dial is fastened to the TV Fine Tuning dial in such a manner that the low end mark on the dial is opposite the radio Index with the gang fully closed. (The radio Index is either to the right, or above the dial. When ordering dial replacement give position of Index.) Before removing the chassis from the cabinet, mark the TV Channel Selector Knob with a grease pencil or bit of plastic tape opposite the radio Index. Remove and replace the knobs when removing the chassis, without changing the position of the TV Channel Selector or Fine Tuning controls. This will provide a reference point for the radio dial settings under the alignment procedure. Dial settings will correspond to signal generator frequencies except for 455 Kc. For this frequency open tuning gang fully.

It is necessary to retain the connections between the radio tuner and the radio built-in antenna fastened to the cabinet, during alignment.

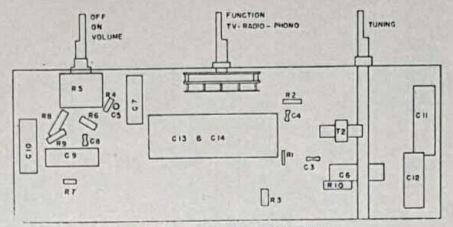
Note: For dial stringing, and schematic, See Page 12.



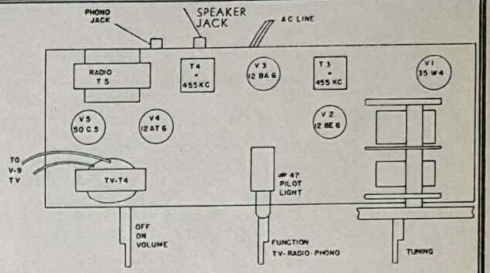
CHASSIS 160—BOTTOM VIEW



CHASSIS 160—TOP VIEW



CHASSIS 113—BOTTOM VIEW



CHASSIS 113—TOP VIEW

ALIGNMENT OF AM RADIO—CHASSIS 113

Set RADIO-PHONO-TV function switch to RADIO position.

Set Volume control at full clockwise position.

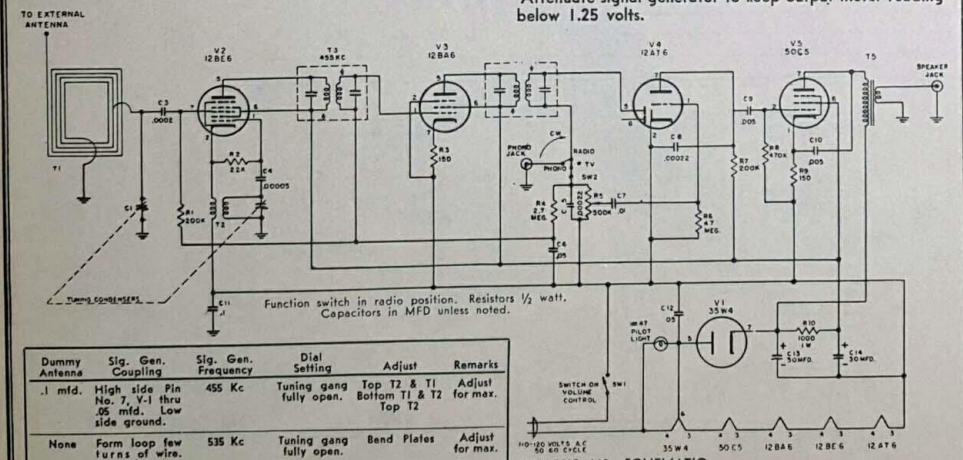
Connect output meter across voice coil.

NOTES:

Use an insulated alignment screwdriver.

Use signal generator having 30% modulation at 40 cycles.

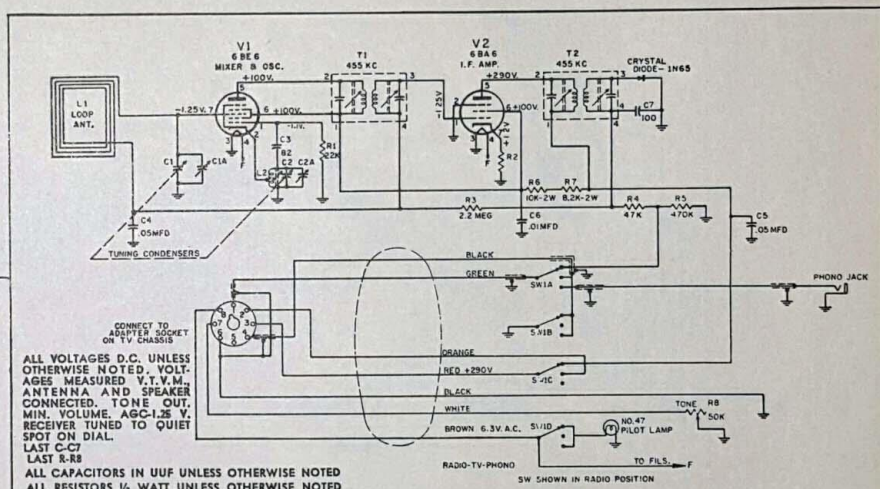
Attenuate signal generator to keep output meter reading below 1.25 volts.



CHASSIS 113—SCHEMATIC

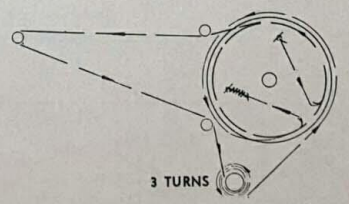
Dummy Antenna	Sig. Gen. Coupling	Sig. Gen. Frequency	Dial Setting	Adjust	Remarks
.1 mfd.	High side Pin No. 7, V-1 thru .05 mfd. Low side ground.	455 Kc	Tuning gang fully open.	Top T2 & T1 Bottom T1 & T2 Top T2	Adjust for max.
None	Form loop few turns of wire. Place in proximity built-in antenna.	535 Kc	Tuning gang fully open.	Bend Plates	Adjust for max.

