

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
I. <u>INSTALLATION</u>	2
A. Unpacking	2
B. Location	2
C. Power Requirements	2
D. Antenna Requirements	2
E. Speaker Requirements	3
F. Headphone Requirements	3
II. <u>OPERATION</u>	4
A. Control Settings	4
B. Adjusting to Desired Station Frequency	4
C. Dial Calibration	5
D. Accessory Frequency Operation	5
III. <u>SW-4 SPECIFICATIONS</u>	7
IV. <u>SERVICE DATA</u>	9
A. Tubes	9
B. Trouble Shooting	9
C. Alignment	9
 <u>CHARTS & ILLUSTRATIONS</u> 	
Fig. # 1 Rear View	3
Fig. # 2 Block Diagram	12
Fig. # 3 Voltage Chart	13
Fig. # 4 Resistance Chart	13
Fig. # 5 Bottom View	14
Fig. # 6 Top View	15
Fig. # 7 Accessory Frequency Chart	16
Fig. # 8 Schematic Diagram	Fold Out

I. INSTALLATION

A. UNPACKING

Carefully remove the SW-4 from the packing carton and examine it closely for signs of physical damage. Should such damage be apparent, save the box and packing material and notify the delivering carrier. Check all tubes and crystals to make sure they are positioned properly in their sockets. Attached to the front cover of your instruction manual you will find a brown envelope containing hardware and a warranty card. Fill out and mail the warranty card. Store the carton and liners should they be needed later.

B. LOCATION

The location of the SW-4 is not critical. However, the receiver should not be placed in an extremely hot location or where air circulation is severely restricted.

C. POWER REQUIREMENTS

A switch at the rear of the SW-4 permits the selection of 120 or 240 volt AC 50 to 60 cycle operation. The unit is shipped from the factory with this switch in the 120 volt position. For 240 volt operation unplug the power cord and remove the two screws which hold the copper plate over the switch. Slide the switch to the 240 volt side, reverse the copper plate, and replace it with the two screws previously removed. The SW-4 is supplied with 3/4 amp slo-blow fuse (Buss MDL 3/4). NOTE: This fuse should be replaced with a 3/8 amp slo-blow fuse (Buss MDL 3/8) when the SW-4 is changed to 240 volt operation. The fuse holder is located at the top and rear of the chassis.

D. ANTENNA REQUIREMENTS

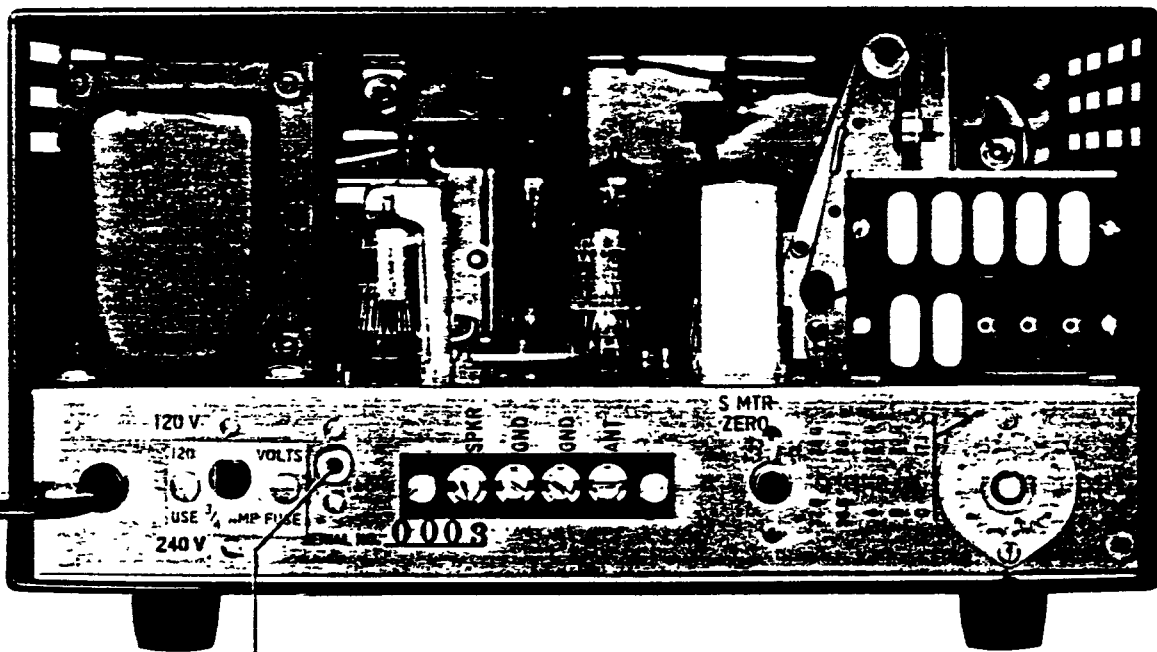
Optimum performance can be achieved by using an antenna resonant at the frequency to be received with an impedance of 50 to 75 ohms. However, the most simple antenna for use with the SW-4 is a length of wire 50 to 75 feet in length. This wire should be attached to the terminal marked ANT. at the rear of the receiver. Such an antenna will work most effectively if it is out-of-doors and in the air as high as is possible. A commercially available antenna (such as the Mosely SWL-7) will satisfy more exacting standards for shortwave listening.

