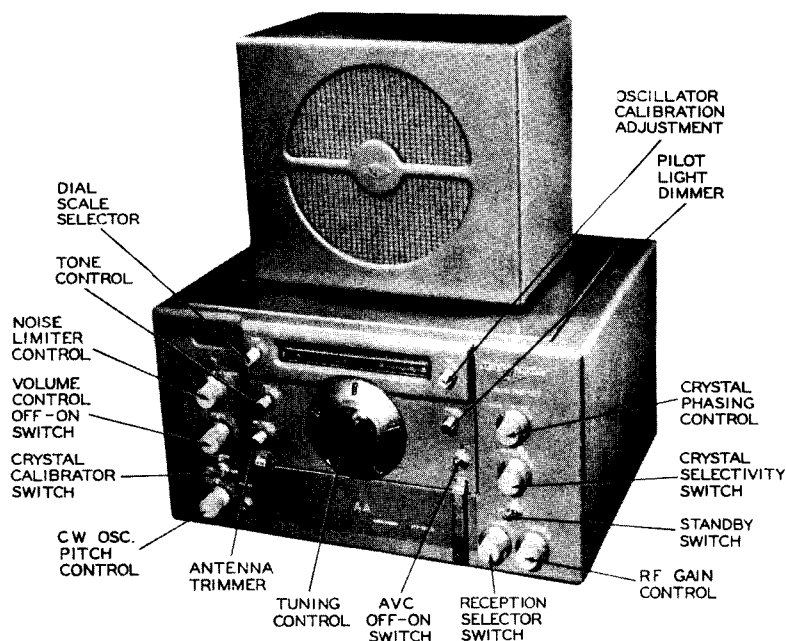


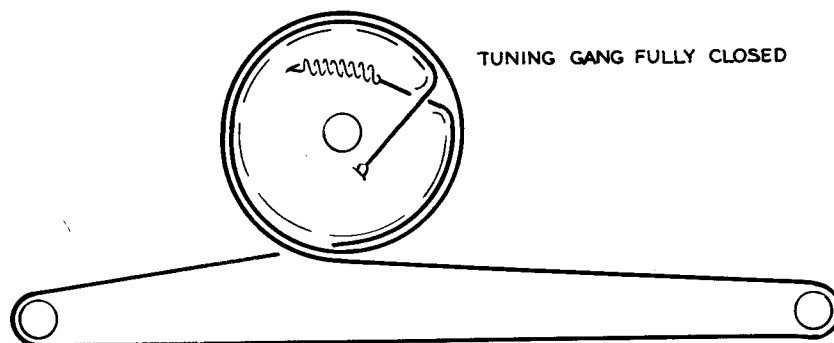


NATIONAL
MODEL HRO-50



NATIONAL MODEL HRO-50

TRADE NAME	National, Model HRO-50 (Accessories-NFM-50, XCU 100/1000)
MANUFACTURER	National Co. Inc., Malden, Mass.
TYPE SET	AC Operated Multi-Band Communications Receiver (Accessories-Narrow Band FM Adaptor, Crystal Calibrator Unit)
TUBES(SEVENTEEN)	Types 6BA6 1st RF Amp., 6BA6 2nd RF Amp., 6BE6 Mixer, 6C4 HF Osc., 6K7 1st IF Amp., 6K7 2nd IF Amp., 6J7 BFO, 6H6 DET-AVC, 6SN7GT S Meter Amp. -Phase Inv., 6H6 Noise Limiter, 6SJ7 Audio Amp., (2) 6V6GT Power Output, 0B2 Voltage Regulator, 5U4G Rectifier, 6AK6 Crystal Osc., 6SK7 FM IF Amp., 6H6 Ratio Det.
POWER SUPPLY	110-120 or 220-240 Volts AC
RATING	.95 Amp. at 117 Volts AC
TUNING RANGE	Band "A" 14-30MC, "B" 7-14.4MC, "C" 3.5-7.3MC, "D" 1.7-4MC, "E" 900-2050KC, "F" 480-960KC, "G" 180-430KC, "H" 100-200KC, "J" 50-100KC, "AA" 27.5-30MC, "AB" 25-35MC, "AC" 21-21.5MC



DIAL CORD DRIVE

NATIONAL
MODEL HRO-50

HOWARD W. SAMS & CO., INC. • Indianapolis 1, Indiana

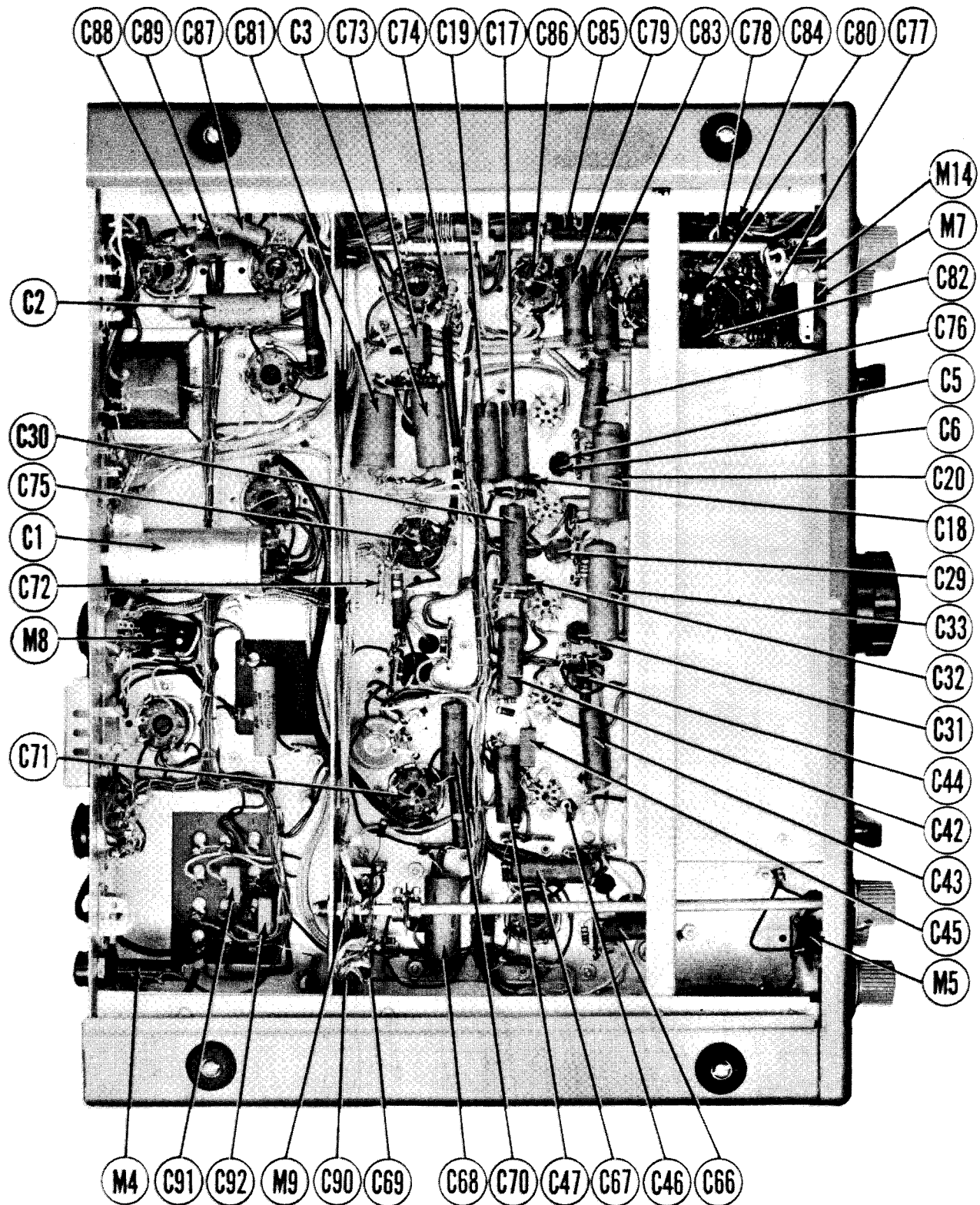
"The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed."
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DATE 11-50

SET 112

FOLDER 7



ALIGNMENT INSTRUCTIONS (CONT.)

1st RF STAGE ALIGNMENT WITH LOW IMPEDANCE TRANSMISSION LINE

If a low impedance transmission line is to be used with the receiver it may be necessary to realign the first RF amplifier at the high frequency end of each band.

GENERAL COVERAGE ALIGNMENT

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	COIL SET	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
Direct	High side to antenna terminal "A". Low side to chassis.	14.4 MC (400 % Mod.)	Band B	Tune for max. output	Across voice coil	A20 (pos. 2)	Adjust for maximum output.
Direct	"	7.3 MC	Band C	"	"	A28 (pos. 2)	"
Direct	"	900KC	Band F	"	"	A48 (pos. 2)	"
Direct	"	200KC	Band H	"	"	A59 (pos. 2)	"
Direct	"	100KC	Band J	"	"	A65 (pos. 2)	"
Direct	"	30MC	Band AA	"	"	A71 (pos. 1)	"
Direct	"	35MC	Band AB	"	"	A83 (pos. 2)	"
Direct	"	21.5MC	Band AC	"	"	A95 (pos. 1)	"

BANDSPREAD ALIGNMENT

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	COIL SET	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
Direct	High side to antenna terminal "A". Low side to chassis.	30MC (400 % Mod.)	Band A	Tune for max. output	Across voice coil	A107 (pos. 1)	Adjust for maximum output.
Direct	"	14.4 MC	Band B	"	"	A115 (pos. 1)	"
Direct	"	7.3 MC	Band C	"	"	A123 (pos. 1)	"
Direct	"	4MC	Band D	"	"	A131 (pos. 1)	"

"S" METER ADJUSTMENT

Before attempting this adjustment set the controls as follows: Set the RF gain control at zero, the AVC switch to "AVC", the control switch to "AM", and the AC switch to "ON".
Adjust the "S" meter balancing control R6 for a zero reading on the "S" meter.