When the chassis is replaced in the cabinet, adjust the pointer to make the dial settings conform with known frequencies.



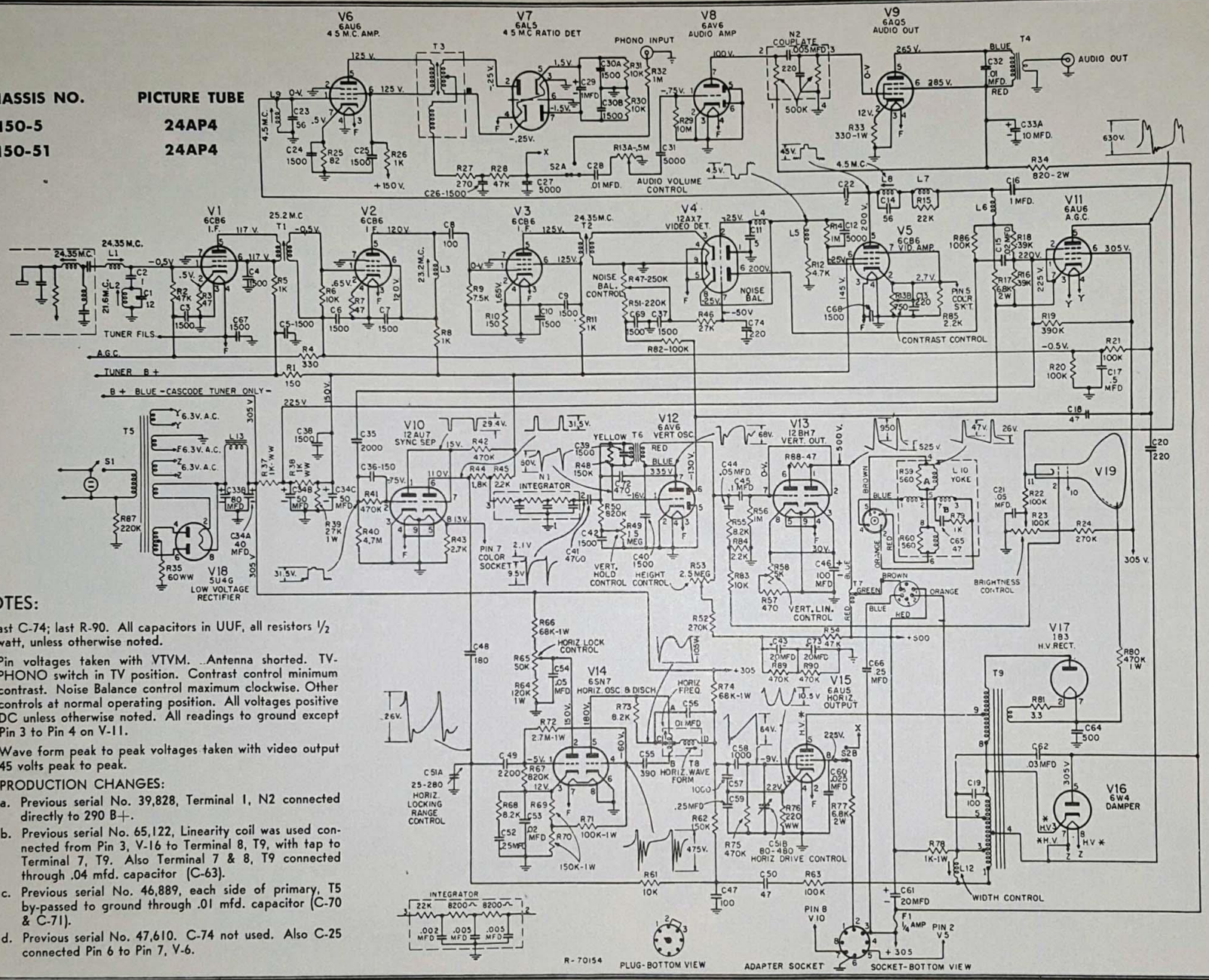
ALL VOLTAGES D.C. UNLESS OTHERWISE NOTED. VOLTAGES MEASURED V.T.V.M. ANTENNA AND SPEAKER CONNECTED. TONE OUT, MIN. VOLUME. AGC-1.25 V. RECEIVER TUNED TO QUIET SPOT ON DIAL.
LAST C-C7
LAST R-R8

ALL CAPACITORS IN UUF UNLESS OTHERWISE NOTED
ALL RESISTORS ½ WATT UNLESS OTHERWISE NOTED
R2, 330 OHMS, WAS 150 OHMS IN EARLY MODELS.



