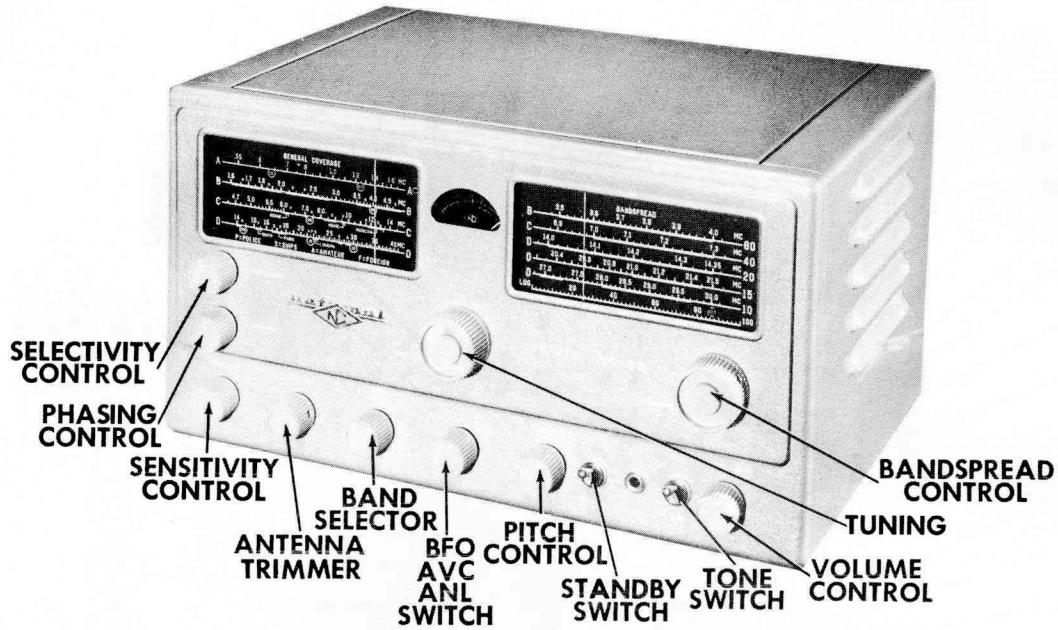
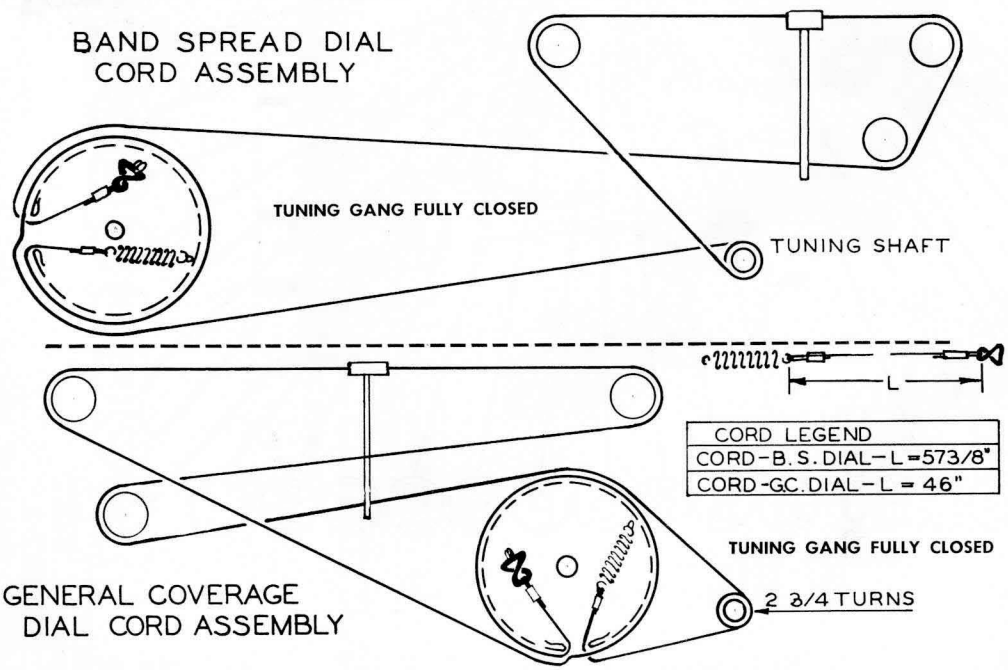
NATIONAL
MODEL NC-98

