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Section I  
Specifications1.1 TUNING RANGES

<u>Band</u>	<u>Frequencies Tuned (Megahertz)</u>		
.2	.150	to	.500
.5	.450	to	1.050
1.0	.950	to	1.550
6.0	5.950	to	6.550
7.0	6.950	to	7.550
9.5	9.450	to	10.050
11.5	11.450	to	12.050
15.0	14.950	to	15.450
17.5	17.450	to	18.050
21.5	21.450	to	22.050
25.5	25.450	to	26.050

1.2 SENSITIVITY

The SW-4A has a signal-to-noise ratio of 10 decibels with an input signal of 1 microvolt (3 microvolt on .2 band) when the input signal is modulated 30% with 400 Hertz. Simply stated, this means that you get 10 times as much signal output as noise output from your receiver when you have a signal as small as 1 millionth of a volt on your antenna.

1.3 SELECTIVITY

The SW-4A has a bandwidth of 5 kilohertz at 6 dB down and 16 kilohertz at 60 dB down. This selectivity gives adequate bandwidth for optimum reception without allowing significant interference from stations operating near the frequency to which you are tuned.

1.4 ANTENNA

The nominal input impedance of the antenna circuit is 52 ohms. This provides excellent reception characteristics with most commercial short-wave antennas, while also giving good performance with properly installed long-wire antennas.

1.5 DIAL CALIBRATION

The tuning dial of the SW-4A is accurate to + 3 KHz after calibration on a particular band.

1.6 OUTPUT

Output impedances of 4 and 8 ohms are provided, The SW-4A has a maximum audio output (volume) of 3 watts, At a 2 watt level, the harmonic distortion is 5%.

Section I  
Specifications1.7 STABILITY

After a five minute warm-up, the SW-4A will not drift more than 100 Hertz above or below the frequency to which it is tuned, A 10% change in line voltage, either above or below the nominal value , will cause a frequency shift of not more than 100 Hertz.

1.8 INTERMEDIATE FREQUENCIES

The first conversion is made at a frequency of 5,645 megahertz, the second at .455 megahertz. A crystal lattice filter is used in the first conversion.

1.9 AUTOMATIC GAIN CONTROL

An amplified-delayed automatic gain control circuit is used in the SW-4 A 90 dB change in R,F, input causes a 3 dB change in audio output, In other words, the volume from the SW-4A does not change much from very weak signals to very strong signals.

1.10 POWER

The power consumption of the SW-4A is 30 watts.

1.11 DIMENSIONS

The SW-4A is 5-1/2 inches high, 10-3/4 inches wide, and 12-1/4 inches deep, It weighs 16 pounds.

1.12 TUBES AND SEMICONDUCTORS

The SW-4A uses 6 tubes, 7 transistors, and 8 semiconductor diodes, These are listed on the next page.

Section I  
Specifications1.12 TUBES AND SEMICONDUCTORS (cont'd.)

<u>Identification</u>	<u>Type</u>	<u>Function</u>
v1	12BZ6	Radio frequency amplifier
v2	6HS6	First mixer
v3	12BE6	Second mixer
v4	12BA6	First intermediate frequency amplifier
v5	12BA6	Second intermediate frequency amplifier
v6	6HS6	Premixer
Q1	2N3394	Crystal oscillator
Q2	2N3858	Buffer for variable frequency oscillator
Q3	2N706	Variable frequency oscillator
Q4	2N3858	Automatic gain control amplifier
Q5, Q6	2N3394	Audio frequency amplifiers
Q7	RCA 40310	Audio output
D1	1N483	Automatic volume control clamp
D2	1N714	Voltage regulator
D3	1N270	Detector
D4	1N3194	Bias rectifier
D5, D6, D7, D8	1N3194	Power supply rectifiers

Section II  
Installation2.1 UNPACKING

Carefully remove the receiver from the shipping carton, and examine it for evidence of damage. If any damage is discovered, immediately notify the transportation company that delivered the receiver. Be sure to keep the shipping carton and packing material, as the transportation company will want to examine them if there is a damage claim. Keeping the carton and packing material is recommended even when no shipping damage occurs, as having the original carton available makes shipment of the receiver much easier should it ever be necessary to return it to the factory for service.

On the front of this manual you will find a brown envelope, which contains a warranty card and some hardware. Fill out the warranty registration card and mail it. Lay the hardware aside temporarily. Turn your SW-4A so the rear of the cabinet is facing you, and check that all tubes and crystals are firmly in their sockets.

2.2 LOCATION

The SW-4A will work well in almost any location. Avoid placing it in an extremely hot area (such as over a radiator), and do not restrict air circulation around the receiver. It is best to leave an inch or more clearance on each side of the receiver.

2.3 ANTENNAS

Your SW-4A is an excellent receiver, and should be used with an adequate antenna system. A carefully installed long wire antenna, 50 to 75 feet in length, and located as high in the air as possible, will give good reception with the SW-4A. Commercially available antennas, such as the Mosely SWL-7, will give even better results. In any case, a standard radio lightning arrester should be installed in the antenna lead. The antenna lead is connected to a screw terminal (marked ANT) on the rear of the receiver. For .15 - 1.5 megahertz use the accessory DRAKE AL-4 Shielded Directional Loop Antenna if directional reception is desired.

2.4 SPEAKER

The SW-4A requires an external speaker, which may have an impedance of 4 or 8 ohms. The Drake MS-4 Speaker, housed in a cabinet that matches the SW-4A, provides excellent audio reproduction and comes equipped with a cable terminated in a phono plug matching the 4 ohm output socket of the receiver. Screw terminals, marked 8 ohms and GND are provided on the rear of the SW-4A for connection of speaker leads if an 8 ohm speaker is used. (See Figure 1).

## 2.5 HEADPHONES

Headphones having an impedance of 500 to 1000 ohms may be used with the SW-4A. Best results will be obtained with a set of good quality 600 ohm headphones. The headphone connection is made through the socket marked PHONES at the bottom center of the front panel of the receiver, A standard 1/4 inch phono plug will mate with this socket. Connecting the headphones to the receiver will shut off the speaker output.

## 2.6 POWER

Your SW-4A was shipped from the factory ready for operation from a 120 volt 50 to 60 Hertz (cycles per second) power line. A 3/4 ampere slo-blow fuse (Buss type MDL 3/4) is installed in the fuseholder at the rear of the chassis. If your receiver is to be operated on 120 volts, no changes need be made.

If your line voltage is 240 volts, your receiver is easily adapted to operation at that voltage. Make sure the power cord is not connected. Turn the receiver so the rear of it is facing you. At the left side of the receiver, (see Figure 1) near the place where the power cord passes through the chassis, is a switch. A copper plate surrounds the switch handle, and the plate is marked "120 volts", use a 3/4 amp. fuse. Remove the two (2) screws holding the copper plate to the chassis, remove the plate, and push the sliding handle of the switch down as far as it will go. Turn the copper plate so the side marked "240 volts use 3/8 amp. fuse" is toward you, and place the plate in position around the switch handle. Install the two (2) screws to hold the copper plate in place, Remove the knurled cap from the fuse holder (next to the power transformer on the top rear of the chassis) and remove the 3/4 ampere fuse, Obtain and install 3/8 ampere slo-blow fuse (Buss type MDL 3/8) in the fuseholder and tighten the fuseholder cap, Your receiver is now ready for operation on 240 volts.

## 2.7 GROUNDING

The receiver should be connected to a ground that is as near as possible to earth potential. A cold water pipe will usually make a satisfactory ground connection, Either of the screw terminals marked GND may be used for this connection, Use a commercial ground clamp for fastening the ground wire to the water pipe, and make sure the clamp makes solid physical contact with the pipe.