E. SPEAKER REQUIREMENTS

The SW-4 requires a 4 ohm auxiliary speaker. The MS-4 speaker console fulfills this requirement while providing excellent broadcast audio. For correct operation insert the phono plug at the end of the MS-4 cable into the socket marked SPKR at the rear of the SW-4. Screw terminals are also provided on the rear of the SW-4 for connecting a speaker that does not have the phono connector.

F. HEADPHONE REQUIREMENTS

Headphones may be used with the SW-4. We recommend phones having an impedance of 500 to 1000 ohms. A socket for such headphones is provided on the front panel. The plug diameter must be .25 of an inch.



SPKR

FIG. #1 REAR VIEW

II. OPERATION

A. CONTROL SETTINGS

1. To turn on the SW-4 rotate the VOLUME control clockwise. Allow the receiver a short warm-up period before attempting to tune.
2. Move the BAND switch to the position which indicates the frequency range you wish to receive. The BAND switch is calibrated to indicate the lowest frequency in megacycles of that band to be covered. Each band is .5 MC in width. For example: if the BAND switch were turned to the 11.5 MC position, the SW-4 would tune from 11.5 MC's to 12.0 MC's. (Yellow dot)
3. Locate the RANGE MC switch in the position which includes the number to which the BAND switch is set. For example: if the BAND switch were turned to the 11.5 MC position, the RANGE MC switch should be placed in the 10-16 position. (Yellow dot)
4. Position the RANGE PEAK control in the segment which is of the same color as the dots closest to the settings of both the BAND switch and the RANGE MC switch. For example: In the 11.5 MC position the dots will be yellow. NOTE: If all controls are adjusted properly the dots will be of the same color. Turn up the VOLUME control slightly and peak the RANGE PEAK control by moving it (either direction) until maximum noise is heard from the speaker.

B. ADJUSTING TO DESIRED STATION FREQUENCY

The SW-4 has the unique capability to be set exactly on the frequency where a station may be expected to broadcast.

To do this, the "BAND" knob selects a quartz controlled fixed frequency, slightly lower than the desired frequency. To this is added by the TUNE knob a smaller accurately adjustable frequency* so that the sum of the two is equivalent to the desired frequency. This provides a frequency that is very stable and still precisely adjustable.

Follow these 3 steps to set the station frequency.

- a. Set "BAND" switch to largest number which does not exceed the station frequency.

* The adjustable part of the frequency is equal to $b + c$.

- b. Turn TUNE knob to add main dial number (window). Turn to number which is largest that can be added to "a" without exceeding station frequency. Stop knob at "0" on knob skirt.
- c. Turn knob slowly C.C.W. (counter clock wise) to set knob skirt at number needed to bring sum of a. + b. + c. to the desired station frequency. (note knob skirt is calibrated 0 - 25 KC which is 0 - .025 MC)

Example 1. Desired station frequency 6.468 MC.

- a. 6.0 "BAND" setting
- b. .45 Main dial (approx.)
- c. .018 Knob skirt (18 KC) C.C.W.
- 6.468 Desired station frequency.

Example 2. Desired station frequency 17.807 MC.

- a. 17.5 "BAND" setting
- b. .300 Main dial (approx.)
- c. .007 Knob skirt (7 KC) C.C.W.
- 17.807 Desired station frequency.

C. DIAL CALIBRATION

The dial in the SW-4 may be calibrated using the known frequency of the National Bureau of Standards WWV at 10 MC. Turn the BAND switch to the 9.5 position (Orange dot) and set the RANGE MC control to the 6 - 10 position. Turn the tuning knob to the 1.000 reading and peak the RANGE PEAK control for maximum noise. At this point or very near it the pulsating beat of WWV should be heard. Slide the dial skirt so the zero is lined up with the mark-on the front panel. Adjust the main dial pointer, with the red post to the right of the dial window, until it is directly in line with the 1.000 reading and at the loudest portion of the WWV signal.

D. ACCESSORY FREQUENCY COVERAGE

Three additional frequency bands .5 megacycles in width may be received between 1.5 and 30.0 megacycles excluding 5.0 to 6.0 megacycles. Extra crystals are required for such accessory operation and are to be inserted in the three unused sockets at the left rear of the chassis.

In order to tune in an accessory frequency, first position the BAND switch to a position corresponding to the crystal socket in which the accessory crystal is inserted. Then set the RANGE MC switch to the setting indicated on the Accessory Frequency Chart for that particular accessory band.

Set the Tuning Dial in exactly the same manner as for normal operation; i.e. the main dial (window), and knob skirt readings (steps b and c) are added to the frequency of the low limit of the accessory band. (This corresponds to the BAND switch number in step a.)

