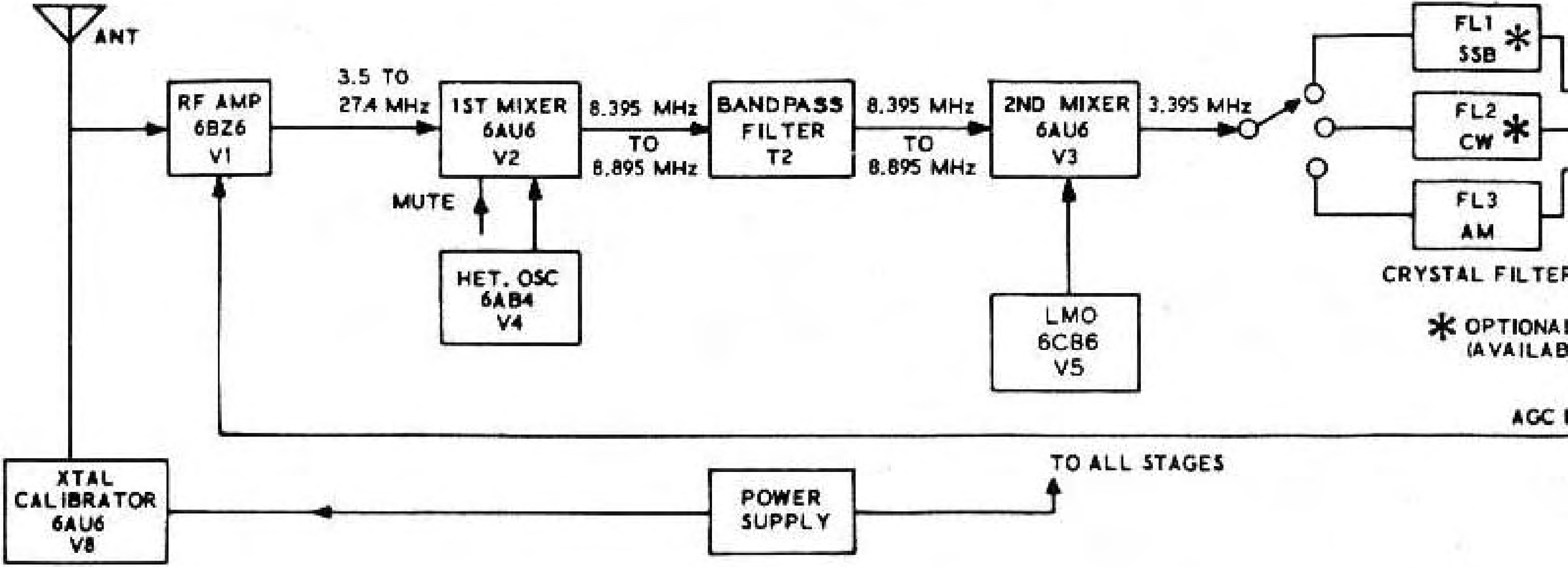
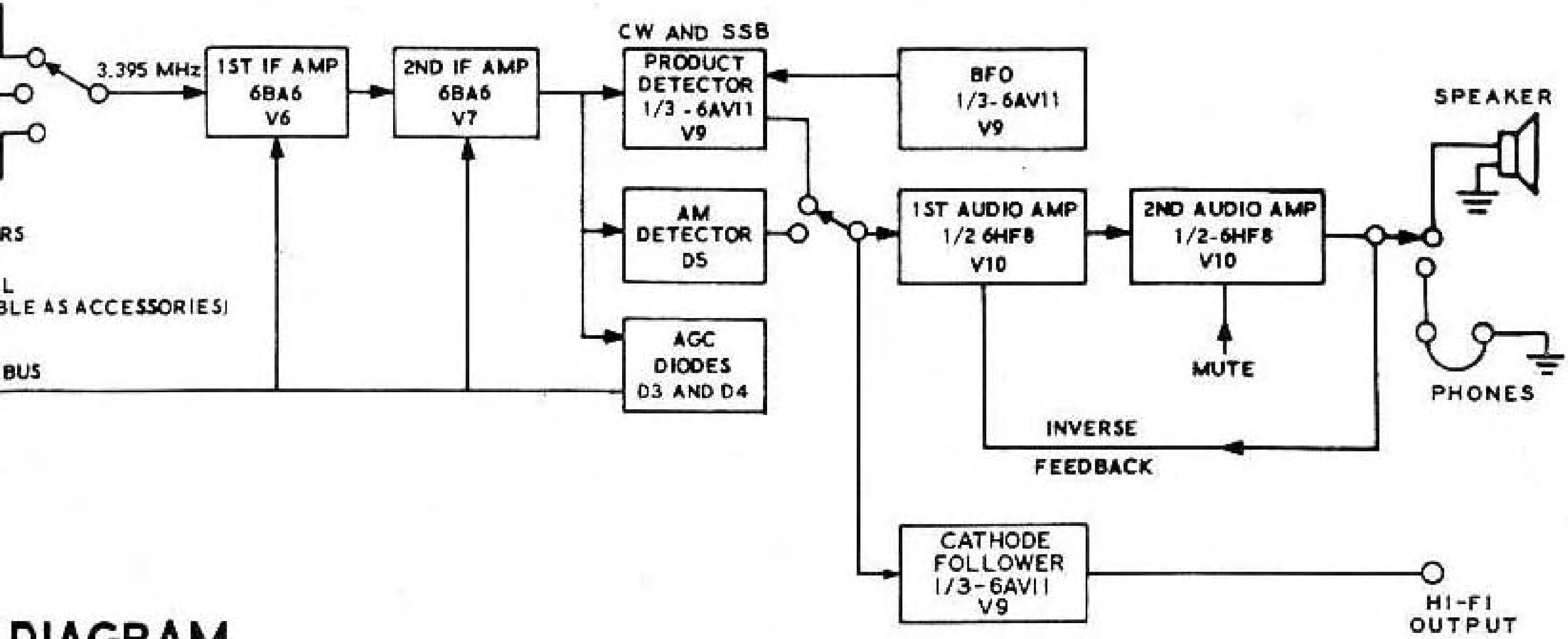
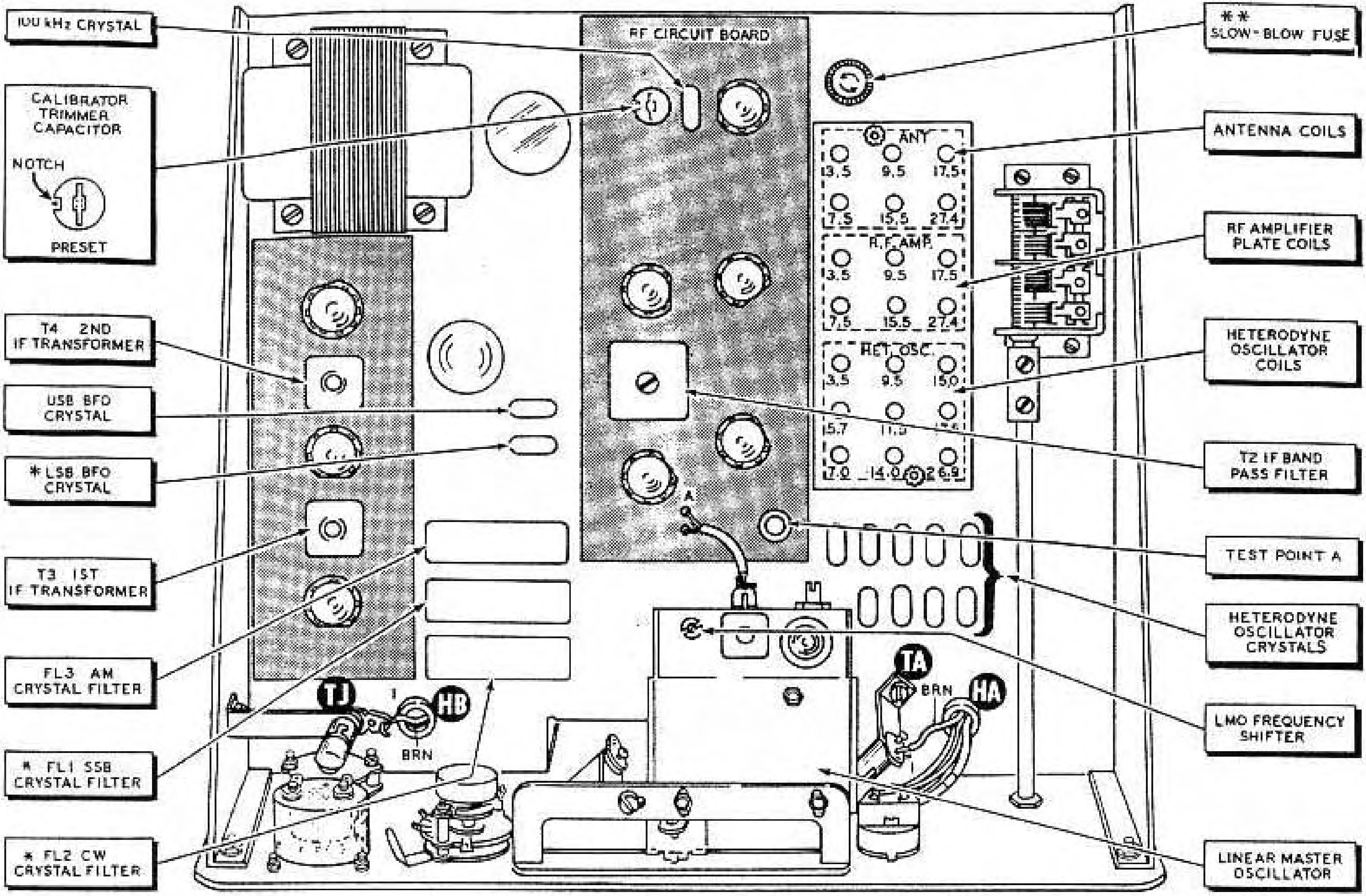

ANT
RF AMP
6BZ6
V1
3.5 TO
27.4 MHz
1ST MIXER
6AU6
V2
MUTE
HET. OSC
6AB4
V4
8.395 MHz
TO
8.895 MHz
BANDPASS
FILTER
T2
8.395 MHz
TO
8.895 MHz
2ND MIXER
6AU6
V3
LMO
6CB6
V5
3.395 MHz
FL1
SSB *
FL2
CW *
FL3
AM
XTAL
CALIBRATOR
6AU6
V8
POWER
SUPPLY
TO ALL STAGES

BLOCK


RS
L
BLE AS ACCESSORIES)
BUS
3.395 MHz
1ST IF AMP
6BA6
V6
2ND IF AMP
6BA6
V7
CW AND SSB
PRODUCT
DETECTOR
1/3 - 6AV11
V9
AM
DETECTOR
D5
AGC
DIODES
D3 AND D4
BFO
1/3- 6AV11
V9
1ST AUDIO AMP
1/2 6HF8
V10
2ND AUDIO AMP
1/2-6HF8
V10
MUTE
INVERSE
FEEDBACK
CATHODE
FOLLOWER
1/3- 6AV11
V9
SPEAKER
PHONES
HI-FI
OUTPUT