## 2.8 VIEWING ANGLE OPTIONS

As supplied, your SW-4A sits with its base parallel to the mounting surface, as its front panel vertical to the mounting surface. Using the hardware that was packed with your warranty registration card, it is possible to change the viewing angle. The top illustration in Figure 2 shows the SW-4A as supplied, To change to the other mounting shown in Figure 2, it is necessary to remove

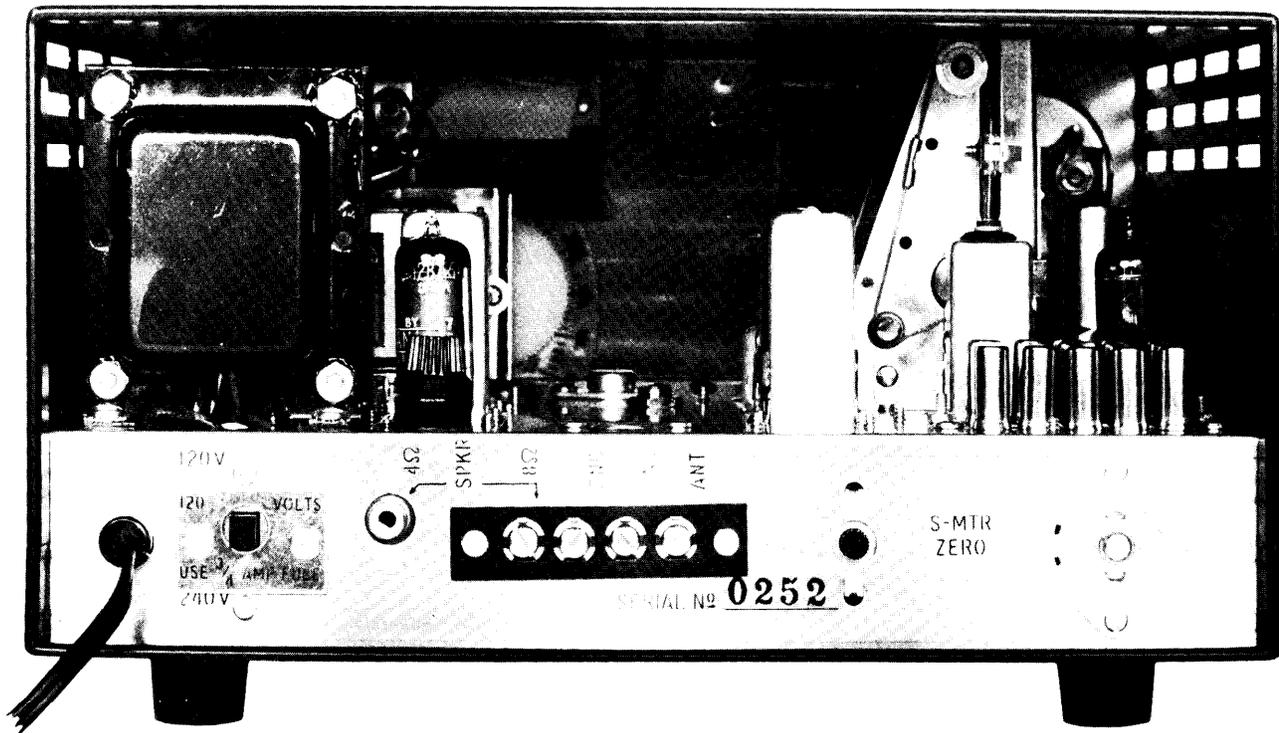
Section II  
Installation

FIG. 1 REAR VIEW SW-4A

the bottom cover of your SW-4A. To do this, first obtain a piece of soft material, such as a rubber mat or a blanket, and place it on the work surface. Turn the SW-4A upside down, and set it on its top cover, on the mat. You will note two rows of three screws each on each side of your receiver. To remove the bottom cover, remove the rows of three screws that are nearest the bottom cover, and lift the cover from the receiver.

Next, remove the screws holding the rear mounting feet to the receiver, Near the holes from which you removed the screws are two other holes,, Take the small hemispherical rubber feet that were supplied, and snap the cylindrical portion of these into the holes next to the screw holes,, If you want the viewing angle shown in Option #1, all that remains to be done is to put the bottom cover back onto your receiver.

For mounting as shown in Option #2, remove the front mounting feet, invert them, and remount them on the original mounting screws. Then take the two threaded studs supplied (these look like bolts without heads) and thread them into the bottom of the inverted mounting feet. Now screw the mounting feet that were removed from the rear of the receiver onto the protruding studs, (See detail drawing at bottom of Figure 2).

Section II  
Installation2.9 ACCESSORIES

In addition to the MS-4 matching speaker, a special loop antenna, Model AL-4 is available.

ASSEMBLY AND USE OF THE ACCESSORY AL-4 LOOP ANTENNAAssembly

Your AL-4 Loop Antenna is shipped in five separate pieces; 4 struts and 1 body piece. The body piece has a length of coaxial wire attached at the handle-plug and attached to the wire are 4 eyelets. To assemble the AL-4, first insert the 4 struts into the 4 holes in the aluminum disc part of the body piece. Either end may be inserted. It will probably be easiest to do this with the antenna lying horizontally on a table. Next insert 3 of the eyelets into the ends of 3 of the struts. The 4th eyelet is then inserted into the 4th strut by bending this strut up out of the plane of the other struts; be careful not to bend excessively so that it will take a permanent set. When the struts and eyelets are in place, the struts should form shallow "S's". This completes the assembly of the AL-4 Loop Antenna.

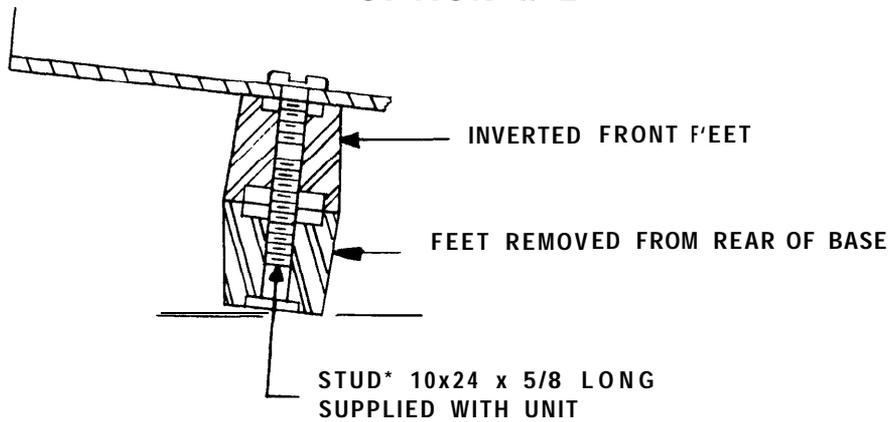
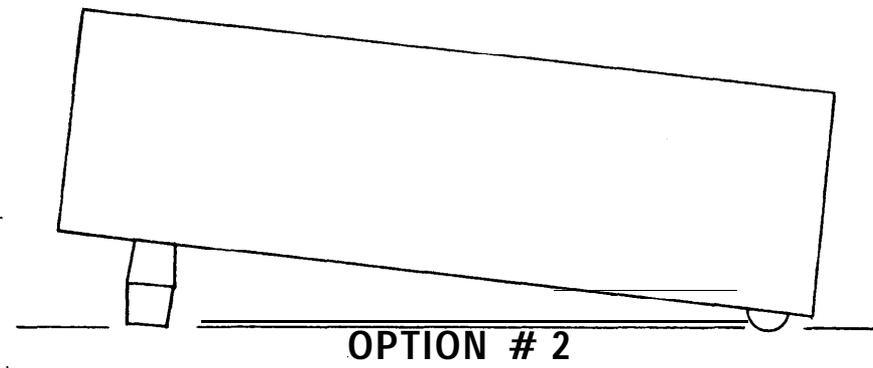
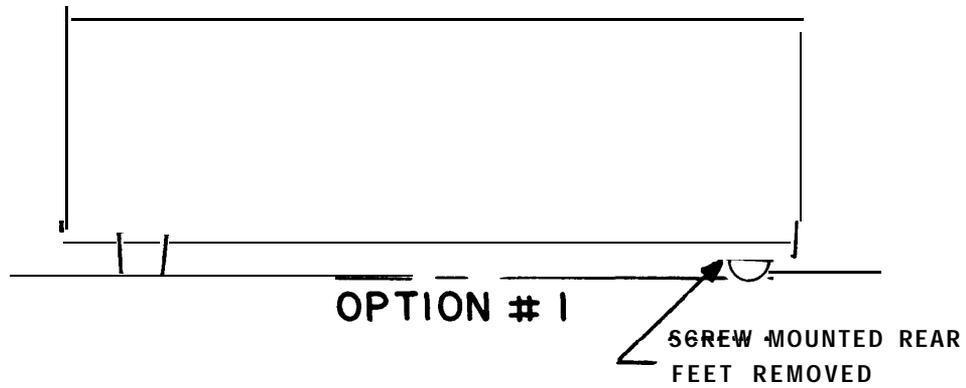
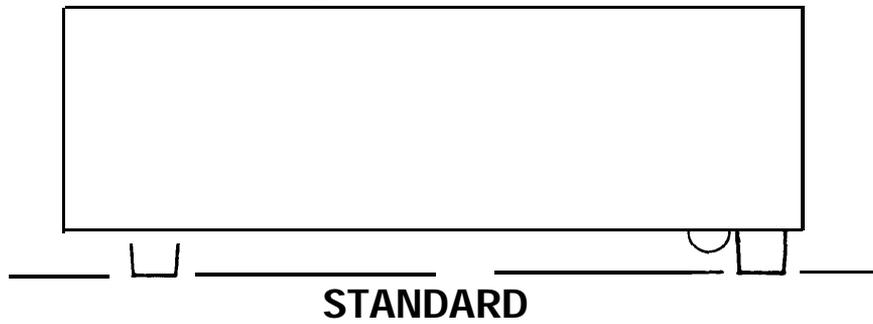
Use

