REPAIR MANUAL

COMMUNICATIONS RECEIVR MODEL SX-117

HALLICRAFTERS
SX-117
REPAIR MANUAL

THIS DOCUMENT IS DESIGNED TO BE A COMPANION DOCUMENT TO THE

HALLICRAFTERS OPERATING AND SERVICE INSTRUCTIONS
COMMUNICATION RECEIVER MODEL SX-117 MANUAL

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ACKNOWLEDGEMENTS

Many thanks to Jim, K9AXN and Al, W8UT
who loaned me SX-117's
for the 4 months it took to write this document

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1, INTRODUCTION

The SX-117 is an amateur radio receiver designed to operate on the HF bands from 80 meters through 10 meters with option for 10MHz WWV. Operation on LF band can be achieved with the companion accessory, the HA-10 converter. Its design was finalized in 1961 and was in production from 1962 through 1964. The average cost through its production years was $395.95. It has been referred to as the poor man's SX-115, this is a big mistake. The SX-115 cost ran $599.50. The electrical designs are quite similar. The design of the VFO in the SX117 is significantly more stable eliminating the need for a VR regulator tube. The SX117 uses more dual tubes so the active tube stage count for the 117 is 22 and for the 115 it is 21. A good part of the cost difference was the production cost. The mechanical design of the 115 was expensive and complicated. Because of the improved mechanical design, from an owner's standpoint the SX-117 is much simpler to maintain. So overall, in my mind the SX-115 gets a *** rating and the SX117 gets ****.

If you compare the specifications, point for point you find the SX-115 and the SX117 are very much the same. If you compare the actual performance the SX-117 Is much better. The S+N:N spec for both radios is the same, SSB, ½ microvolt for 10db s+n:n. The 115 commonly runs 12 to 15db. The 117 commonly runs 18 to 24db. The AVC figure of merit for the 115 is no more than 10db audio change over an input signal change of 60db. The 115 demonstrates 5 to 8db change in audio over 60db which is very good. However, the 117 spec states 5db over an 80db range. The 117 demonstrates ¾ to 1db over 80db which is outstanding. When you combine the better signal to noise ratio with the superior AVC performance you have a quiet, comfortable copy of the HF bands.

2, GETTING STARTED

2-1, MANUAL STRUCTURE

The analysis and troubleshooting procedures are sequenced in a specific manner to minimize back tracking.

Section 2-3, Test equipment requirements defined
Section 3, Cleaning, recapping and visual inspection.
Section 4, Verify the power source.
Section 5, The oscillators tested and verified.
Section 6, The receiver train signal tracing.
Section 7' Simplified schematics and voltage charts
--Section 7-1, AVC circuit performance.
--Section 7-2 through 7-10, Subsystem troubleshooting and voltage charts.
Section 8, Production run determination
Section 9, APPENDIX

2-2, PRODUCTION RUN

Prior to any maintenance activity you need to determine which production run your rig is. Refer to section 8, to make this determination. You should make upgrade changes to your rig before starting the maintenance activity. It is highly recommended to upgrade to at least level C (production run 3). ***BE AWARE:*** The voltage and signal levels in all of the subsystem charts apply to production run 3 and above radios. Unmodified run 1 and run 2 radios will vary greatly.

2-3, TEST EQUIPMENT

There is no need for expensive or elaborate test equipment. I purposefully minimized the test equipment I used to develop this document.

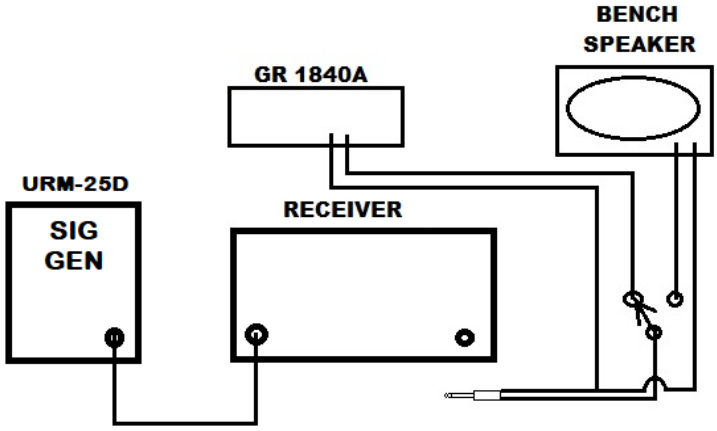
2-3-1, SIGNAL GENERATOR

The signal generator needs to cover, minimum, 50KHz to 30MHz. The key feature is a calibrated output. The output should be metered with a step attenuator, and capable of precise output from 0.1uv to 100kuv. For the development of this document, I used the URM25-D.

2-3-2, AUDIO POWER METER

An audio output meter such as the General Radio 1840A (my choice) is all that is needed. There are many that are up to the task. The key features are: Internal variable load (at least 3 ohms to 1.5k), variable full-scale power, 2mw to 20w and a meter calibrated in watts and DB. Fully self-contained no power no batteries. The majority of the receiver test specs involve a fixed signal input and a minimum or fixed audio output across a fixed load. Other specs involve a change in audio output across a given load due to a change in input signal. All of these measurement requirements are satisfied by a good audio power meter.

For my bench setup I have a standard ¼ inch phone plug which goes to a switch. The switch selects either a speaker or the audio power meter. Like the SX-117 most of the equipment I work on (Hallicrafters SR series) has a front panel phone jack that disconnects internal speakers. I have an adaptor phone jack with clip leads for working on various other radios. A side benefit of using an audio power meter with built in load is, you do not have to listen to the constant drone of the receiver. Switching in the speaker allows you to quickly find the signal when you change frequencies.



2-3-3, OSCILLOSCOPE

You will need to accurately measure DC levels as well as AC and RF signals. I used a Hantek DSO5102 to develop this document ($219 @ amazon). This is not an endorsement of Hantek. I got it because I had never used a digital scope and it was inexpensive. What I like about a digital scope is all the information presented on the screen; frequency, period, mean voltage, peak to peak voltage, signal minimum, signal maximum, pulse width, rise time and a myriad of other features I have yet to explore.