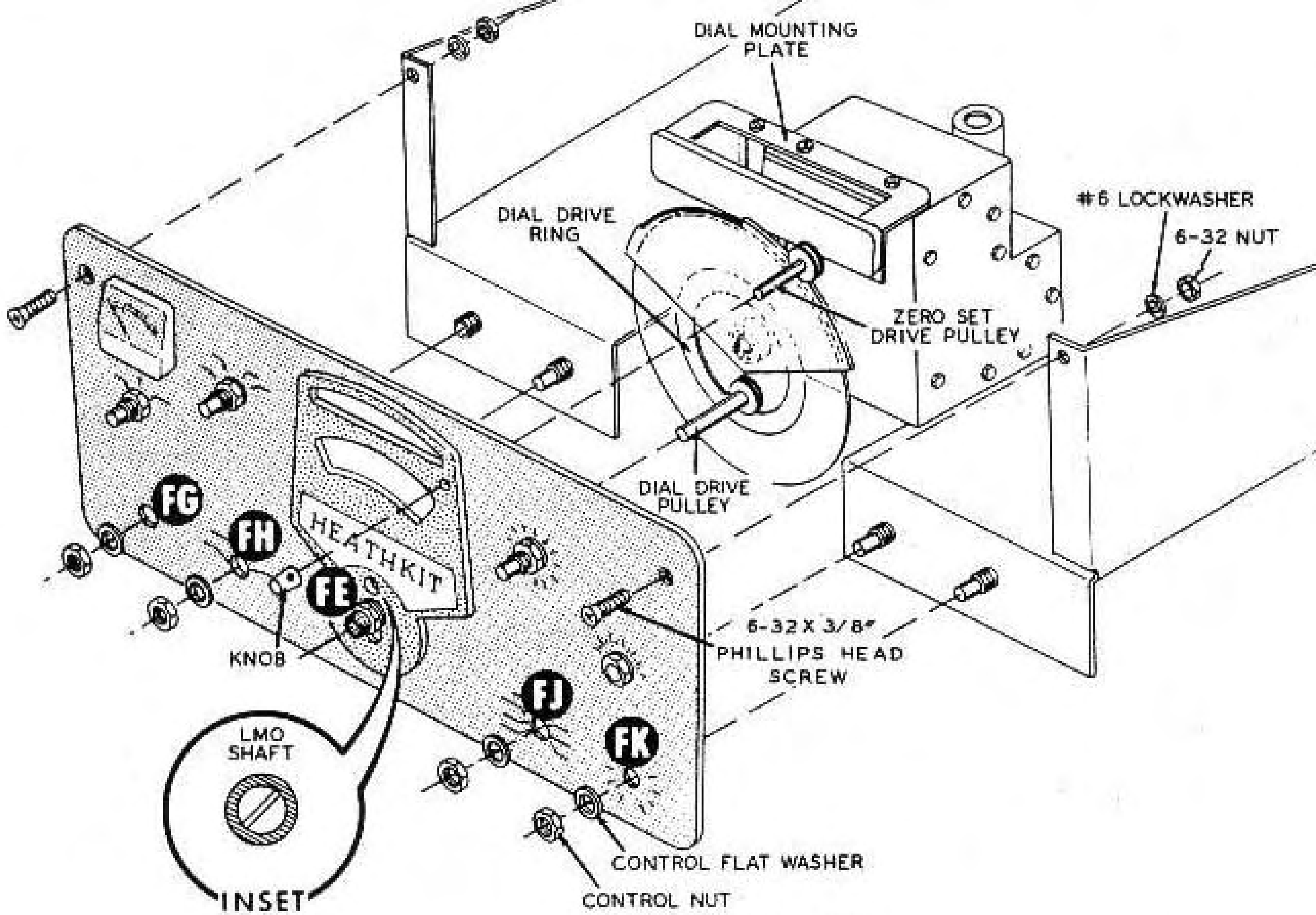
DIAGRAM



* ACCESSORY

**
120 VAC: 2 AMPERE
240 VAC: 1 AMPERE

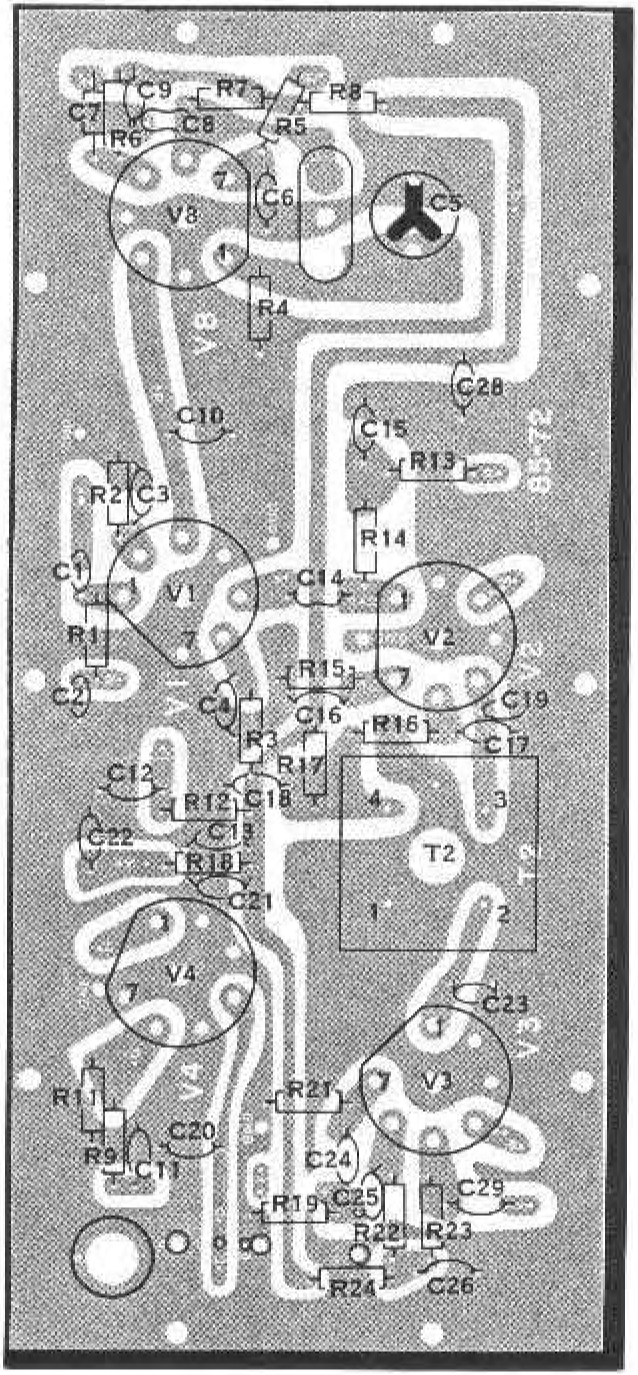
FIGURE 1-2


DIAL MOUNTING PLATE
#6 LOCKWASHER
6-32 NUT
DIAL DRIVE RING
ZERO SET DRIVE PULLEY
DIAL DRIVE PULLEY
HEATHKIT
FG
FH
FE
FJ
FK
KNOB
6-32 X 3/8" PHILLIPS HEAD SCREW
LMO SHAFT
INSET
CONTROL FLAT WASHER
CONTROL NUT

Detail 5-4B

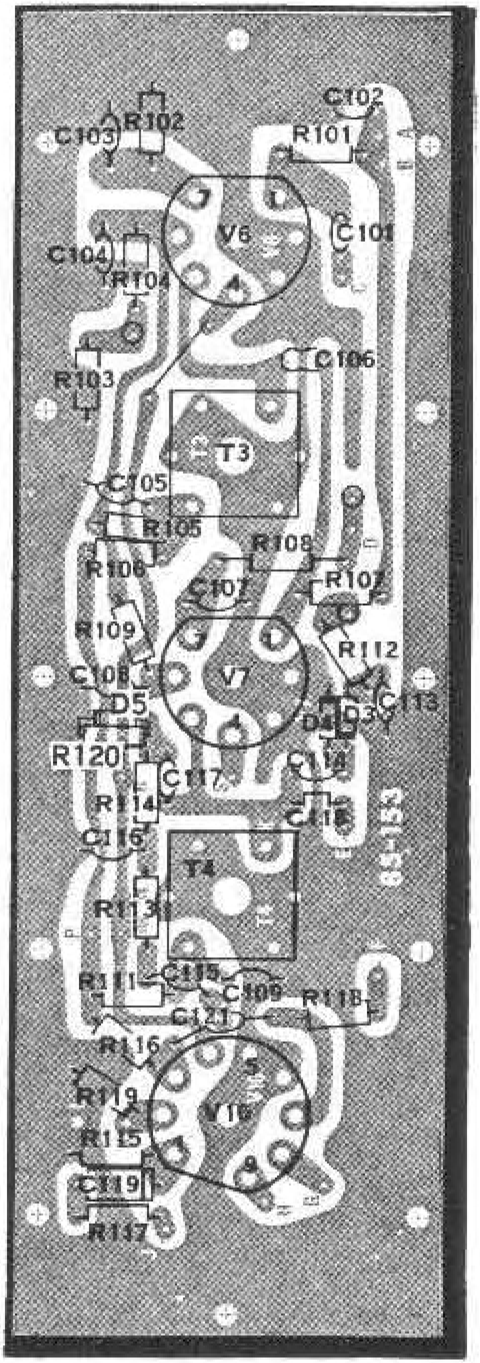
CIRCUIT BOARD X-RAY VIEWS

(VIEWED FROM FOIL SIDE)

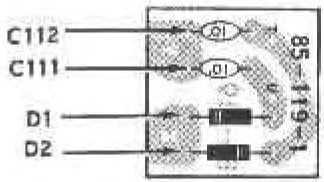


RF CIRCUIT BOARD

Figure 7-1



IF CIRCUIT BOARD



NOISE LIMITER CIRCUIT BOARD

Figure 7-2

ALIGNMENT

READING RECEIVER FREQUENCY

To read frequency, add to the BAND switch setting in megahertz, the dial pointer setting in hundreds of kilohertz, and the circular dial setting in kilohertz.

For example (see Pictorial 5-5 on Page 68): If the BAND switch is set to 3.5, the dial pointer is between 2 and 3, and the circular dial is set to 50, the frequency is 3.750 MHz. If the BAND switch is set to 5.7, the dial pointer between 0 and 1, and the circular dial is set to 12, the frequency is 5.712 MHz.

In some of the following steps you will be instructed to set the MAIN TUNING dial at "0 MHz". This means to turn the MAIN TUNING dial so the dial pointer is at "0" on the upper scale, and the circular dial is at "0".

NOTE: A speaker or headphones should be connected whenever the Receiver is turned on.

HETERODYNE OSCILLATOR PRESET ADJUSTMENT

( ) Turn the FUNCTION switch to OPR.

( ) Connect a vacuum tube voltmeter with an 11 megohm input impedance between the chassis and test point A on the RF circuit board. Use the voltmeter 5 volt scale to read negative DC volts.

Refer to the following chart and complete each step by adjusting the indicated coil for a -2.7 volts DC indication on the voltmeter. Use the adjustment tool supplied. On one side of the voltage peak, the voltage will rise and drop in a slow, linear fashion. Use this side of the slope. On the wrong side of the peak, the voltage will drop rapidly. The frequency of each coil is marked on the coil cover in the area designated HET OSCILLATOR. In general, it should not be necessary to turn any coil cores more than 3 turns, from the starting point, to obtain the voltages on the chart.

	BAND SWITCH POSITION	ADJUST HET OSCILLATOR COIL
( )	3.5	3.5
( )	5.7	5.7
( )	7.0	7.0
( )	9.5	9.5
( )	11.5	11.5
( )	14.0	14.0
( )	15.0	15.0
( )	17.5	17.5
( )	26.9	26.9

Recheck the adjustment of each coil for proper voltage.

( ) Disconnect the vacuum tube voltmeter from the Receiver.

ZERO BEAT

The term "zero beat" is used several times in this alignment procedure (for example: "tune to zero beat" and "tune to one side of zero beat"). This term can be briefly explained as follows:

When two radio frequencies meet in a circuit, a third frequency is produced (and a fourth that we are not concerned with here) that is equal to the difference between the two original frequencies. This difference frequency decreases and can be heard as an audible tone that decreases in pitch as the two original frequencies come closer together. When the two original frequencies coincide, no difference frequency (or tone) is produced; at this point, the two frequencies are zero beat with each other. Then as you continue to turn the knob, the tone begins to increase again.

During the alignment of this Receiver, when you zero beat a signal you will have the FUNCTION switch in the CAL position and the MODE switch in CW or USB. You will thus be zero beating the Receiver's crystal calibrator signal against the BFO signal.

ANTENNA-RF COIL ALIGNMENT

A very accurate but simple way to align the coils of your Receiver is to use the 100 kHz crystal calibration oscillator which is built into the Receiver. However, there may be some who prefer to use a signal generator. Instructions for both methods of coil alignment are given in this section.

To avoid interfering signals, be sure the antenna is disconnected during the Antenna-RF Coil Alignment.

ALIGNMENT WITH 100 kHz CRYSTAL CALIBRATOR

During alignment with the 100 kHz crystal calibrator you may hear two signals approximately 5 kHz apart near the O point, or some of the 100 kHz markings, on your dial. It is important to ALWAYS use the higher frequency signal.

IF Alignment

NOTE: If at any time during the alignment the S-Meter needle reaches maximum deflection before a peak indication in coil adjustment is obtained, turn the AGC switch to OFF, and continue the adjustment.