The AL-4 Loop Antenna handle should be inserted into the hole on the top of the SW-4A Shortwave Listening Receiver cabinet, and the plug inserted in the jack on top of the chassis. The AL-4 is intended for use primarily on the 3 lowest bands. For directional effect, disconnect any antenna connected to the antenna terminal at the rear of the chassis. The antenna is directional in that it has a very sharp null in two directions. When using the AL-4 (or any other antenna) quite often there will be interfering stations operating on the same frequency. To best receive the desired signal, in the presence of an interfering station, the AL-4 should be rotated until the interfering station is "nulled" out. When there is no interfering station, rotate the loop for maximum strength of the desired signal.



VIEWING ANGLE OPTIONS

Fig 2



### 3.1 CONNECTIONS

Connect an antenna, a ground wire, and a speaker (or headphones) to your SW-4A, following the instructions in Section II. Do not connect the receiver to the powerline until you have become familiar with the information in Paragraphs 3.2 through 3.9.

### 3.2 OPERATING CONTROLS

The operating controls of your SW-4A are identified, by number, in Figure 3. The use of these controls is described below.

### 3.3 VOLUME ON-OFF

With this control knob (1) in its extreme counterclockwise position no power is applied to the receiver. Clockwise rotation of this control knob trips a switch which turns on the receiver. Continued rotation of the knob in the clockwise direction increases the volume of sound produced by the receiver.

### 3.4 TONE

The tone control knob (2) enables you to adjust the tone of your receiver to suit your personal taste. With the knob adjusted to the clockwise end of its range, the widest audio response is obtained. Counterclockwise rotation of this control knob will decrease the treble response, and thus is useful in suppressing hiss or noise.

### 3.5 BAND

Rotation of the band selector knob (3) connects the proper radio frequency circuits for each frequency band tuned by your SW-4A. The numbers encircling the knob indicate the base frequency in each band, with the frequencies being expressed in megahertz. (The Hertz is a recently adopted standard unit of frequency, one Hertz being one cycle per second. This usage was recommended by the International Organization for Standardization and the International Electrotechnical Commission. All frequencies in this manual are expressed in Hertz. No confusion should result, for the change is one of name only. Thus 60 cycles per second becomes 60 Hertz, 583 kilocycles per second becomes 583 kilohertz, 15.55 megacycles per second becomes 15.55 megahertz, and so on.

To illustrate the function of the band selector knob, rotate the knob so that the white line on the knob is aligned with 6.0 on the front panel of the receiver. With this band setting, your SW-4A can be tuned from 5.950 megahertz to 6.550 megahertz, as the variable tuning section of the SW-4A can be tuned as much as

### Section III Operation

0,05 megahertz less than the frequency indicated by the band selector, and up to 0,55 megahertz higher than the frequency indicated by the band selector, If the band selector were set to 0.5, the receiver could be tuned from 0.450 to 1.050 megahertz, etc.