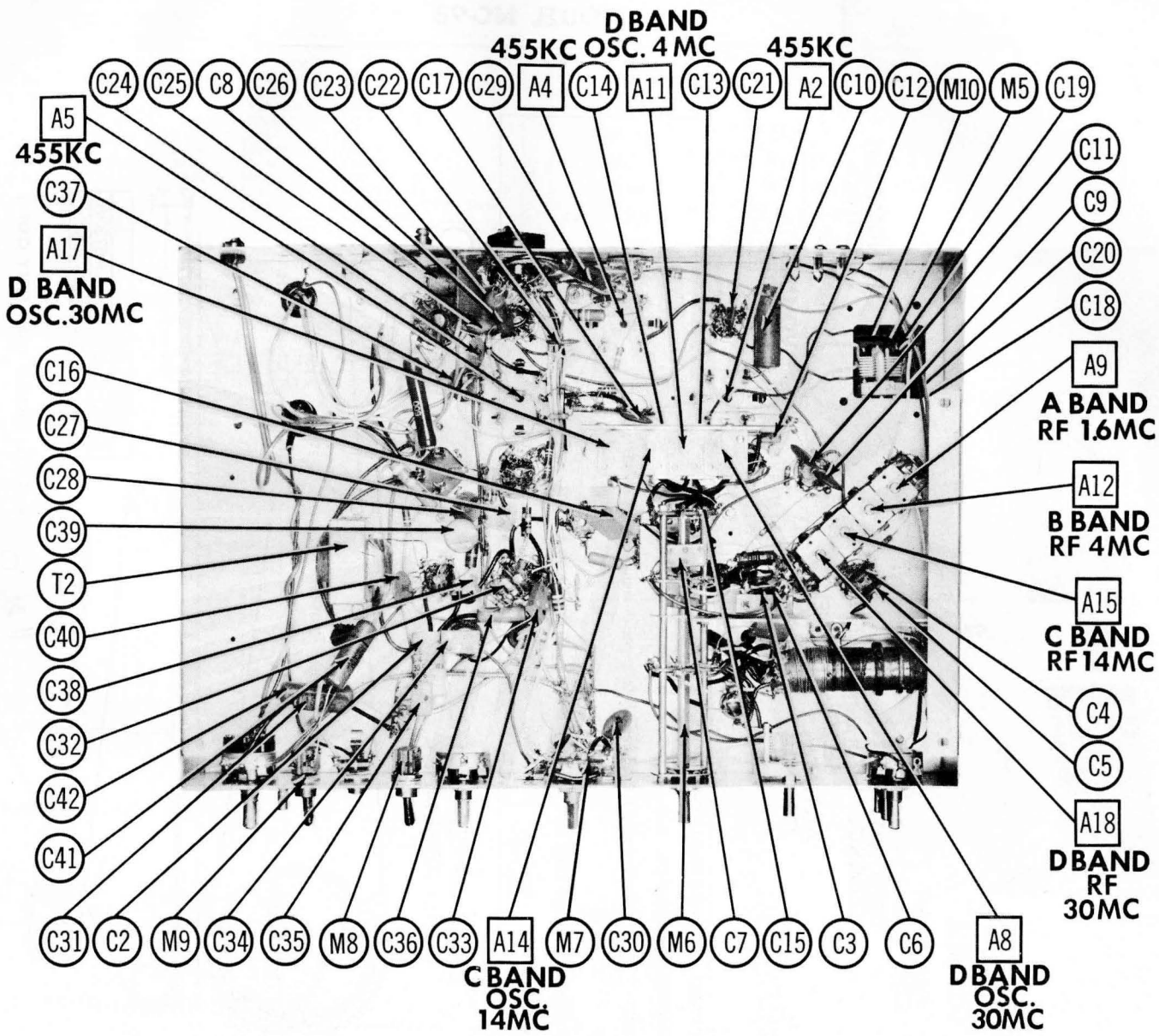


TRADE NAME	National Model NC-98		
MANUFACTURER	National Co., Inc., 61 Sherman St., Malden 48, Mass.		
TYPE SET	AC Operated Multi-Band Superheterodyne Communications Receiver		
TUBES	Nine		
POWER SUPPLY	105-130 Volts AC - 50/60 Cycles	RATING	.6 Amp. @ 117 Volts AC
TUNING RANGE	Band "A" 540-1600KC Band "B" 1.6 - 4.7MC	Band "C" 4.7 -14MC Band "D" 14 - 40MC	