( ) Set the front panel controls as follows:

PRESELECTOR - To the proper setting for the band being aligned. See Figure 2-2 (fold-out from Page 70).
RF GAIN - Full clockwise.
BAND - 3.5.
AF GAIN - 3 o'clock.
AGC - FAST.
FUNCTION - CAL.
MODE - USB.
MAIN TUNING - 0 MHz.

( ) Refer to Figure 1-2 (foldout from Page 69) and preset the calibrator trimmer capacitor by positioning the notch as shown.

( ) Tune the MAIN TUNING knob to one side of zero beat, until you obtain a maximum indication on the S-Meter.

( ) Use the alignment tool to adjust IF transformers T3 and T4 for a maximum audio output or S-Meter reading.

Antenna And RF Amplifier Alignment

NOTE: Be sure to adjust the PRESELECTOR properly during the rest of this Alignment procedure. The proper PRESELECTOR knob setting for each band is shown in Figure 2-2.

( ) All front panel controls should be set as described previously for Alignment With 100 kHz Crystal Calibrator.

Refer to Figure 2-1 (fold-out from Page 70) and complete each step on the Antenna-RF Coil Alignment Chart. For the Receiver Frequency column in each step, first turn the MAIN TUNING to the listed frequency. Then adjust the MAIN TUNING to the side of zero beat that gives a maximum indication on the S-Meter. NOTE: The MAIN TUNING knob must be tuned carefully to keep the signal in the center of the crystal filter's passband. This is indicated by a maximum S-Meter reading.

OPTIONAL ALIGNMENT USING A SIGNAL GENERATOR

IF Transformer Alignment

( ) Set the front panel controls as follows:

PRESELECTOR - Anyplace.
RF GAIN - Full clockwise.
BAND - 3.5.
AF GAIN - 3 o'clock.
AGC - FAST.
FUNCTION - OFF.
MODE - AM.
MAIN TUNING - 0 MHz.

( ) Turn the FUNCTION switch to the OPR (Operate) position and allow the tubes to warm up.

( ) Connect the RF output of the signal generator through a .01 μfd or .001 μfd disc capacitor to lug 1 of tube socket V6. Use a 1 millivolt signal level. Set the generator for a 3.395 MHz unmodulated signal.

( ) Adjust IF transformers T3 and T4 for maximum S-Meter reading. Alternate from T3 to T4 until no further increase can be noticed in the S-Meter reading.

( ) Turn the Receiver OFF and disconnect the signal generator.

ANTENNA AND RF AMPLIFIER ALIGNMENT

NOTE: It is very important that the PRESELECTOR be adjusted properly during the rest of the Alignment procedure. The proper PRESELECTOR knob settings for the various bands are shown in Figure 2-2.

( ) All front panel controls should be set as follows:

PRESELECTOR - To the proper setting for the band being aligned. See Figure 2-2.
RF GAIN - Full clockwise.
BAND - In accordance with the chart in Figure 2-1.
AF GAIN - 3 o'clock.
AGC - FAST.
FUNCTION - Operate.
MODE - USB.
MAIN TUNING - In accordance with Figure 2-1, Antenna-RF Alignment Chart (fold-out from Page 70).

( ) Connect the RF output of the signal generator to the ANTENNA jack on the rear of the Receiver.

( ) Adjust the coils designated in Figure 2-1 for maximum S-Meter reading or maximum audio. Use the alignment tool furnished. Usually, not more than three turns will be required.

CRYSTAL CALIBRATOR ALIGNMENT

The crystal calibrator circuit is provided to enable you to accurately calibrate (adjust) your tuning dial every 100 kHz. Two methods of accurately adjusting this circuit are given in this section: Calibration Direct to WWV, and Calibration Using Another Receiver. The WWV method is preferred.

Whenever the FUNCTION switch is placed in the CAL position, you should be able to hear a harmonic (multiple) of the calibration oscillator at each 100 kHz dial marking.

( ) Refer to Figure 1-2 (fold-out from Page 69) and be sure the notch of the Calibration Trimmer capacitor on the RF Circuit Board is set as shown.

RADIO STATION WWV

Radio station WWV is operated by the National Bureau of Standards and is located near Fort Collins, Colorado. It transmits extremely accurate frequency and time signals which are widely used as standards by both science and industry.

The signals of station WWV are most easily identified as a steady signal (carrier), frequently modulated with tones of 440 or 600 Hz, and further modulated by a "tick" at one second intervals. Other modulation is also used. Identify the station positively by the voice announcements every five minutes.

CALIBRATION DIRECT TO WWV

( ) Set the front panel controls as follows:

RF GAIN - Fully clockwise.
BAND - 15.
AF GAIN - 3 o'clock.
AGC - FAST.
FUNCTION - OPR.
MODE - USB.
MAIN TUNING - 0.
PRESELECTOR - 15.5 MHz (Figure 2-2).

( ) Connect the antenna to the rear apron phono socket. Use one of the phono plugs provided.

( ) Peak the PRESELECTOR for maximum noise or signal.

( ) Turn the MAIN TUNING knob back and forth. Station WWV should be heard very close to the 0 mark on the circular dial (within 1 to 3 kHz).

( ) Adjust the MAIN TUNING knob so that the tone from WWV goes lower in frequency and just disappears.

( ) Turn the FUNCTION switch to CAL. The tone from the calibrator should be heard.

( ) Adjust the Trimmer Capacitor (Figure 1-2, fold-out from Page 69) on the RF Circuit Board so the calibrator tone descends in frequency and just disappears. The calibration oscillator is now in zero beat with WWV. Set the FUNCTION switch to OPR and then back to CAL to be sure you have a true zero beat.

CALIBRATION USING ANOTHER RECEIVER

( ) Set the front panel controls as follows:

PRESELECTOR - Anyplace.
RF GAIN - Full clockwise.
BAND - 3.5 MHz.
AF GAIN - 3 o'clock.
AGC - FAST.
FUNCTION - OFF.
MODE - USB.
MAIN TUNING - 3.5 MHz.

( ) Couple the antenna connector of the SB-310 Receiver to the antenna connector of another receiver capable of receiving WWV at 2.5 MHz, 5 MHz, 10 MHz, or 15 MHz. If this is not possible, a receiver tuned to a standard broadcast station, operating at an even multiple of 100 kHz, can be used.

( ) Turn ON the SB-310 Receiver and the other receiver. Set the FUNCTION switch of the SB-310 Receiver to the CAL position. Turn the SB-310 Receiver AUDIO GAIN control fully counterclockwise.

( ) Tune the other receiver to WWV or a standard broadcast station as described above. Adjust the Calibrator Trimmer capacitor on the RF circuit board, with an insulated screwdriver for a "zero beat" in the other receiver. When WWV is used, the period when no tone modulation is present allows easier identification of the zero beat. Zero beat is the point at which a harmonic of 100 kHz corresponds to the frequency of the station tuned in on the receiver. As zero beat is approached, a tone that decreases in frequency until it finally stops, will be heard from the receiver. Set the FUNCTION switch to OPR and then back to CAL to be sure you have a true zero beat.

LMO SHIFTER AND DIAL ADJUSTMENTS

LMO SHIFTER ADJUSTMENT

This adjustment can be made only when the SSB crystal filter and the LSB BFO crystal are installed. If you have not installed these accessory items, proceed to Dial Calibration; however, you should remember to make the LMO Shifter Adjustment should the accessory filter and BFO crystal be purchased at some future time.

The purpose of this adjustment is to insure that the LMO remains at zero beat when it is shifted from one sideband to the other.

( ) Set the Main Tuning for 3.8 MHz.

( ) Turn the FUNCTION switch to CAL, and the MODE switch to USB. Carefully zero beat the calibrator signal, using the Main Tuning knob, and peak the PRESELECTOR.

( ) Turn the MODE switch to the LSB position. Be careful not to touch the Main Tuning dial. Now note that the calibrate signal may or may not be exactly at zero beat in the LSB position. Turn the FREQUENCY SHIFT adjustment (on the LMO) for an exact zero beat in the LSB mode. Recheck the zero beat in the USB mode to be certain of the adjustment. Repeat the procedure if necessary.

DIAL CALIBRATION

( ) Zero beat the crystal calibrator at 3.8 MHz.

( ) Set the adjustable index line in the center of the circular dial window.

( ) Remove the knob from the MAIN TUNING shaft without disturbing the zero beat.

( ) Place a screwdriver through the hole in the dial escutcheon directly above the MAIN TUNING shaft and into the LMO dial drive shaft.

( ) Hold the LMO drive shaft on zero beat and loosen the setscrew in the circular dial bushing. Turn the circular dial until the 0 is directly under the adjustable index line. Now tighten the setscrew.

( ) Make sure that the circular dial turns freely and that the nylon spiral follower is properly engaged in the spiral before proceeding.

( ) Replace the knob on the MAIN TUNING shaft.

( ) Readjust the Heterodyne Oscillator coils for maximum S-Meter reading. Be sure to adjust the coil on the side of the peak with the slow rise and fall of voltage.

This completes the Alignment of your Heathkit SB-310 Receiver.

CIRCUIT DESCRIPTION

Refer to the Block Diagram (fold-out from Page 92) and the Schematic (fold-out from Page 105) when reading the Circuit Description. To help you locate parts on the Schematic, the letter-number designations for the parts have been coded as follows:

1 to 99 **Parts** on the RF Circuit Board.
100 to 199 **Parts** on the IF Circuit Board.
200 to 299 **Parts** on the Chassis.

NOTE: To make the various functions of the Receiver easier to understand, a lower sideband frequency of 3.895 megahertz will be used when tracing through the circuit in this description. All switches are shown in appropriate positions on the Schematic. The following chart lists the various frequencies that will be found throughout the Receiver. The first line indicates the frequencies referred to in the Circuit Description.

BAND	HETERODYNE OSCILLATOR FREQUENCY	RECEIVED SIGNAL FREQUENCY	PASSBAND SIGNAL FREQUENCY	LMO MIXER OUTPUT	LMO
3.5 to 4.0	12.395	3.895	8.5	3.395	5.105
5.7 to 6.2	14.595	6.0	8.595	3.395	5.2
7.0 to 7.5	15.895	7.2	8.695	3.395	5.3
9.5 to 10.0	18.395	9.8	8.595	3.395	5.3
11.5 to 12.0	20.395	11.6	8.795	3.395	5.4
14.0 to 14.5	22.895	14.2	8.695	3.395	5.3
15.0 to 15.5	23.895	15.2	8.695	3.395	5.3
17.5 to 18.0	26.395	17.5	8.895	3.395	5.5
26.9 to 27.4	35.795	27.4	8.395	3.395	5.0

Frequencies in Megahertz

RF AMPLIFIER

The received signal is connected from the antenna to BS5R (band switch, wafer 5, rear of wafer). BS5R selects the primary of the antenna coil and BS4F (band switch, wafer 4, front of wafer) selects the secondary of the antenna coil for the band being used. Each tuned circuit consists of a coil and capacitor combination which resonates at frequencies within the band in use. The signal, after passing through coil L1, is connected to C201C and C201D by a tie pin that connects the selector contacts of BS4F and the entire rotor portion of BS4R. Capacitors C201C and C201D are adjusted by the Preselector control to tune the grid circuit of V1, the RF amplifier, to the desired frequency in the 3.5 megahertz band. Only capacitor C201C is used on the 14.0, 15.0, 17.5, and 26.9 MHz bands.

The plate circuit of V1 is tuned to the same frequency as the grid circuit by capacitors C201A and C201B, and coil L7. The plate coil for the band being used is selected by BS3F, and the appropriate tuning capacitor is selected by the use of a tie pin to BS3R. Plate voltage is supplied to this stage through the same tie pin. Only capacitor C201A is used for the 14.0, 15.0, 17.5, and 26.9 MHz bands.

HETERODYNE OSCILLATOR AND FIRST MIXER

The amplified signal from V1 is coupled through capacitor C14 to the grid of V2, the first mixer. Also being fed to the grid of V2 is a highly stable crystal-controlled signal from V4, the heterodyne oscillator. BS1R selects the proper crystal for the band being used. In this case Y1 is switched into the grid circuit of V4 to produce an oscillator frequency of 12.395 megahertz.

The plate circuit of V4 is tuned by coils L13 through L21. The proper coil is connected to BS2R and through a tie pin at BS2F to the plate of tube V4. B+ voltage follows this same path.

The received signal of 3.895 megahertz and the oscillator signal are mixed in V2 to produce the sum and difference frequencies of 16.29 and 8.5 megahertz, respectively. Passband coupler T2 is designed to pass only frequencies in a range between 8.395 and 8.895 megahertz, and to greatly attenuate all other frequencies. The 16.29 megahertz frequency, being too high, is attentuated, whereas the difference frequency of 8.5 megahertz passes through T2 without attenuation.