Section III  
Operation

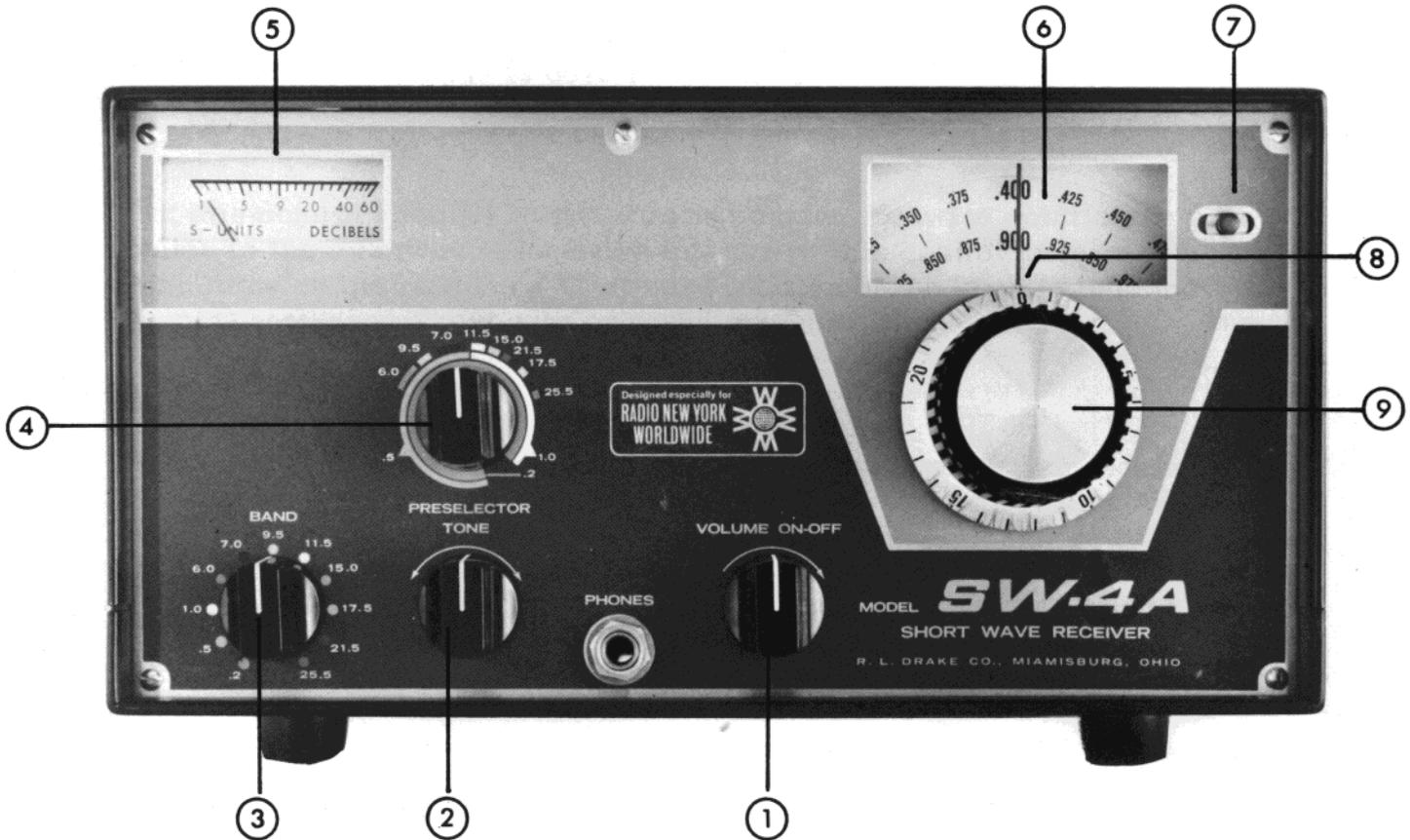


FIG 3 FRONT VIEW SW-4A

### 3.6 PRESELECTOR

Rotation of the preselector knob (4) changes the tuning of the antenna and radio frequency circuits of your receiver so you may get maximum sensitivity on each band. The numbers (and the colors) around the preselector knob correspond to the numbers (and colors) around the band selector knob. When these knobs are both set to the same number (and color), the tuning of the preselector circuits will be approximately correct for the band selected. The length of the colored areas around the preselector knob indicate the range through which the preselector tuning must be varied as you tune through each particular band. The use of the preselector will be more thoroughly described in Paragraph 3.9.

### 3.7 S-METER

The S-meter (5) serves as a signal strength indicator. Since the maximum indication occurs when the SW-4A is accurately tuned to the station being received, the S-meter also serves as a tuning indicator. The tuning dial settings that cause the S-meter pointer to move farthest toward the right will normally be the settings corresponding to the best reception of the signal.

### 3.8 TUNING CONTROLS

One of the major advantages of your SW-4A is the ease with which it can be tuned exactly to a station frequency. Your understanding of the proper use of this tuning system will add a new dimension to your short wave listening by enabling you to find any station quickly and accurately.

An understanding of the units used in expressing frequencies is essential for you to get the maximum satisfaction from this feature of your SW-4A. You were introduced to Hertz, kilohertz, and megahertz in Paragraph 3.5, but some review and further explanation might be useful. A Hertz is a frequency of 1 cycle per second. The prefix kilo- means thousand, the prefix mega- means million; therefore 1 kilohertz is 1,000 cycles per second (formerly called 1 kilocycle) and 1 megahertz is 1,000,000 cycles per second (formerly called 1 megacycle). The numbers around the band selector and preselector knobs of your SW-4A stand for frequencies expressed in megahertz. If you set these two knobs to 9.5, for example, you are adjusting your SW-4A to receive a band of frequencies near 9.5 megahertz.

Most of the currently available short-wave station listings give station frequencies in kilohertz. This poses no problem, for the decimal relationship between kilo- and mega- makes conversion from one to the other very easy. Any frequency expressed in kilohertz can be converted to megahertz by dividing by 1,000, which is accomplished by moving the decimal point three places to the left. For example: a station frequency listed as 9745 kilohertz is 9.745 megahertz, 15115 kilohertz is 15.115 megahertz, 842 kilohertz is .842 megahertz, etc.

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Operation

Near the middle of the window covering the main tuning dial (6) is a red tuning index. If this red index is not aligned with the engraved marking (8) at the center of the bottom of the window, grasp the red handle (7) and move the index until it is aligned with the marks. Next, rotate the tuning knob (9) to bring the 0 mark on the top row of numbers on the tuning dial (6) directly under the index. Now examine the metal skirt around the base of the tuning knob. It is marked into 25 divisions. If the zero on this skirt is not aligned with the index mark (8) hold the tuning knob in position, and turn the skirt to bring the zero mark into alignment with the index mark (8). Do not allow the tuning knob to turn while you are moving the metal skirt. The zero marks on both dials should now be aligned with the index mark (8) and the red tuning index.

Start turning the tuning knob slowly counterclockwise, and stop when the .025 mark on the upper scale of the main tuning dial is under the red index. Look at the metal skirt of the tuning knob, and you will note that the zero mark is again aligned with the index mark (8). One revolution of the tuning knob (25 divisions) is therefore equal to .025 on the main tuning dial. Since the main tuning dial is marked in megahertz, it follows that 1 division on the metal skirt is .001 megahertz. Thus it is possible, with the SW-4A, to adjust frequency accurately in steps of .001 megahertz. Turn the main tuning knob clockwise, and return to the zero settings of both the main tuning dial and the metal skirt.

### 3.9 TUNING A STATION

Now that the tuning controls are "zeroed", your SW-4A is ready for a tuning demonstration. Suppose you wish to receive a transmission from station HCJB, Quito, Ecuador, on a frequency listed as 15235 kilohertz. The first step is to convert this frequency to a megahertz (see Paragraph 2.8). The frequency is 15.235 megahertz. This is in the 15 megahertz band, so the band selector (3) and the pre-selector (4), must be set to 15.

Setting these controls to 15 in effect tunes your SW-4A to 15,000 megahertz, since the variable tuning section was set to 0 (in the last step of Paragraph 2.8). To tune the remaining .235 megahertz of the selected frequency (15,235 megahertz): first determine which of the two scales on the main tuning dial to use. When the number lies between 0 and .500, you use the upper scale, and when the number lies between .500 and 1.0, you use the lower scale. Since .235 is the required frequency in this case, you use the upper scale. Turn the tuning knob (9) counterclockwise until the point marked .225 is under the red tuning index. The SW-4A is now tuned to 15.225 megahertz, or .010 megahertz less than the desired frequency. Since the next marked point on the main tuning dial scale is .250, you know the desired point is between your present dial setting and the next dial marking. To reach .235 megahertz, you merely tune upscale from .225 until the figure 10 on the metal skirt is aligned with the index mark (8) on the front panel of the receiver. The SW-4A is then tuned precisely to 15.235 megahertz.

Section III  
Operation

Or suppose you wish to tune in a broadcast from the Vatican City, on 5985 kilohertz. This is 5.985 megahertz, and lies in the band covered at the 6.0 setting of the band selector and preselector. Set these two controls to 6.0, and adjust the main tuning knob to bring the 0 on the main tuning dial under the red tuning knob skirt in line with the index mark on the front panel. Your SW-4A is now tuned to 6.0 megahertz. Since the desired frequency is below 6.0, you must tune below the 0 on the main tuning dial to read it. The difference between 6.0 and 5.985 is .015 megahertz. Since each division on the tuning knob skirt is .001 megahertz, turning the tuning knob clockwise 15 skirt divisions will tune your receiver 15 times .001 megahertz below 6.0 megahertz which is 5.985 megahertz.

The instructions above apply to all bands except the .2 megahertz band. On the .2 band the indicated value on the upper scale of the main tuning dial, and on the skirt of tuning knob, must be added to .2 to determine frequency. Thus, if the main tuning dial is at .125, and the skirt at 10, the frequency would be  $.2 + .125 + .010$ , or .335 megahertz.

### 3.10 USING YOUR SW-4A

Make sure the antenna, ground, and speaker (or headphones) are connected. Be sure your SW-4A is set for operation on the same voltage as your power line supplies, and plug in the power cord. Rotate the volume control clockwise, turning the receiver on, and allow it to warm up for a minute or so.

For your first station, choose one of the standard frequency transmissions, such as that of the National Bureau of Standards (WWV) at 10.0 or 15.0 megahertz, or that of the Canadian standard frequency station (CHU) at 7.335 megahertz. By tuning in a standard frequency transmission, you will be able to check the dial calibration of your SW-4A while getting some practice in the use of its operating controls. Although you have adjusted the red index line and the skirt on the tuning knob so that the zero settings are in agreement, slight individual variations between receivers exist. Therefore, to accurately calibrate the dial of your SW-4A, it is necessary for you to check it against some recognized standard frequency. After this initial calibration, it is good practice to re-check the calibration periodically, and circuit elements in the receiver will change somewhat as they age, regardless of how carefully they are selected and assembled.