NARROW BAND FM ADAPTOR ALIGNMENT

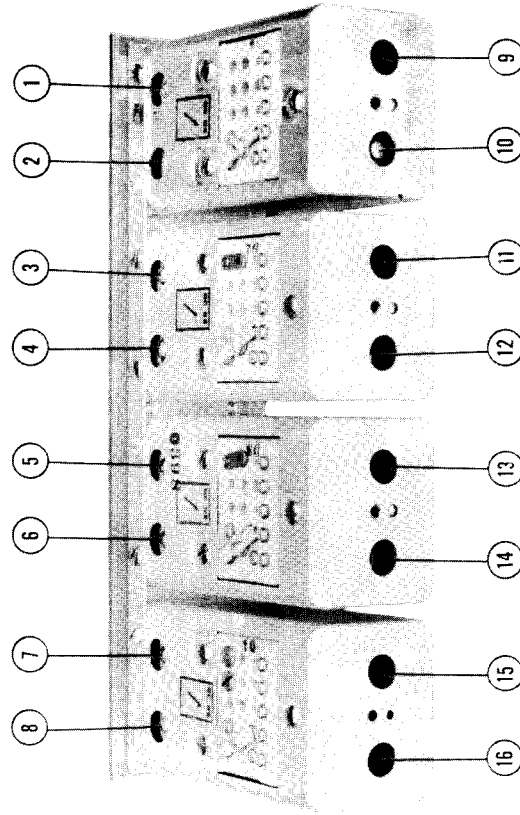
It will be necessary to realign primary trimmer A6 as follows: Plug in the adaptor and adjust all controls for normal "AM" operation. Disconnect the antenna and adjust A6 for maximum background noise.
The NFM-30 adaptor unit is pre-aligned at the factory and realignment should not be required unless the adaptor is accidentally misaligned.

If the adaptor requires alignment set the controls as follows: Control switch to "NFM", the selectivity switch to "OFF", the limiter control to "OFF", the B- switch to "ON", the AVC switch to "AVC", the RF gain control to "10". Plug in coil set "E". If available, if not plug in coil set "D".

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	COIL SET	RADIO DIAL SETTING	CONNECT	ADJUST	REMARKS
3000 carbon res.	High side thru antenna terminal "A". Low side to other antenna terminal "A".	1500KC (Unmod.) or 2.25MC	Band E or Band D	Tune for max. deflection.	DC Probe to Point A. Common to chassis.	A136 to Point A. A137	Detune A136 and A137 by turning adjustment screws counter-clockwise as far as possible. Then adjust A136 for maximum deflection. Adjust A137 for zero reading.
"	"	"	"	"	Not used	A138	Adjust for a null in audio output. Readjust A137 and A138 until a zero reading and a null in audio output is obtained.

CRYSTAL CALIBRATOR UNIT ADJUSTMENT

Set controls of receiver for normal CW operation.
Set the front panel calibrator switch at the 100KC position.
Tune in the signal from WWV and adjust A139 so that 100KC signal harmonic is zero beat with the signal received from WWV.



VOLTAGE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Top Cap
V 1	6BA6	Δ0V. #-.3VDC	1.4VDC	0V.	6.3VAC	245VDC	120VDC	1.4VDC		
V 2	6BA6	Δ0V. #-.3VDC	34VDC	0V.	6.3VAC	245VDC	120VDC	34VDC		
V 3	6BE6	0V.	1.2VDC	6.3VAC	0V.	245VDC	85VDC	0V.		
V 4	6C4	105VDC	0V.	6.3VAC	0V.	105VDC	§-7.6VDC	0V.		TOP CAP Δ0V.
V 5	6K7	0V.	0V.	245VDC	130VDC	37VDC	35VDC	6.3VAC	37VDC	#-.2VDC
V 6	6K7	0V.	0V.	245VDC	130VDC	35VDC	0V.	6.3VAC	35VDC	Δ0V. #-.2VDC
V 7	6J7	0V.	0V.	†60VDC	†22VDC	0V.	†245VDC	6.3VAC	0V.	- .4VDC
V 8	6H6	0V.	0V.	- .5VDC	0V.	-3VDC	-3VDC	5VAC	0V.	
V 9	6SN7GT	Δ0V. #-.6VDC	30VDC	0V.	30VDC	190VDC	60VDC	0V.	6.3VAC	
V 10	6H6	0V.	0V.	42VDC Δ0V.	42VDC Δ0V.	42VDC Δ0V.	35VDC Δ0V.	5VAC	42VDC Δ0V.	
V 11	6SJ7	0V.	0V.	4.7VDC	0V.	4.7VDC	115VDC	6.3VAC	34VDC	
V 12	6V6GT	0V.	0V.	245VDC	250VDC	0V.	245VDC	6.3VAC	16VDC	
V 13	6V6GT	0V.	0V.	245VDC	250VDC	0V.	250VDC	6.3VAC	16VDC	
V 14	OB2	105VDC	0V.	0V.	0V.	105VDC	0V.	0V.		
V 15	5U4G	0V.	295VDC	0V.	255VAC	0V.	255VAC	0V.	295VDC	
V 16	6AK6	*-.5VDC	0V.	0V.	6.3VAC	*3.4VDC	*70VDC	0V.		
V 17	6SK7	0V.	0V.	7.3VDC	0V.	7.3VDC	120VDC	6.3VAC	210VDC	
V 18	6H6	0V.	0V.	- .1VDC	.4VDC	- .4VDC	- .4VDC	6.3VAC	- .1VDC	

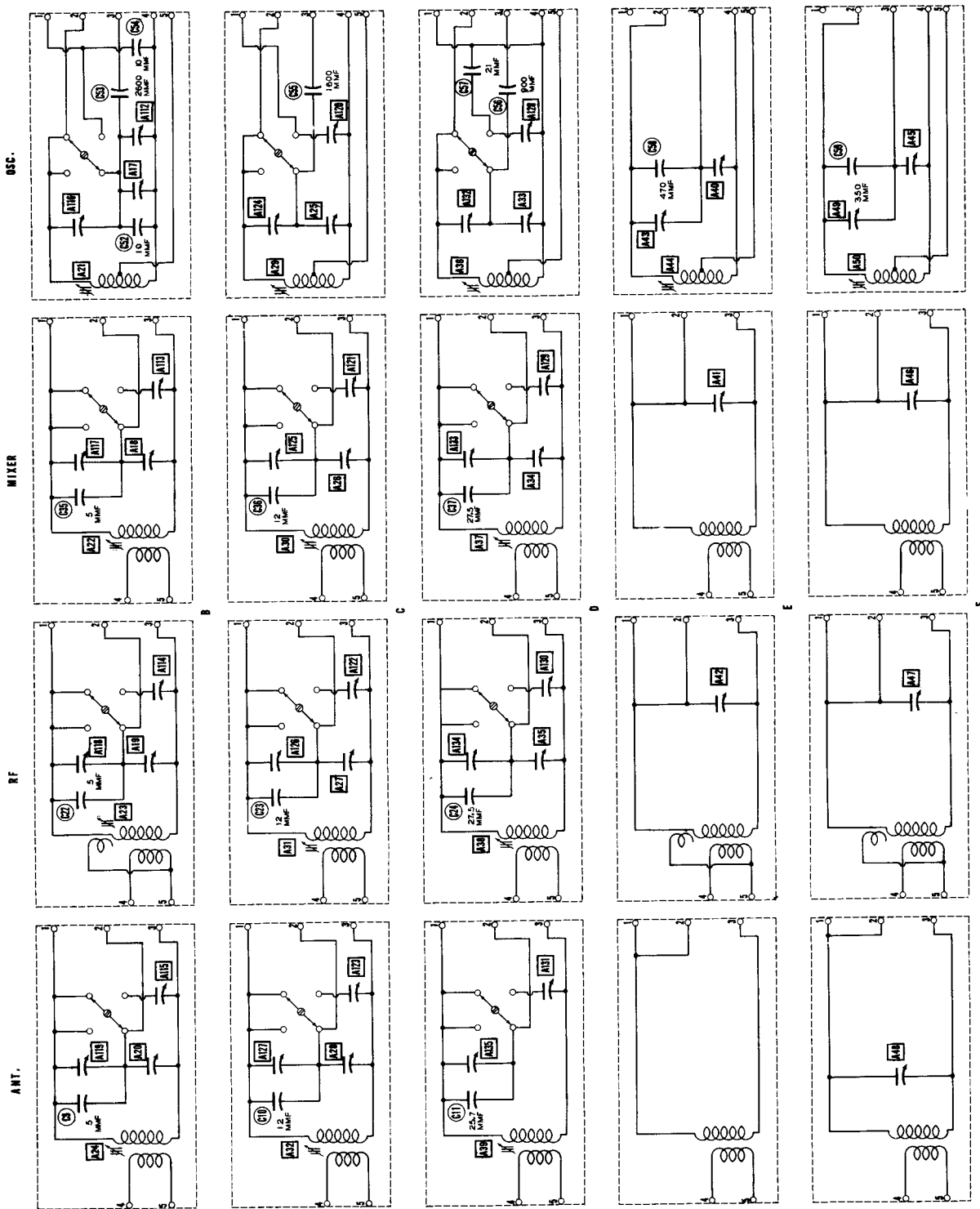
FUNCTION SWITCH IN "AM" POSITION UNLESS OTHERWISE NOTED.
 LIMITER SWITCH "OFF" UNLESS OTHERWISE NOTED.
 B+ SWITCH MUST BE ON FOR THESE MEASUREMENTS.
 CALIBRATION SWITCH "OFF" UNLESS OTHERWISE NOTED.
 Δ AVC SWITCH "OFF".
 # AVC SWITCH "ON".
 † LIMITER SWITCH "ON" AND CONTROL TURNED CLOCKWISE.
 ‡ FUNCTION SWITCH IN "CW" POSITION.
 * CALIBRATION SWITCH 100 or 1000 POSITION.
 § TAKEN WITH VACUUM TUBE VOLTMETER.