You will note that the RANGE PEAK control has several arcs of various lengths and positions. There is an arc for each setting of the RANGE MC switch. For the approximate position of the knob, estimate the received frequency within the limits of the correct arc and then peak for maximum noise or S-meter reading.

In order to determine the crystal frequency to use for a desired accessory band, consult the Accessory Frequency Chart near the rear of this book. All crystals listed on this chart may be obtained by writing to the R. L. DRAKE COMPANY, Service Department. When ordering please mention your receiver by model number (SW-4) and mention the frequency band (from the Accessory Frequency Chart) that you wish to receive. All SW-4 crystals may be purchased for \$5.00 (U.S. funds) each.

Example: Desired frequency is 1.935 Megacycles.

Crystal frequency	12.6 MC (from chart)
BAND setting/socket	A, B, or C
RANGE MC setting	1.5 - 3 (from chart)
RANGE PEAK	Peaked in C.C.W. third of 1.5 - 3 arc.

a.	1.5	Low limit of band (from chart)
b.	.425	Main tuning dial (window) setting
c.	<u>.010</u>	Tuning knob skirt 10 kilocycles C.C.W.
	1.935 MC	Desired frequency

III SPECIFICATIONS

A. PERFORMANCE

FREQUENCY COVERAGE - 6.0 - 6.5 MC, 9.5 - 10.0 MC, 11.5 - 12.0 MC, 15.0 - 15.5 MC, 17.5 - 18.0 MC, 21.5 - 22.0 MC, and 25.5 - 26.0 MC with crystals supplied. Three accessory crystal sockets are provided for coverage of any three additional 500 KC ranges between 1.5 and 30 MC with the exception of 5.0 - 6.0 MC.

SELECTIVITY - 5 KC at 6 DB down and 16 KC at 60 DB.

I.F. FREQUENCIES - First I.F. - 5645 KC crystal lattice filter, second I.F. - 455 KC.

STABILITY - Less than 100 cycles after warm-up. Less than 100 cycles for 10% line voltage change.

SENSITIVITY - Signal to noise ratio of 10 DB with less than 2 uv input signal modulated 30%.

MODE OF OPERATION - AM

DIAL CALIBRATION - Main dial (window) calibrated 0 - .500 MC and .500 to 1.000 MC in 5 KC divisions. Vernier dial calibrated 0 to 25 KC in 1 KC divisions.

CALIBRATION ACCURACY - \pm 5KC if dial is set to known frequency within the band.

AGC - Amplified delayed. 3 DB change in AF output with 60 DB change in RF input.

AUDIO OUTPUT - 2 watts at 5% H.D., 3 watts maximum.

AUDIO OUTPUT IMPEDANCE - 4 ohms

ANTENNA INPUT - 52 ohms nominal

B. TUBE AND SEMICONDUCTOR COMPLEMENT

12BZ6	RF Amp
6HS6	1st Mixer
6HS6	Premixer
12BE6	2nd Mixer
12BA6	1st I.F. Amp
12BA6	2nd I.F. Amp
12AV6	AGC Amp
12AX7	Phase inverter/AF Amp
2 - 6AQ5	Push-pull AF output
2N3858	VFO
2N3858	VFO Buffer
2N3394	Xtal Oscillator
2 - 1N3194	Power Supply Rectifiers
1N3194	Bias Rectifier
1N714	Voltage Regulator
SG952A	Detector

C. GENERAL SPECIFICATIONS

FRONT PANEL CONTROLS - Band Switch, Range Peak, Range MC, Tone, Volume/On-Off, Headphone Jack, and Main Tuning.

REAR CONTROLS & CONNECTIONS - S-Meter Zero, 120/240 Volt Switch, Speaker Connections, and Antenna Connections.

POWER CONSUMPTION - 45 Watts, 120/240 VAC, 50/60 Cycles.

DIMENSIONS - 5-1/2" high, 10-3/4" wide, cabinet depth 11-5/8", overall depth 12-1/4", weight 16 lbs.

V. SERVICE DATA

A. TUBES

Most trouble experienced in the operation of radio equipment is a result of tube failure. The SW-4 was designed so that realignment is not required when tubes are changed. The most effective way to find a defective tube is to observe receiver performance after replacement with a tube known to be good.

B. TROUBLE SHOOTING

If some difficulty is suspected that cannot be linked directly to tube failure, we would recommend contacting our Service Department, giving a full description of the problem so that the difficulty can be eliminated rapidly.

DO NOT RETURN EQUIPMENT FOR SERVICE UNLESS PRIOR AUTHORIZATION IS OBTAINED.

Equipment to be returned for service should be repacked in its original shipping carton. Include a sheet on which you describe the SW-4's physical and electrical condition at time of shipment.

Voltage and resistance charts for the SW-4 are provided in this section so that qualified technicians can isolate minor problems. We do not recommend that service be attempted unless the technician is especially competent and is thoroughly familiar with modern service techniques. Service can be performed more rapidly and accurately at our factory.