155 RADIO DIAL STRINGING

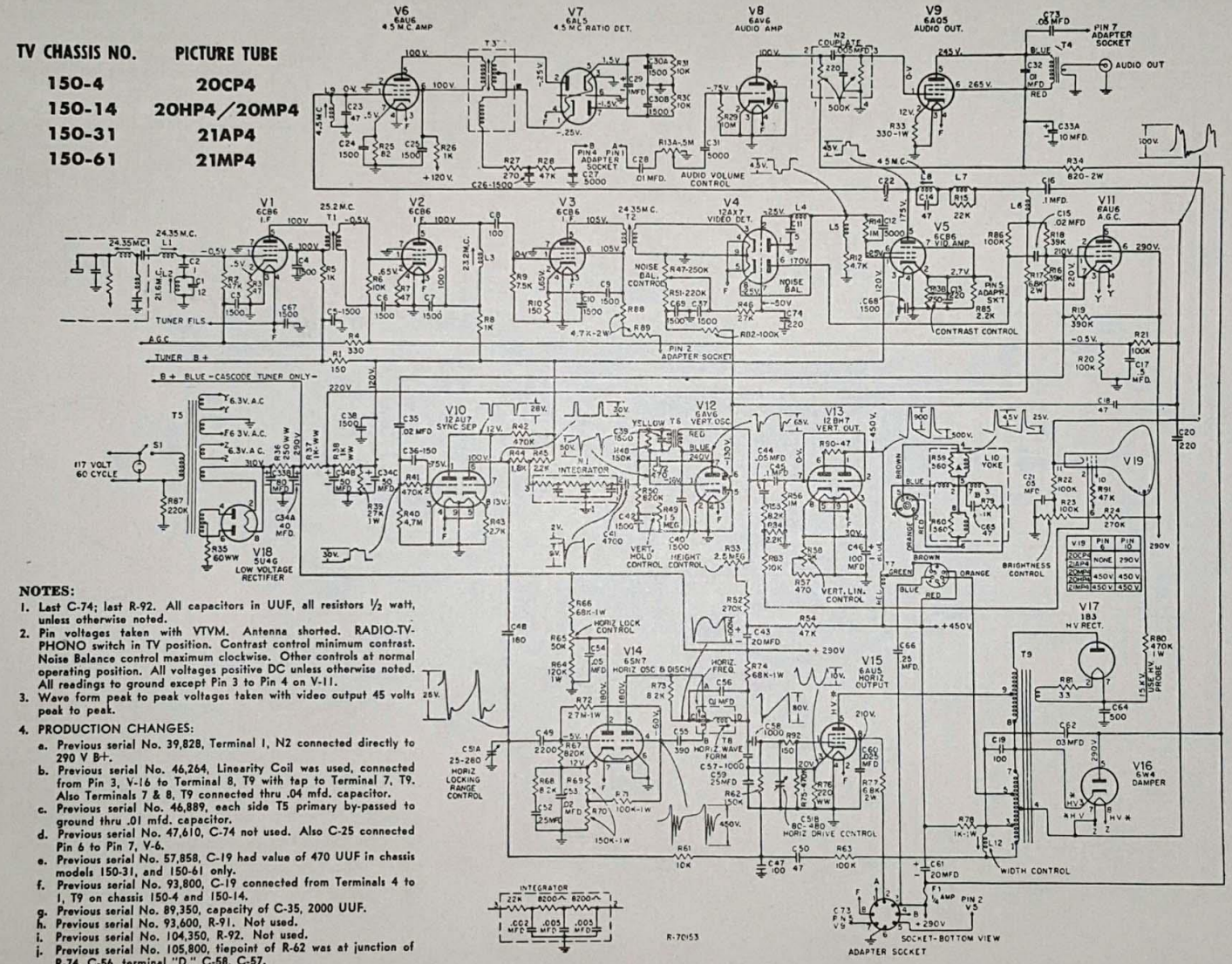
TV CHASSIS NO.	PICTURE TUBE
150-5	24AP4
150-51	24AP4



NOTES:

1. Last C-74; last R-90. All capacitors in UUF, all resistors 1/2 watt, unless otherwise noted.
2. Pin voltages taken with VTVM. Antenna shorted. TV-PHONO switch in TV position. Contrast control minimum contrast. Noise Balance control maximum clockwise. Other controls at normal operating position. All voltages positive DC unless otherwise noted. All readings to ground except Pin 3 to Pin 4 on V-11.
3. Wave form peak to peak voltages taken with video output 45 volts peak to peak.
4. PRODUCTION CHANGES:
   a. Previous serial No. 39,828, Terminal 1, N2 connected directly to 290 B+.
   b. Previous serial No. 65,122, Linearity coil was used connected from Pin 3, V-16 to Terminal 8, T9, with tap to Terminal 7, T9. Also Terminal 7 & 8, T9 connected through .04 mfd. capacitor (C-63).
   c. Previous serial No. 46,889, each side of primary, T5 by-passed to ground through .01 mfd. capacitor (C-70 & C-71).
   d. Previous serial No. 47,610. C-74 not used. Also C-25 connected Pin 6 to Pin 7, V-6.

TV CHASSIS NO.	PICTURE TUBE
150-4	20CP4
150-14	20HP4/20MP4
150-31	21AP4
150-61	21MP4



NOTES:

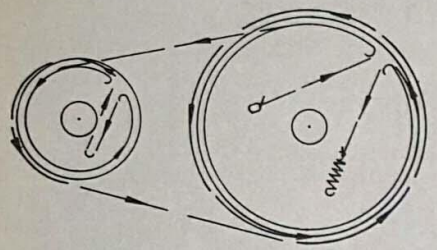
1. Last C-74; last R-92. All capacitors in UUF, all resistors ½ watt, unless otherwise noted.
2. Pin voltages taken with VTVM. Antenna shorted. RADIO-TV-PHONO switch in TV position. Contrast control minimum contrast. Noise Balance control maximum clockwise. Other controls at normal operating position. All voltages positive DC unless otherwise noted. All readings to ground except Pin 3 to Pin 4 on V-11.
3. Wave form peak to peak voltages taken with video output 45 volts peak to peak.
4. PRODUCTION CHANGES:
   a. Previous serial No. 39,828, Terminal 1, N2 connected directly to 290 V B+.
   b. Previous serial No. 46,264, Linearity Coil was used, connected from Pin 3, V-16 to Terminal 8, T9 with tap to Terminal 7, T9. Also Terminals 7 & 8, T9 connected thru .04 mfd. capacitor.
   c. Previous serial No. 46,889, each side T5 primary by-passed to ground thru .01 mfd. capacitor.
   d. Previous serial No. 47,610, C-74 not used. Also C-25 connected Pin 6 to Pin 7, V-6.
   e. Previous serial No. 57,858, C-19 had value of 470 UUF in chassis models 150-31, and 150-61 only.
   f. Previous serial No. 93,800, C-19 connected from Terminals 4 to 1, T9 on chassis 150-4 and 150-14.
   g. Previous serial No. 89,350, capacity of C-35, 2000 UUF.
   h. Previous serial No. 93,600, R-91. Not used.
   i. Previous serial No. 104,350, R-92. Not used.
   j. Previous serial No. 105,800, tiepoint of R-62 was at junction of R-74, C-56, terminal "D," C-58, C-57.

NOTES:

1. Last C-73; last R-92. All capacitors in UUF, all resistors ½ watt, unless otherwise noted.
2. Pin voltages taken with VTVM. Antenna shorted. TV-PHONO switch in TV position. Contrast control minimum contrast. Noise Balance control maximum clockwise. Other controls at normal operating position. All voltages positive DC unless otherwise noted. All readings to ground except Pin 3 to Pin 4 on V-11.
3. Wave form peak to peak voltages taken with video output 45 volts peak to peak.
4. PRODUCTION CHANGES:
   a. Previous serial No. 39,828, Terminal 1, N2 connected directly to 290 V B+.
   b. Previous serial No. 46,264, Linearity Coil was used, connected from Pin 3, V-16 to Terminal 8, T9 with tap to Terminal 7, T9. Also Terminals 7 & 8, T9 connected thru .04 mfd. capacitor.
   c. Previous serial No. 46,889, each side T5 primary by-passed to ground thru .01 mfd. capacitor.
   d. Previous serial No. 47,610, C-73 not used. Also C-25 connected Pin 6 to Pin 7, V-6.
   e. Previous serial No. 89,350, capacity of C-35, 2000 UUF.
   f. Previous serial No. 93,600, R-91 not used.
   g. Previous serial No. 104,350, R-92 not used.
   h. Previous serial No. 105,800 tiepoint of R-62 was at junction of R-74, C-56, terminal "D," C-58, C-57.