RESISTANCE READINGS

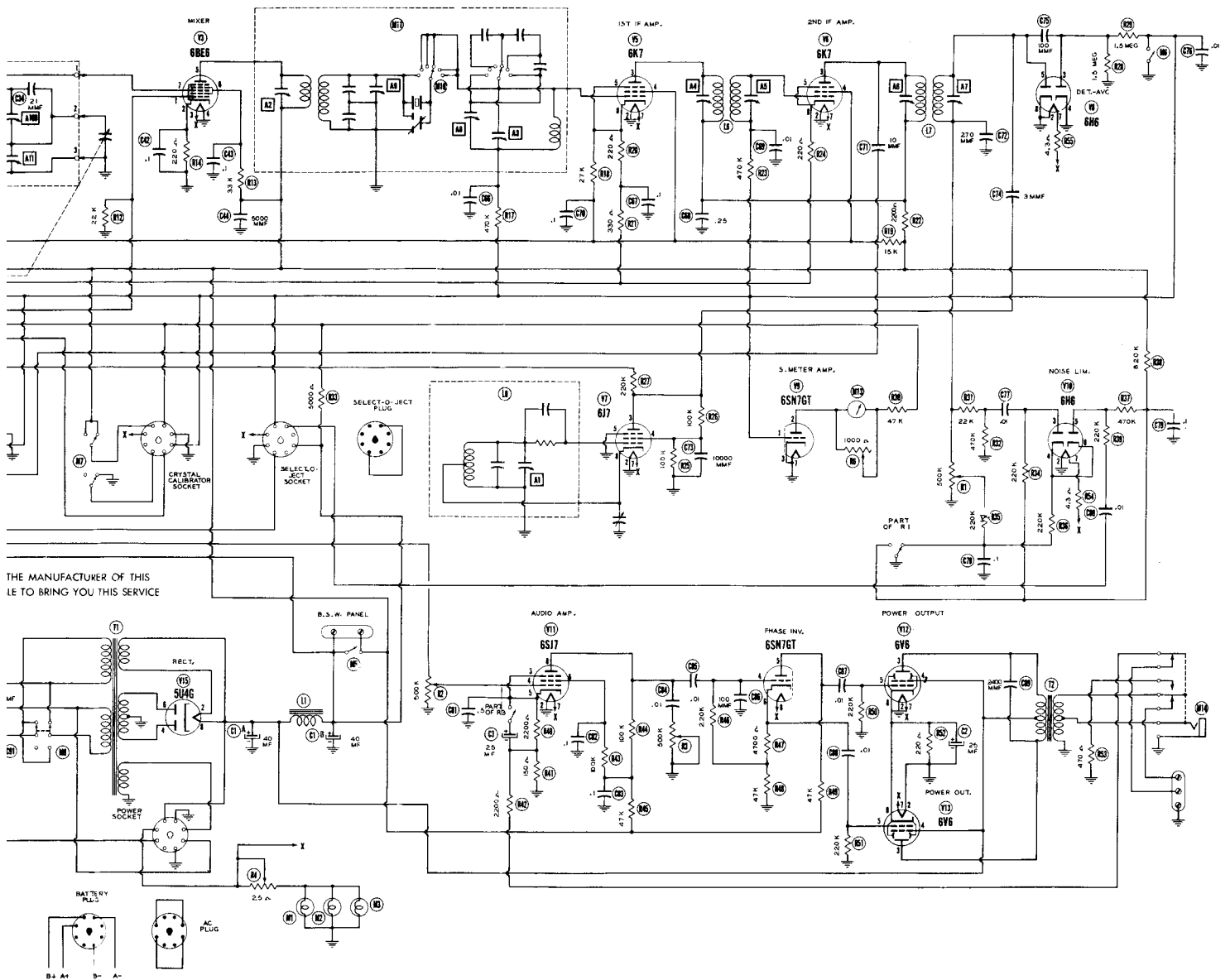
Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Top Cap
V 1	6BA6	Δ470KΩ #3.5Meg.	100Ω	0Ω	.1Ω	†290Ω	†17KΩ	100Ω		
V 2	6BA6	Δ470KΩ #3.5 Meg.	10KΩ	0Ω	.1Ω	†290Ω	†17KΩ	10KΩ		
V 3	6BE6	22KΩ	220Ω	.1Ω	0Ω	†290Ω	†33KΩ	.1Ω		
V 4	6C4	†5.3KΩ	0Ω	.1Ω	0Ω	†5.3KΩ	22KΩ	0Ω		Δ470KΩ #3.5 Meg.
V 5	6K7	0Ω	0Ω	†2.5KΩ	†15KΩ	10KΩ	10KΩ	.1Ω	10KΩ	Δ470KΩ #3.5 Meg.
V 6	6K7	0Ω	0Ω	†2.5KΩ	†15KΩ	10KΩ	Inf.	.1Ω	10KΩ	Δ470KΩ #3.5 Meg.
V 7	6J7	0Ω	0Ω	††120KΩ	††100KΩ	0Ω	†† 290Ω	.1Ω	2Ω	47KΩ
V 8	6H6	0Ω	0Ω	Δ750KΩ #1.5 Meg.	0Ω	150KΩ Δ300KΩ	150KΩ Δ300KΩ	2.5Ω	0Ω	
V 9	6SN7GT	#3 Meg.	†50KΩ	0Ω	270KΩ	†47KΩ	50KΩ	0Ω	.1Ω	
V 10	6H6	0Ω	0Ω	† 1 Meg. †Δ 350KΩ	220KΩ Δ500KΩ	†1.3Meg. †Δ600KΩ	†1.5 Meg. †Δ800KΩ	2.5Ω	220KΩ 500KΩ	
V 11	6SJ7	0Ω	0Ω	2.3KΩ	100Ω	2.3KΩ	†47KΩ	.1Ω	†47KΩ	
V 12	6V6GT	0Ω	0Ω	†340Ω	†290Ω	220KΩ	†340Ω	.1Ω	220Ω	
V 13	6V6GT	0Ω	0Ω	†340Ω	†290Ω	220KΩ	†290Ω	.1Ω	220Ω	
V 14	OB2	†5.3KΩ	0Ω	Inf.	0Ω	†5.3KΩ	Inf.	0Ω		
V 15	5U4G	Inf.	45KΩ	Inf.	115Ω	Inf.	115Ω	Inf.	45KΩ	
V 16	6AK6	4.7 Meg.	0Ω	0Ω	.1Ω	† Inf. †Δ470KΩ	† Inf. †Δ22KΩ	0Ω		
V 17	6SK7	0Ω	0Ω	1000Ω	1 Meg.	1000Ω	†50KΩ	.1Ω	†5KΩ	
V 18	6H6	0Ω	0Ω	Inf.	15KΩ	15KΩ	.1Ω	Inf.		

FUNCTION SWITCH IN "AM" POSITION UNLESS OTHERWISE NOTED.
 LIMITER SWITCH OFF UNLESS OTHERWISE NOTED.
 B+ SWITCH MUST BE ON FOR THESE MEASUREMENTS.
 CALIBRATION SWITCH "OFF" UNLESS OTHERWISE NOTED.
 Δ AVC SWITCH "OFF".
 # AVC SWITCH "ON".
 † LIMITER SWITCH "ON" AND CONTROL TURNED CLOCKWISE.
 ‡ MEASURED FROM PIN 8 OF V15.
 † FUNCTION SWITCH IN "CW" POSITION.
 * CALIBRATION SWITCH IN 100 or 1000 POSITION.

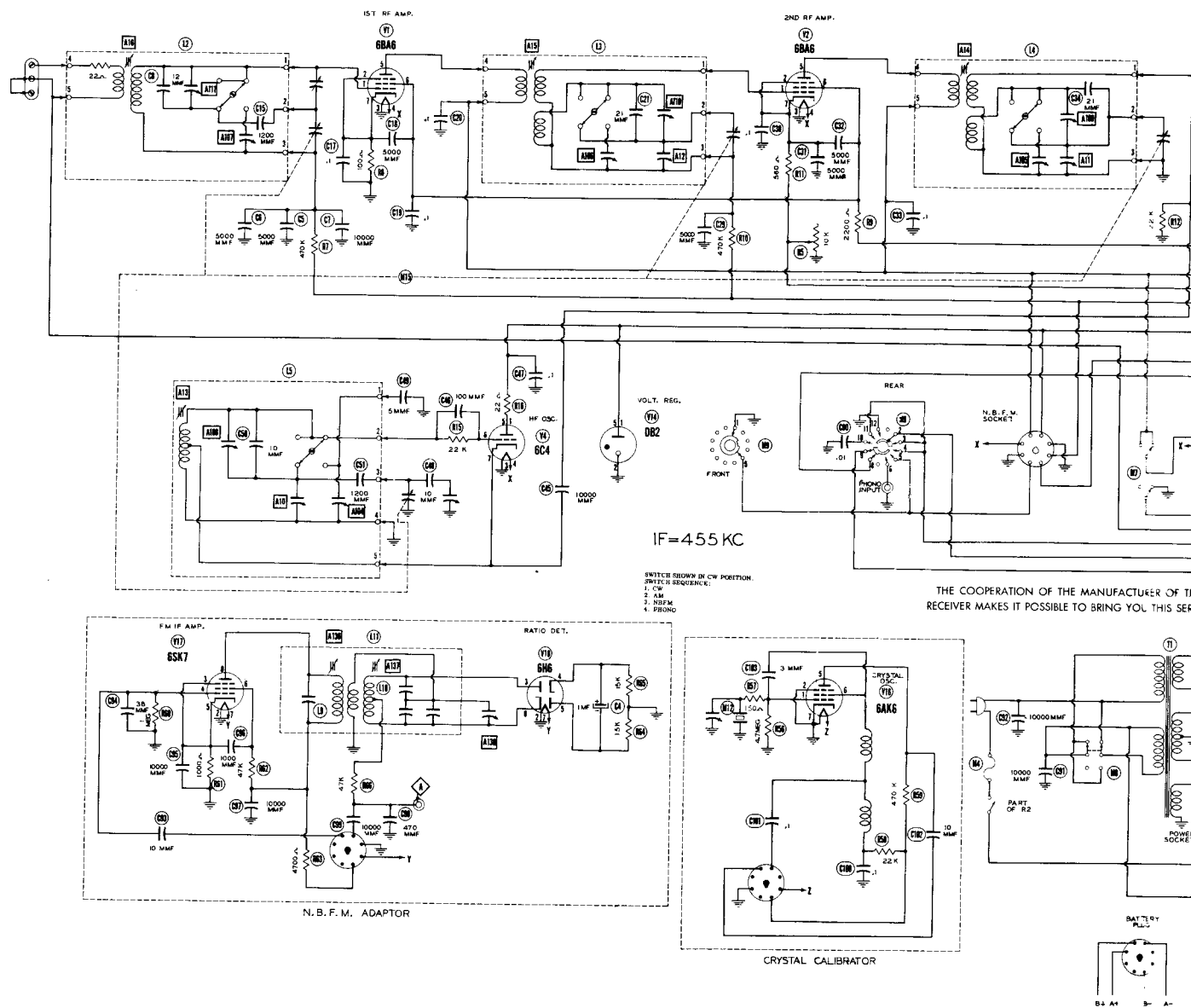
- DC-Voltage measurements are at 20,000 ohms per volt; AC Voltages measured at 1,000 ohms.
- Socket connections are shown as bottom views.
- Measured values are from socket pin to common negative.
- Line voltage maintained at 117 volts for voltage readings.
- Nominal tolerance on component values makes possible a variation of ±15% in voltage and resistance readings.
- Volume control at maximum, no signal applied for voltage measurements.