Should any part be required to assure proper performance in the SW-4, write to our Service Department giving its designation from the schematic and we will supply information concerning delivery and cost.

C. ALIGNMENT

Alignment of the SW-4 will require the following equipment.

1. A reasonably stable signal generator having a frequency range from 1.5 to 30 MC's and a variable output level.
2. An 11 megohm Vacuum Tube Volt Meter (VTVM).
3. A 12.6 MC series resonant crystal if 1.5 - 3 range is to be aligned.
4. A 14.6 MC series resonant crystal if 3 - 5 range is to be aligned.
5. Two - 10 K ohm, 1/2 watt composition resistors.

6. An accurate rule with 1/32" divisions.

Before alignment is attempted the SW-4 should be turned on and allowed to operate for at least 1/2 hour.

455 KC I.F. ALIGNMENT

1. Connect the signal generator to Pin 7 of V3 and adjust its frequency to 5645 KC. Attach the VTVM DC probe to Pin 7 of V7.
2. Adjust the signal generator output until approximately -2 volts is indicated on the VTVM.
3. Adjust T6, T7, and T8 top and bottom for maximum VTVM negative indication while readjusting the output of the signal generator to prevent this negative voltage from exceeding -2.5 volts.
4. Remove the VTVM and signal generator.

CRYSTAL FILTER AND FILTER MATCH TRANSFORMER ALIGNMENT

1. Attach the signal generator to Pin 1 of V2 and set the generator frequency to 5645 KC.
2. Rock the generator frequency back and forth slightly across 5645 KC until a peak S-meter reading is obtained. Adjust the generator output level until the S-meter reads approximately S9 on the peak.
3. Increase the signal generator frequency slightly while watching the S-meter. You will note that the S-meter will start to drop. Continue increasing the generator frequency until the S-meter reading drops to S5.
4. Then adjust T5 and T6 for maximum reading.
5. Remove the signal generator from V2.

ANTENNA RF AND INJECTION CIRCUIT ALIGNMENT

1. Turn off receiver and temporarily connect a 10 K resistor from the side rotor contact of S5C to ground and from the corresponding contact of S5D to the nearby terminal strip terminal to which the blue and white striped B+ wire is attached. S5C and S5D are the 3rd and 4th Bandswitch wafers as viewed from the front of the receiver. You will note that each of these switches has two rotor contacts. The ones to use are the most easily accessible. All rotor contacts are green in color.

2. Disconnect the antenna and connect the signal generator across the antenna terminals.
3. Install the 12.6 MC crystal and the 14.6 MC crystal in the A and B accessory sockets respectively for alignment of the 1.5 - 3 and 3 - 5 RANGE MC positions.
4. Turn the RANGE PEAK control fully clockwise against the stop and make sure that the pointer points directly toward the K in the work PEAK. If it does not, loosen the set screw and reposition the knob until it indicates correctly.
5. Carefully measure the distance from the top of the white sleeves protruding from the top of T1, T2, T3 and T4 to the tops of their respective cores. This distance should be exactly 9/16". If necessary, adjust the cores to this setting. (This was done at the factory and should be correct). Check measurements accurately before altering the positions of any of these cores.
6. Turn on the receiver, set the BAND switch to 25.5, the RANGE MC switch to 23 - 30 position and set the RANGE PEAK control to the counterclockwise end of the purple segment.
7. Set the main tuning dial to the 0.000 setting and set the generator to 25.5 MC's so that a strong signal is indicated on the receiver S-meter. Adjust the generator output for no more than an S9 reading on the S-meter.
8. Adjust all 4 trimmers marked 23 - 30 for maximum S-meter reading.
9. Repeat 6, 7 and 8 using the BAND, RANGE MC, RANGE PEAK and signal generator settings indicated in the following chart.

<u>RANGE</u>	<u>RANGE MC</u>	<u>RANGE PEAK</u>	<u>GENERATOR</u>	<u>DIAL</u>
25.5	23 - 30	CCW end of purple line	25.5 MC	0.000
21.5	16 - 23	CCW end of dark blue line	21.5 MC	0.000
9.5	6 - 10	CCW end of orange line	9.5 MC	0.000
B	3 - 5	[Tops of cores flush with [tops of white coil sleeves	3.8 MC	.800
A	1.5 - 3		1.9 MC	0.900

10. Turn off receiver and remove the two 10 K resistors installed previously. This completes the alignment procedure.

VFO ADJUSTMENT

The permeability tuned VFO was carefully adjusted at the factory and should require no further alignment.

If you notice the same error in the dial from one end of the band to the other, and you cannot correct it with the moveable dial index, the main dial may be slipped on its shaft enough to bring the calibration back into range.

S-METER ADJUSTMENT

1. With the SW-4 turned on and thoroughly warmed up, disconnect the antenna and detune the RANGE PEAK control until no signals are heard.
2. Adjust the S-meter Zero control, located on the rear of the chassis, until an S-meter reading of S-1 is obtained.