TV CHASSIS NO. 150-10

PICTURE TUBE 21MP4



160 RADIO DIAL STRINGING

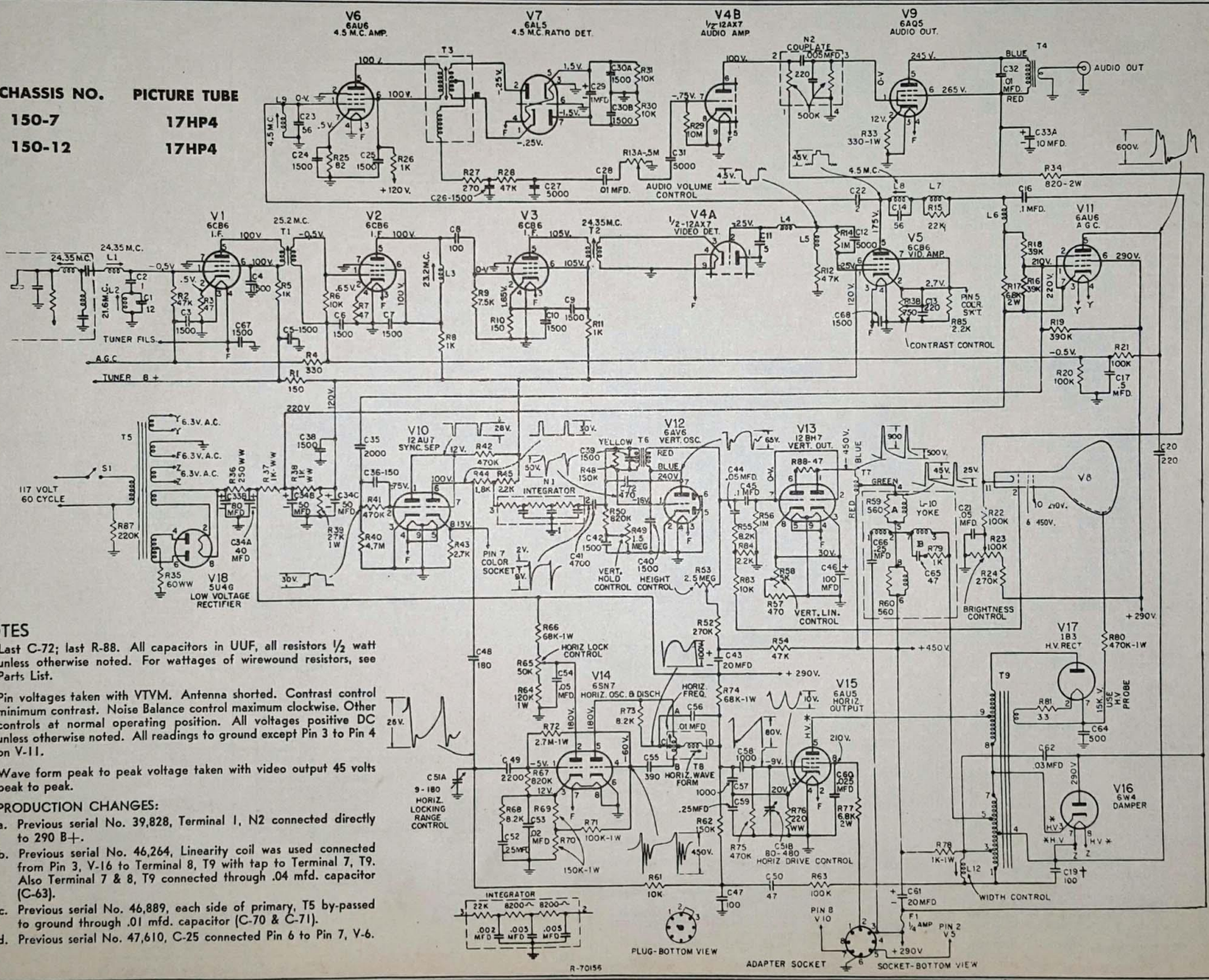
RADIO-TV-PHONO FUNCTION SWITCH SHOWN IN RADIO POSITION

REFER TO T.V. SCHEMATIC

ALL RESISTORS ½ WATT UNLESS OTHERWISE NOTED.
ALL CAPACITORS IN UUF UNLESS OTHERWISE NOTED.
ALL VOLTAGES D.C. UNLESS OTHERWISE NOTED.
VOLTAGES MEASURED WITH V.T.V.M. RECEIVER OFF STATION, ANTENNA SHORTED, SPEAKER CONNECTED.
MAX. VOLUME A.G.C.-.15 V.

CHASSIS 160—SCHEMATIC

TV CHASSIS NO.	PICTURE TUBE
150-7	17HP4
150-12	17HP4



NOTES

1. Last C-72; last R-88. All capacitors in UUF, all resistors 1/2 watt unless otherwise noted. For wattages of wirewound resistors, see Parts List.
2. Pin voltages taken with VTVM. Antenna shorted. Contrast control minimum contrast. Noise Balance control maximum clockwise. Other controls at normal operating position. All voltages positive DC unless otherwise noted. All readings to ground except Pin 3 to Pin 4 on V-11.
3. Wave form peak to peak voltage taken with video output 45 volts peak to peak.
4. PRODUCTION CHANGES:
   a. Previous serial No. 39,828, Terminal 1, N2 connected directly to 290 B+.
   b. Previous serial No. 46,264, Linearity coil was used connected from Pin 3, V-16 to Terminal 8, T9 with tap to Terminal 7, T9. Also Terminal 7 & 8, T9 connected through .04 mfd. capacitor (C-63).
   c. Previous serial No. 46,889, each side of primary, T5 by-passed to ground through .01 mfd. capacitor (C-70 & C-71).
   d. Previous serial No. 47,610, C-25 connected Pin 6 to Pin 7, V-6.

REPAIR PARTS LIST

TELEVISION CHASSIS

PART NO.	SCHEMATIC LOCATION	DESCRIPTION
		COMPOSITION CAPACITORS
PMA-40519-1	C2	1 UUF
PMA-40519-3	C22	2 UUF
		CERAMIC CAPACITORS
PMB-40518-1	C11	5 UUF 500 DCWV
	C1 (Part of L2)	12 UUF † 500 DCWV
	C14, C23 (Part of L8-L9)	47 UUF 500 DCWV
PMB-40518-14	C8, C47	100 UUF 500 DCWV
PMA-40523-23	C19	100 UUF 2 KV
PMB-40518-17	C36	150 UUF 500 DCWV
PMB-40518-19	C13, C73 (C74, 150-4, 150-5, 150-31, 150-51, 150-61)	220 UUF 500 DCWV
PMA-40520-23	C72	470 UUF 1000 DCWV
PMB-40518-24	C25, C39, C40	1500 UUF 500 DCWV
PMA-40517-2	C3, C4, C5, C6, C7, C9, C10, C24, C26, C37, C38, C42, C67, C68, C69	1500 UUF 500 DCWV
PMA-40517-4	C30a, C30b (Dual)	1500 UUF 500 DCWV
PMB-40518-27	C35 (150-5, 150-7, 150-12, 150-51)	2000 UUF 500 DCWV
PMB-40518-32	C27	5000 UUF 500 DCWV
PMA-40517-3	C12, C31	5000 UUF 500 DCWV
		MOLDED PAPER CAPACITORS
PMB-41007-45	C70, C71	.01 MFD 600 DCWV
PMB-41007-74	C15	.02 MFD 400 DCWV
PMB-41007-85	C35	.02 MFD 600 DCWV
PMB-41007-86	C62	.03 MFD 600 DCWV
PMB-41007-30	C21	.05 MFD 400 DCWV
PMB-41007-51	C16	.1 MFD 600 DCWV
PMB-41007-53	C66	.25 MFD 600 DCWV
PMB-41007-17	C17	.5 MFD 200 DCWV
		PAPER CAPACITORS
PMB-41006-39	C58	.001 MFD 600 DCWV
PMA-41009	C56 (Oil Filled)	.01 MFD 200 DCWV
PMB-41006-45	C32	.01 MFD 600 DCWV
PMB-41006-7	C28	.01 MFD 200 DCWV
PMB-41006-28	C53	.02 MFD 400 DCWV
PMB-41006-47	C60	.025 MFD 600 DCWV
PMB-41006-76	C63	.04 MFD 400 DCWV
PMB-41006-49	C44, (C73, 150-4, 150-31, 150-61)	.05 MFD 600 DCWV
PMB-41006-30	C54	.05 MFD 400 DCWV
PMB-41006-51	C45 (C66, 150-5, 150-51)	.1 MFD 600 DCWV
PMB-41006-15	C52, C59	.25 MFD 200 DCWV
		MICA CAPACITORS
PMB-40003-15	C18, C50	47 UUF † 500 DCWV
PMB-40002-15	C65	47 UUF * 100 DCWV
PMB-40003-29	C48	180 UUF † 500 DCWV
PMA-40005-1	C20	220 UUF † 1500 DCWV
PMB-40003-37	C55	390 UUF † 500 DCWV
PMA-40004	C64	500 UUF 20 KV
PMB-40003-47	C57	1000 UUF † 500 DCWV
PMB-40003-55	C49	2200 UUF† 500 DCWV
PMB-40003-63	C41	4700 UUF † 500 DCWV
		ELECTROLYTIC CAPACITORS
PMA-42002	C29	1 MFD 50 DCWV
PMA-42006	C61, C43 (Paper Case) (C73, 150-5; 150-51)	20 MFD 300 DCWV
	(C43a	40 MFD 450 DCWV
PMA-42001	(C43b	50 MFD 350 DCWV
	(C43c	50 MFD 300 DCWV
PMA-42000	(C33a	10 MFD 400 DCWV
	(C33b	80 MFD 450 DCWV
PMA-42005	C46 (Paper Case)	100 MFD 50 DCWV
		MICA TRIMMER CAPACITORS
PMA-43001	C51a, C51b	25 to 280 UUF, 80 to 480 UUF