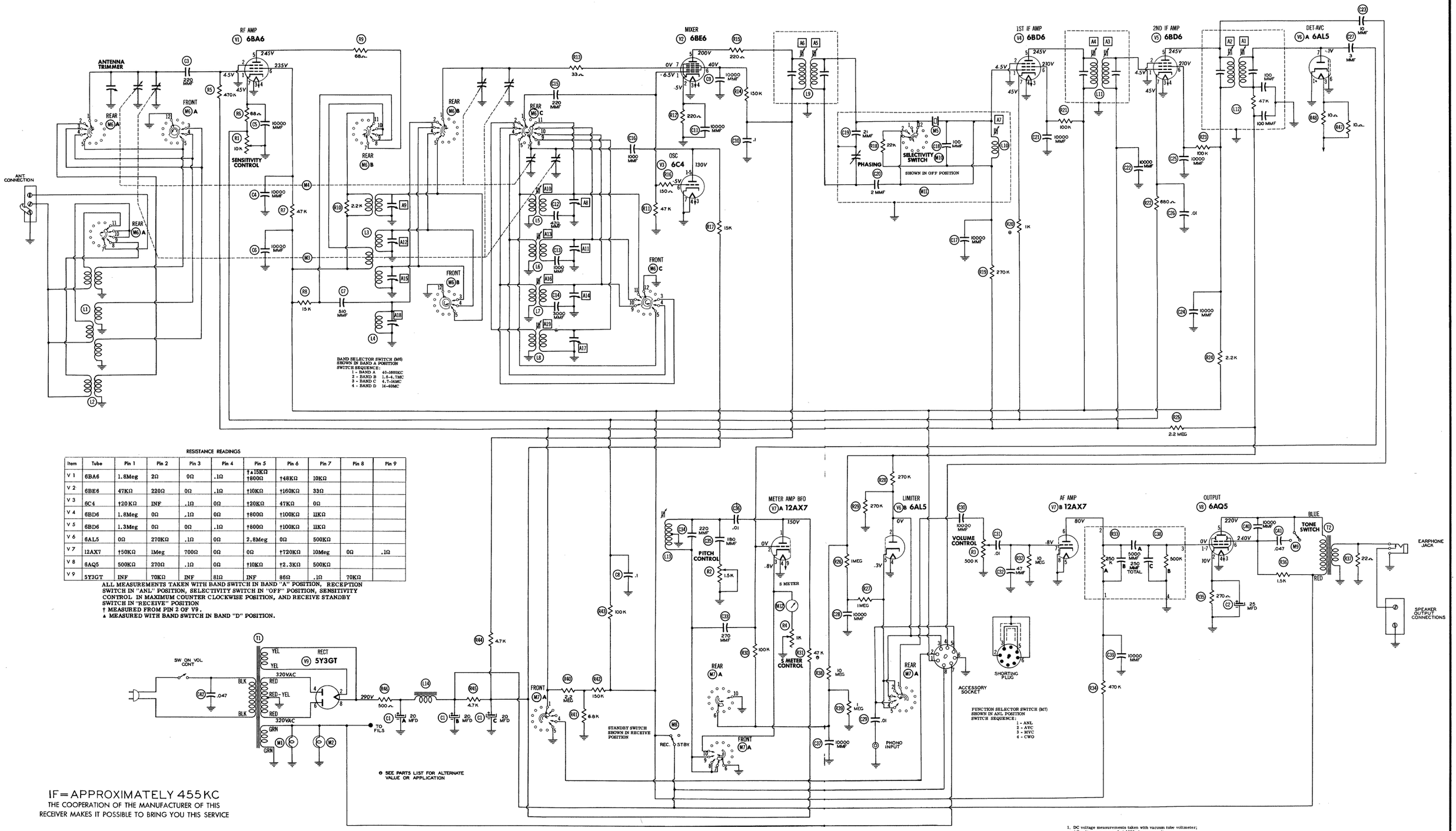


DIAL CORD STRINGING

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana



CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION



RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	6BA6	1.8Meg	2Ω	0Ω	.1Ω	†▲15KΩ †800Ω	†48KΩ	10KΩ		
V 2	6BE6	47KΩ	220Ω	0Ω	.1Ω	†10KΩ	†160KΩ	33Ω		
V 3	6C4	†20KΩ	INF	.1Ω	0Ω	†20KΩ	47KΩ	0Ω		
V 4	6BD6	1.8Meg	0Ω	.1Ω	0Ω	†800Ω	†100KΩ	1KΩ		
V 5	6BD6	1.3Meg	0Ω	0Ω	.1Ω	†800Ω	†100KΩ	1KΩ		
V 6	6AL5	0Ω	270KΩ	.1Ω	0Ω	2.8Meg	0Ω	500KΩ		
V 7	12AX7	†50KΩ	1Meg	700Ω	0Ω	0Ω	†720KΩ	10Meg	0Ω	.1Ω
V 8	6AQ5	500KΩ	270Ω	.1Ω	0Ω	†10KΩ	†2.3KΩ	500KΩ		
V 9	5Y3GT	INF	70KΩ	INF	81Ω	INF	86Ω	.1Ω	70KΩ	