2-3-4, FREQUENCY COUNTER

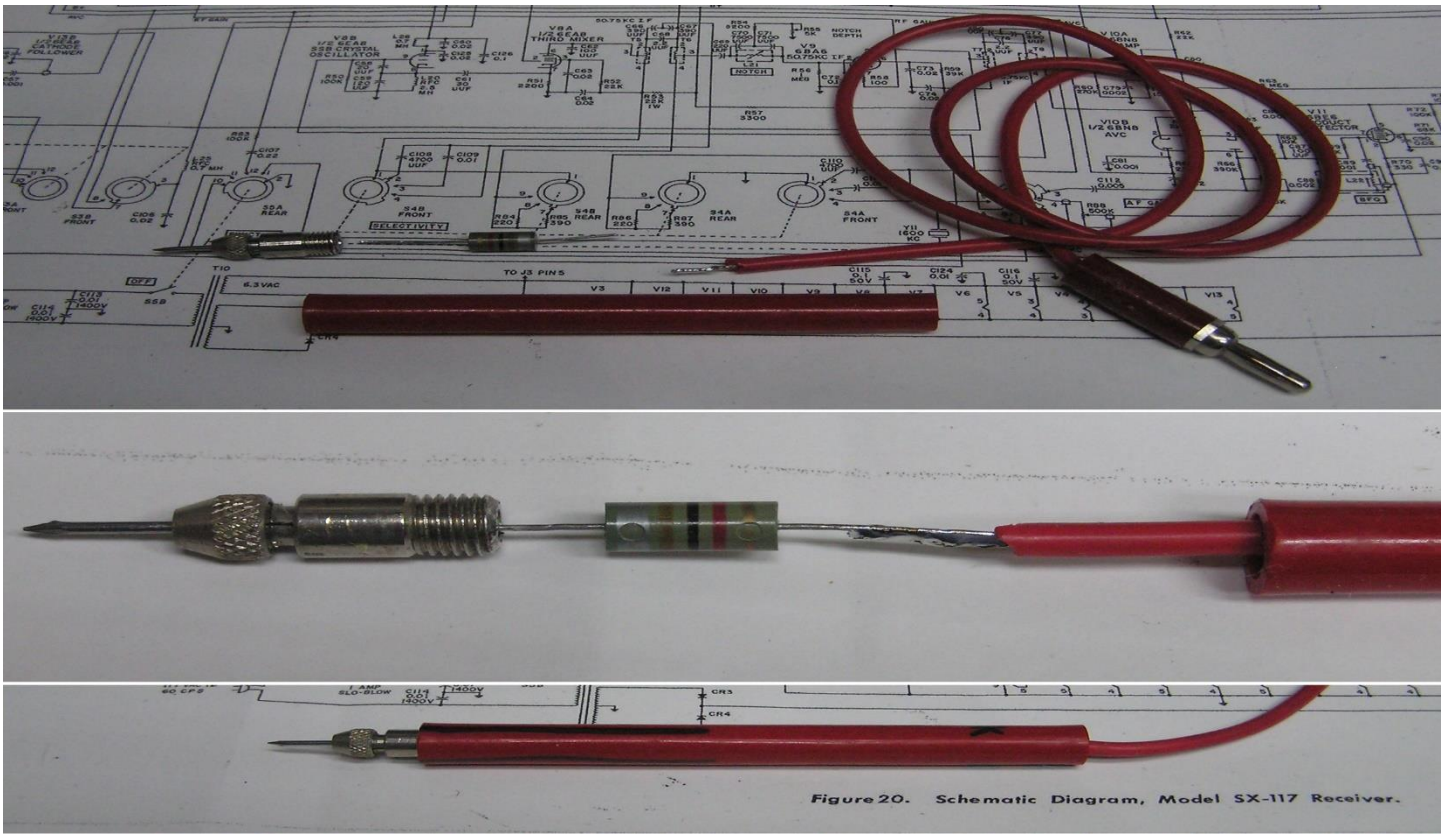
You need a range of 50KHz through 30MHz.

2-3-5, TEST METER

Here you can save a little money. Nothing in the SX-117 (or most of the vintage receivers of the era) requires measurements of the four digit or better accuracy. The $4.00 on sale DVM at Harbor Freight is perfect. Just be sure you get the one with the 1000vdc scale.

2-3-5-1, RF BLOCKING PROBE

These inexpensive meters work fine unless you are trying to measure a dc voltage with RF present, like the plate, grid or cathode of an oscillator or mixer. It is simple to make an RF blocking probe for an inexpensive meter. Install a 270uh – 1mh choke in the barrel of a dc probe. It will work with oscillators and low power mixers. Don't go messing about in the PA of a transmitter with one.



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2-3-6, AUDIO OSCILLATOR

Be careful here. Most function generators will not work. Most function generators are 50-ohm output, you need 600 ohms. Most function generators are limited to 10 to 20vpp output. You need at least 50vpp. I used a WAVEFORMS 401B for the development of this document. The old HP 200 series are great and inexpensive.

2-3-7, CAPACITIVE TUBE PICKUP

The capacitive pickup tool is a metal sleeve that slides over a tube to sample any RF present. It is used most commonly to sample oscillator, driver and mixer signals without presenting a load to the circuit. It fits snuggly over the tube without contacting the chassis. The most common method of construction is the cut the base off a tube shield. It will be used to test the BFO or any oscillator you choose.

3, PRELIMINARY INSPECTION

3-1, VISUAL/MECHANICAL INSPECTION

Now is the time for a very intensive inspection for broken or burned parts. A thorough cleaning of the chassis, controls and drive trains.
For details see: https://wd0gof.files.wordpress.com/2019/02/rig-cleaning.pdf.

3-2, RECAP

There are two must replace capacitors in the SX-117. One is the three-section filter capacitor C117A, B &C. The other is the cathode bypass capacitor for V12B, C98, 25uf 25v.
There are differing opinions about paper capacitors. If you are in the camp that always replaces paper caps, there are five of them, C107, C108, C109, C110 and C111.

3-3, PRODUCTION RUN UPGRADE

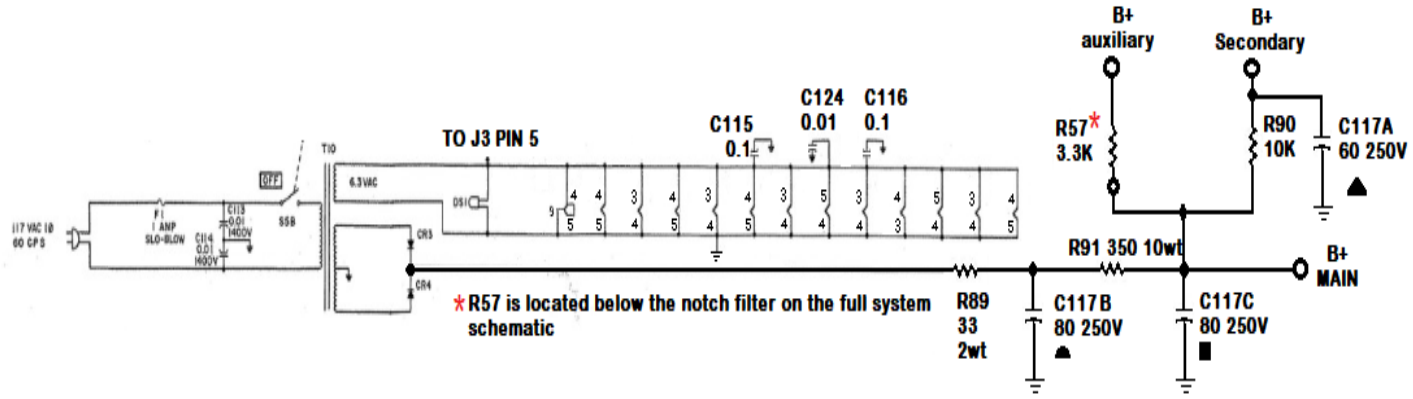
Refer to section 8 and determine which of the upgrades you want to include and make those modifications before starting fault isolation process.