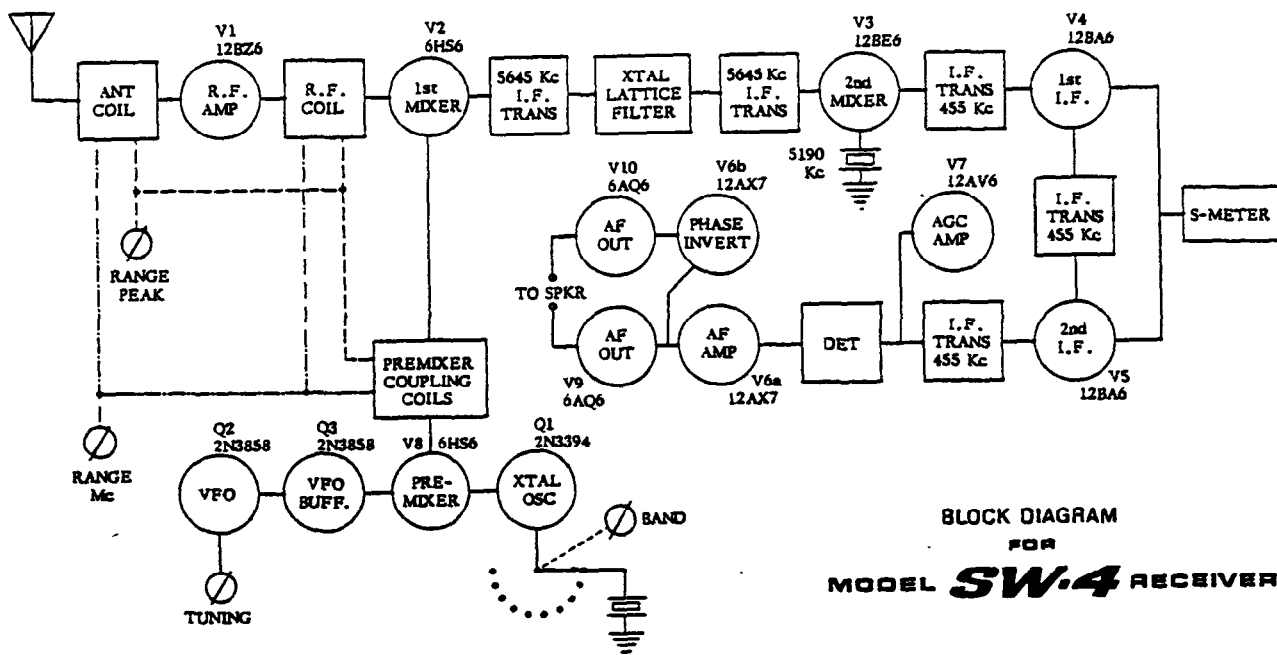


FIGURE 2

Fig. # 3 VOLTAGE CHART

Number	Type	1	2	3	4	5	6	7	8	9
V1	12BZ6	-1.25	1.5	0	12.6*	145	130	0		
V2	6HS6	0	0	12.6*	6.3*	140	84	2.5		
V3	12BE6	-13	2.8	0	12.6*	143	137	0		
V4	12BA6	-1.25	0	0	12.6*	140	76	1.3		
V5	12BA6	-1.25	0	0	12.6*	140	76	1.4		
V6	12AX7	86	-.8	0	0	12.6*	76	-.8	0	N.C.
V7	12AV6	-80	-66	12.6*	0	N.C.	N.C.	-1.25		
V8	6HS6	0	0	0	6.3*	150	120	2.7		
V9	6AQ5	0	9.2	6.3*	0	160	160	N.C.		
V10	6AQ5	0	9.2	12.6*	6.3*	160	160	N.C.		

NOTE:

1. All measurements made with 11 megohm VTVM.
2. Unit connected to 120 VAC 60 cycles.
3. An * indicates AC voltage.
4. Antenna is disconnected and no station is tuned in.
5. VOLUME control is fully clockwise. Position of the other controls is unimportant.

Fig. # 4 RESISTANCE CHART

Number	Type	1	2	3	4	5	6	7	8	9
V1	12BZ6	4.8M	150	0	F11	8K	8K	0		
V2	6HS6	2.2M	0	F11	F11	8.5K	220K	2.2K		
V3	12BE6	150K	330	0	F11	8.5K	85K	330K		
V4	12BA6	3.3M	0	0	F11	8.5K	33K	330		
V5	12BA6	3.3M	0	0	F11	8.5K	33K	330		
V6	12AX7	220K	6.8M	6.8	0	F11	380K	6.8M	0	N.C.
V7	12AV6	200K	70K	F11	0	N.C.	N.C.	2.2M		
V8	6HS6	330K	0	0	F11	5.8K	30K	470		
V9	6AQ5	335K	220	F11	0	5.5K	6K	N.C.		
V10	6AQ5	330K	220	F11	F11	5.5K	6K	N.C.		