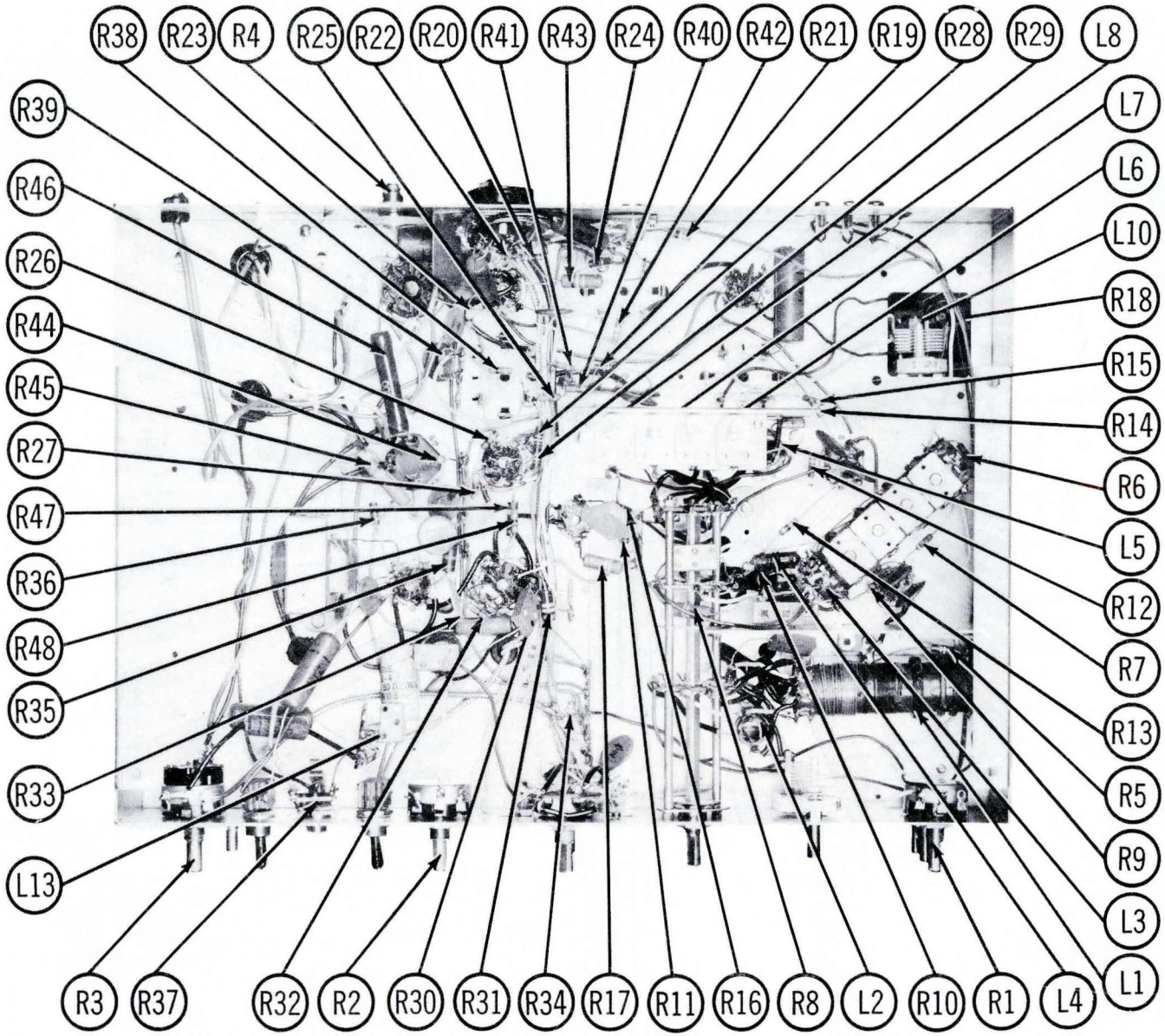
ALL MEASUREMENTS TAKEN WITH BAND SWITCH IN BAND "A" POSITION, RECEPTION SWITCH IN "ANL" POSITION, SELECTIVITY SWITCH IN "OFF" POSITION, SENSITIVITY CONTROL IN MAXIMUM COUNTER CLOCKWISE POSITION, AND RECEIVE STANDBY SWITCH IN "RECEIVE" POSITION
† MEASURED FROM PIN 2 OF V9.
▲ MEASURED WITH BAND SWITCH IN BAND "D" POSITION.

⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

IF = APPROXIMATELY 455 KC
THE COOPERATION OF THE MANUFACTURER OF THIS RECEIVER MAKES IT POSSIBLE TO BRING YOU THIS SERVICE

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 10% in voltage and resistance readings.
6. Volume control at maximum, no signal applied for voltage measurements.

264-14



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

Only qualified technicians thoroughly familiar with communications type receivers should attempt alignment of this receiver. Alignment should not be attempted until a thorough check of receiver performance against normal performance has been made.
With main tuning gang fully closed, slide dial pointer to coincide with the last low frequency mark on the "C" scale. With the band spread tuning capacitor fully closed, set band spread dial pointer to coincide with the "O" index mark on the log scale.
Allow a 15 minute warm-up period for receiver and test equipment.
Volume control should be at maximum position. Output of signal generator should be no higher than necessary to obtain an output reading. Use an insulated alignment screwdriver for adjusting.