LINEAR MASTER OSCILLATOR (LMO) AND SECOND MIXER

The 8.5 megahertz signal from T2 is coupled to the grid of V3, the second mixer. Coupled to the cathode of V3 is a signal from the tunable LMO. The LMO, consisting of tube V5 with its associated circuit, forms a very stable linear oscillator that operates over a frequency range of 5 to 5.5 megahertz. Varying the Main Tuning changes the frequency of the LMO and thus changes the operating frequency of the Receiver. The frequency at which the LMO operates is always the difference between the output frequency from the passband filter, T2, and the 3.395 megahertz IF frequency.

In this instance, a signal at 3.895 megahertz beating with the heterodyne oscillator frequency of 12.395 megahertz produces an output frequency of 8.5 megahertz. An LMO frequency of 5.105 megahertz is required to obtain the 3.395 megahertz IF frequency.

The output signal from V3 is passed through the crystal filter for bandwidth selectivity. The input and output of SSB (single sideband), CW, or AM crystal filters are selected by MS2R (Mode switch, wafer 2, rear of wafer) and MS1F respectively.

Only the AM filter is furnished with the Receiver. The CW and SSB filters may be obtained as accessories. See Figure 6-1 for the bandpass characteristic of each filter, and Page 82 for their operational use.

IF AMPLIFIERS

The signal is then fed through capacitor C101, and through stages V6 and V7, the first and second IF amplifiers. These stages are high gain voltage amplifiers. T3 and T4 are tuned for maximum gain per stage.

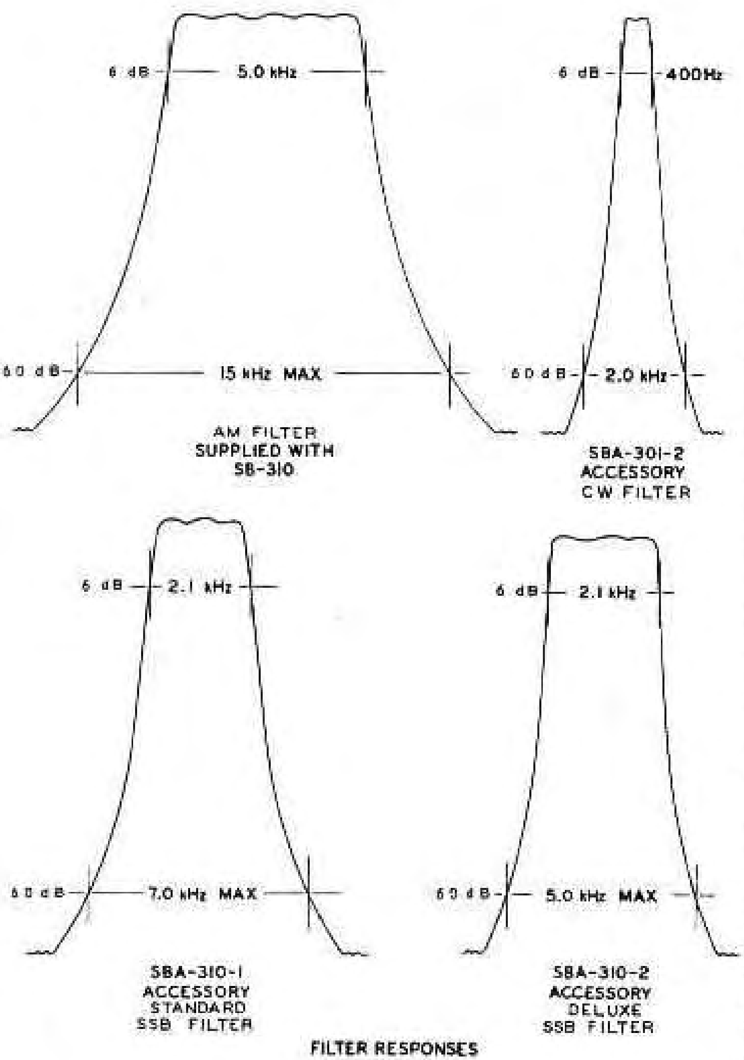


Figure 6-1

The "S" meter is connected in the IF circuits to indicate received signal strength. The S-Meter Adjust control is adjusted for zero S-units with the antenna disconnected and the RF Gain control fully clockwise.

NOISE LIMITER

The noise limiter circuit, which consists of diodes D1 and D2, capacitors C111 and C112, and resistor R235, is a full-wave, shunt-type diode limiter. The limiter is self-biased and automatically adjusts itself to the degree of modulation of the received signal.

The advantage of this self-biasing type of limiter is that as the signal level moves up or down, the point at which it starts to limit also moves up or down. The ANL (automatic noise limiter) switch is located on the AF Gain control. The control knob is pulled out to turn the limiter on.

AGC

The desired amount of amplification for the RF and IF amplifiers is determined by the negative grid bias set by the RF Gain control. Also present on this same line is the AGC (automatic gain control) voltage. This voltage is obtained by coupling a portion of the IF output signal through capacitor C114 to AGC diodes D3 and D4. These diodes produce a negative DC voltage proportional to the signal strength. A signal producing a negative AGC voltage higher than the preset bias voltage causes the gain of V1, V6, and V7 to be reduced below the preset level. This produces an output level from the first RF and IF amplifier stages that remains nearly constant in spite of wide changes in the amplitude of the received signal.

The AGC action is instantaneous. However, the length of time it remains in control is determined by capacitors C114 and C228 along with resistor R112. These capacitors are charged by the AGC voltage when a higher than normal signal is received; C114 has a fast rate of discharge, and C228 a slow rate of discharge. The capacitors discharge through resistors R208 and R214, and the RF Gain control. Because resistor R208 is so much larger than R214 and the RF Gain control, changing the setting of the RF Gain control has very little effect on the discharge time of capacitors C114 and C228. The AGC switch places only one of these capacitors in the circuit at a time.

PRODUCT DETECTOR/BFO

Tube V9 is made up of three triodes. The IF output signal in the LSB, USB, and CW modes is fed through capacitor C118 to the grid of the product detector, V9A. V9B serves as a BFO (beat frequency oscillator). The frequency at which V9B oscillates is determined by crystals Y10 and Y11. These crystals are selected by MS4R.

With the Mode switch in the LSB position, crystal Y10 is selected to produce a carrier frequency of 3393.6 kHz.

If USB (upper sideband) operation is desired, the Mode switch is placed in the USB position. MS4R switches crystal Y11 into the circuit, increasing the operating frequency of the BFO by 2.8 kilohertz. When this is done, the LMO frequency must also be changed 2.8 kilohertz, but in the opposite direction. These frequency changes result in changing to the upper sideband without changing the receiver main tuning. The change in operating frequency of the LMO is done by a switching diode in the LMO.

AF AMPLIFIERS

The audio output signal results from mixing the IF and BFO frequencies in the Product Detector.

The audio signal is coupled through capacitor C242 to MS4R. From MS4R the signal is fed to the grid of V10A, the first audio amplifier. This amplified signal is coupled through capacitor C121 to V10B, the second audio amplifier. The signal is then coupled through output transformer T5 to a speaker or headphones. From the secondary of T5, an 8 Ω output is available for speaker operation, and a high impedance output is available for headphone operation. A 500 Ω audio output is also available. Resistor R117 and capacitor C119 from the secondary of T5 to the cathode of V10A form a negative feedback circuit. The negative feedback circuit is used to provide a low distortion, stable audio output power of 1 watt.

AM DETECTION

In the AM mode, the BFO is turned off and the Product Detector is disconnected from the audio amplifier by MS4R. The IF output signal is coupled through capacitor C117 to D5, the AM detector diode. RF signals are bypassed to ground through capacitor C116. The resulting amplitude-detected audio signal is routed by MS4R to the AF Gain control and to audio amplifier stages V10A and V10B. The setting of the AF Gain control determines the audio output level from the Receiver. The detected audio from either the product detector or the AM detector is also fed to the grid of cathode follower V9C. The cathode follower maintains a low level, low impedance output suitable for the "tuner" input of a hi-fi amplifier.

CRYSTAL CALIBRATOR

The 100 kHz signal produced by V8, the crystal controlled calibrator stage, is coupled to the Receiver input. This signal can be used at any time to check dial calibration by placing the Function switch in the CAL position, and the Mode switch in the LSB or USB position. Zero beat cannot be heard in the CW mode due to the narrow passband of the CW filter, nor in the AM mode due to the absence of BFO injection.

MUTE JACK

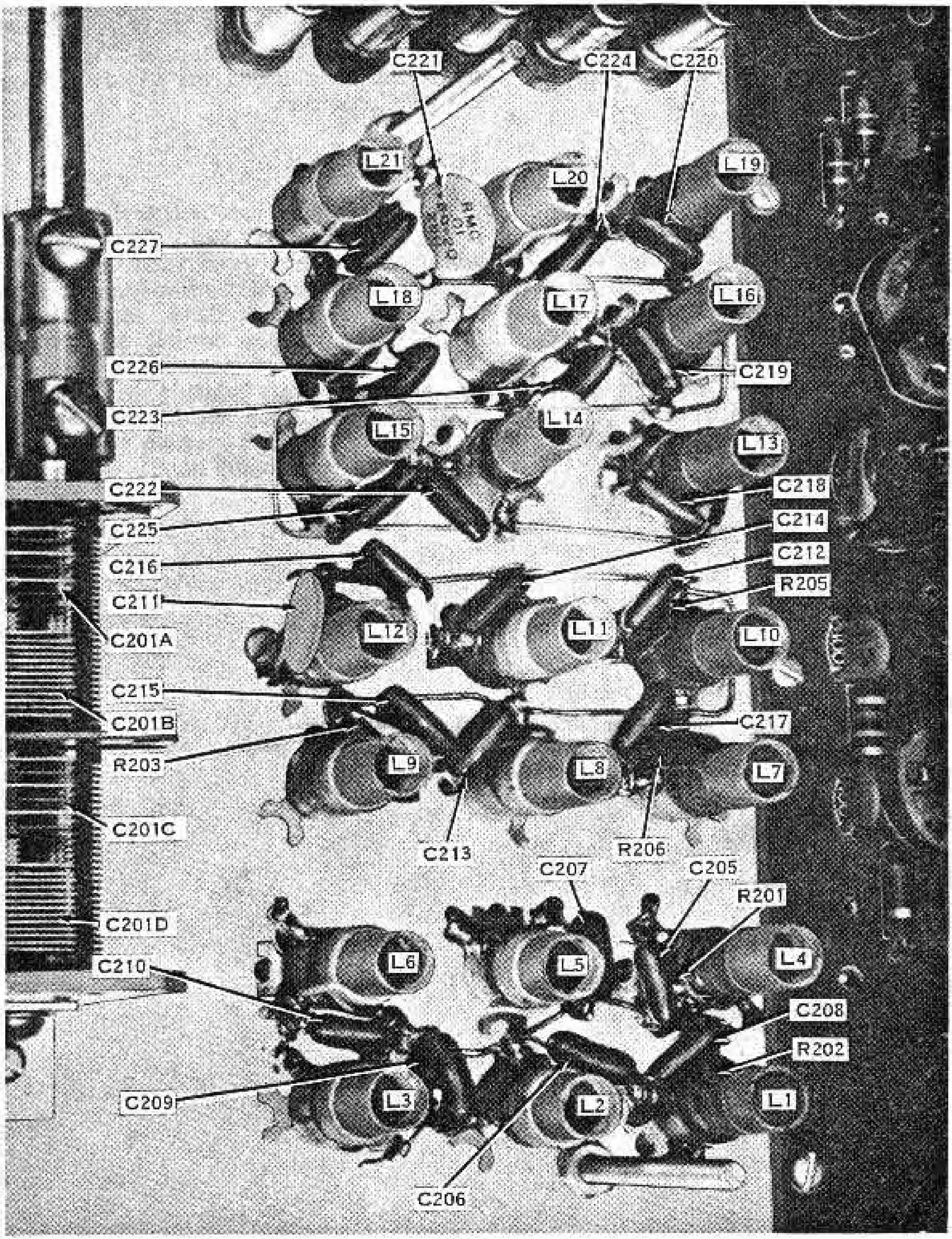
The Mute jack on the rear of the Receiver is used to bias receiver tube stages V1, V2, V6, V7, and V10B to cutoff for muting.