4, POWER SUPPLY-TEST AND EVALUATION

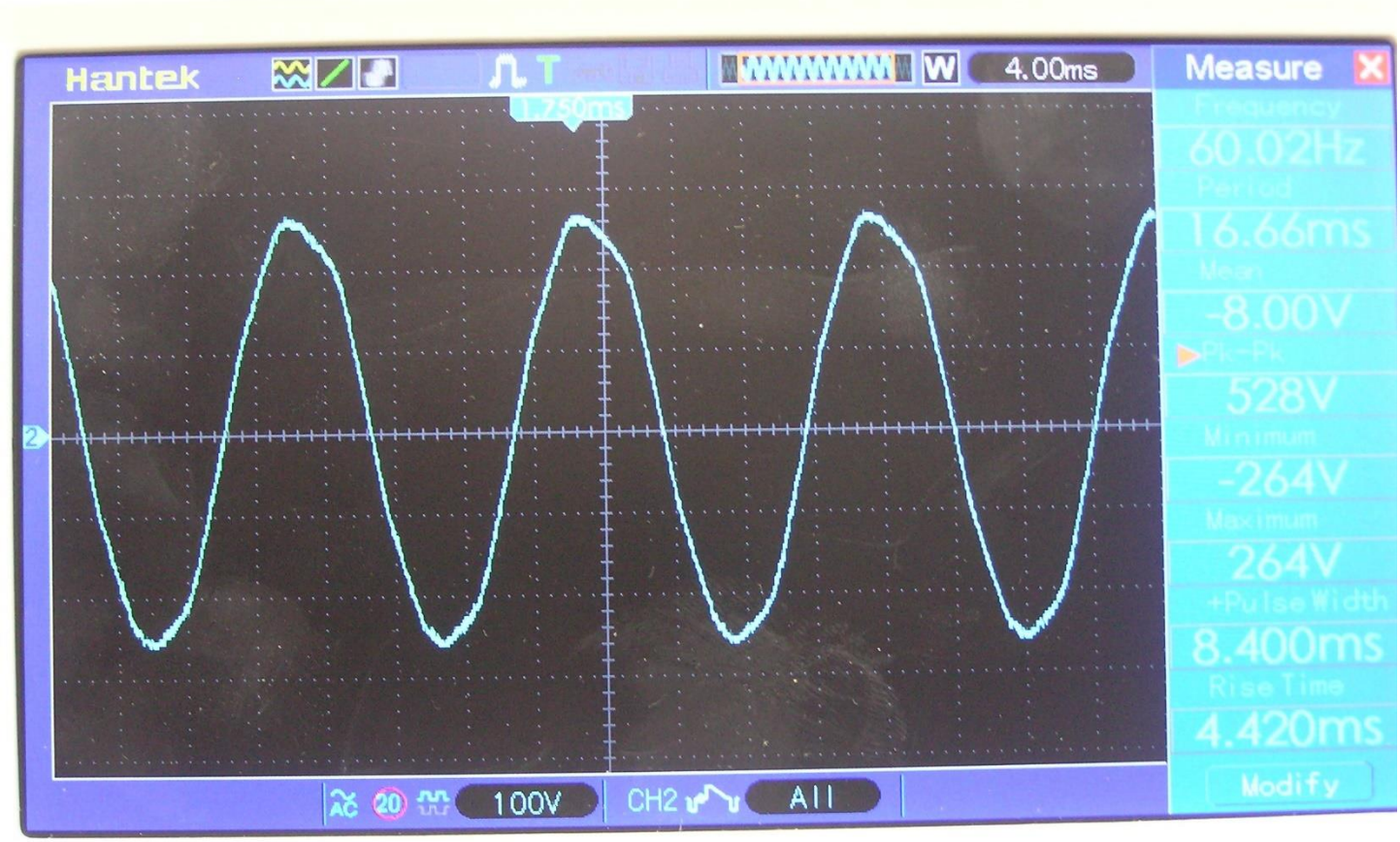
The power supply for the SX-117 was designed to operate on 105 to 125vac, 50/60Hz.The power consumption at 117vac is projected to be 70 watts. There are two secondary windings on the power transformer, the filament and the B+ windings. The center tapped B+ winding feeds a full wave rectifier that produces a raw 200vdc which is filtered to produce the nominal 168vdc primary B+ supply. Via R90 (10K) a secondary B+ is produced which feeds the audio detectors and audio preamp. A third auxiliary B+ supply Is produced by R-57 that provides the screen voltage for the 3rd IF amp V9 and the B+ for the 100KHz oscillator if installed.

The following chart provides the power supply measurement of an SX-117 that functions properly and meets all specifications. It should be noted that the power supplies in equipment of this era were subject to quite a wide variance in actual operating voltages. Variations of +/- 10% are common. These measurements were recorded with the bench supply running 123.5vac and the equipment was drawing 0.58amps.

DESCRIPTION	TEST POINT	DC COMPONENT	AC RIPPLE
B+ Secondary (Measurements taken using a scope)	Anode CR3 to center tap	///////////////	530vpp
	Anode CR4 to center tap	///////////////	530vpp
Raw rectified power.	JUNCTION OF CR3, CR4 AND R89	230vdc	30vpp
INPUT SIDE OF PI FILTER	JUNCTION OF C117B AND R91	227VDC	10vpp
PRIMARY B+ SUPPLY	JUNCTION OF C117C AND R91	179VDC	0.200vpp
SECONDARY B+ SUPPLY	JUNCTION OF C117A AND R90	153VDC	0.01vpp
AUXILIARY B+ SUPPLY	JUNCTION OF R57 AND T7 PIN3	168VDC CAL osc off 163VDC CAL osc on	0.200vpp



Voltage patten seen on anodes of CR3 and CR4. Pattern is identical on both anodes.



5, OSCILLATORS-TEST AND EVALUATION

The normal operation of everything in the receiver train from T1 through the BFO is dependent upon the oscillators being on frequency. This fact cannot be over stated. Extra effort getting the oscillators right will be rewarded by better than average performance of the equipment.

Power up the equipment and allow 30 minutes warm up. All the crystal oscillators will be tested first to allow maximum time for the VFO to stabilize. Set all SX-117 controls as follows:

The following settings will be Standard for all oscillator testing.