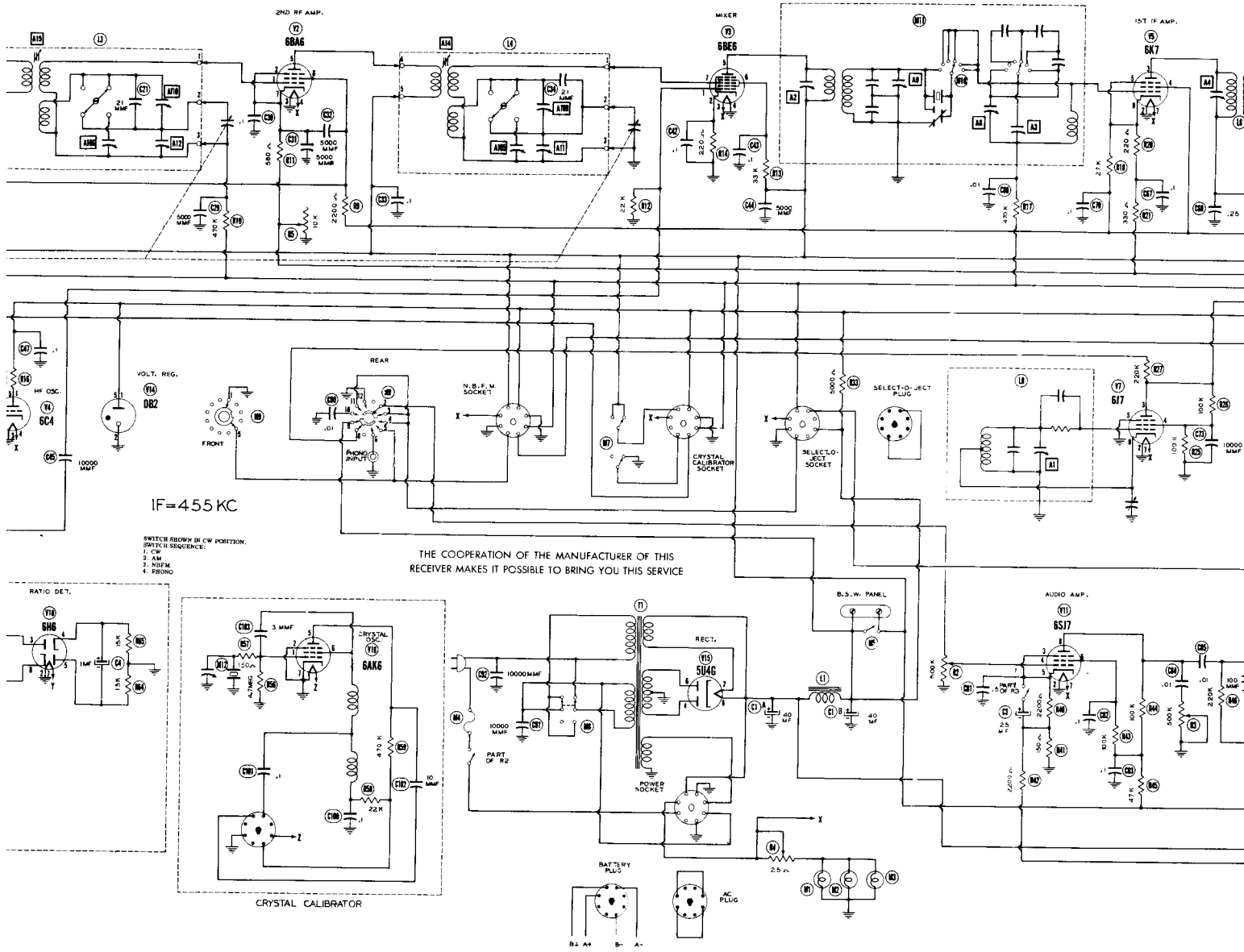


A PHOTOFACT STANDARD NOTATION SCHEMATIC
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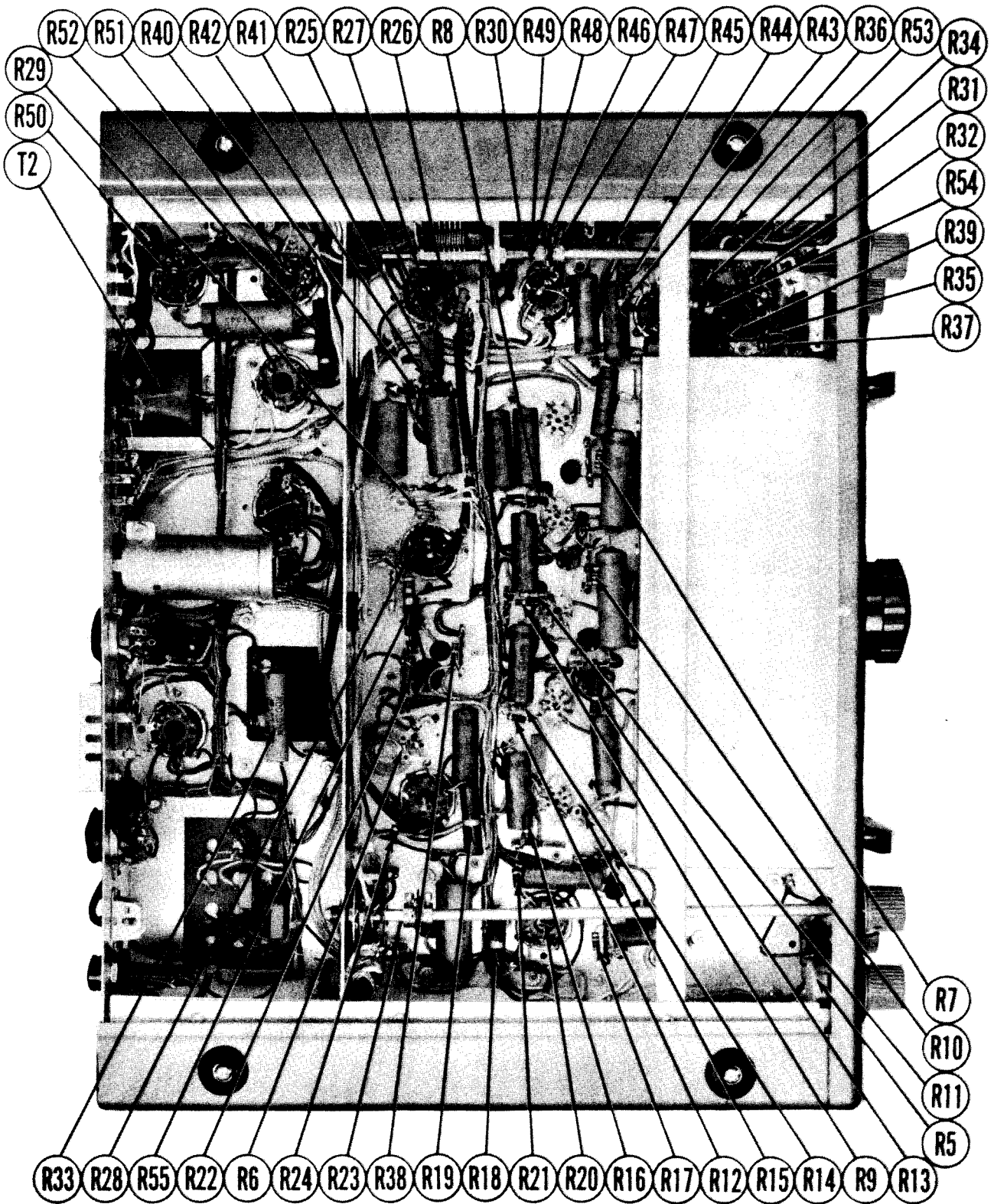


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LE TO BRING YOU THIS SERVICE





NATIONAL
MODEL HRO-50



PARTS LIST AND DESCRIPTIONS
TUBES (SYLVANIA or Equivalent)