To demonstrate the calibration procedure, assume that you decide to tune to station WWV at 10.000 megahertz. To accomplish this, you have set the band selector and preselector controls to 9.5 band, and have tuned, reading the lower scale, up to 1.0. After the 1.0 on the main tuning dial, and the 0 on the tuning knob skirt, are aligned with the index, rock the preselector knob back and forth slightly, stopping at the setting at which maximum audio signal and/or noise is heard. You should now be able to hear the 1 second time markers of WWV. If not, tune slowly to either side of the dial settings until the signal is heard.

Carefully adjust the tuning for maximum signal. If the 1.0 of the main tuning dial is not exactly aligned with the red tuning index, use the calibration slide handle to move the index into line with the 1.0 mark. Do not move the tuning knob. Then check whether 0 on the skirt of the tuning knob is aligned with the front panel index mark. If it is not, hold the tuning knob, and slip the skirt around until 0 is so aligned. It may be necessary to repeat this operation several times before you get things adjusted so that proper tuning indications and maximum signal strength coincide.

In using your SW-4A, you will find that as you tune across a frequency band the level of sound coming from the speaker will vary. This is due to the fact that the section of your SW-4A tuned by the preselector is rather sharply tuned, and does not pass all frequencies in the band with equal efficiency at any one setting. Therefore, it is necessary to change the setting of the preselector control occasionally in order to get the best performance from your receiver.

To assist you in making this adjustment, the front panel of your SW-4A has colored markings to show the limits of preselector adjustment necessary for each band. For example: the 6.0 band is marked by a red dot next to the band selector knob, and a red bar next to the preselector control knob. Tune the SW-4A to 6,000 megahertz (band selector and preselector set to 6.0, main tuning dial and tuning knob skirt at 0), and adjust the volume control for a comfortable output level. Then slowly turn the preselector control knob back and forth within the area of the red bar until you reach a setting that gives maximum sound. Now slowly tune upscale, not changing the preselector setting, and note the decrease of volume. Stop tuning, and readjust the preselector for maximum volume.

You will find that each time you tune in a station it is necessary, for the very best reception, to alternately "touch-up" the tuning of the preselector and of the main tuning section. With a little practice you will find you can do both simultaneously, thus assuring optimum performance at all times.

### 3.11 S-METER ADJUSTMENT

The S-Meter of your SW-4A should indicate S-1 with no signal input. To check the operation of the S-Meter, disconnect the antenna from the SW-4A, then turn the receiver on and allow it to warm up for 5 minutes. Turn up the volume, and vary the setting of the preselector knob until you are sure no signals are being heard. The S-Meter should now indicate S-1. If it does not, adjust the S-Meter zero control (see Figure 1) until a reading of S-1 is obtained.

### 3.12 STATION LISTINGS

Now that you are familiar with the operation of your SW-4A, and have seen how it can be precisely set to a selected frequency, a listing of short-wave station frequencies would be a valuable accessory for your listening pleasure. One of the more readily available sources of station listings is the magazine "Popular Electronics", which features a monthly column devoted to the short-wave

### Section III Operation

listening . For complete information regarding station frequencies and broadcast schedules the "World Radio-Television Handbook" by O. Johanson is recommended . Issued yearly, this book lists all AM, FM, TV, and short-wave broadcasting stations. Frequencies, call signs, transmitter power , and program details are included, as well as numerous articles of interest to the short-wave listener, Your radio dealer may be able to supply you with this publication,, If not, the English language edition is available from Gilfer Associates, Box 239 Park Ridge, New Jersey 07656, The most recent advertised price was \$4.95.

#### SW-4A ALTERNATE FREQUENCY COVERAGE

Basically the SW-4A is designed to operate in the range of 150 thru 1600 kHz and 4.5 thru 30,0 mHz. Crystals are provided as standard for reception in ten segments that are most commonly used, each segment being 500 kHz (See Sec. 1.1 of manual).

Alternate 500 kHz tuning ranges are possible providing the requirement falls with the ranges noted in the paragraph above. To do so a new crystal must be installed in the set and one of the existing 500 kHz ranges sacrificed. The new crystal can only be used in a socket that had a crystal comparable in frequency. For example:

<u>500 kHz Coverage Between</u>			<u>Band to be Sacrificed</u>		
.5	and	1.6 mHz	.5	or	1.0
4.5	and	9.5 mHz	6.0	or	7.0
9.5	and	15.0 mHz	9.5	or	11.5
15.0	and	21.5 mHz	15.0	or	17.5
21.5	and	30.0 mHz	21.5	or	25.5

As an example: assume alternate coverage is desired from 18.0 to 18.5 mHz. The crystal for this range must be used in either the 15.0 or 17.5 mHz socket.

Order crystals by specifying upper and lower limits of alternate 500 kHz band.

Section IV  
Servicing4.1 TUBES

Tube failure is the most common trouble encountered in radio receivers. The best way to detect a defective tube is to substitute a tube known to be in good condition for the questionable tube, and then observe the receiver's performance. If a difficulty occurs that cannot be corrected by the tube substitution we recommend that you write our Service Department, giving complete details of the set's performance, so we may analyze the problem and suggest how you may correct the problem. Please do not return your receiver for service without first writing the Service Department about the problem. If your receiver must be returned for service, repack it in the original shipping carton, and enclose a note describing the problem with the receiver.

4.2 TROUBLE-SHOOTING

Voltage and resistance tables for the SW-4A are provided in this section so that qualified electronic technicians can service your receiver. In general, we cannot recommend that service be attempted at the neighborhood radio shop unless the technician is known to be thoroughly familiar with the SW-4A receiver. Usually service can be more rapidly and satisfactorily performed by our Service Department.

4.3 ALIGNMENT

For alignment of the SW-4A the following equipment will be required:

- 1, A stable radio frequency generator, covering the frequency range from 0,150 to 30 megahertz, having a continuously variable output attenuator, and an output impedance of 50 ohms.
- 2, A 3000 picofarad ceramic or mica capacitor.
- 3, A narrow-bladed screw driver with plastic handle, approximately 6 inches long overall.
- 4, An accurate scale with 1/32 inch divisions.

Operate the SW-4A at least 1/2 hour before attempting alignment.

4.3.1 ALIGNMENT OF THE 455 kHz I.F.

- 1, Adjust the radio frequency generator to 5645 kHz, and connect the output of the generator to pin 7 of V3. Increase the output of the generator until the receiver's S-Meter indicates approximately S-2.

Section IV  
Servicing

2. Adjust the top and bottom slugs of T7, T8 and T9 for maximum S-Meter reading. Vary the signal level from the generator while making these adjustments so that the S-Meter reading never exceeds S-5.

3. Disconnect the signal generator from the receiver.

#### 4.3. 2 ALIGNMENT OF CRYSTAL FILTER TRANSFORMERS

1. Connect the output of the signal generator to pin 1 of V2, and set the generator frequency to 5645 kHz.

2. Vary the generator frequency about 5645 kHz until a peak S-Meter reading is obtained. Adjust the generator output to give an S-Meter reading of S-9 on this peak signal.

3. Increase the signal generator frequency slowly while watching the S-Meter. When the S-Meter reads S-5, stop changing the frequency.

4. Adjust T5 and T6 for maximum S-Meter reading.

5. Disconnect the signal generator from the receiver.

#### 4.3. 3 ANTENNA AND INJECTION CIRCUIT ALIGNMENT

1. Turn preselector knob counterclockwise to stop. Check to see that pointer points exactly to the counterclockwise end of the gold color segment. If it does not, loosen the knob setscrew and turn knob on shaft to correct the position and tighten setscrew.

2. Turn preselector knob clockwise to a position corresponding to 9 o'clock on a clock face and position the knob flats exactly horizontal. The top of the tuning cores in T1, T2, T3, and T7 should be exactly even with the top of the coil form tube. If not, adjust to correct position by turning spring inserts in the retainers of the moving rack.