RF GAIN – min.
XTAL SELECTOR – NORMAL.
PRESELECTOR – doesn't matter (dm).
BAND SELECTOR – 80 meters.
CAL RESET – ON INDEX MARK.
NL/CAL – off.
FUNCTION – LSB
SELECTIVITY – dm
NOTCH FREQ. – dm
AF GAIN – Min

5-1, OSCILLATOR DEFINITIONS

In the equipment specification and in the system schematic there are 2 oscillators referred to as the CRYSTAL OSCILLATOR. They are V3 crystal oscillator and V13A crystal oscillator. For the purpose of this document V3 will be referred to as the main crystal oscillator. V13A will be referred to as the aux crystal oscillator.

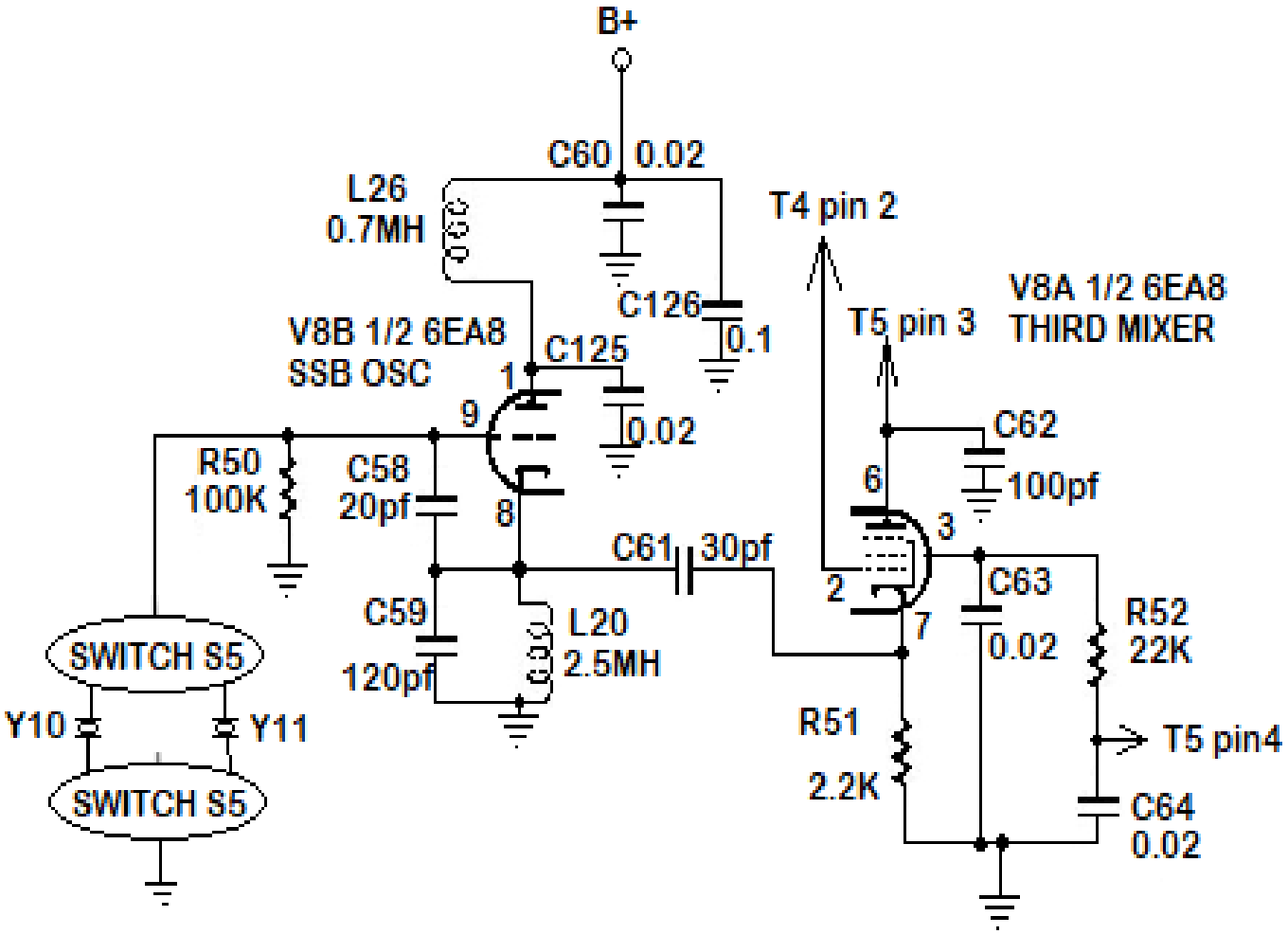
5-2, SSB CRYSTAL OSCILLATOR TEST

The SSB oscillator has no adjustments to pull the xtals on frequency. The original xtals came in matched pairs. Sets of matched pairs are no longer available (***The exact difference of 100KHz between the USB and LSB xtals will affect the BFO adjustments to be done later***). The original designer's view was that if it was off frequency, you replaced the crystals with a new matched pair. Today your options are limited and you may have to get creative. If both xtals are low or high you can change the values of C58 and C59 to pull the xtals up or down. Changing the tube will also pull the xtal frequency. The goal, and important factor is the USB to LSB difference (1700KHz – 1600KHz = 100KHz). If the xtal frequencies are off, but the difference is 100KHz the error can be offset by the VFO CAL RESET and you can still get a zero beat on USB and LSB. Read section 6-11 in the Hallicrafters OPERATING AND SERVICE INSTRUCTIONS manual.

5-2-1, SSB OSCILLATOR TEST

Power up in the configuration listed above. Connect the scope using a 10X probe to pin 7 of V8. You should see a minimum of 5.0 vpp. Move the probe from the scope to the frequency counter. You should read 1600KHz. Switch from LSB to USB. You should read 1700KHz on the counter. Move the probe from the counter to the scope. You should see a minimum of 5.0 vpp. The amplitude of the signals on USB and LSB should be equal. Slight offset errors can be corrected by the VFO CAL RESET; however, you will be required to readjust the CAL RESET each time you change bands.

5-2-2, SSB OSCILLATOR SCHEMATIC & VOLTAGE CHART



PIN #	1	2	3	4	5	6	7	8	9
V8A	//////////	0	110	6.3vac	0	124	4.0	//////////	//////////
V8B	172	//////////	//////////	//////////	//////////	//////////	//////////	0.3	0

VOLTAGES ARE DC UNLESS OTHERWISE NOTED. You will need an RF blocking probe.

5-3, MAIN CRYSTAL OSCILLATOR TEST

Each of the crystals in the oscillator has an adjustment. This adjustment affects both the amplitude and the frequency of the oscillator output.

1, With the controls set per paragraph 5, and the equipment warmed up, connect a cable from the scope to J4 (CRYSTAL OSC OUTPUT). Adjust L10B for max peak to peak voltage. Record the peak to peak voltage. Move the cable from the scope to the frequency counter. Readjust L10B for 10.000MHZ. Move the probe back to the scope observe the signal. If you have not lost more than 10% of the peak to peak voltage that setting is good. Minimum signal level is 1.0 vpp.