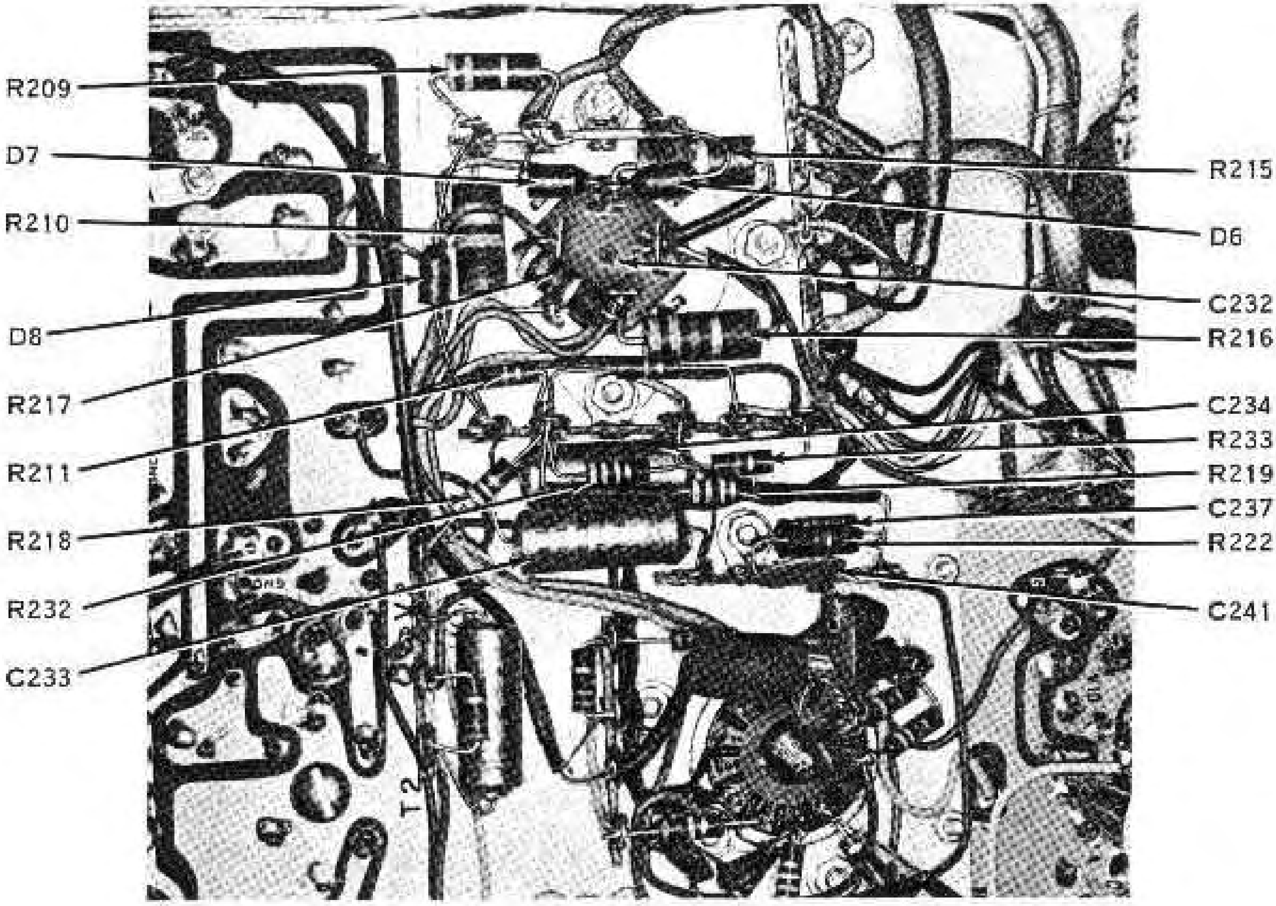
To use the Mute feature, the Function switch is placed in the STBY position. Then, when the Mute line is grounded, the Receiver changes to the OPR condition.

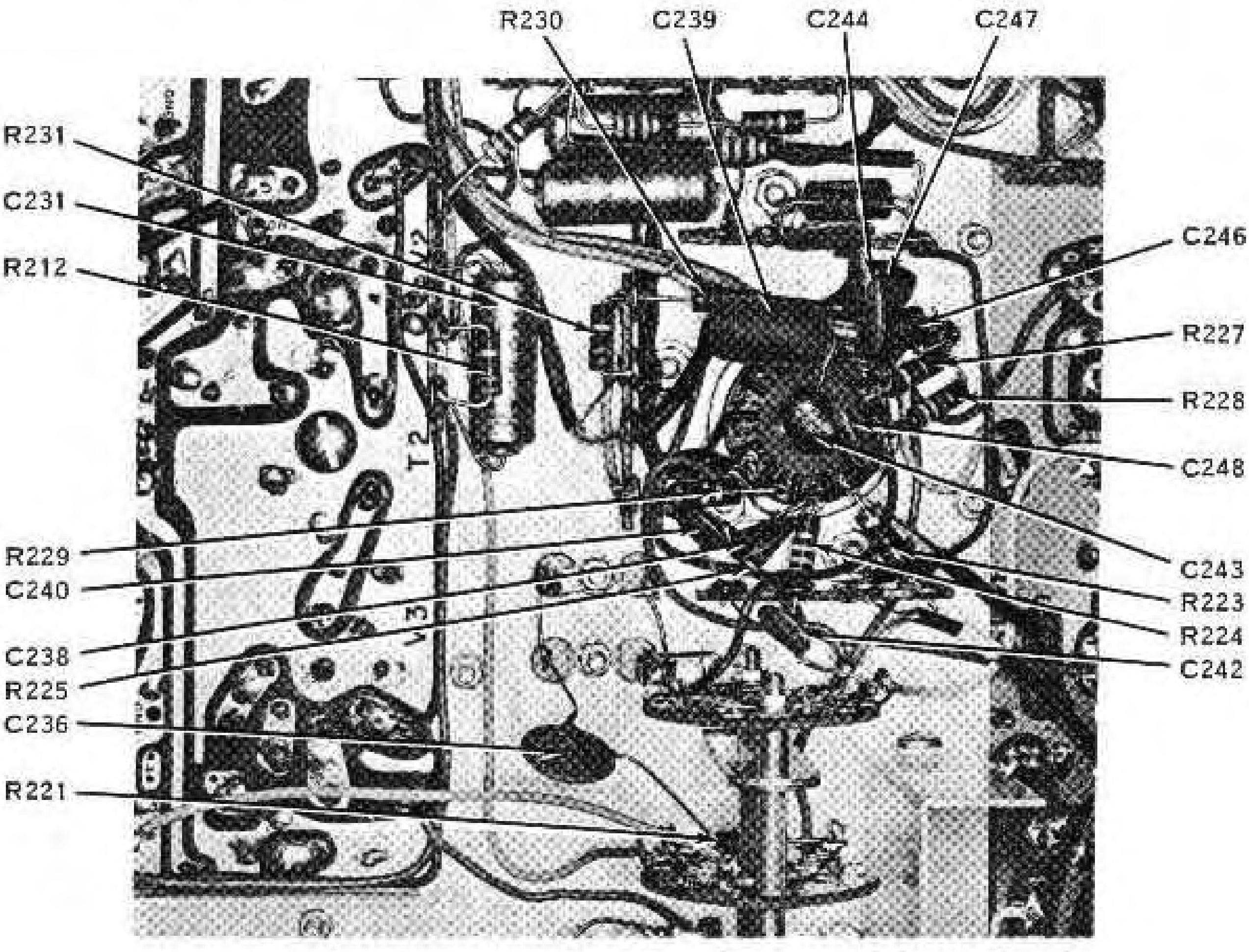
POWER SUPPLY

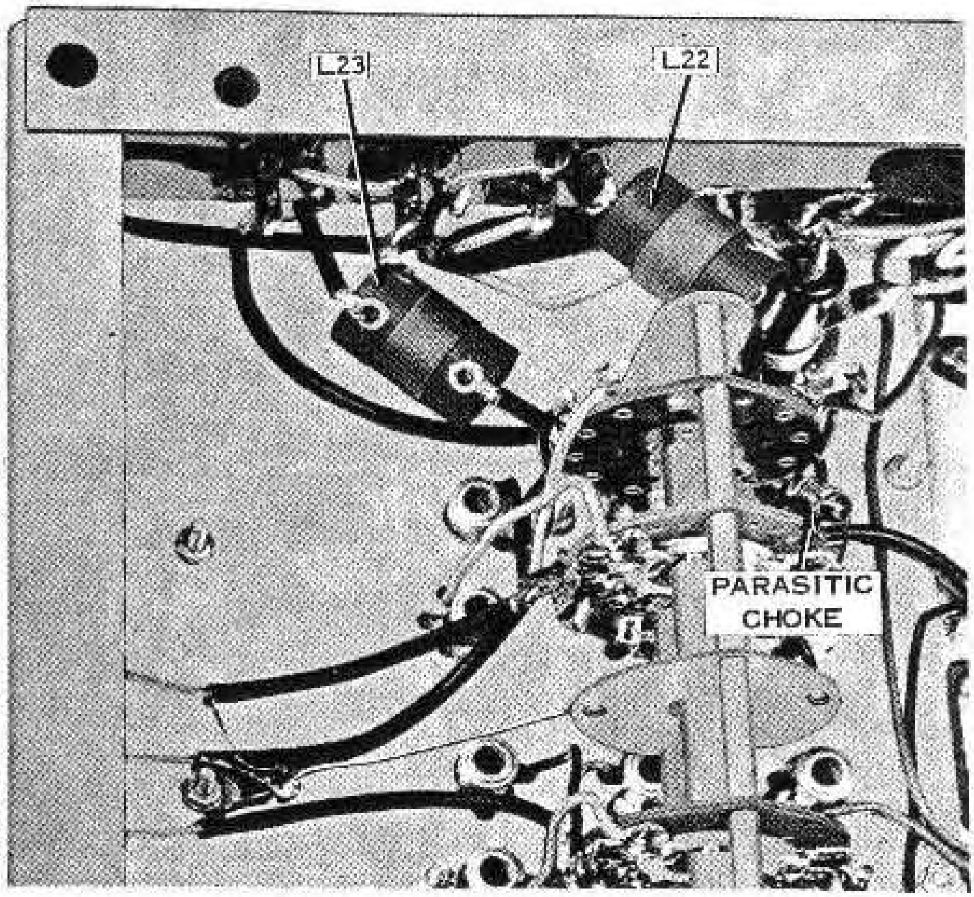
The power supply uses a transformer for isolation from the AC line. Diodes D6 and D7 are used in a full-wave rectifier circuit. The B+ voltage is filtered by four-section capacitor C232 and resistors R215, R216, and R217. Diode D8 is used to develop negative voltage for use as bias. Transformer T1 includes a separate secondary winding for the tube filament and pilot lamp voltage. It has two primary windings which may be wired for either a 120 or 240 volt supply line.