Capacity Values ± 20% Tolerance Except: * ± 5%, † ± 10%.

COILS

PMA-52020	L2	21.5 Mc I. F. Trap
PMA-52021	L3, L1	24 Mc I. F. Coil
PMA-52023	L4	100 UH Peaking Coil
PMA-52024	L5, L6	450 UH Peaking Coil
PMA-52025	L7 & R15	200 UH Peaking Coil Wound on 22K Resistor
PMA-52028-2	L8 & C14, L9 & C23	4.5 Mc Take-off Trap
PMA-56000	L10	Yoke
PMA-56001	L11	Linearity Coil
PMA-56003	L12	Width Coil
PMB-56011	L13	Filter Choke

PRINTED CIRCUITS

PMA-95000	N1	Vert. Integrating Network
PMA-95001	N2	Audio Couplate

COMPOSITION RESISTORS

PMA-45013-1	R81	3.3 OHMS	½ WATT
PMA-45015-9	R3, R7, R88, (R90, 150-4, 150-31, 150-61)	47 OHMS	½ WATT
PMA-45015-12	R25	82 OHMS	½ WATT
PMA-45015-15	R1, R10, R90	150 OHMS	½ WATT
PMA-45015-18	R27	270 OHMS	½ WATT
PMA-45015-19	R4	330 OHMS	½ WATT
PMA-45017-19	R33	330 OHMS	1 WATT
PMA-45015-21	R57	470 OHMS	½ WATT
PMA-45015-22	R59, R60	560 OHMS	½ WATT
PMA-45019-24	R34	820 OHMS	2 WATT
PMA-45015-25	R5, R8, R11, R26, R79	1K	½ WATT
PMA-45017-25	R78	1K	1 WATT
PMA-45015-28	R44	1.8K	½ WATT
PMA-45015-29	R45, R84, R85	2.2K	½ WATT
PMA-45015-30	R43	2.7K	½ WATT
PMA-45015-33	R2, R12	4.7K	½ WATT
PMA-45019-33	R89, R90 (150-4, 150-31, 150-61)	4.7K	2 WATT
PMA-45019-35	R17, R77	6.8K	2 WATT
PMA-45014-70	R9	7.5K *	½ WATT
PMA-45015-36	R55, R68, R73	8.2K	½ WATT
PMA-45015-37	R6, R30, R31, R61, R83	10K	½ WATT
PMA-45015-42	R46	27K	½ WATT
PMA-45017-42	R39	27K	1 WATT
PMA-45015-44	R16, R18	39K	½ WATT
PMA-45015-45	R28, R54, R89, R92	47K	½ WATT
PMA-45017-47	R66, R74	68K	1 WATT
PMA-45015-49	R20, R21, R22, R63, R82,R86	100K	½ WATT
PMA-45017-49	R71	100K	1 WATT
PMA-45017-50	R64	120K	1 WATT
PMA-45015-51	R48, R62	150K	½ WATT
PMA-45017-51	R69, R70	150K	1 WATT
PMA-45015-53	R51, R87	220K	½ WATT
PMA-45015-54	R24, R52	270K	½ WATT
PMA-45015-56	R19	390K	½ WATT
PMA-45015-57	R41, R42, R75 (R89, R90, 150-5 & 150-51)	470K	½ WATT
PMA-45017-57	R80	470K	1 WATT
PMA-45015-60	R50, R67	820K	½ WATT
PMA-45015-61	R14, R32, R56	1 MEG	½ WATT
PMA-45017-66	R72	2.7 MEG	1 WATT
PMA-45015-69	R40	4.7 MEG	½ WATT
PMA-45015-73	R29	10 MEG	½ WATT

WIRE WOUND RESISTORS

PMB-47007-4	R35	60 OHMS	6 WATT
PMB-47007-3	R76	220 OHMS	4 WATT
PMB-47007-5	R36	250 OHMS	15 WATT
PMB-47007-1	R37, R38	1K	7.5 WATT

VARIABLE RESISTORS

PMA-48016	R58	5K, Control, Vertical Linearity
PMB-48014-8	R65	50K, Control, Horizontal Hold
PMB-48014-9	R23	100K, Control, Brightness
PMB-48014-3	R47	250K, Control, Noise Inverter
PMB-48015	R13a, R13b, S1	.5 Meg., 750 Ohms Control, Volume & Contrast & Off Switch
PMB-48014-10	R49	1.5 Meg, Control, Vertical Hold
PMB-48014-5	R53	2.5 Meg, Control, Vertical Height

Resistance Values ± 10% Tolerance Except: * ± 5%.