3. Connect signal generator to antenna terminals.

4. Set band switch to 25.5, dial to 0, and preselector pointer to the counterclockwise end of the 25.5 color segment. Adjust signal generator to give a S-Meter reading of S-2 at the 25.5 megahertz receiver frequency. Adjust all four trimmers marked 25.5 for maximum S-Meter reading (keep level of signal generator output low so the final peaking is done at less than S-5). Detune T4 circuit by touching the 6" screw driver to the rotor blade of switch S1E (front of 3rd switch wafer from front of set) at the same time repeak the 25.5 in the 4th row from front of set.

## Section IV Servicing

Detune "T3 circuit by touching the 6" screwdriver to the rotor blade of switch SIH (rear of the 4th switch wafer from front of set, careful it has B+ on it) at the same time repeak the 25.5 in the 3rd row from front of set.

5. Set band switch to 17.5, dial to 0, and preselector to counterclockwise end of 17.5 color segment. Adjust signal generator to give S-2 reading at 17.5 and adjust all four 17.5 trimmers for peak S-Meter reading (keep signal generator level down).

Detune T4 circuit (as was done at 25.5) and peak 17.5 trimmer in 4th row.

Detune T3 circuit and peak 17.5 in 3rd row.

6. Set band switch to 11.5, dial to 0, and preselector to counterclockwise end of 11.5 color segment. Adjust signal generator to give S-2 reading at 11.5 and adjust all four 11.5 trimmers for peak S-Meter reading. (Keep signal generator level down).

Retune T4 circuit (same as was done at 25.5) and peak 11.5 in 4th row. Detune T3 circuit (same as was done at 25.5) and peak 11.5 in 3rd row.

7. Set band switch to 7.0 dial to 0, and preselector to counterclockwise end of 7.0 color segment. Adjust signal generator for S-2 reading at 7.0 and adjust all four 7.0 trimmers for peak S-Meter reading (keep signal generator level down).

Detune T4 circuit (same as was done at 25.5) and peak 7.0 in 4th row.

Detune T3 circuit (same as was done at 25.5) and peak 7.0 in 3rd row.

8. Connect 3000 picofarad capacitor in series with signal generator lead to antenna terminal screw.

9. Set band switch to .2, dial 50 kHz lower than 0 (receiving frequency at 150 kHz), and preselector to counterclockwise stop. Adjust signal generator for S-2 reading at 150 kHz. Tighten down .2 trimmer (1st row from front of set). Adjust core in T7 by turning spring in retainer for peak S-meter reading (keep signal generator level down).

10. Set band switch to .5 dial to 0, and preselector to counterclockwise stop, Adjust signal generator for S-2 reading at 500 kHz and adjust all three 1.0 trimmers for peak S-Meter reading.

Set band switch to 1.0, dial to .400 and preselector to about 3 o'clock, Tune signal generator to receiver frequency (1400 kHz) and adjust preselector for maximum S-Meter reading.

Signal IV  
Servicing

Detune T4 circuit (same as was done at 25.5) and peak 1.0 in 4th row.

Detune T3 circuit (same as was done at 25.5) and peak 1.0 in 3rd row.

#### 4.3 .4 VFO ADJUSTMENT

The permeability tuned VFO was carefully adjusted at the factory and no further alignment should be attempted. Should a constant error across the band occur which cannot be compensated for with the skirt on the tuning knob, the tuning dial may be repositioned on its shaft to return the unit to proper calibration.

TABLE I: Tube Voltages

PIN NUMBER:	1	2	3	4*	5	6	7
v1 12BZ6	-1.1	+1.2	0	12.6	+82	+120	0
v2 6HS6	0	0	12.6*	6.3	+110	+62	+2
v3 12BE6	-9.4	+2.4	0	12.6	+110	+100	-1.2
v4 12BA6	-1.2	0	0	12.6	+100	+74	+1.5
v5 12BA6	-1.2	0	0	12.6	+100	+74	+1.5
v6 6HS6	-.86	0	0	6.3	+110	+100	+1.7

NOTES:

1. All measurements made with the VTVM, input impedance 11 megohms.
2. Receiver connected to 120 volt 60 Hertz power source.
3. \* indicates A.C. voltage
4. Control settings: Volume control full clockwise, other settings unimportant. Antenna disconnected, no station tuned in.

TABLE II: Resistance to Ground

PIN NUMBER:	1	2	3	4	5	6	7
v1 12BZ6	3.4M	150	0	Fil.	20K	20K	0
v2 6HS6	2.2M	0	Fil.	Fil.	20K	230K	2.2K
v3 12BE6	150K	330	0	Fil.	20K	20K	2.5K
v4 12BA6	4.3M	0	0	Fil.	20K	18K	330
v5 12BA6	4.3M	0	0	Fil.	20K	18K	330
v6 6HS6	330K	0	0	Fil.	19.1K	40K	470

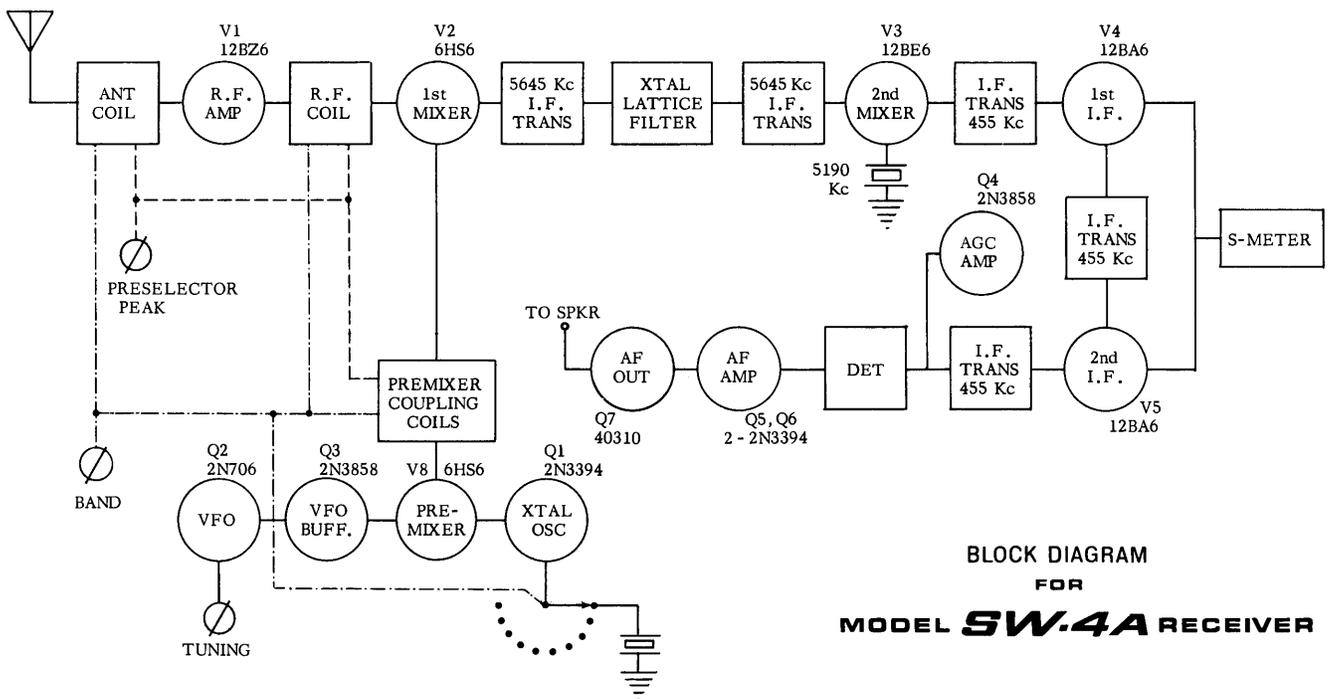
NOTES :