NOTE:

1. Unit disconnect from AC line.
2. Control positions are unimportant.

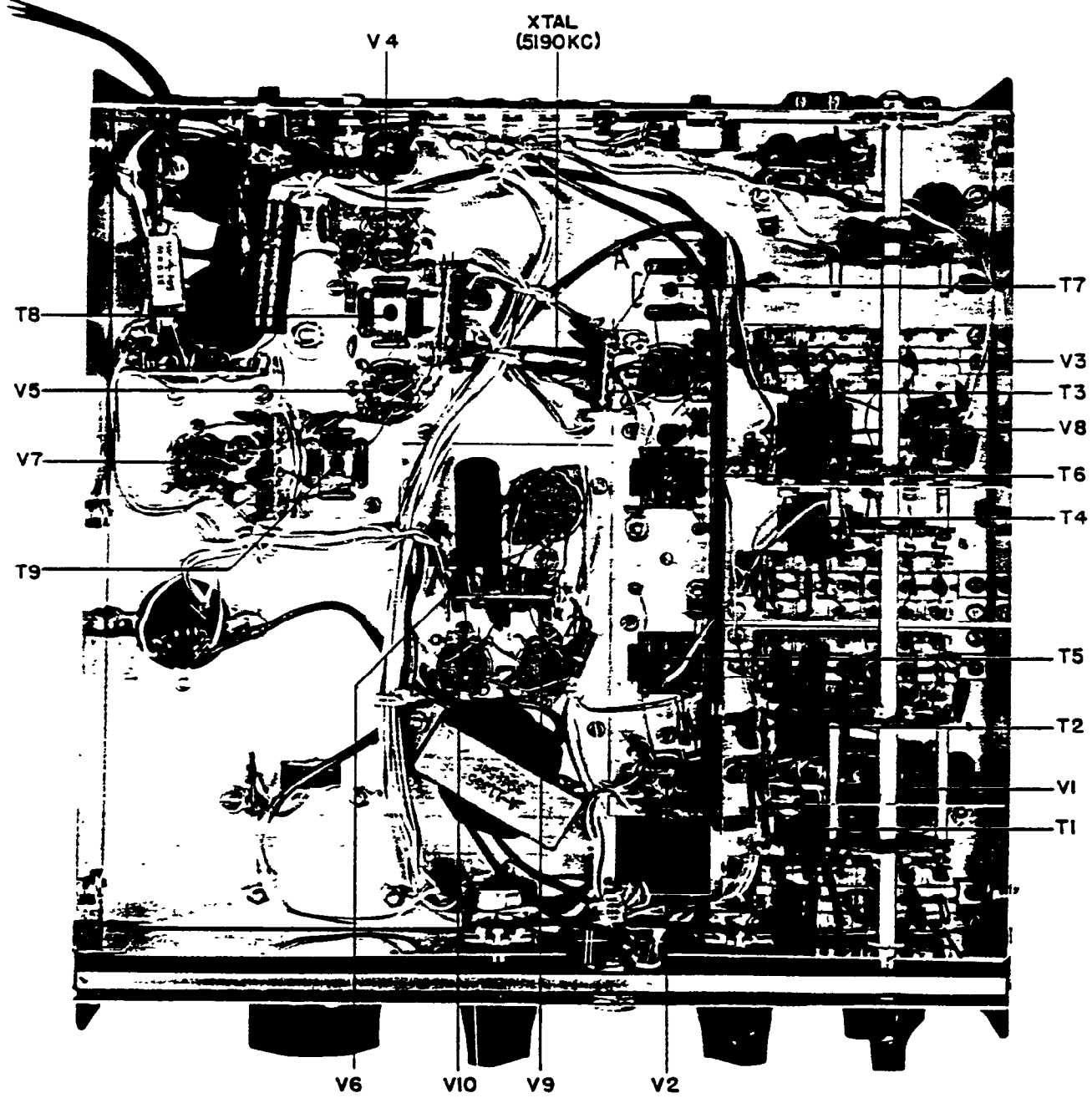


FIGURE 5 BOTTOM VIEW

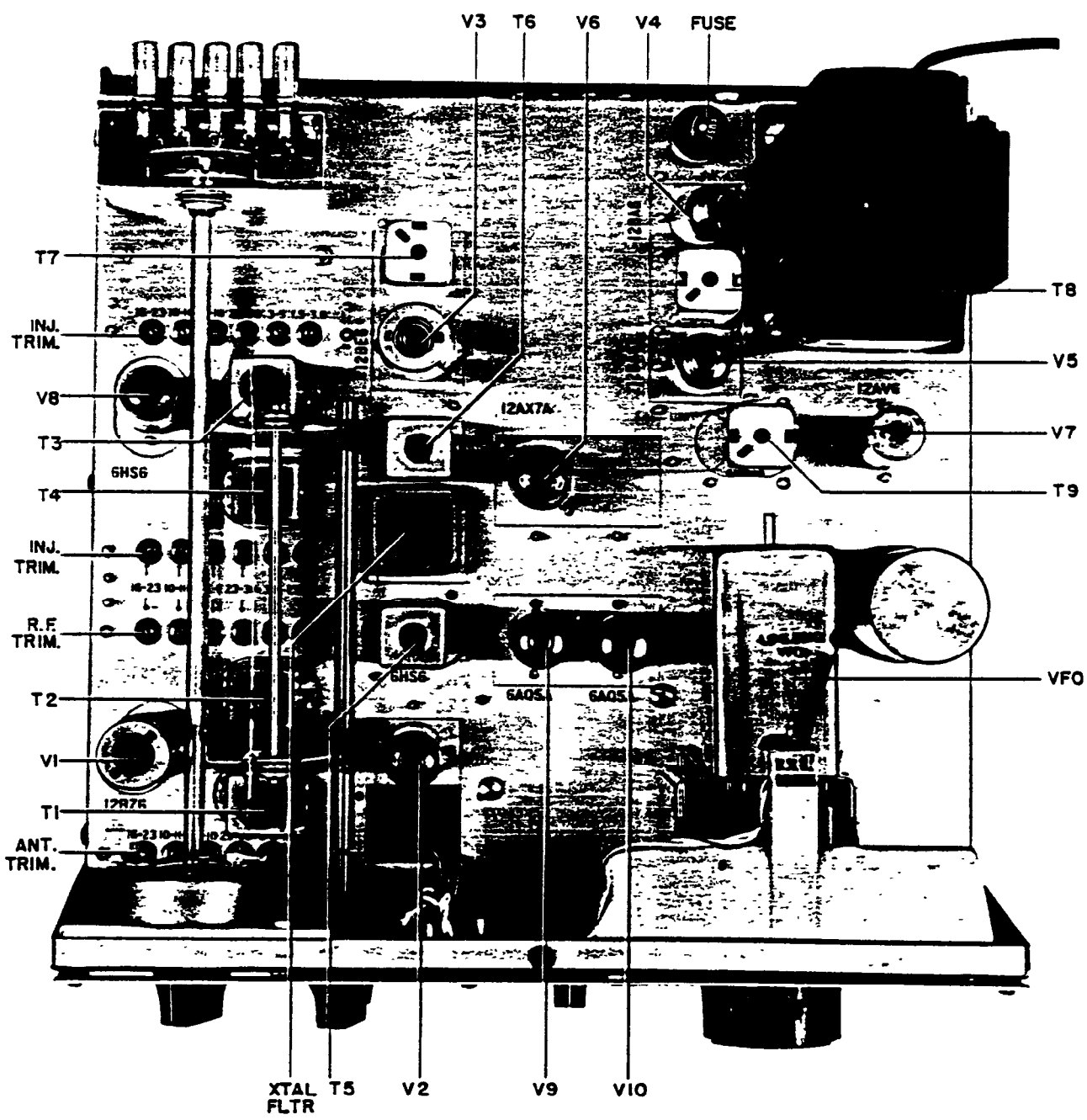


FIGURE 6 TOP VIEW

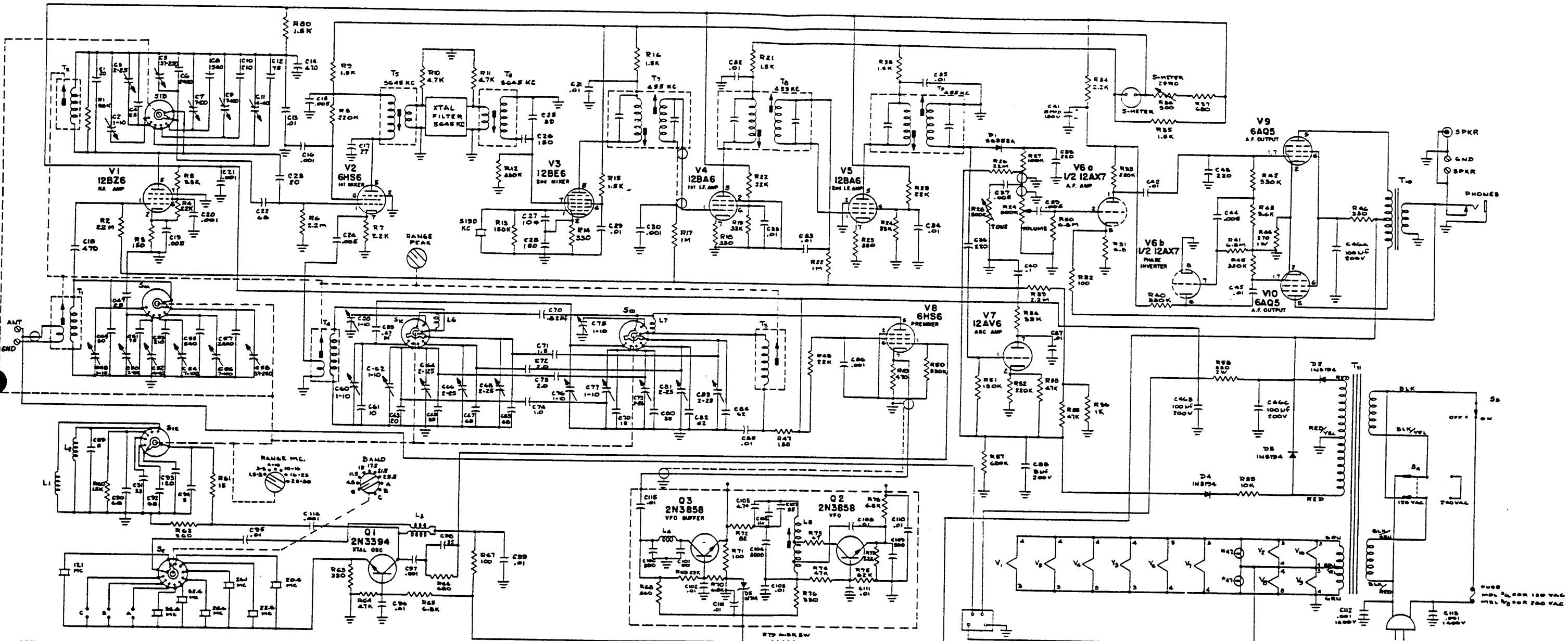
Figure #7 ACCESSORY FREQUENCY CHART

<u>FREQ. BAND</u>	<u>CRYSTAL</u>	<u>RANGE MC. SW</u>	<u>FREQ. BAND</u>	<u>CRYSTAL</u>	<u>RANGE MC. SW</u>
1.5 - 2.0	12.6	1.5 - 3	16.5 - 17.0	27.6	16 - 23
2.0 - 2.5	13.1	1.5 - 3	17.0 - 17.5	28.1	16 - 23
2.5 - 3.0	13.6	1.5 - 3	17.5 - 18.0	28.6*	16 - 23
3.0 - 3.5	14.1	3 - 5	18.0 - 18.5	29.1	16 - 23
3.5 - 4.0	14.6	3 - 5	18.5 - 19.0	29.6	16 - 23
4.0 - 4.5	15.1	3 - 5	19.0 - 19.5	30.1	16 - 23
4.5 - 5.0	15.6	3 - 5	19.5 - 20.0	30.6	16 - 23
6.0 - 6.5	17.1*	6 - 10	20.0 - 20.5	31.1	16 - 23
6.5 - 7.0	17.6	6 - 10	20.5 - 21.0	31.6	16 - 23