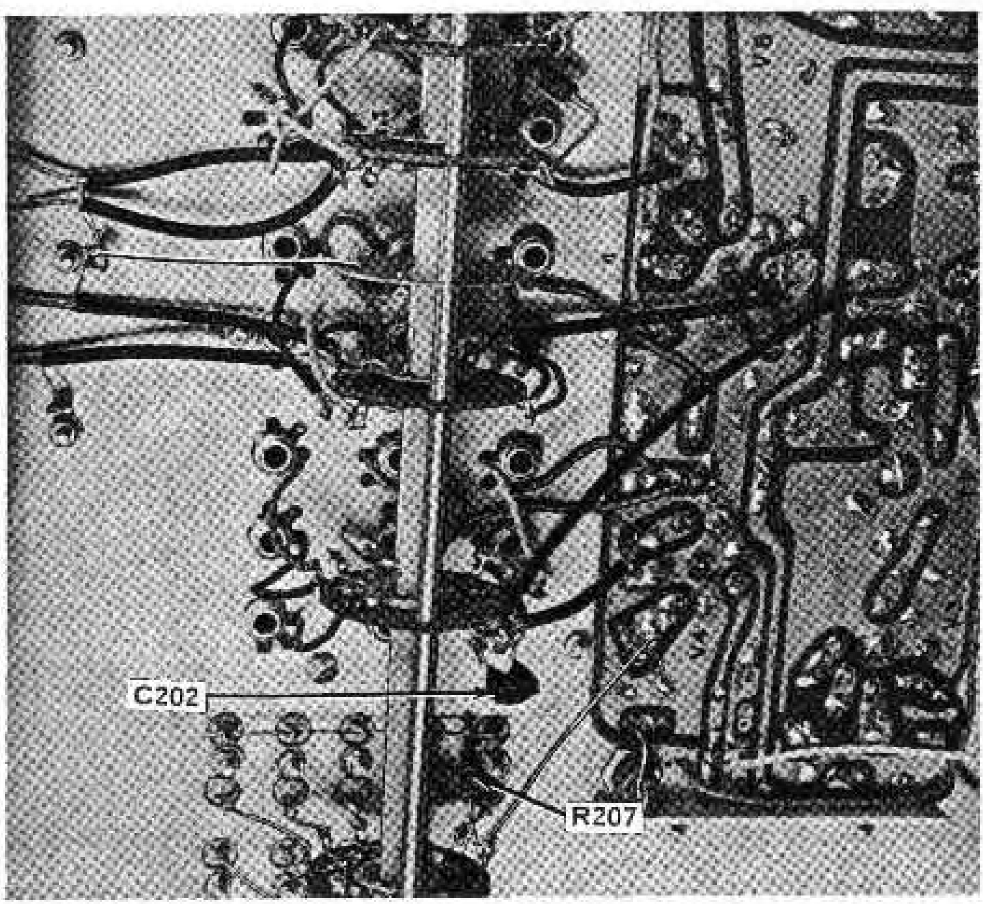
CHASSIS PHOTOGRAPHS

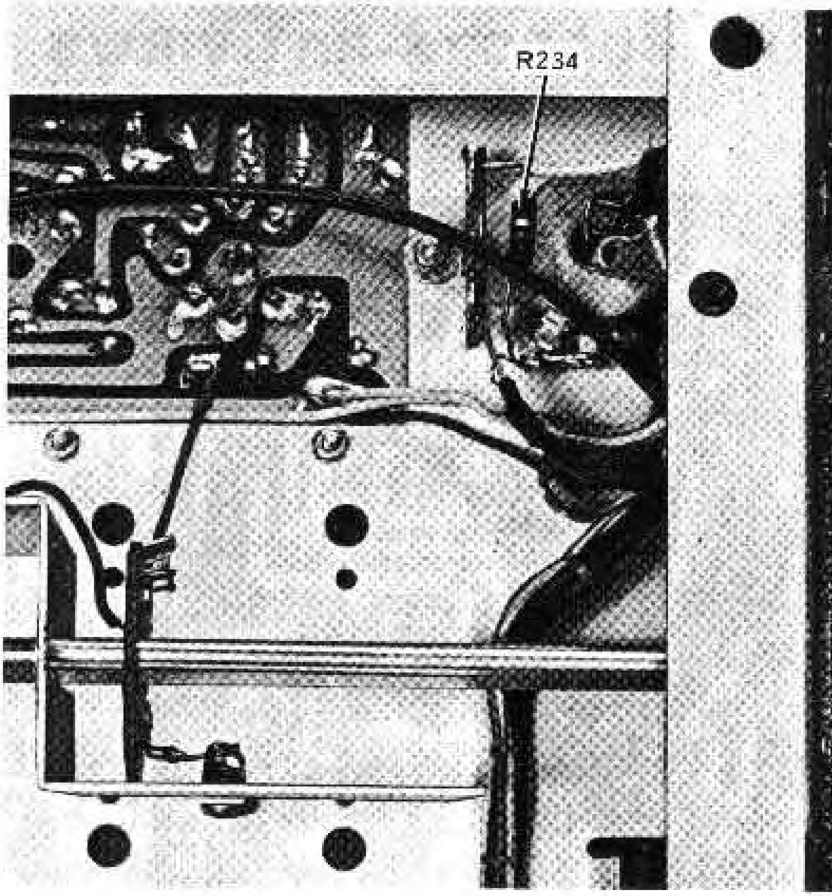


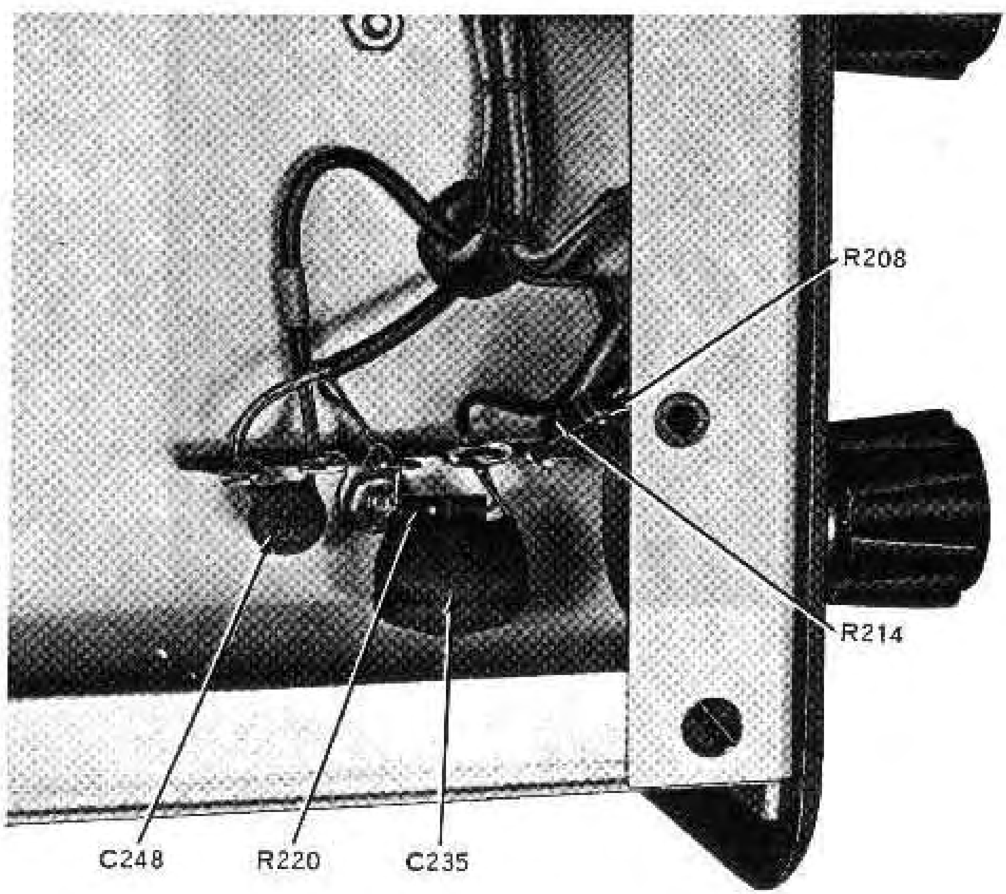

R209
D7
R210
D8
R217
R211
R218
R232
C233
R215
D6
C232
R216
C234
R233
R219
C237
R222
C241
T2


R230
C239
C244
C247
R231
C231
R212
C246
R227
R228
C248
C243
R223
R224
C242
R229
C240
C238
R225
C236
R221
T2
V3

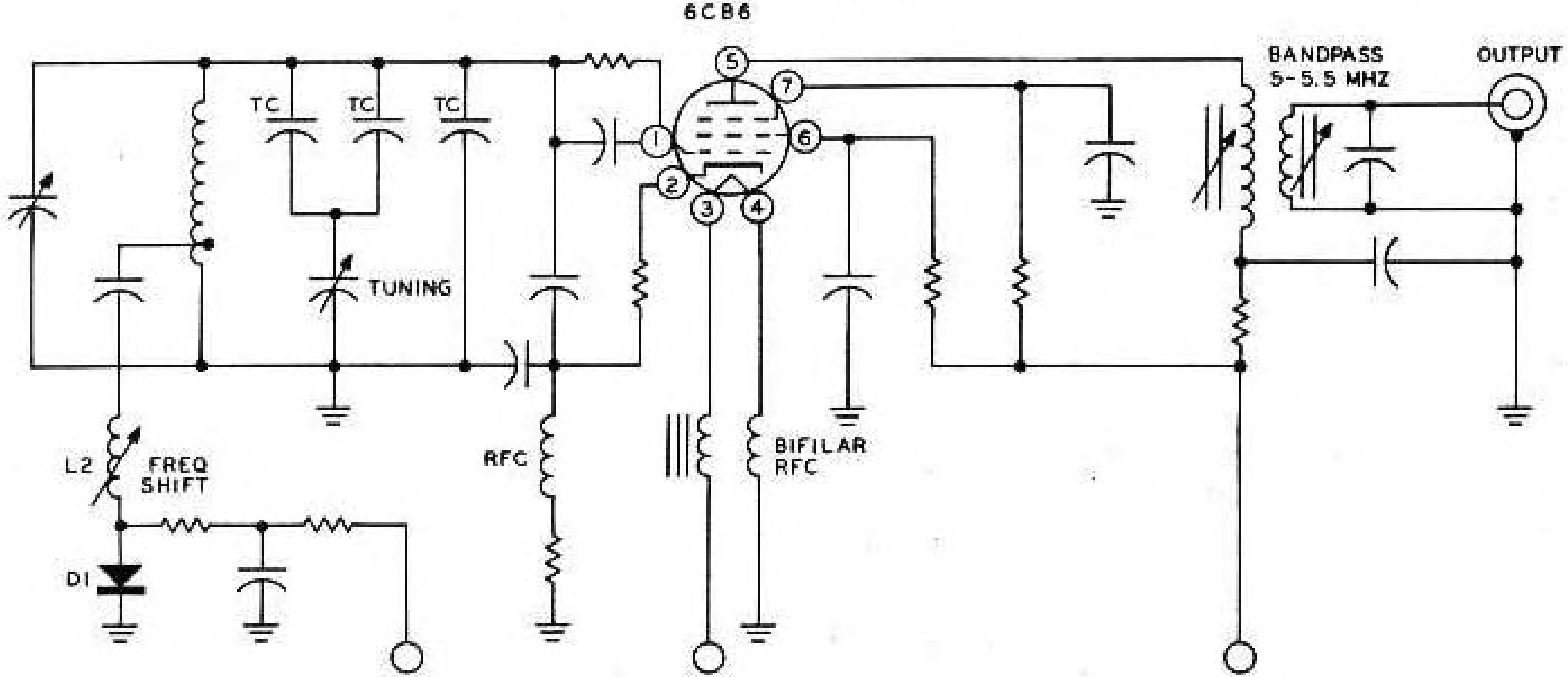

L23
L22
PARASITIC
CHOKE


C202
R207


R234


R208
R214
C248
R220
C235

LMO SCHEMATIC



ANTENNA-RF COIL ALIGNMENT CHART

SET BAND SWITCH TO	RECEIVER FREQUENCY	SET PRESELECTOR* FOR	ADJUST FOR MAXIMUM
( ) 3.5 MHz	3.5 MHz	3.5	ANTENNA coil 3.5
( ) **3.5 MHz	3.5 MHz	3.5	RF AMPLIFIER coil 3.5
( ) 7.0 MHz	7.5 MHz	7.5	ANTENNA coil 7.5
( ) 7.0 MHz	7.5 MHz	7.5	RF AMPLIFIER coil 7.5
( ) 9.5 MHz	9.5 MHz	9.5	ANTENNA coil 9.5
( ) 9.5 MHz	9.5 MHz	9.5	RF AMPLIFIER coil 9.5
( ) 15.0 MHz	15.5 MHz	15.5	ANTENNA coil 15.5
( ) 15.0 MHz	15.5 MHz	15.5	RF AMPLIFIER coil 15.5
( ) 17.5 MHz	17.5 MHz	17.5	ANTENNA coil 17.5
( ) 17.5 MHz	17.5 MHz	17.5	RF AMPLIFIER coil 17.5
( ) 26.9 MHz	27.4 MHz	27.4	ANTENNA coil 27.4
( ) 26.9 MHz	27.4 MHz	27.4	RF AMPLIFIER coil 27.4

* See Figure 2-2.

** Upon completion of this step, readjust transformers T3 and T4 for maximum to compensate for any error in the preceding IF Alignment.

This completes the IF antenna, and RF alignment of the Receiver. The signal generator, if one was used, should be disconnected from the Receiver. Now perform the steps under Crystal Calibrator Alignment.