1. Receiver disconnected from A.C. line.
2. Band switch set to 1.0. Other controls in any position.

Section IV

Figure 4

Block Diagram



BLOCK DIAGRAM  
FOR  
MODEL **SW-4A** RECEIVER

Section IV  
Figure 5  
Bottom View

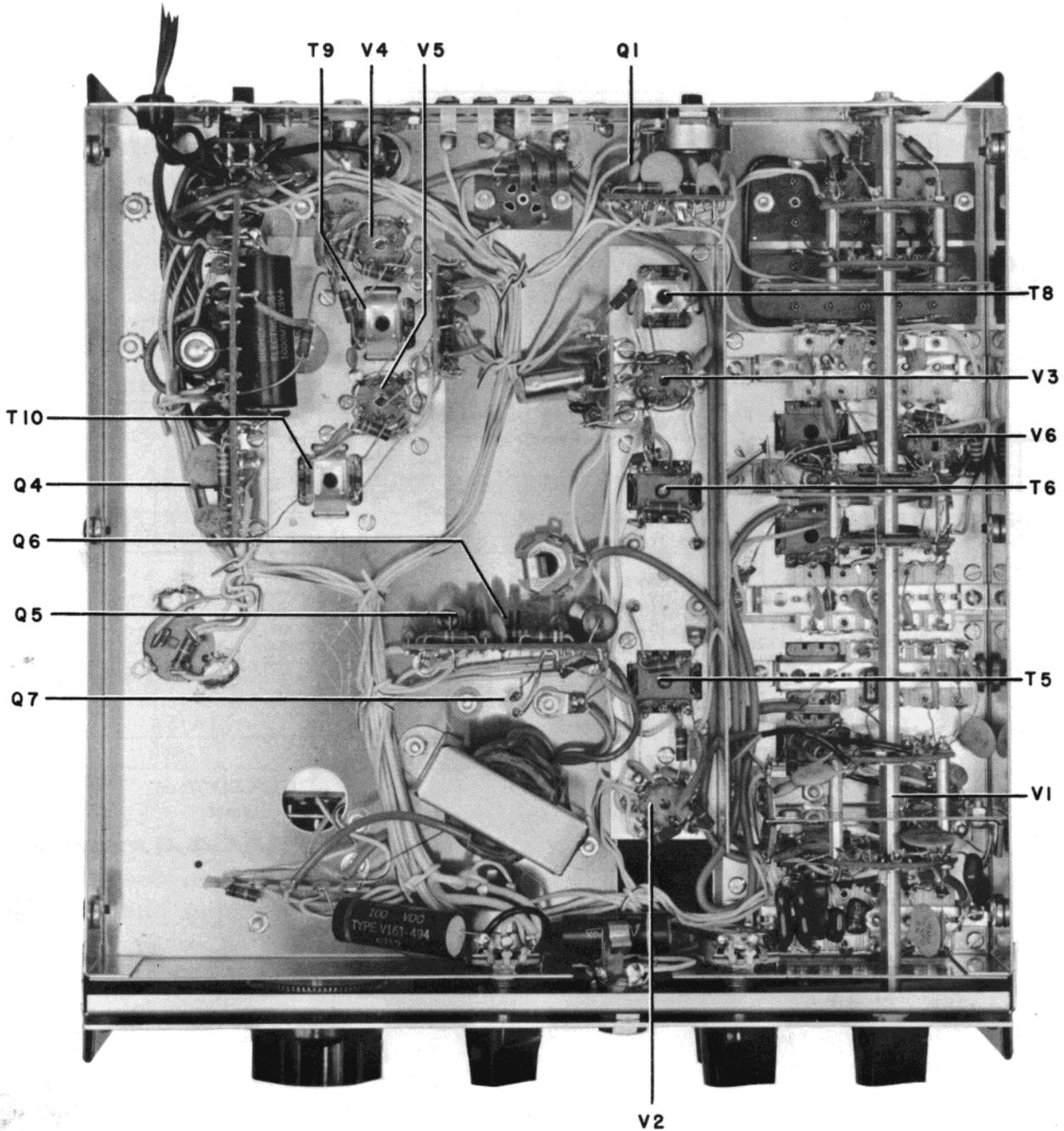


FIG. 5 BOTTOM CHASSIS SW-4A

Section IV

Figure 6

Top View

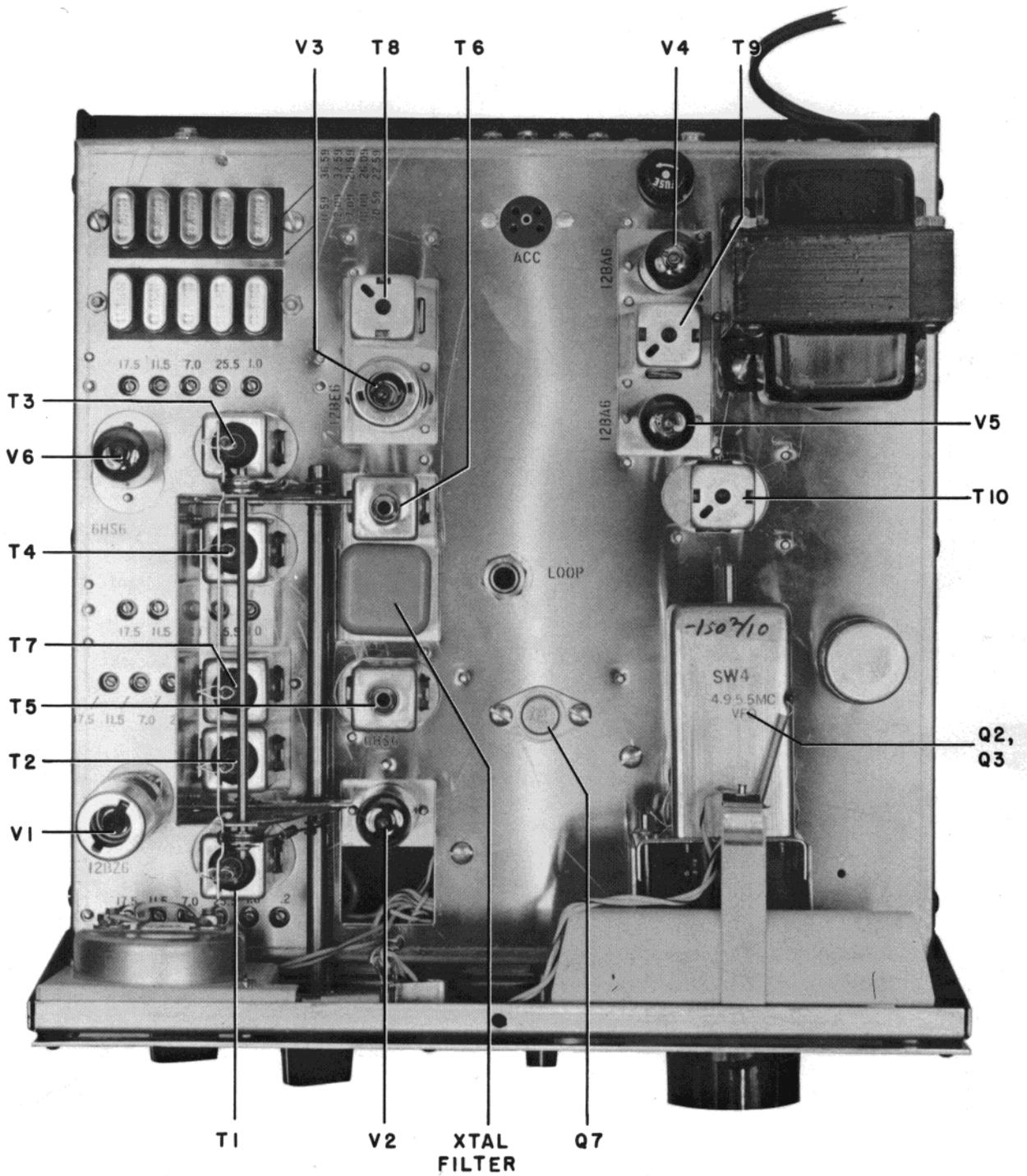
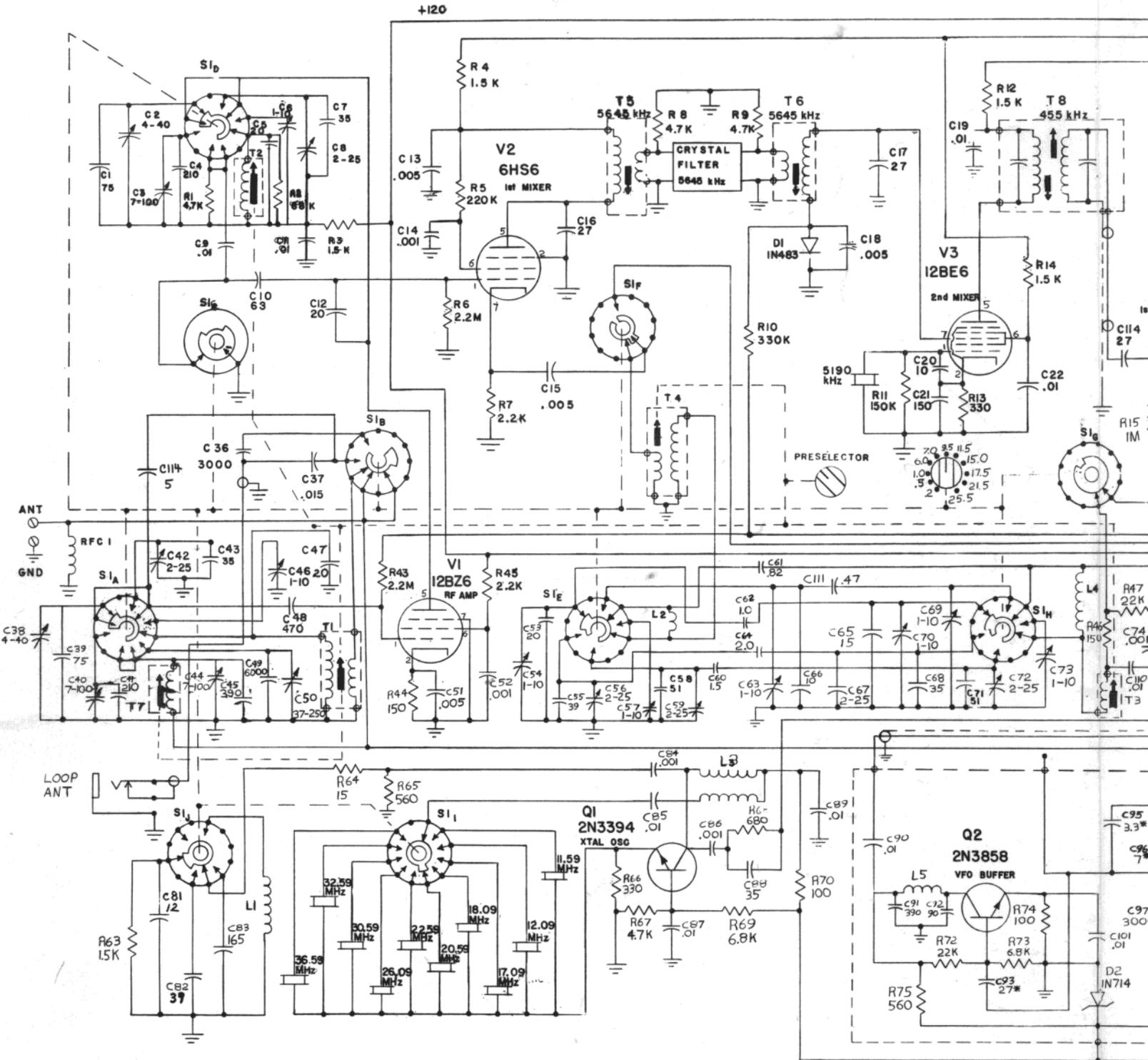