ITEM No.	USE	REPLACEMENT DATA			NOTES
		NATIONAL PART No.	STANDARD REPLACEMENT	RMA BASE TYPE	
V1	1st RF Amp.	6BA6	6BA6	7BK	
V2	2nd RF Amp.	6BA6	6BA6	7BK	
V3	Mixer	6BE6	6BE6	7CH	
V4	HF Oscillator	6C4	6C4	6BG	
V5	1st IF Amp.	6K7	6K7	7R	
V6	2nd IF Amp.	6K7	6K7	7R	
V7	BF Oscillator	6J7	6J7	7R	
V8	Det.-AVC	6HE	6HE	7Q	
V9	"S" Meter Amp. - Phase Inv.	6SN7GT	6SN7GT	8BD	
V10	Noise Limiter	6HE	6HE	7Q	
V11	Audio Amp.	6S17	6S17	8N	
V12	Power Output	6V6GT	6V6GT	7AC	
V13	Power Output	6V6GT	6V6GT	7AC	
V14	Voltage Regulator	0B2	0B2	5B0	
V15	Rectifier	504G	504G	5T	
V16	Crystal Osc.	6AK6	6AK6	7BK	
V17	FM IF Amp.	6SK7	6SK7	8N	
V18	Ratio Det.	6HE	6HE	7Q	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP. VOLT	REPLACEMENT DATA				IDENTIFICATION CODES AND INSTALLATION NOTES
		NATIONAL PART No.	AEROVOX PART No.	CORNEILL DUBLIER PART No.	ERIE PART No.	
C1A	40	K945-3	AF88K	UP4450		• Filter
C2	40	475				▲ Filter
C3	25	E338-4	PRS50/25	BR255A	TVA-1306	Output Cath. Bypass
C4	25	E338-4	PRS50/25	BR255A	TVA-1306	Tone Comp.
C5	5000	K946-1	BPD-005	ID5D5	29C1	Stabilizing Cap.
C6	5000	K946-1	BPD-005	ID5D5	29C1	AVC Filter
C7	10000	J666-56	1467-01	ID3S1	1FM-11	AVC Filter
C8	12	D825D-404				Fixed Padder
C9	5	D825D-401				Fixed Padder
C10	12	D825D-404				Fixed Padder
C11	25.7	D825D-412				Fixed Padder
C12	5	D825D-401				Fixed Padder
C13	10	D825D-402				Fixed Padder
C14	50	D825D-417				Fixed Padder
C15	1200	J666-16				Fixed Padder
C16	120	D825C-305				Fixed Padder
C17	1	D927-11				Fixed Padder
C18	5000	K946-1	P488-1	PTE4P1	4TM-P1	1st RF Cathode
C19	1	D827-11	BPD-005	ID5D5	29C1	Decoupling
C20	1	D827-11	P488-1	PTE4P1	4TM-P1	Decoupling
C21	1	D827-13	P688-1	PTE6P1	6TM-P1	Decoupling
C22	1	D825D-410				Fixed Padder
C23	12	D825D-404				Fixed Padder
C24	27.5	D825D-412				Fixed Padder
C25	21	D825D-410				Fixed Padder
C26	470	J666-56				Fixed Padder
C27	100	D825C-304				Fixed Padder
C28	68	K946-1	BPD-005	ID5D5	29C1	Fixed Padder
C29	5000	D825D-439				Fixed Padder
C30	1	D827-11	P488-1	PTE4P1	4TM-P1	Fixed Padder
C31	5000	K946-1	BPD-005	ID5D5	29C1	Fixed Padder
C32	5000	K946-1	BPD-005	ID5D5	29C1	Fixed Padder
C33	1	D827-13	P688-1	PTE6P1	6TM-P1	Fixed Padder
C34	21	D825D-410				Fixed Padder
C35	5	D825D-401				Fixed Padder
C36	12	D825D-404				Fixed Padder
C37	27.5	D825D-412				Fixed Padder
C38	5	D825D-401				Fixed Padder
C39	100	D825C-304				Fixed Padder
C40	470	J666-56				Fixed Padder
C41	68	D825D-439				Fixed Padder

PARTS LIST AND DESCRIPTIONS (Continued)

CONTROLS

ITEM No.	RATING RESIST-ANCE	REPLACEMENT DATA				INSTALLATION NOTES
		NATIONAL PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	
R1	500KΩ	J681-2	Q13-133	AM-60-Z	B-60-S	Limiter control and switch
R2A	500KΩ	K347-1	Not Req.	FS-3	Not Req.	AF Gain control
R3A	500KΩ	Not Req.	Q13-133	SWA	Not Req.	Attach to R2A per instructions
R4	230	Not Req.	Q13-133	AM-60-Z	B-60-S	Tone control
R5	100KΩ	Not Req.	Not Req.	FS-3	Not Req.	Attach to R3A per instructions
R6	1000Ω	K915-13	W-25	SWA	Not Req.	Dimmer control-Wire Wound
		K349-3	43-1000	V-111		"S" meter adjustment-Wire Wound

RESISTORS

ITEM No.	RATING RESISTANCE WATTS	REPLACEMENT DATA			IDENTIFICATION CODES
		NATIONAL PART No.	IRC PART No.		
R7	470KΩ	J569-57	BTS-470K		AVC Network
R8	100Ω	J569-13	BTS-100		1st RF Amp. Cathode
R9	220KΩ	J569-29	BTS-220K		RF Screen Dropping
R10	470KΩ	J569-57	BTS-470K		AVC Network
R11	560Ω	J569-22	BTS-560		2nd RF Amp. Cathode
R12	22KΩ	J569-41	BTS-22K		Mixer Grid
R13	33KΩ	J571-43	BTA-33K		Mixer Screen
R14	220Ω	J569-17	BTS-220		Mixer Cathode
R15	22KΩ	J569-41	BTS-22K		Osc. Grid
R16	22Ω	J569-5			Parasitic Suppressor
R17	470KΩ	J569-57	BTS-470K		AVC Network
R18	27KΩ	J572-42	BTB-27K		Voltage Divider
R19	15KΩ	J572-39	BTS-15K		Screen Dropping
R20	220Ω	J569-17	BTS-220		1st IF Amp. Cathode
R21	330Ω	J569-19	BTS-330		1st IF Amp. Cathode
R22	2200Ω	J569-29	BTS-2200		Plate Decoupling
R23	470KΩ	J569-57	BTS-470K		AVC Network
R24	220Ω	J569-17	BTS-220		2nd IF Amp. Cathode-See Note 1
R25	100KΩ	J569-49	BTS-100K		Voltage Divider
R26	100KΩ	J569-49	BTS-100K		BFO Screen
R27	220KΩ	J569-53	BTS-220K		BFO Plate
R28	1.5 Meg.	J569-63	BTS-1.5 Meg.		AVC Diode Load
R29	1.5 Meg.	J569-63	BTS-1.5 Meg.		AVC Network
R30	47KΩ	J569-45	BTS-47K		"S" Meter Amp. Plate
R31	22KΩ	J569-41	BTS-22K		Diode Filter
R32	470KΩ	J569-57	BTS-470K		Det. Diode Load
R33	5000Ω	J569-10	1 3/4A-5000		Decoupling-Wire Wound
R34	220KΩ	J569-53	BTS-220K		Noise Limiter Plate
R35	220KΩ	J569-53	BTS-220K		Voltage Divider
R36	220KΩ	J569-53	BTS-220K		Noise Limiter Cathode
R37	470KΩ	J569-57	BTS-470K		Noise Limiter Plate
R38	820KΩ	J569-60	BTS-820K		Decoupling
R39	220KΩ	J569-53	BTS-220K		Voltage Divider
R40	2200Ω	J569-29	BTS-2200		Audio Amp. Cathode
R41	150Ω	J569-15	BTS-150		Audio Amp. Cathode
R42	6800Ω	J569-35	BTS-6800		Feedback
R43	100KΩ	J569-49	BTS-100K		Audio Amp. Screen
R44	100KΩ	J569-49	BTS-100K		Audio Amp. Plate
R45	47KΩ	J569-45	BTS-47K		Audio Amp. Decoupling
R46	220KΩ	J569-53	BTS-220K		Phase Inv. Grid
R47	4700Ω	J569-33	BTS-4700		Phase Inv. Cathode
R48	47KΩ	J569-45	BTS-47K		Phase Inv. Plate
R49	47KΩ	J569-45	BTS-47K		Phase Inv. Cathode
R50	220KΩ	J569-53	BTS-220K		Audio Output Grid
R51	220KΩ	J569-53	BTS-220K		Audio Output Grid
R52	220Ω	J572-17	BW-2-220		Audio Output Cathode-Wire Wound
R53	470Ω	J572-21	BTB-470		Voice Coil Shunt
R54	4.30	K098-34			Noise Limiter Filament-Wire Wound
R55	4.30	K098-34			Det. Filament-Wire Wound
R56	4.7 Meg.	J569-69			Parasitic Suppressor-See Note 2
R57	150Ω	J569-15			Osc. Screen-See Note 3
R58	22KΩ	J571-41			Osc. Plate
R59	470KΩ	J571-57			FM IF Amp. Grid
R60	1 Meg.	K379-81			FM IF Amp. Cathode
R61	1000Ω	K379-81			

ALIGNMENT INSTRUCTIONS (CONT.)