FIGURE 2-1

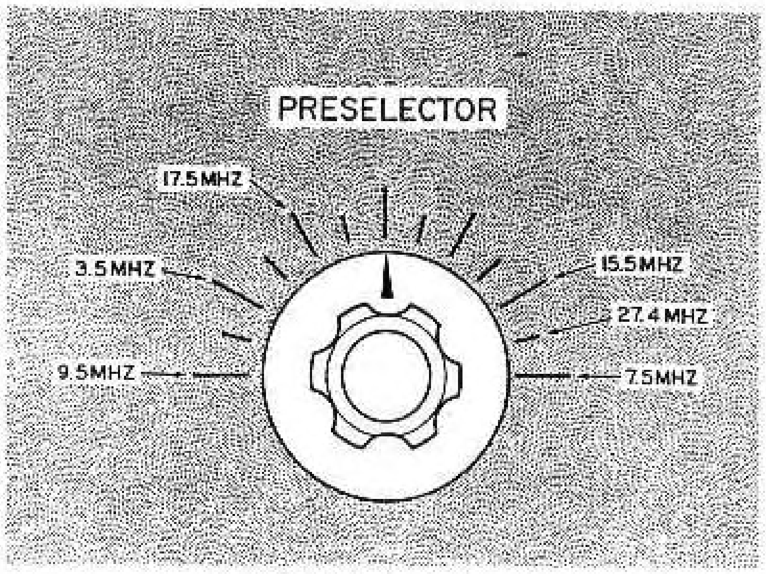
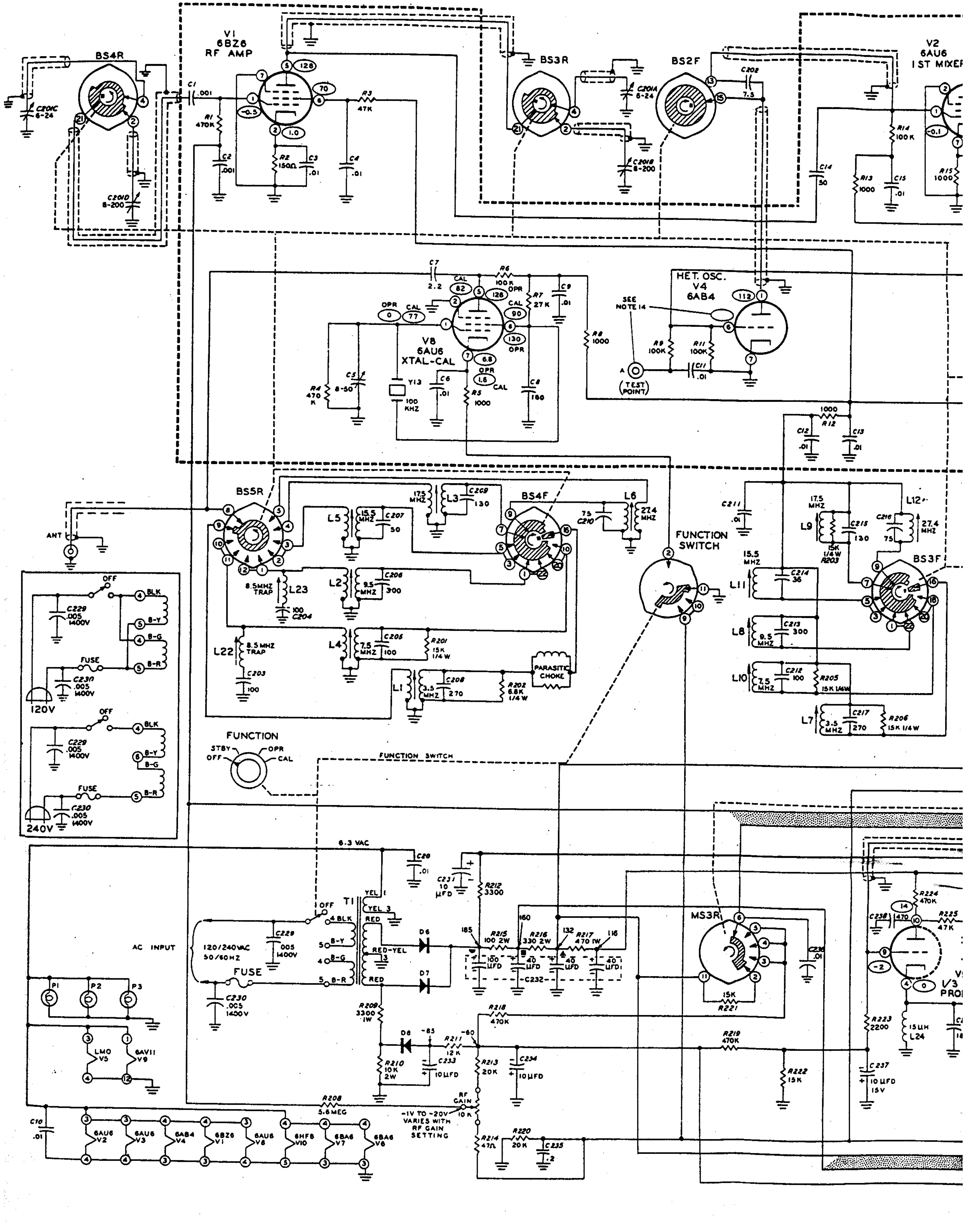
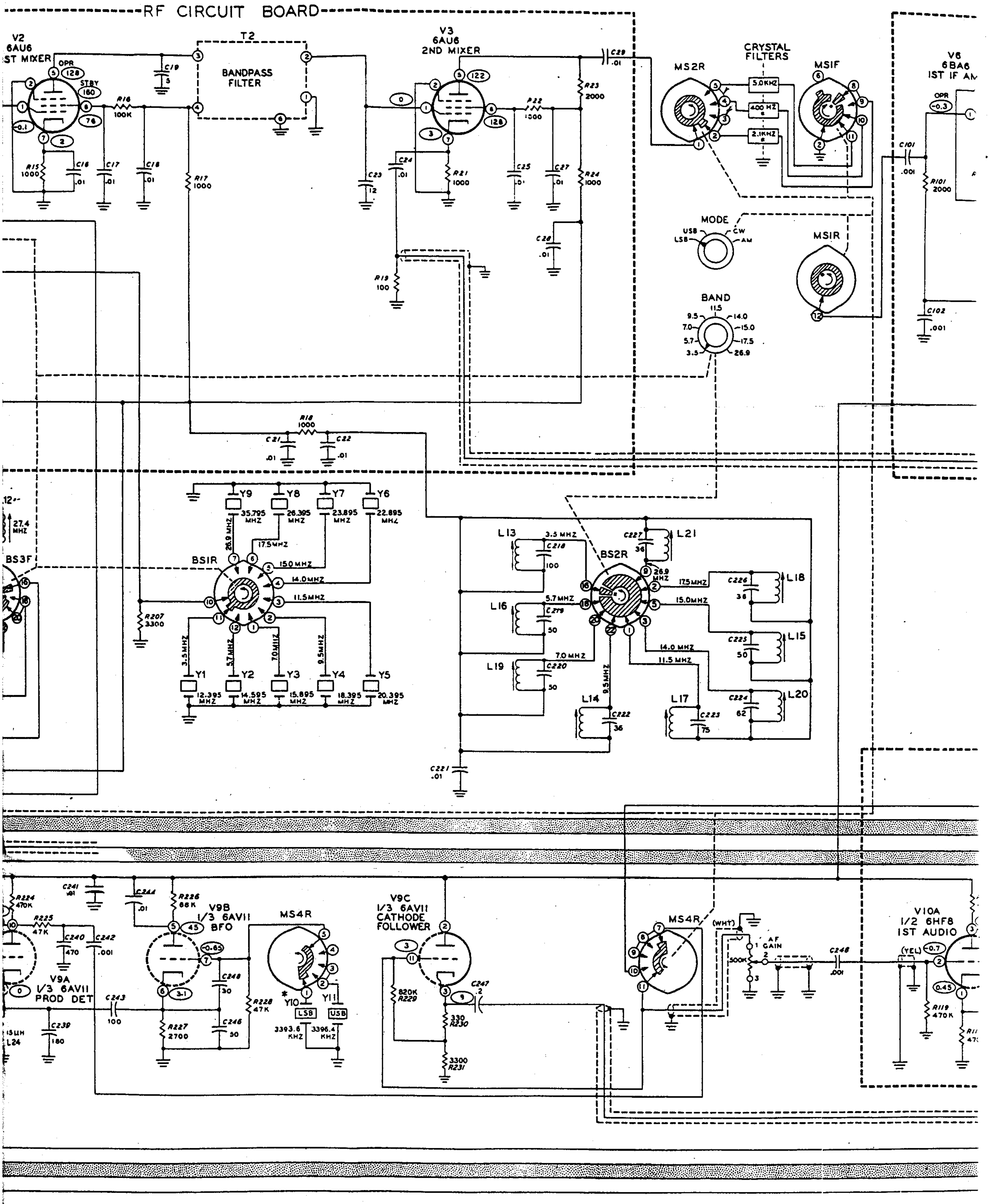
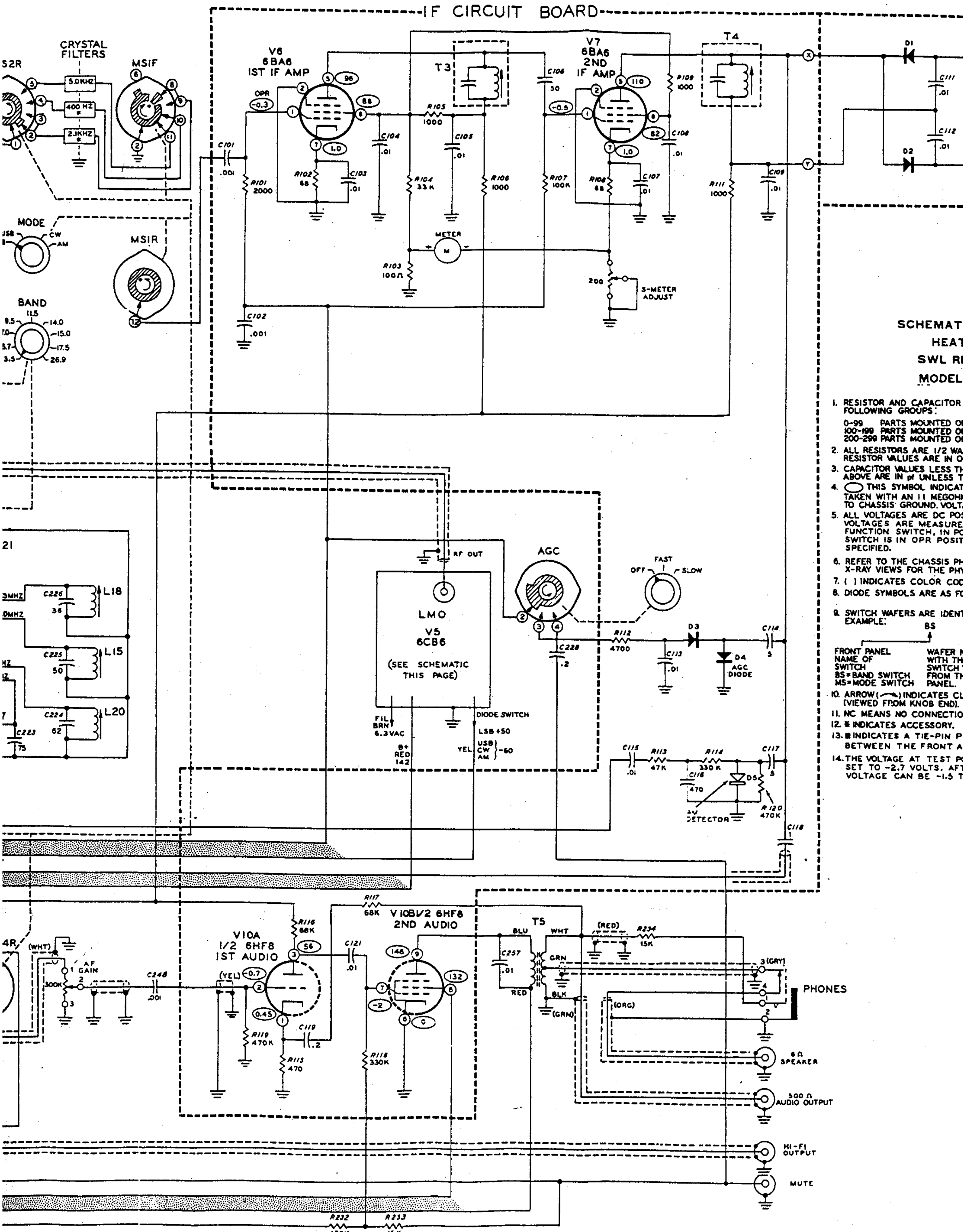