IF ALIGNMENT

The IF frequency is 455KC ±2KC. The crystal used in the crystal filter determines the exact IF frequency.
Connect speaker (or 4Ω resistor) across speaker terminals on rear chassis apron.
Pre-set the front panel controls as follows:

a. Switch selectivity to "Off" position.
b. Adjust phasing control so that red dot is at top of knob.
c. Turn sensitivity control maximum clockwise.
d. Turn reception switch to "AVC" position.
e. Place "Receive-standby" switch in "Receive" position.
f. Turn the AC - "Off-Volume" control fully clockwise.
g. Remove the antenna from the antenna terminals and turn the "Meter Adjust" control (rear chassis apron) until the "S" meter (front panel) reads zero.
h. Switch the reception switch from position in Step d-to "CWO".
i. Change the selectivity switch from position in Step a. to position 2.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1.	.1MFD	High side to mixer stator lug (mid-section) on main tuning gang. Low side to chassis.	Approx. 455KC (Unmod)	"A"	Tuning gang fully open	Across speaker terminals (rear chassis apron)		Adjust pitch control for audible beat in speaker. Slowly vary signal generator between 453 and 457KC until output meter shows a very sharply peaked response. It may be necessary to back off the sensitivity control or attenuate the signal generator output to obtain this peak. The peak indicates the frequency of the crystal and IF alignment should be made at this frequency.
2.	"	"	Exact frequency determined in step 1 (400∿Mod)	"	"	"	A1, A2, A3, A4 A5, A6	Turn "Reception" switch to "AVC" and "Selectivity" switch to "Off". Adjust in order given until maximum output is obtained.
3.	"	"	Tune 2KC higher than frequency determined in step 1.	"	"	"	A7	Change selectivity switch to position 1. Adjust for maximum output.

RF ALIGNMENT

The oscillator operates on the high side on the "A", "B" and "C" bands and on the low side on the "D" band.
Place the band spread dial pointer at "Set" on the log scale.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
4.	300Ω carbon resistor	High side thru 300Ω to ungrounded antenna terminal. Low side to chassis.	1.6MC (400∿Mod)	A	1.6MC	Across speaker terminals	A8, A9	Adjust in order given for maximum output.
5.	"	"	0.6MC	"	0.6MC	"	A10	Adjust for maximum output. Repeat steps 4 and 5.
6.	"	"	4.0MC	B	4.0MC	"	A11, A12	Adjust in order given for maximum output.
7.	"	"	1.6MC	"	1.6MC	"	A13	Adjust for maximum output. Repeat steps 6 and 7.
8.	"	"	14.0MC	C	14.0MC	"	A14	Adjust for maximum output. If two peaks occur use the one closest to MINIMUM capacity.
9.	"	"	"	"	"	"	A15	Adjust for maximum output. If two peaks occur use the one closest to maximum capacity.
10.	"	"	5.0MC	"	5.0MC	"	A16	Adjust for maximum output. Repeat steps 8, 9 and 10.
11.	"	"	30MC	D	30.0MC	"	A17	Adjust for maximum output. If two peaks occur use the one closest to maximum capacity.
12.	"	"	"	"	"	"	A18	Adjust for maximum output. If two peaks occur use the one closest to MINIMUM capacity.
13.	"	"	15.0MC	"	15.0MC	"	A19	Adjust A19 fully counter clockwise, then clockwise until second peak occurs. Adjust for maximum output on second peak. Repeat steps 11, 12 and 13.

PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA		RETMA BASE TYPE	NOTES
		NATIONAL PART No.	STANDARD REPLACEMENT		
V1	RF Amplifier	6BA6	6BA6	6BK	
V2	Mixer	6BE6	6BE6	7CH	
V3	Oscillator	6C4	6C4	6BG	
V4	1st. IF Amplifier	6BD6	6BD6	7BK	
V5	2nd. IF Amplifier	6BD6	6BD6	7BK	
V6	Det.-AVC-Limiter	6AL5	6AL5	6BT	
V7	Meter Amp-BFO-AF Amplifier	12AX7	12AX7	9A	
V8	Output	6AQ5	6AQ5	7BZ	
V9	Rectifier	5Y3GT	5Y3GT	5T	