20.	400Q carbon res.	High side antenna terminals "A". Low side to chassis.	2MC	Band E	2MC	Across voice coil	A41 (pos. 6) A42 (pos. 4)	Adjust for maximum output.	35.	400Q carbon res.	High side antenna terminals "A". Low side to chassis.	100KC	Band J	100KC	Across voice coil	A62 (pos. 8)	Adjust until signal is heard. If signal is not heard, retune generator to 100KC and open A62 to next peak. Adjust for maximum output and recheck for image.
21.	"	"	1MC	"	"	"	A43 (pos. 7)	Adjust until signal is heard.	36.	"	"	"	"	"	"	A63 (pos. 6) A64 (pos. 4) A65 (pos. 2)	Adjust for maximum output.
22.	"	"	1.4MC	"	"	"	A44 (pos. 16)	Adjust until signal is heard. Repeat steps 19 thru 22 until no further improvement can be made.	37.	"	"	50KC	"	50KC	"	A66 (pos. 7)	Adjust until signal is heard.
23.	"	"	900KC	Band F	900KC	"	A45 (pos. 8)	Adjust until signal is heard. If signal is not heard, retune generator to 900KC and open A45 to next peak. Adjust for maximum output and recheck for image.	38.	"	"	75KC	"	75KC	"	A67 (pos. 16)	Adjust until signal is heard. Repeat steps 35, 36, 37 and 38 until no further improvement can be made.
24.	"	"	"	"	"	"	A46 (pos. 6) A47 (pos. 4) A48 (pos. 2)	Adjust for maximum output.	39.	"	"	30MC	Band AA	30MC	"	A68 (pos. 7)	Adjust until signal is heard. Tune signal generator to 30.91 MC. If no signal is heard, retune generator to 30MC and open A68 to next peak. Adjust for maximum output and recheck for image.
25.	"	"	500KC	"	500KC	"	A49 (pos. 7)	Adjust until signal is heard.	40.	"	"	"	"	"	"	A69 (pos. 5) A70 (pos. 3) A71 (pos. 1)	Adjust for maximum output.
26.	"	"	700KC	"	700KC	"	A50 (pos. 16)	Adjust until signal is heard. Repeat steps 23, 24, 25 and 26 until no further improvement can be made.	41.	"	"	27.2MC	"	Tune for max. output	"	A72 (pos. 8) A73 (pos. 6) A74 (pos. 4) A75 (pos. 2)	Adjust A72 until signal is heard. Adjust A73, A74 and A75 for maximum output.
27.	"	"	400KC	Band G	400KC	"	A51 (pos. 8)	Adjust until signal is heard. Tune signal generator to 1310 KC. If signal is not heard, retune generator to 400KC and open A51 to next peak. Adjust for maximum output and recheck for image.	42.	"	"	28MC	"	"	"	A76 (pos. 16) A77 (pos. 13) A78 (pos. 11) A79 (pos. 9)	Adjust A76 until signal is heard. Adjust A77, A78 and A79 for maximum output. Repeat steps 39, 40, 41 and 42 until no further improvement can be made.
28.	"	"	"	"	"	"	A52 (pos. 6) A53 (pos. 4)	Adjust for maximum output.	43.	"	"	35MC	Band AB	35MC	"	A80 (pos. 8)	Adjust until signal is heard. Tune signal generator to 35.91 MC. If signal is not heard, retune generator to 35MC and open A80 to next peak. Adjust for maximum output and recheck for image.
29.	"	"	200KC	"	200KC	"	A54 (pos. 7)	Adjust until signal is heard.	44.	"	"	"	"	"	"	A81 (pos. 6) A82 (pos. 4) A83 (pos. 2)	Adjust for maximum output.
30.	"	"	300KC	"	300KC	"	A55 (pos. 16)	Adjust until signal is heard. Repeat steps 27, 28, 29 and 30 until no further improvement can be made.	45.	"	"	25MC	"	Tune for max. output	"	A84 (pos. 7) A85 (pos. 5) A86 (pos. 3) A87 (pos. 1)	Adjust A84 until signal is heard. Adjust A85, A86 and A87 for maximum output.
31.	"	"	200KC	Band H	200KC	"	A56 (pos. 8)	Adjust until signal is heard. Tune signal generator to 110KC. If signal is not heard, retune generator to 200KC and open A56 to next peak. Adjust for maximum output and recheck for image.									
32.	"	"	"	"	"	"	A57 (pos. 6) A58 (pos. 4) A59 (pos. 2)	Adjust for maximum output.									
33.	"	"	100KC	"	100KC	"	A60 (pos. 7)	Adjust until signal is heard.									
34.	"	"	150KC	"	150KC	"	A61 (pos. 16)	Adjust until signal is heard. Repeat steps 31, 32, 33 and 34 until no further improvement can be made.									

ALIGNMENT INSTRUCTIONS (CONT.)

46.	400Ω carbon res.	High side antenna terminals "A", Low side to chassis.	30MC	Band AB	Tune for max. output	Across voice coil	A88 (pos.16) A89 (pos.13) A90 (pos.11) A91 (pos.9)	Adjust A88 until signal is heard. Adjust A89, A90 and A91 for maximum output. Repeat steps 43, 44, 45 and 46 until no further improvement can be made.
47.	"	"	21.5MC	Band AC	"	"	A92 (pos.7)	Adjust until signal is heard. Tune signal generator to 22.41 MC. If signal is not heard, tune generator to 21.5MC and open A92 to next peak. Adjust for maximum output and recheck for image.
48.	"	"	"	"	"	"	A93 (pos.5) A94 (pos.3) A95 (pos.1)	Adjust for maximum output.
49.	"	"	21MC	"	Tune for max. output	"	A96 (pos.8) A97 (pos.6) A98 (pos.4) A99 (pos.2)	Adjust A96 until signal is heard. Adjust A97, A98 and A99 for maximum output.
50.	"	"	21.3MC	"	"	"	A100 (pos.16) A101 (pos.13) A102 (pos.11) A103 (pos.9)	Adjust A100 until signal is heard. Adjust A101, A102 and A103 for maximum output. Repeat steps 47, 48, 49 and 50 until no further improvement can be made.
BANDSPREAD ALIGNMENT								
Set the bandspread switch to the bandspread position. All other controls remain the same as in GENERAL COVERAGE								
General coverage alignment should be completed before bandspread alignment. Tracking of the RF stages at low frequency end of each band may be checked as follows: After adjustments of padders is completed, attempt to peak each stage with its associated high frequency trimmer. Any change in capacity should cause a decrease in output if that stage is tracking correctly. This checking procedure will misalign the high frequency trimmers, therefore, they should be repeaked at the high frequency end of the band per alignment instructions.								
51.	400Ω carbon res.	High side to antenna terminal "A", Low side to chassis.	30MC (400 % Mod.)	COIL SET Band A	RADIO DIAL SETTING 30MC	OUTPUT METER Across voice coil	A104 (pos.7)	Adjust until signal is heard. Tune signal generator to 30.91 MC. If signal is not heard, retune generator to 30MC and open A104 to next peak. Adjust for maximum output and recheck for image.
52.	"	"	"	"	"	"	A105 (pos.5) A106 (pos.3) A107 (pos.1)	Adjust for maximum output.
53.	"	"	27.2MC	"	Tune for max. output	"	A108 (pos.15) A109 (pos.14) A110 (pos.12) A111 (pos.10)	Adjust A108 until signal is heard. Adjust A109, A110 and A111 for maximum output. Repeat steps 51, 52 and 53 until no further improvement can be made.

54.	400Ω carbon res.	High side to antenna terminal "A", Low side to chassis.	14.4MC	Band B	14.4MC	Across voice coil	A112 (pos.7)	Adjust until signal is heard. Tune signal generator to 15.31 MC. If signal is not heard, retune generator to 14.4MC and open A112 to next peak. Adjust for maximum output and recheck for image.
55.	"	"	"	"	"	"	A113 (pos.5) A114 (pos.3) A115 (pos.1)	Adjust for maximum output.
56.	"	"	14MC	"	Tune for max. output	"	A116 (pos.15) A117 (pos.14) A118 (pos.12) A119 (pos.10)	Adjust A116 until signal is heard. Adjust A117, A118 and A119 for maximum output. Repeat steps 54, 55 and 56 until no further improvement can be made.
57.	"	"	7.3MC	Band C	7.3MC	"	A120 (pos.7)	Adjust until signal is heard. Tune signal to 8.21MC. If signal is not heard, retune generator to 7.3MC and open A120 to next peak. Adjust for maximum output and recheck for image.
58.	"	"	"	"	"	"	A121 (pos.5) A122 (pos.3) A123 (pos.1)	Adjust for maximum output.
59.	"	"	7MC	"	Tune for max. output	"	A124 (pos.15) A125 (pos.14) A126 (pos.12) A127 (pos.10)	Adjust A124 until signal is heard. Adjust A125, A126 and A127 for maximum output. Repeat steps 57, 58 and 59 until no further improvement can be made.
60.	"	"	4MC	Band D	4MC	"	A128 (pos.7)	Adjust until signal is heard. Tune signal generator to 4.91 MC. If signal is not heard, retune generator to 4MC and open A128 to next peak. Adjust for maximum output and recheck for image.
61.	"	"	"	"	"	"	A129 (pos.5) A130 (pos.3) A131 (pos.1)	Adjust for maximum output.
62.	"	"	3.5MC	"	Tune for max. output	"	A132 (pos.15) A133 (pos.14) A134 (pos.12) A135 (pos.10)	Adjust A132 until signal is heard. Adjust A133, A134 and A135 for maximum output. Repeat steps 60, 61 and 62 until no further improvement can be made.

PARTS LIST AND DESCRIPTIONS (Continued)

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP. VOLT	REPLACEMENT DATA			IDENTIFICATION CODES AND INSTALLATION NOTES
		NATIONAL PART No.	CORNBELL DUBILIER PART No.	SPRAGUE PART No.	
C42	.1	D827-11	P488-1	4TM-P1	Mixer Cath. Byp.
C43	.1	D827-11	P488-1	4TM-P1	Mixer Screen Byp.
C44	5000	K946-1	BFD-005	29C1	Decoupling *
C45	10000	T686-56	I467-01	IF M-II	Osc. Coupling
C46	100	D825D-421	SI100	19C11	Osc. Grid Cap.
C47	.1	D827-11	5W5T1	4TM-P1	Decoupling
C48	.1	D827-11	P488-1	19C4	Fixed Padder
C49	5	H672-3	SI10N750		Fixed Padder
C50	10	D825D-402			Fixed Padder
C51	1200	J666-63			Fixed Padder
C52	10	D825D-437			Fixed Padder
C53	500	J666-61			Fixed Padder
C54	10	D825D-437			Fixed Padder
C55	1600	J666-21			Fixed Padder
C56	900	J666-62			Fixed Padder
C57	21	D825D-410			Fixed Padder
C58	470	H500-18			Fixed Padder
C59	350	D825C-331			Fixed Padder
C60	100	D825C-304			Fixed Padder
C61	50	D825D-417			Fixed Padder
C62	68	D825D-439			Fixed Padder
C63	68	D825D-439			Fixed Padder
C64	100	D825C-304			Fixed Padder
C65	68	D825D-439			Fixed Padder
C66	.01	D827-7			Fixed Padder
C67	.1	D827-11			Fixed Padder
C68	.25	D827-19			Fixed Padder
C69	.01	D827-7			Fixed Padder
C70	.1	D827-11			Fixed Padder
C71	10	D825D-402			Fixed Padder
C72	270	J633-2			Fixed Padder
C73	10000	J666-56			Fixed Padder
C74	3	J685-4			Fixed Padder
C75	100	D825D-421			Fixed Padder
C76	.01	D825-7			Fixed Padder
C77	.01	D827-7			Fixed Padder
C78	.1	D827-11			Fixed Padder
C79	.1	D827-11			Fixed Padder
C80	.01	D827-7			Fixed Padder
C81	.5	D827-49			Fixed Padder
C82	.1	D827-11			Fixed Padder
C83	.1	D827-11			Fixed Padder
C84	.01	D827-7			Fixed Padder
C85	.01	D827-7			Fixed Padder
C86	100	D825D-421			Fixed Padder
C87	.01	D827-7			Fixed Padder
C88	.01	D827-7			Fixed Padder
C89	2400	J667-68			Fixed Padder
C90	.01	D827-01			Fixed Padder
C91	10000	J666-56			Fixed Padder
C92	10000	J666-56			Fixed Padder
C93	10	D825D-402			Fixed Padder
C94	38	D825D-414			Fixed Padder
C95	10000	J666-56			Fixed Padder
C96	1000	J665-71			Fixed Padder
C97	10000	J666-56			Fixed Padder
C98	470	J666-56			Fixed Padder
C99	10000	J666-56			Fixed Padder
C100	.1	D827-11			Fixed Padder
C101	.1	D827-11			Fixed Padder
C102	10	D822-1			Fixed Padder
C103	3	J685-4			Fixed Padder

* Not used in all models.

PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

ITEM No.	RESISTANCE	REPLACEMENT DATA			IDENTIFICATION CODES
		WATTS	NATIONAL PART No.	IRC PART No.	
R62	47K Ω		K379-45	BTS-47K	FM IF Amp. Screen
R63	4700 Ω		J569-33	BTS-4700	FM IF Amp. Decoupling
R64	15K Ω		K379-39	BTS-15K	Ratio Det. Diode Load
R65	15K Ω		K379-39	BTS-15K	Ratio Det. Diode Load
R66	47K Ω		K379-45	BTS-47K	De-emphasis

Note 1. Some models use a 3300 Ω resistor in this application.

Note 2. Not used in all models.

Note 3. Some models use a 2200 Ω , 1 watt resistor in this application.

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA		
	PRI.	SEC. 1	SEC. 2	SEC. 3	NATIONAL PART No.	STANCOR PART No.	CHICAGO PART No.
T1	117VAC	540VCT	5VAC	6.3VAC	P188-1		
	③ .95A	.140ADC	③ 2A	③ 5.2A		P-2059 ① ②	

① Drill new mounting holes.

② Add series resistor to reduce plate voltage.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	RATING				REPLACEMENT DATA		
	IMPEDANCE	DC RES.	SEC.	SEC.	NATIONAL PART No.	STANCOR PART No.	CHICAGO PART No.
T2	6000 Ω	500 Ω	3000	200	P187-1		
	CT	Tan ϕ	CT	Tap ③			
		8 Ω		8 Ω			

SPEAKER

ITEM No.	RATINGS				REPLACEMENT DATA		
	FIELD	V. C. IMP.	SEC.	SEC.	NATIONAL PART No.	JENSEN PART No.	QUAM PART No.
SP1	COM DIA.	6.5 Ω			P297-1	ST-120	
SP2	9 3/8"	3/4"				MOD. P10-S	8A-4

FILTER CHOKE

ITEM No.	RATINGS			REPLACEMENT DATA		
	TOTAL DIRECT CURRENT	D. C. RESISTANCE	D. C. INDUCTANCE (1000 μ)	NATIONAL PART No.	STANCOR PART No.	CHICAGO PART No.
L1	.140ADC	280 Ω	1 Henry	SA-1694		R-2310 ①

COILS (RF-IF)

ITEM No.	USE	DC RES.		REPLACEMENT DATA		NOTES
		PRI.	SEC.	NATIONAL PART No.	MEISSNER PART No.	
L2A	Ant. Trans.	.2 Ω	.1 Ω	SA-8803		50-100KC J Band
B	Ant. Trans.			SA-8803		100-200KC H Band
C	Ant. Trans.			SA-8665		180-430KC G Band
D	Ant. Trans.			SA-8660		480-960KC F Band
E	Ant. Trans.			SA-8513		900-2050KC E Band
F	Ant. Trans.			SA-8635		1.7-4MC D Band
G	Ant. Trans.			SA-8759		3.5-7.3MC C Band
H	Ant. Trans.			SA-8755		7-14.4MC B Band
I	Ant. Trans.			SA-8654		14-30MC A Band
J	Ant. Trans.			SA-8073		21-21.3MC AC Band
K	Ant. Trans.			SA-8675		25-35MC AB Band
L	Ant. Trans.			SA-8814		27-30MC AA Band

MODEL HRO-50

NATIONAL

PARTS LIST AND DESCRIPTIONS (Continued) **COILS (RF-IF)**

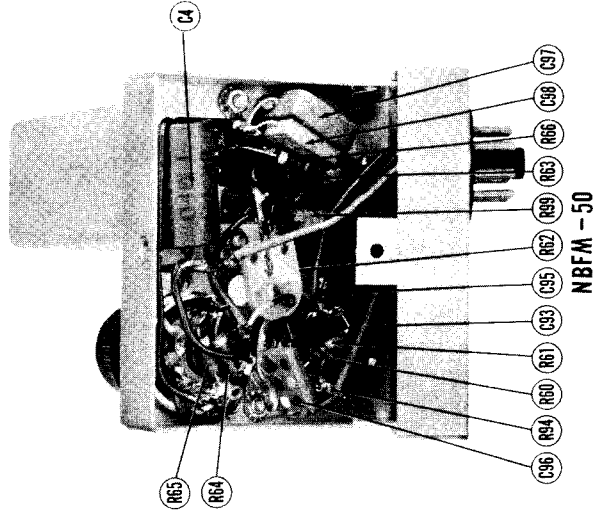
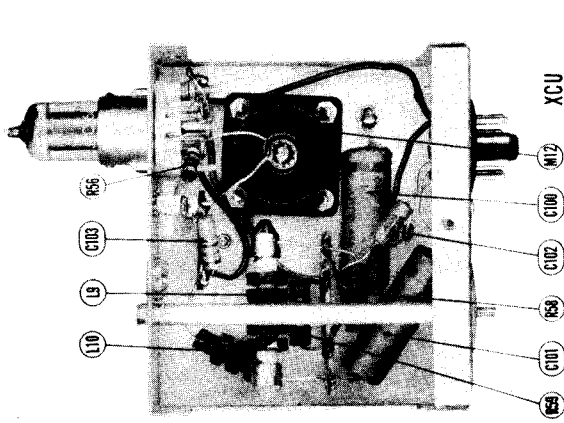
ITEM No.	USE	DC RES.		REPLACEMENT DATA		NOTES
		PRI.	SEC.	NATIONAL PART No.	WEISSNER PART No.	
L3A	1st RF Trans.	.10	.10	SA-6809		50-100KC J Band
B	1st RF Trans.			SA-6669		100-200KC H Band
C	1st RF Trans.			SA-6667		180-430KC G Band
D	1st RF Trans.			SA-6662		480-960KC F Band
E	1st RF Trans.			SA-6540		900-2050KC E Band
F	1st RF Trans.			SA-6637		1.7-4MC D Band
G	1st RF Trans.			SA-6641		3.5-7.3MC C Band
H	1st RF Trans.			SA-6650		7-14.4MC B Band
I	1st RF Trans.			SA-6751		14-30MC A Band
J	1st RF Trans.			SA-6751		21-21.5MC AC Band
K	1st RF Trans.			SA-6673		25-35MC AB Band
L	1st RF Trans.			SA-6673		27-30MC AA Band
L3A	2nd RF Trans.	.20	.10	SA-6804		50-100KC J Band
B	2nd RF Trans.			SA-6800		100-200KC H Band
C	2nd RF Trans.			SA-6794		180-430KC G Band
D	2nd RF Trans.			SA-6789		480-960KC F Band
E	2nd RF Trans.			SA-6638		900-2050KC E Band
F	2nd RF Trans.			SA-6642		1.7-4MC D Band
G	2nd RF Trans.			SA-6756		3.5-7.3MC C Band
H	2nd RF Trans.			SA-6752		7-14.4MC B Band
I	2nd RF Trans.			SA-6752		14-30MC A Band
J	2nd RF Trans.			SA-6676		21-21.5MC AC Band
K	2nd RF Trans.			SA-6676		25-35MC AB Band
L	2nd RF Trans.			SA-6811		27-30MC AA Band
L3A	HF Osc.	.10		SA-6805		50-100KC J Band
B	HF Osc.			SA-6785		100-200KC H Band
C	HF Osc.			SA-6785		180-430KC G Band
D	HF Osc.			SA-6795		480-960KC F Band
E	HF Osc.			SA-6631		900-2050KC E Band
F	HF Osc.			SA-6776		1.7-4MC D Band
G	HF Osc.			SA-6760		3.5-7.3MC C Band
H	HF Osc.			SA-6678		7-14.4MC B Band
I	HF Osc.			SA-6656		14-30MC A Band
J	HF Osc.			SA-8076		21-21.5MC AC Band
K	HF Osc.			SA-6819		25-35MC AB Band
L	HF Osc.			SA-6816		27-30MC AA Band
L6	1st IF	8.40	8.40	SA-32492		Includes trimmer, 2 capacitors and resistor.
L7	2nd IF	8.40	8.40	SA-41G		5 microhenries
L8	BFO Coil	47K0		SA-3361		.5 microhenries
L9	100KC Induct-					
L10	or	950		SA-4373		
L11	Ratio Det. Trans.	170		SA-2514		
		80	90	SA-4890		