NOTE: Arbitration of signal amplitude and frequency for each crystal in this oscillator may be required. If possible, go with the most accurate frequency rather than peak output voltage. The CAL RESET function of the VFO can offset up to +/- 1500Hz. Ideally you would adjust for exact frequency. But unless you have a lot of spare xtals this is impractical.

2, If the WWV xtal is installed turn the BAND SELECTOR to the WWV position repeat the process in step 1 above adjusting L14.

3, Set the band switch to 7.0 and repeat the process in step 1 above adjusting L11B.

4, Set the band switch to 14.0 and repeat the process in step 1 above adjusting L13B.

5, Set the band switch to 21.0 and repeat the process in step 1 above adjusting L12B.

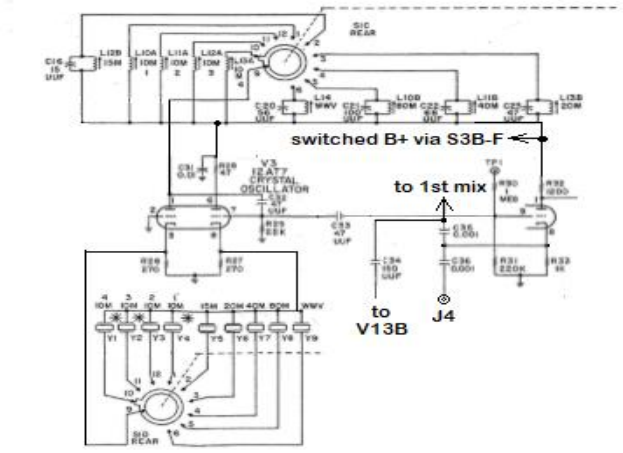
6, If xtal is installed set the band switch to 28.0 and repeat the process in step 1 above adjusting L10A.

7, Set the band switch to 28.5 and repeat the process in step 1 above adjusting L11A.

8, If the xtal is installed set the band switch to 29.0 and repeat the process in step 1 above adjusting L12A.

9, If the xtal is installed set the band switch to 29.5 and repeat the process in step 1 above adjusting L13A.

5-3-1, MAIN OSCILLATOR SCHEMATIC & VOLTAGE CHART



PIN #	1	2	3	4	5	6	7	8	9
VOLTAGE	170	0	1.3	6.3vac	6.3vac	170	0	1.0	0

ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED. You will need an RF blocking probe.

5-4, AUXILIARY CRYSTAL OSCILLATOR TEST

The following assumes the normal configuration, that is without any axillary crystals installed. This procedure is an optional operation. The object is to prove the operation of the auxiliary even though it is most likely not in use. If the auxiliary sockets are populated select each installed crystal in order and perform steps c through g. Otherwise:

a, Pull the 80-meter crystal, Y8 and install in auxiliary socket 1.

b, Set the XTAL SELECTOR switch to position 1

c, Power up, any mode. RF and AF GAIN at min.

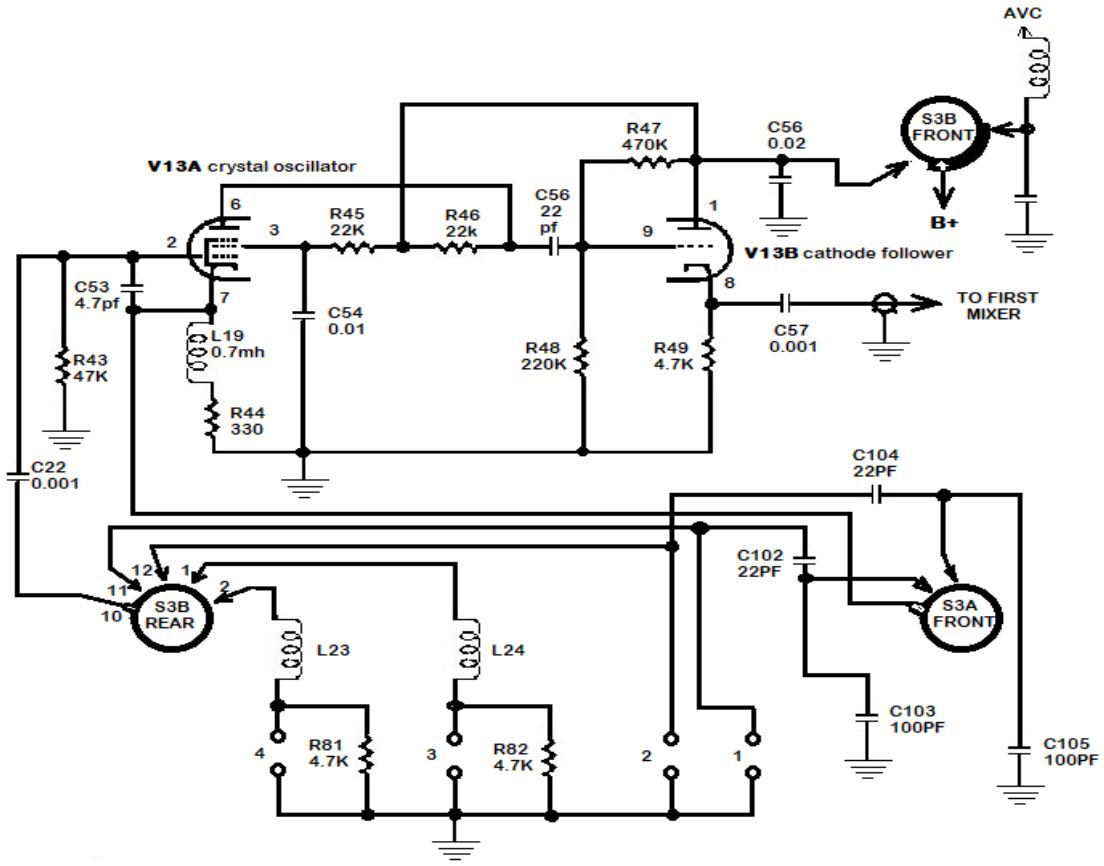
d, Connect scope probe to the junction of C57 and the terminal strip.

e, The signal level should be 10vpp.

f, Move the probe from the scope to the frequency counter.

g, it should read the crystal frequency.

5-4-1, AUXILIARY OSCILLATOR SCHEMATIC & VOLTAGE CHART



PIN #	1	2	3	4	5	6	7	8	9
VOLTAGE	170	0	130	6.3vac	0	55	2.0	33	47

Measurements taken with 80-meter xtal plugged into Aux socket 1 and XTAL SELECTOR in position 1. Switch the OFF/NL/CAL switch to the CAL position, tune for a zero beat to ensure the aux oscillator is working. You will need an RF blocking probe.

5-5, VFO OSCILLATOR TEST

NOTE: If the C15f to C127 mod has not been installed see APPENDIX 9-2 for instructions and complete the modification before proceeding.