7.0 - 7.5	18.1	6 - 10	21.0 - 21.5	32.1	16 - 23
7.5 - 8.0	18.6	6 - 10	21.5 - 22.0	32.6*	16 - 23
8.0 - 8.5	19.1	6 - 10	22.0 - 22.5	33.1	16 - 23
8.5 - 9.0	19.6	6 - 10	22.5 - 23.0	33.6	16 - 23
9.0 - 9.5	20.1	6 - 10	23.0 - 23.5	34.1	23 - 30
9.5 - 10.0	20.6*	6 - 10	23.5 - 24.0	34.6	23 - 30
10.0 - 10.5	21.1	11 - 16	24.0 - 24.5	35.1	23 - 30
10.5 - 11.0	21.6	11 - 16	24.5 - 25.0	35.6	23 - 30
11.0 - 11.5	22.1	11 - 16	25.0 - 25.5	36.1	23 - 30
11.5 - 12.0	22.6	11 - 16	25.5 - 26.0	36.6*	23 - 30
12.0 - 12.5	23.1	11 - 16	26.0 - 26.5	37.1	23 - 30
12.5 - 13.0	23.6*	11 - 16	26.5 - 27.0	37.6	23 - 30
13.0 - 13.5	24.1	11 - 16	27.0 - 27.5	38.1	23 - 30
13.5 - 14.0	24.6	11 - 16	27.5 - 28.0	38.6	23 - 30
14.0 - 14.5	25.1	11 - 16	28.0 - 28.5	39.1	23 - 30
14.5 - 15.0	25.6	11 - 16	28.5 - 29.0	39.6*	23 - 30
15.0 - 15.5	26.1*	11 - 16	29.0 - 29.5	40.1	23 - 30
15.5 - 16.0	26.6	11 - 16	29.5 - 30.0	40.6	23 - 30
16.0 - 16.5	27.1	16 - 23			

* Supplied with receiver

NOTE: If a frequency band is desired which does not begin with an even megacycle or half megacycle and is thus not noted on the above chart, the crystal frequency can be determined by adding 11.1 MC to the lowest frequency of the band to be covered.

Example: To tune from 3.8 to 4.3 MC add 11.1 to 3.8 MC. The crystal frequency would then be 14.9 MC.



NOTE:
 Capacitors marked 1.0 to 3000 are in pf and capacitors from .001 to .47 are in uf unless otherwise noted.
 Resistors in VFO are 1/4 watt 10%. All others are 1/2 watt unless otherwise noted.
 * indicates value selected in production
 All switches viewed from front in counterclockwise position.

ACCESSORY SOCKET (BOTTOM VIEW)

SCHEMATIC DIAGRAM MODEL SW-4 RECEIVER