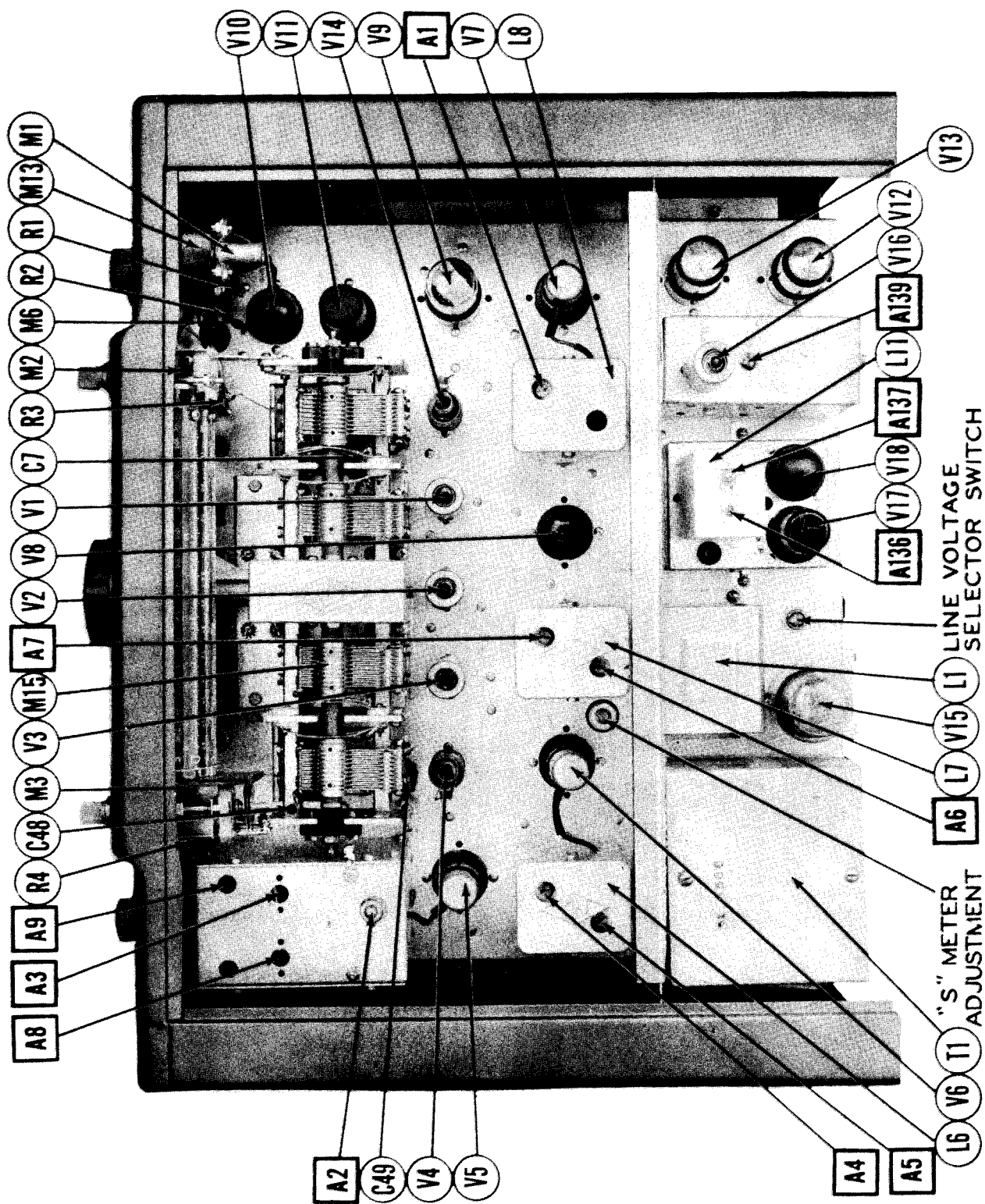
DIAL LIGHTS

ITEM No.	BASE TYPE	VOLTS	AMPS.	REPLACEMENT DATA		NOTES
				NATIONAL PART No.	WEISSNER PART No.	
M1	Bayonet	6-8	.15	F136-6		Type #47
M2	Bayonet	6-8	.15	F136-6		Type #47
M3	Bayonet	6-8	.15	F136-6		Type #47

MISCELLANEOUS

ITEM No.	PART NAME	NATIONAL PART No.	NOTES
M4	Fuse	F135-4	3AG 2 Amp. at 250V
M5	Switch	E230-2	B+ On-Off
M6	Switch	E230-2	AVC
M7	Switch	P738-1	Calibrate
M8	Switch	H340-4	110-120/220-240
M9	Switch	SA-6546	Function
M10	Switch	E195-3	Selectivity
M11	Crystal Filter	SA-3654	455KC
M12	Crystal	E979-1	Carrier Level
M13	Meter	J984-5	Four Section
M14	Phone Jack	F316-1	
M15	Tuning Gang	SA-6592	





NATIONAL
MODEL HRO-50

10.	ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT							
	To set the main tuning dial turn the tuning gang fully closed, loosen set screws and turn the dial slowly until the dial reads zero.							
	To set pointer, set the band selector until the band "P" scale appears and turn the main tuning dial to 490 and set pointer to 4MC reference mark on dial scale.							
11.	IF ALIGNMENT "CHECK" TO BE MADE PRIOR TO ALIGNMENT							
	(a) Set the AVC switch to "OFF", the control switch to "CW", the phasing control at zero, the selectivity switch at "5" and the RF gain control at 10.							
	(b) Vary the CWO control to point of lowest background noise and note the setting.							
	(c) Turn the selectivity switch to "OFF" position, and adjust "CWO" control to point of lowest background noise and note the setting.							
	(d) If IF Alignment is correct the two settings (b) and (c) should coincide and steps 1 thru 6 may be omitted.							
12.	IF ALIGNMENT							
	Controls should be set as follows except where noted otherwise: Set the control switch to "CW", the AVC switch to "OFF", the phasing control at zero, the selectivity switch to "5", the AF gain control to 10, and the RF gain control to 9.							
1.	DUMMY ANTENNA Direct	SIGNAL GENERATOR COUPLING High side to pin 7 (Grid) of 6BE6 (V3). Low side to chassis.	SIGNAL GENERATOR FREQUENCY 455KC (Unmod.)	COIL SET Any	RADIO DIAL SETTING Tuning gang fully open	OUTPUT METER Across voice coil	ADJUST	REMARKS Adjust the "CWO" control for audio beat-note. If it is difficult to obtain the beat note, an adjustment of A1 will be required. Vary the signal generator for between 453 and 457KC for a sharp peak response. Set the generator at this peak for IF Alignment.
2.	Direct	"	As set in step 1	"	"	"	A2, A3, A4, A5, A6, A7	Set the selectivity switch to "OFF", the control switch to "AM" position. Turn modulation of signal generator on. Adjust for maximum output.
3.	Direct	"	Two KC above frequency determined in step 1	"	"	"	A2,	Set the selectivity switch to "I" and adjust A2 for maximum output.
4.	Direct	"	Exact frequency determined in step 1	"	"	"	A8	Tune selectivity switch to "OFF" position. Adjust for maximum output.
5.	The phasing control is pre-set at the factory, and should not require adjustment, when correctly set a decrease in the background level will be noted with the selectivity switch at "5" and the phasing control at zero. If not, a slight adjustment of A9 will be required for proper setting.							
6.	Turn modulation of signal generator off and set control switch to "CW" position. Turn the "CWO" control fully clockwise and set knob to "5" on its scale. Adjust "CWO" control to zero beat with signal generator. If zero beat does not occur at "0" on the control dial a careful readjustment of A1 will be required.							
	GENERAL COVERAGE ALIGNMENT							
17.	Set all controls as follows: Set the control switch to "AM", the AVC switch to "OFF", the selectivity switch to "OFF", the RF gain control to 10, the bandspread switch to the general coverage position. The position of the antenna and oscillator trimmers should be with the arrows of these controls in a vertical position.							
7.	DUMMY ANTENNA 400Ω carbon res.	SIGNAL GENERATOR COUPLING High side antenna terminal "A". Low side to chassis.	SIGNAL GENERATOR FREQUENCY 30MC (400% Mod.)	COIL SET Band A	RADIO DIAL SETTING 30MC	OUTPUT METER Across voice coil	ADJUST A10 (pos. 8)	REMARKS Adjust until signal is heard. Tune signal generator to 30.91 MC. If signal is not heard, re-tune generator to 30MC and open A10 to next peak. Adjust for maximum output and recheck for image.
8.	"	"	"	"	"	"	A11 (pos. 6) A12 (pos. 4)	Adjust for maximum output.
9.	"	"	14.4MC	"	Tune for max. output	"	A13 (pos. 16) A14 (pos. 13) A15 (pos. 11) A16 (pos. 9)	Adjust A13 until signal is heard. Adjust A14, A15 and A16 for maximum output. Repeat steps 7, 8, and 9 until no further improvement can be made.

400Ω carbon res.	High side antenna terminal "A". Low side to chassis.	14.4MC	Band B	14.4MC	Across voice coil	A17 (pos. 8)	Adjust until signal is heard. Tune signal generator to 15.31 MC. If no signal is heard, re-tune generator to 14.4MC and open A17 to next peak. Adjust for maximum output and re-check for image.
"	"	14.4MC	"	14.4MC	"	A18 (pos. 6), A19 (pos. 4), A20 (pos. 2)	Adjust for maximum output.
"	"	7MC	"	Tune for max. output	"	A21 (pos. 16), A22 (pos. 13), A23 (pos. 11), A24 (pos. 9)	Adjust A21 until signal is heard. Adjust A22, A23 and A24 for maximum output. Repeat steps 10, 11 and 12 until no further improvement can be made.
"	"	7.3MC	Band C	7.3MC	"	A25 (pos. 8)	Adjust until signal is heard. Tune signal generator to 8.21MC. If signal is not heard re-tune generator to 7.3MC and open A25 to next peak and adjust for maximum output and recheck for image.
"	"	"	"	"	"	A26 (pos. 6), A27 (pos. 4), A28 (pos. 2)	Adjust for maximum output.
"	"	3.5MC	"	Tune for max. output	"	A29 (pos. 16), A30 (pos. 13), A31 (pos. 11), A32 (pos. 9)	Adjust A29 until signal is heard. Adjust A30, A31 and A32 for maximum output. Repeat steps 13, 14 and 15 until no further improvement can be made.
"	"	4MC	Band D	4MC	"	A33 (pos. 8)	Adjust until signal is heard. Tune signal generator to 4.91 MC. If no signal is heard, re-tune generator to 4MC and open A33 to next peak. Adjust for maximum output and recheck for image.
"	"	"	"	"	"	A34 (pos. 6), A35 (pos. 4)	Adjust for maximum output.
"	"	1.8MC	"	Tune for max. output	"	A36 (pos. 16), A37 (pos. 13), A38 (pos. 11), A39 (pos. 9)	Adjust A36 until signal is heard. Adjust A37, A38 and A39 for maximum output. Repeat steps 16, 17 and 18 until no further improvement can be made.
"	"	2MC	Band E	2MC	"	A40 (pos. 8)	Adjust until signal is heard. Tune signal generator to 2.91 MC. If signal is not heard, re-tune generator to 2MC and open A40 to next peak. Adjust for maximum output and recheck for image.