TRANSFORMERS

PMA-52029	T1, T2	Bifilar I. F. Coil
PMA-52027	T3	4.5 Mc Ratio Detector
PMB-51005	T4	Audio Output Transformer
PMB-50003	T5	Power Transformer
PMA-56005	T6	Vertical Oscillator Trans.
PMA-56004	T7	Vertical Output Trans.
PMB-52019	T8	Synchroguide
PMC-56002	T9	Horizontal Output Trans.

PART NO.	DESCRIPTION	Used Only in Chassis No.
PM-155	AM Radio Tuner	150-4 150-31, 150-61
PM-160	AM Radio Tuner	150-10
PMA-52017	Antenna	

PMB-56012	Centering Magnet	150-7, 150-9, 150-12, 150-16 & 150-61
PMA-10044-2	Extension, Focus Control Screw	150-4, 150-5, 150-31, 150-51
PMB-56008	Focus Magnet	150-4, 150-5, 150-31, 150-51
PMA-95002-1	Fuse, ¼ Amp., 250 V, Type 3AG	
PMB-56013	Ion Trap	
PMA-62001	Jack, Speaker and Phono	
PMA-10043	Lever—Centering Ring	150-4, 150-5, 150-31, 150-51
PMB-97088	Plug, Yoke Connection	
PMB-57003	Rotary Switch Tuner	150-7
PMB-97089	Receptacle, Yoke Connection	
PMB-80094	Spring, Ground	
PMA-23057	Tube Mount Strap	150-10, 150-31, 150-61
PMA-23046-3	Tube Mount Strap	150-7, 150-9, 150-12, 150-16

TV CHASSIS—Continued

PART NO.	DESCRIPTION	Used Only in Chassis No.
PMA-23066	Tube Mount Strap	150-5, 150-51
PMB-61012-4	Tube Socket, Octal, Molded (V-16 & V-17)	
PMB-61012-5	Tube Socket, Octal, Molded (V-15)	
PMA-61106	Tube Socket, 9 Pin Molded (V-13)	
PMA-61107	Tube Socket, 9 Pin	
PMB-57002-1	Turret Cascode Tuner	150-10, 150-16, 150-31, 150-51, 150-61
PMB-57001	Turret Pentode Tuner	150-4, 150-5, 150-9, 150-12

AM RADIO TUNER CHASSIS 155 & 155-1

PART NO.	SCHEMATIC LOCATION	DESCRIPTION
		CAPACITORS
PMB-40003-21	C3	82 UUF Mica 300 DCWV
PMB-40518-14	C7	100 UUF Ceramic 500 DCWV
PMB-44001	C1,C1a,C2,C2a	420/162 UUF Variable
PMA-40517-5	C6	.01 MFD Ceramic 500 DCWV
PMB-41006-30	C4	.05 MFD Paper 400 DCWV
PMB-41006-49	C5	.05 MFD Paper 600 DCWV
		RESISTORS
PMB-45015-19	R2	330 Ohms ½ WATT
PMB-45019-36	R7	8.2K 2 WATT
PMB-45019-37	R6	10K 2 WATT
PMB-45015-41	R1	22K ½ WATT
PMB-45015-45	R4	47K ½ WATT
PMB-45018-2	R8	50K Variable ½ WATT
PMB-45015-57	R5	570K ½ WATT
PMB-45015-65	R3	2.2 MEG ½ WATT
		COILS & TRANSFORMERS
PMB-52034	L1	Coil—Antenna Loop
PMA-52032	L2	Coil—Oscillator
PMD-52033-1	T1	Transformer—Interstage I. F.
PMD-52033-2	T2	Transformer—Diode I. F.
		SWITCHES
PMB-60006	SW1, a,b,c,d	Switch—Rotary
PMB-97077	Cable Assembly & Plug	
PMB-97075	Tuner Shaft & Pulley Assembly	
PMA-97076	Cord—Dial Assembly	
PMA-61104	Pilot Light Socket	
	Pilot Light—Bayonet Base—Type 49	
PMB-61012-1	Tube Socket, 7 Pin, Mini	
PMA-62001	Phono Jack	
PMA-62007	Plug	
PMA-57502	Crystal Detector, 1N65	

AM RADIO TUNER CHASSIS 160

PART NO.	SCHEMATIC LOCATION	DESCRIPTION
		CAPACITORS
PMB-40006-21	C4	82 UUF Mica 300 DCWV
PMB-40518-14	C7	100 UUF Ceramic 500 DCWV
PMB-44001	C1,C1a,C2,C2a	420/162 UUF, Variable
PMA-40517-5	C5, C6, C8	.01 MFD Ceramic 500 DCWV
PMB-41006-66	C3	.05 MFD Paper 200 DCWV
PMB-41006-30	C9	.05 MFD Paper 400 DCWV
		COMPOSITION RESISTORS
PMA-45015-11	R2, R8	68 Ohms ½ WATT
PMA-45015-35	R3	6.8K ½ WATT
PMA-45015-41	R1, R7	22K ½ WATT
PMA-45015-45	R5	47K ½ WATT
PMA-45015-57	R6	470K ½ WATT
PMA-45015-65	R4	2.2 MEG ½ WATT
		COILS, TRANSFORMERS AND SWITCHES
PMB-52034	L1	Coil-Antenna Loop
PMA-52035	L2	Oscillator Coil
PMD-52037	T1, T2	Interstage & Diode I.F. Transformers
PMB-60007	SW1a, b, c	Switch—Rotary
PMA-97086	Cord Assembly	
PMB-62012-1	Tube Socket, 7 Pin, Mini	
PMA-57502	Crystal Detector, 1N65	
PMB-40518-6	C4	47 UUF Ceramic 500 DCWV
PMB-40518-19	C3, C5, C8	220 UUF Ceramic 500 DCWV