The following procedure is a substitute for the VFO alignment and adjustment found in sections 6-8 and 6-9 of the Hallicrafters OPERATING AND SERVICE INSTRUCTIONS manual.

SETUP:
Connect frequency counter to pin 8 of V6 or J5.
Preset C127 to the center of its tuning range.
CAL RESET to center of its rotation.

Turn the FUNCTION switch to any mode.
Allow 30 minutes warm-up/stabilize time.

INITIAL PRESET.
Tune the main tuning dial to 300.
Adjust L16 for a reading of 4.550MHz on the frequency counter.

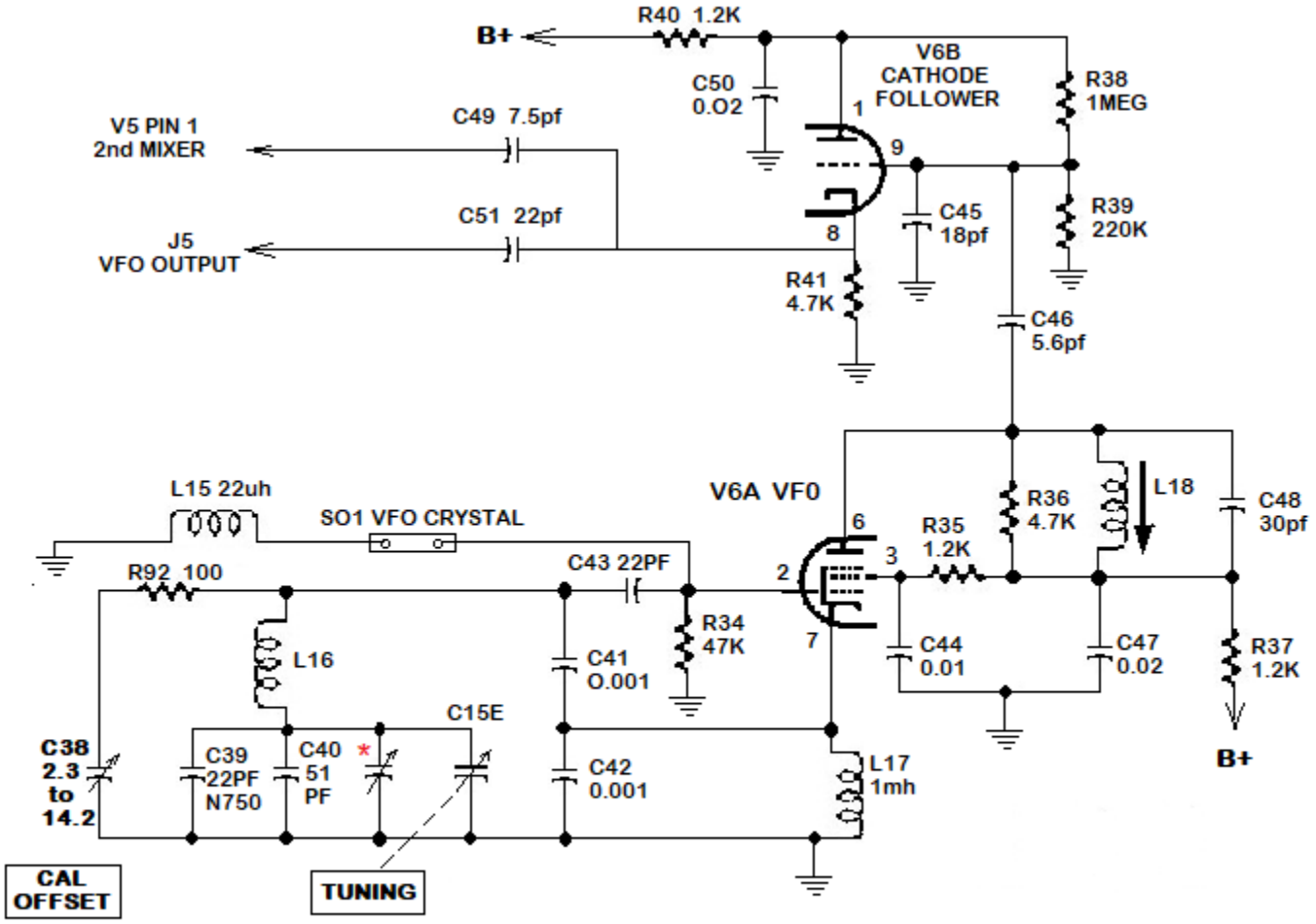
TRACKING ALIGNMENT.
Tune the main tuning to 100 and adjust C127 for 4.750MHz on the counter.
Tune the main tuning to 400 and adjust L16 for 4.450MHz on the counter.

NOTE: These two adjustments interact, you may have to go back and forth several times, under or over correction at one or the other end to get both ends correct. +/- 500 is good, right on is best

FINAL CHECK

MAIN TUNING	FREQUENCY
0	4.850MHz
100	4.750MHz
200	4.650MHz
300	4.550MHz
400	4.450MHz
500	4.350MHz

5-5-1 VFO SCHEMATIC & VOLTAGE CHART



*This capacitor may be C15f or C127 depending upon the production run.

PIN	1	2	3	4	5	6	7	8	9
VOLTAGE	164	1.2	150	0	6.3vac	155	0.2	31	24.6

ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED. You will need an RF blocking probe. It will be helpful if you switch on the CAL oscillator and tune for a good tone in the speaker. If your RF blocking probe is working correctly you may shift the frequency of the tone a little, but it will not kill the oscillator. If the tone goes away completely then you need to find a better blocking probe.

5-6, CRYSTAL CALIBRATOR TEST

Power up and allow 10 to 15 minutes for stabilization. Set controls as follows

RF GAIN – **MIN**.
XTAL SELECTOR – NORMAL.
PRESELECTOR – upper portion 80 meters.
BAND SELECTOR – 80 meters.
CAL RESET – ON INDEX MARK.
TUNING -red scale **700**.
NL/CAL – **ON**.
FUNCTION – LSB
SELECTIVITY – 2.5
NOTCH FREQ. – off
AF GAIN – **MIN**

As soon as the radio warms up connect the scope (10X probe) to pin 3 of J3. You should see a sawtooth waveform with a minimum peak to peak amplitude of 50v. Move the probe from the scope to the frequency counter. Turn the Calibrator on and off several times to insure there is no hesitation in startup. If it is not precisely on frequency adjust C301 for exactly 100.000KHz. After adjusting C301 turn the calibrator off and back on to see where it stabilized. Readjust if necessary.

Turn the RF GAIN to maximum gain. Turn the AF GAIN to 3.5. Depending upon the accuracy of all the other oscillators in the radio you should have tone and S-meter deflection at or about 700 on the tuning dial. Set the dial exactly on the 700-index mark on the dial and adjust the CAL RESET control for max S-meter reading. Then check for tone at 600 and 800 on the dial. If the tone is off the mark at 600 or 800 on the dial you need to recheck the VFO alignment.