FIG. 6 TOP CHASSIS SW-4 A

Section IV  
Schematic Diagram



NOTE: Capacitors marked 1.0 to 4000 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. Band switch viewed from front in

SCHMATIC DIAGRAM  
MODEL SW-4A RECEIVER

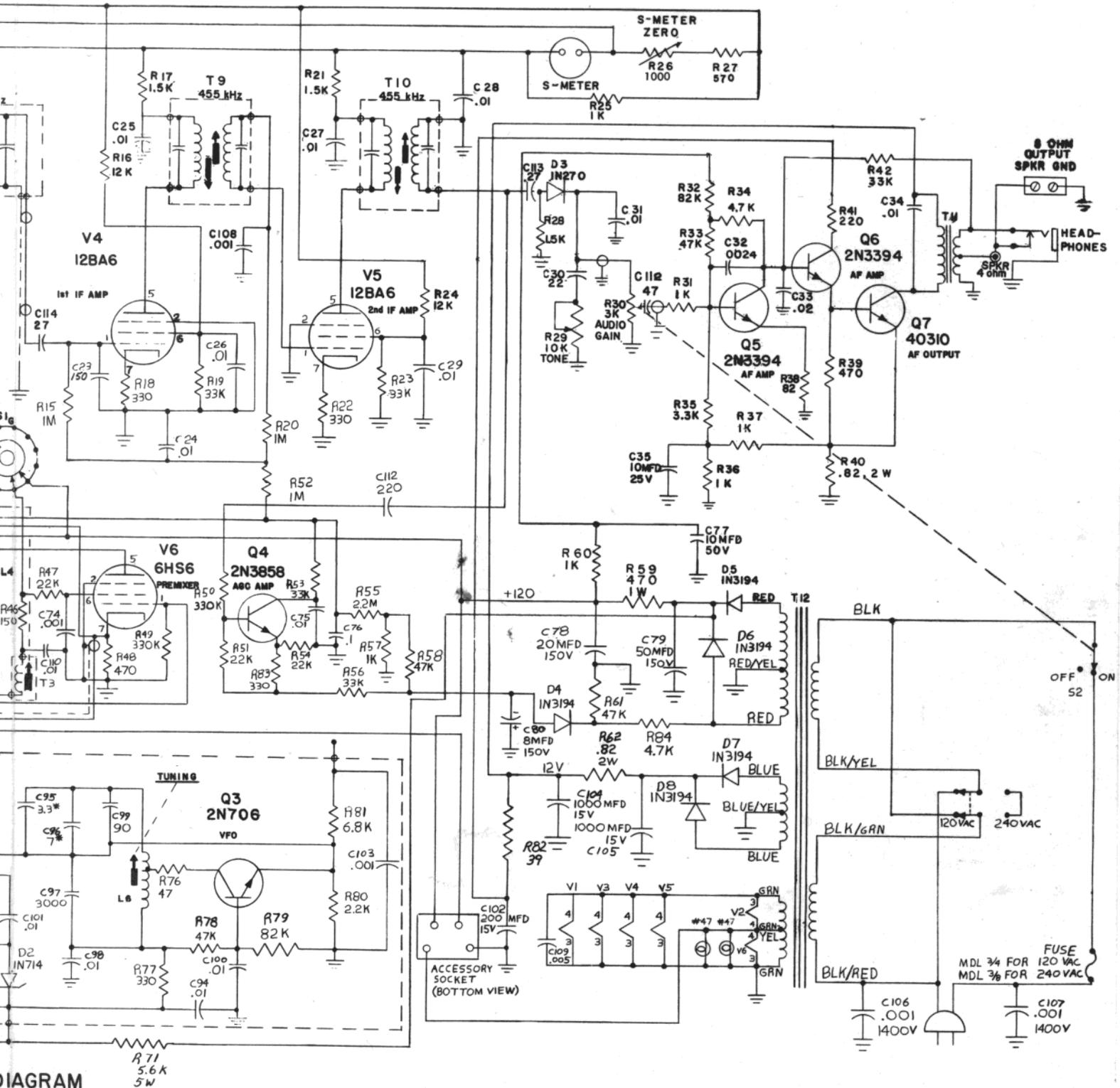


DIAGRAM  
REIVER