AM RADIO CHASSIS 113

PART NO.	SCHEMATIC LOCATION	DESCRIPTION
PMB-44001	C1, C2	420/162 UUF Variable
PMB-41006-43	C9, C10	500 UUF Paper 500 DCWV
PMB-41006-26	C7	.01 MFD Paper 400 DCWV
PMB-41006-30	C6, C12	.05 MFD Paper 400 DCWV
PMB-41006-51	C11	.1 MFD Paper 400 DCWV
PMA-65009-1	C13, C14	50 MFD, 30 MFD Electrolytic Dual 150 DCWV
PMA-45015-15	R3, R9	150 Ohms Composition ½ WATT
PMA-45017-25	R10	1K Composition 1 WATT
PMA-45015-41	R2	22K Composition ½ WATT
PMA-45015-53	R1, R7	220K Composition ½ WATT
PMA-45015-57	R8	470K Composition ½ WATT
PMA-45017-66	R4	2.7 MEG Composition 1 WATT
PMA-45015-69	R6	4.7 MEG Composition ½ WATT
PMA-65009-4	R5 & S1	500K Volume Control—On-Off Switch
PMA-65009-5	S2	Function Switch
PMA-65009-2	L1	Coil—Antenna Loop
PMA-65009-3	L2	Coil—Oscillator
PMA-65009-7	T1	Transformer—I. F. Interstage
PMA-65009-8	T2	Transformer—I. F. Diode
PMA-65009-6	T3	Transformer—Audio Output

CABINET ACCESSORIES

PMB-80066-1	Back, Models 2080, 2081
PMD-80117	Back, Models 2117, 2192, 2193
PMB-80119	Back, Model 2114
PMB-80164	Back, Models 2118, 2194
PMB-80177	Back, Model 2119
PMB-80155	Back, Model 2124
PMB-80066-2	Back, Models 2152 & 2181
PMB-80182-1	Back, Model 2184
PMB-80083	Back, Model 2401
PMB-80091	Back, Model 4317
PMB-80180	Back, Model 4321
PMB-80062-2	Back, Model 4721
PMD-7018	Bezel, Models 2080, 2081
PMD-7023	Bezel, Models 2181, 2114
PMB-30007-1	Cup, Tube Protection CRT, 2" Deep
PMB-30026-1	Cup, Tube Protection CRT, 3½" Deep
PMA-5029	Dial, Station Selector, 160 Radio
PMA-5031	Dial, 155-1 Radio
PMB-80085	Glass, 155 Radio Dial
PMB-5026	Glass, UHF Dial, Model 2152
PMA-80089	Glass, 12½" x 16"
PMA-80107	Glass, 16" x 20"
PMB-80151-2	Glass, 16" x 20½"
PMB-80151-3	Glass, 16" x 24"
PMA-80084	Glass, 20" x 25"
PMA-80056-1	Knob, Channel Selector, Gold (outer)
PMB-80056-2	Knob, Channel Selector, Model 2401
PMA-80056-3	Knob, Channel Selector, Tan (outer)
PMA-80158-1	Knob, Channel Selector, Brown (inner)
PMA-80158-3	Knob, Channel Selector, Tan (inner)
PMA-80054-1	Knob, Fine Tuning, Brown (inner)
PMA-80054-2	Knob, Fine Tuning, Tan (inner)
PMA-80159-1	Knob, Fine Tuning, Brown outer)
PMA-80159-2	Knob, Fine Tuning, Tan (outer)
PMB-80055-1	Knob, On-Off-Volume, Gold (outer)
PMB-80055-2	Knob, On-Off-Volume, Tan (outer)
PMB-80160-1	Knob, On-Off-Volume, Brown (inner)
PMB-80160-2	Knob, On-Off-Volume, Tan (inner)
PMB 80053-1	Knob, Picture Contrast, Brown (inner)
PMB-80053-2	Knob, Picture Contrast, Tan (inner)
PMB-80161-1	Knob, Picture Contrast, Brown (outer)
PMB-80161-2	Knob, Picture Contrast, Tan (outer)
PMA-80087-1	Knob, Function Switch, Radio & UHF, Brown
Pi..A-80087-3	Knob, Function Switch, Radio & UHF, Tan
PMA-80068-1	Knob, Function Switch, Radio, Model 2080, Brown
PMA-80068-2	Knob, Tone & Tune—155 Radio, Tuning—UHF, Brown
PMA-80068-5	Knob, Function Switch, Radio Model 2080, Tan
PMA-80068-6	Knob, Tone & Tune—155 Radio, Tuning—UHF, Tan
PMD-7012	Mask, Models 2080 and 2081
PMD-7031	Mask, Models 2117, 2118, 2119, 2152, 2181, 2184, 2194
PMD-7032	Mask, Models 2192, 2193, 4321, 4721
PMD-7035	Mask, Models 2114, 2181 with Bezel
PMR-7042	Mask, Model 2124
PMD-7026	Mask, Model 2401
PMD-7034	Mask, Model 4317
PMA-90021	Speaker,, 5"
PMA-90012	Speaker, 8"
PMA-90017	Speaker, 10"