The calibrator assembly is a high reliability item. The most common failure other than the tube is C301. It MUST be replaced with a type N750 capacitor.

6, RECEIVER TRAIN EVALUATION

If you have followed the procedure the power supply system and all the oscillators have been tested and are fully operational. Now when progressing through the receiver train these items can be eliminated as sources of faults. This will greatly narrow your focus while analyzing faults.

6-1 CONTROL SETUP FOR FAULT ANALYSIS

Remove V10, ground the tie point of R65 and C82. Power up and allow 5 minutes warm up.

6-2, INJECTION LEVEL/SIGNAL TRACING CHART

	INJECTION FREQUENCY	INJECTION POINT	GEN. OUTPUT	PROBE	AUDIO OUT	TEST SUCCESS/FAILURE IMPLICATIONS	TROUBLESHOOT REF SECTION
1	1000Hz	V12 pin 8	4.5vpp	1x	500mw	Passed, proceed to step 2. Failed, fault in V12B stage. Check voltages on V12.	7-10
2	1000Hz	Input side C94	0.20vpp	1x	500mw	Passed, proceed to step.3. Failed, fault in V12A stage. Check voltages on V12. Insure AF gain at max	7-10
3	50.75KHz	V11 pin 7	3K uv	1x	200mw	Passed, proceed to step 4. Failed, fault in V11 stage. Check V11 voltages. Peak the BFO.	7-5
4	50.75KHz	V9 pin1	37k uv	1X	500mw	Passed, proceed to step 5. Failed, fault in V9 or V10. Check tubes voltages. Test continuity of T7 & T8.	7-5
5	50.75KHz	T6 pin 3	6k uv	1X	250mw	Passed, proceed to step 6. Failed, continuity test l21, R55 and associated passive components.	--
6	1650KHz	V8 pin 2	150k uv	10X	500mw	Passed, proceed to step 7. Failed, fault in V8A, T5 or T6 or associated passive components.	5-2-1
7	1650KHz	V7 pin 1	200 uv	10X	500mw	Passed, proceed to step 8. Failed, fault in V7, T4 or associated passive components.	7-6
From this point on, ensure the tuning is peaked							
8	6.2MHz	V5 pin 7	70 uv	10X	500mw	Passed, proceed to step 9. Failed, fault in V5, T3 or associated passive components.	7-7
9	6.2MHz	V4 pin1	8 uv	10X	500mw	Passed, proceed to step 10. Failed, fault in V4, T2 or associated passive components.	7-8
10	3.9MHz	Junction of C11 & R5	50 uv	10X	500mw	Passed, proceed to step 12. Failed, fault in V2A, T1 or associated passive components.	7-9
11	3.9MHz	Junction of S1A-8 &C4	5 uv	10x	500mw	Passed, proceed to step 13. Failed, fault in V1, l6, S1 or associated passive components. Clean S1	7-3
12	3.9MHz	J2	0.6 uv	Coax	500mw	Passed, proceed to step 14. Failed, fault in S1, L1A & B, L5, or preselector control.	
13	When the radio has successfully passed all tests to this point proceed to AVC FUNCTION TEST section 7-1. Once the AVC is proven to be functioning properly the radio should be ready for a by the book alignment. Replace v10 and remove ground from R65.						

As indicated above once the AVC is tested and is operational the radio is ready for a by the book alignment. Section VI of the factory manual contains the procedures for a full alignment. In the factory manual the procedures in paragraphs 6-4 and 6-6 require additional crystals which may not be available. In section 9-6 and 9-7 of this manual you will find procedures that do not require additional crystals.

7, SUBSYSTEM TEST AND EVALUATION

BE AWARE: The voltage and signal levels in all of the subsystem charts apply to production run 3 and above radios. Unmodified run 1 and run 2 radios will vary greatly.

7-1, AVC FUNCTION TEST

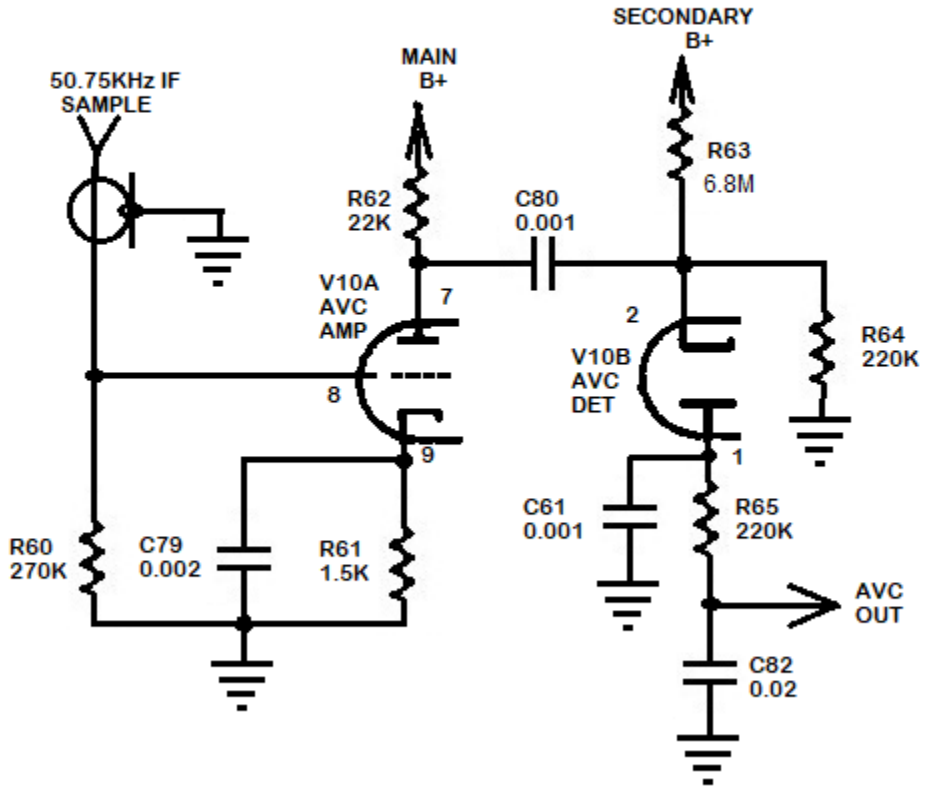
7-1-1, AVC TRACKING

BE AWARE: the AVC will track differently from radio to radio. Minor differences in gain in each stage of the receiver train will affect the slope of the input voltage to AVC voltage curve. The following data was taken from an above average receiver and a just in spec receiver. Properly functioning receivers should fall somewhere within this range. If, with no signal on the antenna and the RF GAIN set to zero, the AVC does not fall between +0.20 and +0.65 vdc there is a fault.