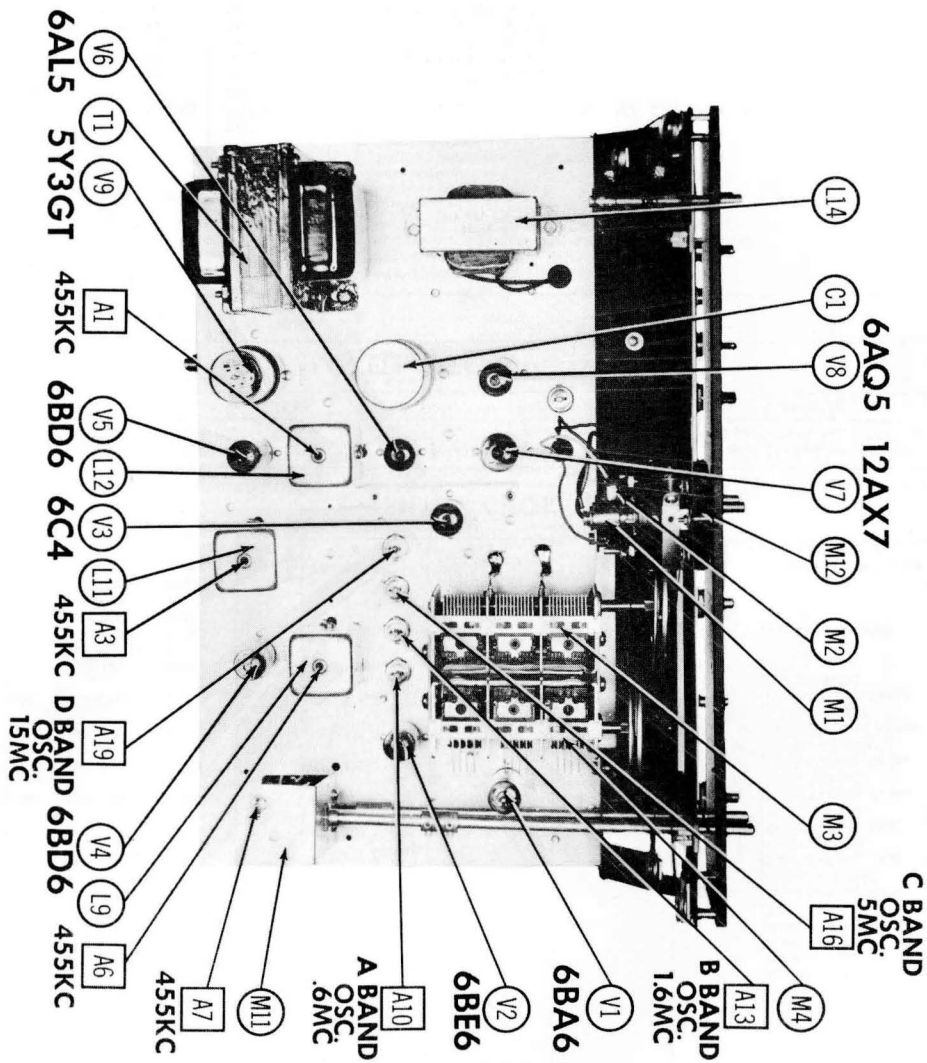
CAPACITORS

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		REPLACEMENT DATA							NOTES
	CAP.	VOLT	NATIONAL PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C1A	▲20	450	H235-2	AFH3-36		C027		FP376.5	TVL-3780	
B	■20	450								
C	▲20	450								
C2	25	50	E338-4	PRS50/25		BR255		TC36	TVA-1306	
C3	220	500	J665-44	1469-0002		22R5T22		MCE240	MS-32	
C4	10000		K946-2	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C5	10000		K946-2	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C6	1000		K946-2	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C7	510	500	J665-57	1469-0005		5R5T51		MCE245	MS-35	
C8	.1	400	Q693-34	P488-1	DF-104	CUB4P1		PT401	4TM-P1	
C9	10000		K946-2	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C10	.1	400	Q693-34	P488-1	DF-104	CUB4P1		PT401	4TM-P1	
C11	10000		K946- 2	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C12	470		J665-55	1469-0005		5R5T47		MCE245	MS-35	
C13	1000		J665-70	1464-001		1R5 D1		MCE255	MS-21	
C14	3000		J660-3 0	1464-003		1R5D3		MCE461	MS-23	
C15	220	500	J665-44	1469-0002		22R5T22		MCE240	MS-32	
C16	1000	500	J666-14	1464-001		1R5D1		MCE255	MS-21	
C17	10000		K946-2	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C18	100	500	J665-32	1469-0001		22R5T1		MCE235	MS-31	
C19	21		D825D-410							
C20	2		F912-3							
C21	10000		K946-2	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C22	10000		K946-2	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C23	10		J695-2	SI10	D6-100	TP09	GP1K-100	UC-541	5GA-Q1	
C24	10000		K946-2	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C25	10000		K946-2	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C26	.01	400	Q693-19	P488-01	DF-103	CUB4S1	GP2-333-103	PT411	4TM-S1	
C27	3		J695-4							
C28	10000		K946-2	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C29	.01	400	Q693-19	P488-01	D6-103	CUB4S1	GP2-333-103	PT411	4TM-S1	
C30	10000		K946-2	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C31	.01	400	Q693-19	P488-01	D6-103	CUB4S1	GP2-333-103	PT411	4TM-S1	
C32	47		D825D-447	SI47	D6-470	TP29	GP1K-470	UC-5347	5GA-Q47	
C33	270	500	J665-47	1469-00025		22R5T25		MCE240	MS-33	
C34	220	500	J665-44	1469-0002		22R5T22		MCE240	MS-32	
C35	180	500	J665-41	1469-0002		22R5T18		MCE237	MS-32	
C36	.01	400	Q693-19	P488-01	D6-103	CUB4S1	GP2-333-103	PT411	4TM-S1	
C37	10000		K946-2	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C38A	5000									
B	250		♦R983-1	♦PA-112-2	♦PC-71	♦112TM2	♦1406-02		♦T-4	
C										
C39	10000		K946-2	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C40	10000		K946-2	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C41	.047	400	Q693-28	P488-047	DF-503	CUB4S47		PT4147	4TM-S47	
C42	.047	400	Q693-28	P488-047	DF-503	CUB4S47		PT4147	4TM-S47	