FIGURE 2-2



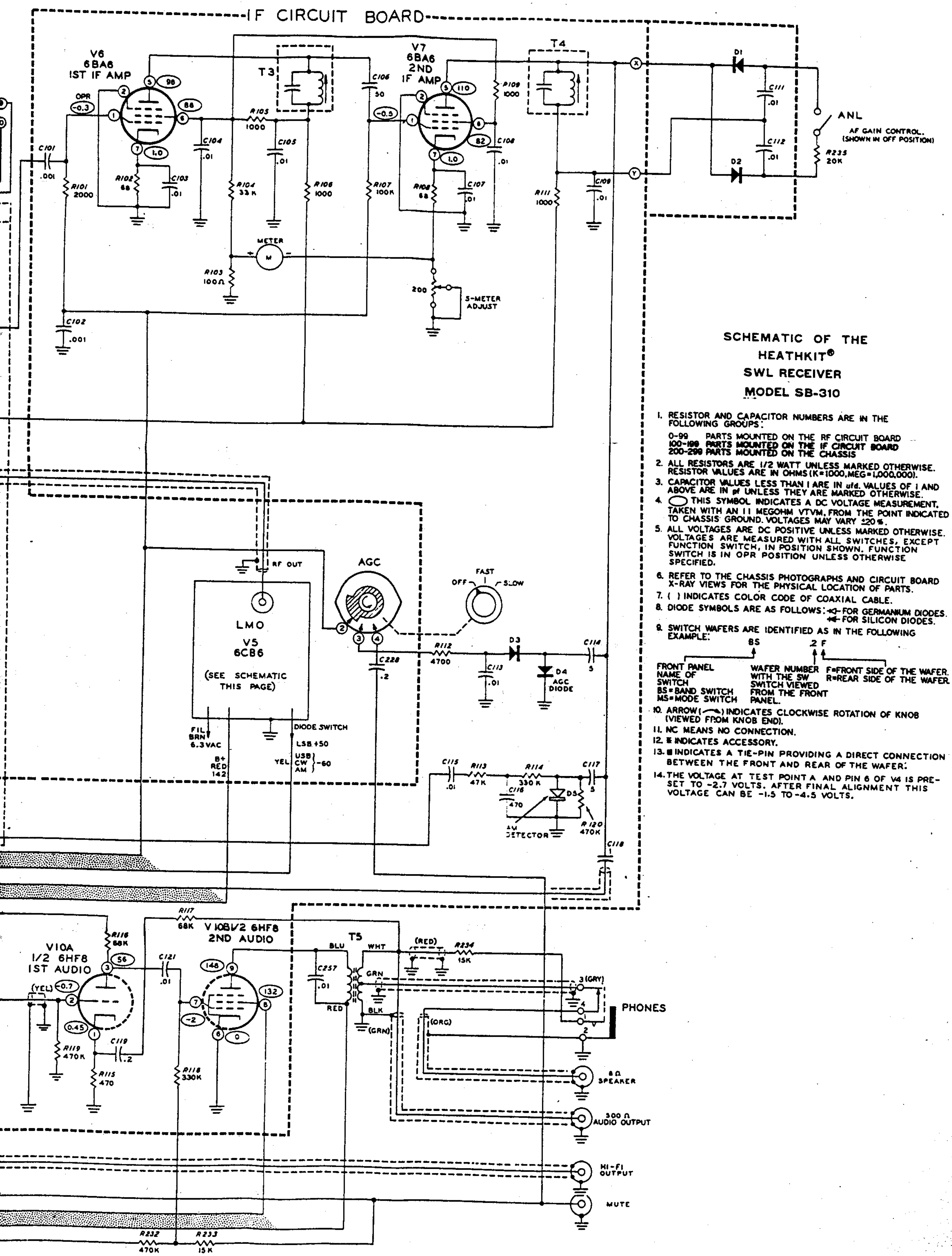
BS4R
C201C 6-24
C201D 8-200
V1 6BZ6 RF AMP
C1 .001
R1 470K
C2 .001
R2 150Ω
C3 .01
R3 47K
C4 .01
BS3R
C201A 6-24
C201B 8-200
BS2F
C202 7.5
V2 6AU6 1ST MIXER
R14 100K
C14 50
R13 1000
C15 .01
R15 1000
C7 2.2
R6 100K
R7 27K
C9 .01
V8 6AU6 XTAL-CAL
OPR
CAL
R4 470 K
C5 8-50
Y13 100 KHZ
C6 .01
R5 1000
C8 180
R8 1000
HET. OSC. V4 6AB4
SEE NOTE 14
R9 100K
R11 100K
C11 .01
A (TEST POINT)
R12 1000
C12 .01
C13 .01
BS5R
BS4F
ANT
L5 15.5 MHZ C207 50
17.5 MHZ L3 C209 130
L6 27.4 MHZ
C210 75
L2 9.5 MHZ C206 300
8.5MHZ TRAP L23
C204 100
L4 7.5 MHZ C205 100
R201 15K 1/4W
L22 8.5 MHZ TRAP
C203 100
L1 3.5 MHZ C208 270
R202 6.8K 1/4W
PARASITIC CHOKE
FUNCTION SWITCH
C211 .01
17.5 MHZ
L9
C215 130
15K 1/4W R203
C216 75
L12 27.4 MHZ
BS3F
L11 15.5 MHZ C214 36
L8 9.5 MHZ C213 300
L10 7.5 MHZ C212 100
R205 15K 1/4W
L7 3.5 MHZ C217 270
R206 15K 1/4W
C229 .005 1400V
FUSE
C230 .005 1400V
BLK
B-Y
B-G
B-R
OFF
120V
240V
FUNCTION
STBY
OPR
OFF
CAL
FUNCTION SWITCH
6.3 VAC
C20 .01
C231 10 µFD
R212 3300
T1
YEL 1
YEL 3
RED
RED-YEL
AC INPUT
120/240VAC 50/60HZ
D6
D7
R215 100 2W
R216 330 2W
R217 470 1W
C232
MS3R
R221 15K
C236 .01
P1 P2 P3
R209 3300 1W
D8
R211 12K
R210 10K 2W
C233 10 µFD
R218 470K
R213 20K
C234 10 µFD
R219 470K
R222 15K
LMO V5
6AV11 V9
C10 .01
R208 5.6 MEG
RF GAIN 10K
-1V TO -20V VARIES WITH RF GAIN SETTING
R214 47Ω
R220 20K
C235 .2
6AU6 V2
6AU6 V3
6AB4 V4
6BZ6 V1
6AU6 V8
6HF8 V10
6BA6 V7
6BA6 V6
R224 470K
R225 47K
C238 470
R223 2200
L24 15 µH
C237 10 µFD 15V


RF CIRCUIT BOARD
V2 6AU6 1ST MIXER
T2
BANDPASS FILTER
V3 6AU6 2ND MIXER
CRYSTAL FILTERS
MS2R
MS1F
5.0KHZ
400 HZ
2.1KHZ
V6 6BA6 1ST IF AMP
MODE
USB LSB CW AM
MS1R
BAND
BS1R
BS2R
BS3F
Y1 Y2 Y3 Y4 Y5 Y6 Y7 Y8 Y9
L13 L14 L15 L16 L17 L18 L19 L20 L21
MS4R
V9A 1/3 6AV11 PROD DET
V9B 1/3 6AV11 BFO
V9C 1/3 6AV11 CATHODE FOLLOWER
Y10 LSB 3393.6 KHZ
Y11 USB 3396.4 KHZ
AF GAIN
V10A 1/2 6HF8 1ST AUDIO



SCHEMATIC
HEATHI
SWL RECI
MODEL SI

1. RESISTOR AND CAPACITOR NU
FOLLOWING GROUPS:
0-99 PARTS MOUNTED ON TI
100-199 PARTS MOUNTED ON TI
200-299 PARTS MOUNTED ON TI
2. ALL RESISTORS ARE 1/2 WATT
RESISTOR VALUES ARE IN OHMS
3. CAPACITOR VALUES LESS THAN
ABOVE ARE IN pf UNLESS THEY
4. ◯ THIS SYMBOL INDICATES
TAKEN WITH AN 11 MEGOHM V
TO CHASSIS GROUND. VOLTAGE
5. ALL VOLTAGES ARE DC POSITI
VOLTAGES ARE MEASURED W
FUNCTION SWITCH, IN POSIT
SWITCH IS IN OPR POSITION
SPECIFIED.
6. REFER TO THE CHASSIS PHOT
X-RAY VIEWS FOR THE PHYSIC
7. ( ) INDICATES COLOR CODE C
8. DIODE SYMBOLS ARE AS FOLL
9. SWITCH WAFERS ARE IDENTIFI
EXAMPLE: BS
FRONT PANEL NAME OF SWITCH BS=BAND SWITCH MS=MODE SWITCH
WAFER NUM WITH THE S SWITCH VIEW FROM THE F PANEL.
10. ARROW (⌒) INDICATES CLOC
(VIEWED FROM KNOB END).
11. NC MEANS NO CONNECTION.
12. * INDICATES ACCESSORY.
13. ■ INDICATES A TIE-PIN PROV
BETWEEN THE FRONT AND
14. THE VOLTAGE AT TEST POIN
SET TO -2.7 VOLTS. AFTER
VOLTAGE CAN BE -1.5 TO -



SCHEMATIC OF THE HEATHKIT® SWL RECEIVER MODEL SB-310

1. RESISTOR AND CAPACITOR NUMBERS ARE IN THE FOLLOWING GROUPS:

   0-99 PARTS MOUNTED ON THE RF CIRCUIT BOARD
   100-199 PARTS MOUNTED ON THE IF CIRCUIT BOARD
   200-299 PARTS MOUNTED ON THE CHASSIS
2. ALL RESISTORS ARE 1/2 WATT UNLESS MARKED OTHERWISE. RESISTOR VALUES ARE IN OHMS (K=1000, MEG=1,000,000).
3. CAPACITOR VALUES LESS THAN 1 ARE IN μfd. VALUES OF 1 AND ABOVE ARE IN pf UNLESS THEY ARE MARKED OTHERWISE.
4. ◯ THIS SYMBOL INDICATES A DC VOLTAGE MEASUREMENT. TAKEN WITH AN 11 MEGOHM VTVM, FROM THE POINT INDICATED TO CHASSIS GROUND. VOLTAGES MAY VARY ±20%.
5. ALL VOLTAGES ARE DC POSITIVE UNLESS MARKED OTHERWISE. VOLTAGES ARE MEASURED WITH ALL SWITCHES, EXCEPT FUNCTION SWITCH, IN POSITION SHOWN. FUNCTION SWITCH IS IN OPR POSITION UNLESS OTHERWISE SPECIFIED.
6. REFER TO THE CHASSIS PHOTOGRAPHS AND CIRCUIT BOARD X-RAY VIEWS FOR THE PHYSICAL LOCATION OF PARTS.
7. ( ) INDICATES COLOR CODE OF COAXIAL CABLE.
8. DIODE SYMBOLS ARE AS FOLLOWS: FOR GERMANIUM DIODES. FOR SILICON DIODES.
9. SWITCH WAFERS ARE IDENTIFIED AS IN THE FOLLOWING EXAMPLE:

   BS 2 F

   FRONT PANEL NAME OF SWITCH
   BS=BAND SWITCH
   MS=MODE SWITCH

   WAFER NUMBER WITH THE SW SWITCH VIEWED FROM THE FRONT PANEL.

   F=FRONT SIDE OF THE WAFER.
   R=REAR SIDE OF THE WAFER.
10. ARROW ( ) INDICATES CLOCKWISE ROTATION OF KNOB (VIEWED FROM KNOB END).
11. NC MEANS NO CONNECTION.
12. ✱ INDICATES ACCESSORY.
13. ■ INDICATES A TIE-PIN PROVIDING A DIRECT CONNECTION BETWEEN THE FRONT AND REAR OF THE WAFER.
14. THE VOLTAGE AT TEST POINT A AND PIN 6 OF V4 IS PRE-SET TO -2.7 VOLTS. AFTER FINAL ALIGNMENT THIS VOLTAGE CAN BE -1.5 TO -4.5 VOLTS.