♦ Items C37A, C37B, C37C, R33A and R33B are combined in one unit.
When replacing items individually, items C37B and C37C should total 250MMF.

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	NATIONAL PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	
R1A	10KΩ	2	K349-3		A43-10K		R10,000L	Sensitivity-Wire Wound
B	Shaft		Not Req.		FS-3		DS-36	Attach to R1A
R2A	1500Ω	½	K915-16	Q11-110	A47-2000-S	B-6	U-6	Pitch
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R2A
R3A	500KΩ	½	K347-1	Q13-133	A47-500K-Z	B-60-S	U-48	Volume
B	Shaft		Not Req.	Not Req.	RS-2	Not Req.	Not Req.	Attach to R3A
C	Switch		Not Req.	76-1	SWE-12	Not Req.	US-26	Attach to R3A
R4A	1000Ω	1	D-831-2	W-1000	A43-1000		R1000L	S. Meter Adj.-Wire Wound
B	Shaft		Not Req.	Not Req.	FKS-1/4		Not Req.	Attach to R4A

RESISTORS

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	NATIONAL PART No.	IRC PART No.	
R5	470KΩ	½	J569-57	BTS-470K	
R6	68Ω	½	J569-11	BTS-68	
R7	47KΩ	½	J569-45	BTS-47K	
R8	15KΩ	1	J571-39	BTA-15K	
R9	68Ω	½	J569-11	BTS-68	
R10	2200Ω	½	J569-29	BTS-2200	
R11	47KΩ	½	J569-45	BTS-47K	
R12	220Ω	½	J569-17	BTS-220	
R13	33Ω	½	J569-7	BTS-33	
R14	150KΩ	½	J569-51	BTS-150K	
R15	220Ω	½	J569-17	BTS-220	
R16	150Ω	½	J569-15	BTS-150	
R17	15KΩ	1	J571-39	BTA-15K	
R18	22KΩ	½	J569-41	BTS-22K	
R19	270KΩ	½	J569-54	BTS-270K	
R20	1000Ω	½		BTS-1000	Note 1
R21	100KΩ	½	J569-49	BTS-100K	
R22	680Ω	½	J569-23	BTS-680	
R23	100KΩ	½	J569-49	BTS-100K	
R24	2200Ω	½	J569-29	BTS-2200	
R25	2.2Meg	½	J569-65	BTS-2.2Meg	
R26	1Meg	½	J569-61	BTS-1Meg	
R27	1Meg	½	J569-61	BTS-1Meg	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	NATIONAL PART No.	IRC PART No.	
R28	270KΩ	½	J569-54	BTS-270K	
R29	270KΩ	½	J569-54	BTS-270K	
R30	100KΩ	½	J569-49	BTS-100K	
R31	47KΩ	1		BTA-47K	Note 2
R32	10Meg	½	J569-73	BTS-10Meg	
R33A	250KΩ	½	♦R983-1		
B	500KΩ	½			
R34	470KΩ	½	J569-57	BTS-470K	
R35	270Ω	1	J571-18	BTA-270	
R36	1500Ω	½	J569-27	BTS-1500	
R37	22Ω	1	J571-5		
R38	10Meg	½	J569-73	BTS-10Meg	
R39	1Meg	½	J569-61	BTS-1Meg	
R40	2.2Meg	½	J569-65	BTS-2.2Meg	
R41	6800Ω	½	J569-35	BTS-6800	
R42	150KΩ	½	J569-51	BTS-150K	
R43	100KΩ	1	J571-49	BTA-100	
R44	4700Ω	½	J569-33	BTS-4700	
R45	4700Ω	2	J572-33	BTB-4700	
R46	500Ω	10	M707-3	1 3/4A-500	
R47	10Ω	1	J569-1		
R48	10Ω	½	J569-1	BTS-10	

Note 1: Some models may use a 1500Ω resistor in this application.
Note 2: Some models may use a 27KΩ resistor in this application.
Items R33A, R33B, C35A, C35B and C35C are combined in one unit.

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	NATIONAL PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.
T1	117VAC @ .6A	610VCT .076ADC	5VAC @ 2A	6.3VAC @ 3A	K316-5	PC-8422① ②	P-3151① ②	R-9A① ②	P9312①②	

① Drill new mounting holes.
② Tape 6.3V center tap.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	NATIONAL PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.	
T2	4.6KΩ	3 to 4Ω	K-313-3	A-3877	A-2930	S-3X	Z1004	24S51	

PARTS LIST AND DESCRIPTIONS (Continued)

COILS (RF-IF)

ITEM No.	USE	DC RES.		REPLACEMENT DATA				NOTES
		PRI.	SEC.	NATIONAL PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	
L1	Ant. Coil	3.5Ω	.4Ω	SB:1517				Band A-Freq. Range 540 - 1600KC
	Ant. Coil	40Ω	1.2Ω					Band B-Freq. Range 1.6MC - 4.7MC
	Ant. Coil	40Ω	.5Ω					Band C-Freq. Range 4.7MC - 14MC
L2	Ant. Coil	40Ω	.5Ω	SB:1519				Band D-Freq. Range 14MC - 40MC
L3	RF Coil	28Ω	2.8Ω	SB:1518				Band A-Freq. Range 540 - 1600KC
	RF Coil	29Ω	1.8Ω					Band B-Freq. Range 1.6MC - 4.7MC
	RF Coil	29Ω	.1Ω					Band C-Freq. Range 4.7MC - 14MC
L4	RF Coil	0Ω		SB:1520				Band D-Freq. Range 14MC - 40MC
L5	Osc. Coil	1.6Ω	.9Ω	SB:1573-1	14-1073	BC-381	70-Osc.	Band A-Freq. Range 540 - 1600KC
L6	Osc. Coil	1.2Ω	.8Ω	SB:1574-1				Band B-Freq. Range 1.6MC - 4.7MC
L7	Osc. Coil	.2Ω	.1Ω	SB:1575-1				Band C -Freq. Range 4.7MC - 14MC
L8	Osc. Coil	.1Ω	.1Ω	SB:1576-1				Band D-Freq. Range 14MC - 40MC
L9	Input IF	20Ω	20Ω	Q242-2	16-6758*		1483-C	
L10	Crystal Filter Coil	9.5Ω		SB:2641	19-5100		4652	975 Microhenries
L11	Output IF	20Ω	20Ω	Q242-2	16-6758*		1484-C	
L12	Detector Input Coil	20Ω		Q242-1				
L13	BFO Coil	4.2Ω		SB:2642				Tapped at 2.9Ω; Core part no. D166-5.

* Enlarge chassis hole and use adaptor plate.

FILTER CHOKE

ITEM No.	RATINGS			REPLACEMENT DATA					
	TOTAL DIRECT CURRENT	D. C. RESISTANCE	INDUCTANCE (0 CURRENT 1000 ∿)	NATIONAL PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.
L14	.076A	260Ω	8 Hy.	K317-1	C-1709 ①	C-2995 ①	C-8X	C5015 ①	

① Drill one new mounting hole.

MISCELLANEOUS

ITEM No.	PART NAME	NATIONAL PART No.	NOTES
M1	Dial Light	F136-11	#47, Bayonet
M2	Dial Light	F136-11	#47, Bayonet (meter)
M3	Tuning Cap.	P-705-2	Main tuning - 13-454MMF, 13-454MMF, 13-454MMF
M4	Tuning Cap.	P-706-2	Bandspread - 10-37MMF, 10-37MMF, 10-37MMF
M5	Crystal	E-979-1	Filter - Selectivity
M6	Switch	S-245-1	Band
M7	Switch	T-364-1	Reception
M8	Switch	E230-2	Toggle - Receiver - Standby
M9	Switch	E230-2	Toggle - Tone
M10	Switch	T365-1	Selectivity
M11	Crystal Filter Unit	SB2636	Includes phasing trimmer, M10, M5, C18, C19, R18, L10
M12	Meter	T366-1	
A9	Trimmer Cap.	D832.5	RF (2.2-4MMF) Band A
A12	Trimmer Cap.	D832.5	RF (2.2-4MMF) Band B
A15	Trimmer Cap.	D832.5	RF (2.2-4MMF) Band C
A18	Trimmer Cap.	D832.5	RF (2.2-4MMF) Band D
A8	Trimmer Cap.	E311-2	Osc. (5-20MMF) Band A
A11	Trimmer Cap.	E311-2	Osc. (5-20MMF) Band B
A14	Trimmer Cap.	E311-1	Osc. (2.5-6MMF) Band C
A17	Trimmer Cap.	E311-2	Osc. (5-20MMF) Band D
	Trimmer Cap.	S662-1	Ant. & Phasing (5-50MMF) 2 used
	Knob	SA5292-2	Tuning & bandspread
	Knob	SA9305	7 used
	Knob	SB2644	Antenna