Set up the receiver on the 80-meter band and tune up in LSB mode at 3.900 MHz.
1, Allow 15 minutes warm up.
2, Turn RF gain to zero. Adjust meter zero pot for 0 on the S-meter.
3, Turn RF gain to max.
4, Set generator for 50 microvolts output @ 3.900 MHz.
5, Set AF gain for 500 mw out. Set factory gain pot for S9 on meter.

RF @ THE ANTENNA	**AVG VOLTAGE** **Measured at the tie point of R65 and C81**		**S-METER** **Above average receiver**
	TEST UNIT 1 **Above average receiver**	**TEST UNIT 2** **Marginal / in spec receiver**	
For baseline test set Rf gain set to min J1 GROUNDED	0.300V	0.560v	Zero
SET RF GAIN TO MAX			
O.5uv	0.280	O.560V	S-1
5.0uv	-1.430	-0.920v	S-3
50uv	-4.090	-3.480v	S-9
500uv	-5.620	-4.400	15db
5000uv	-6.830	-5.600v	35db
50,000uv	-8.540	-6.800V	55DB
100,000UV	-9.500	-7.600V	60DB

AVC AMP AND DETECTOR VOLTAGE CHART



RECHECK S-METER ZERO AND S9 SETTINGS.

1, Warm up 15 minutes.

2, Turn RF gain to zero. Adjust meter zero pot for 0 on the S-meter.

3, Turn RF gain to max. Set generator for 5 microvolts output.

4, On 80 meters tune up @ 3.900 MHz. Insure both preselector and tuning are peaked.

5, Set generator for 50 microvolts output @ 3.900 MHz.

6, Set AF gain for 500 mw out. Set factory gain pot for S9 on meter.

AVC VOLTAGE CHART

For this test NO SIG = RF GAIN control set at 0. S9 = RF GAIN set to 10.

PIN #	1	2	3	4	5	6	7	8	9
NO SIG	0.3	3.7	/////////	6.3vac	0.0	/////////	146.0	0.0	1.8
S-9	-4.1	4.1	/////////	/////////	/////////	/////////	145.0	0.0	1.78

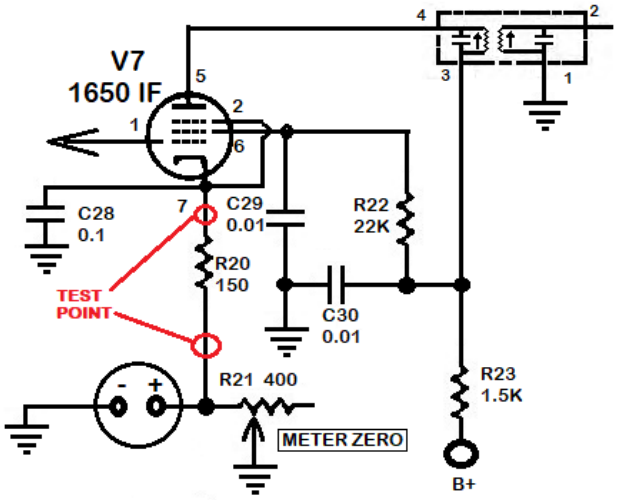
POSITIVE DC VOLTS UNLESS OTHERWISE NOTED

7-2, S-METER EVALUATION

The s-meter in the 117 is very basic. It is measuring the cathode current of V7, the 1650 IF amp. If V7 is good and the radio has no other faults and the alignment is correct, it just works. Turn the RF GAIN control to minimum and adjust the meter zero control for zero on the meter. The meter ckt will drift for the first 15 to 20 minutes of operation. Allow it to stabilize before adjusting.

It is futile to work on the s-meter circuitry before all other problems are eliminated and the receiver is in perfect alignment.

7-2-1, S-METER SCHEMATIC & VOLTAGE CHART



Warm up 15 minutes. On 80 meters tune up @ 3.900MHz. Recheck S-meter calibration at zero and 50microvolts input. Inject 50 microvolts into J2. Turn RF Gain to max. Tune receiver for max S-meter indication. Set AF gain for 500mw out.

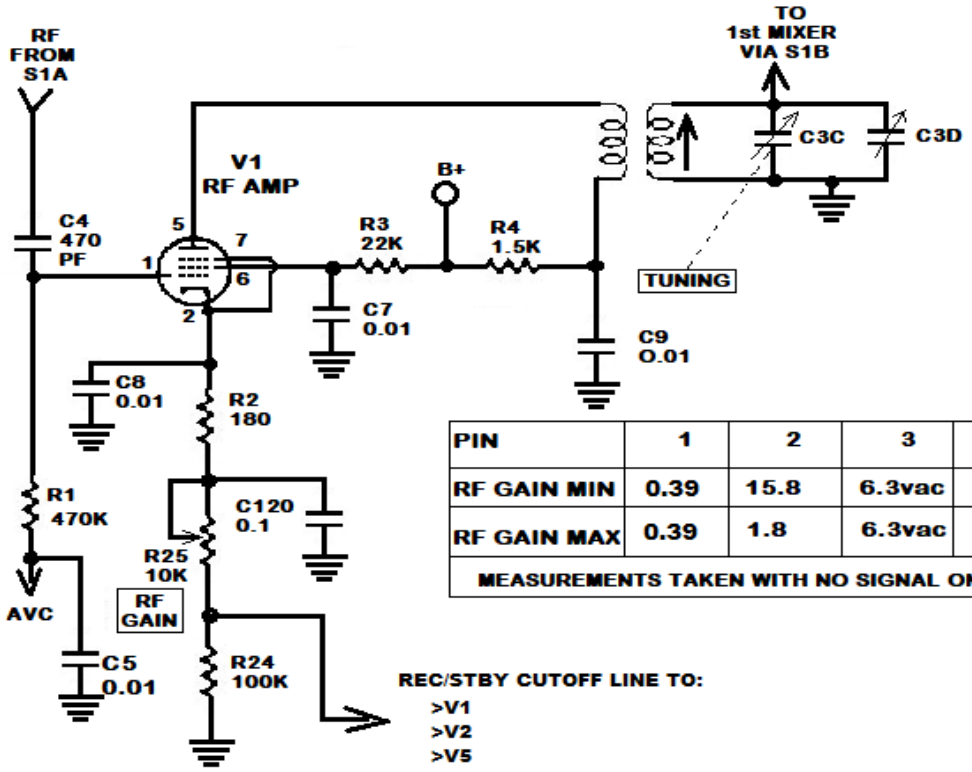
For this test NO SIG = RF GAIN control set at 0. The S9 = RF GAIN set to 10.

	V7 PIN 7	JUNCTION R20 & R21
NO SIG	2.3vdc	0.41vdc
S9	1.15vdc	0.21vdc

The s-meter is only true when the RF GAIN is set to max. The standard for s-meter readings in HF receivers is: 3uv in will present S5 and 50uv in will produce S9. If everything else is working properly there are only 5 parts that will cause the s-meter to malfunction: V7, the meter, R20, R21, and C28.

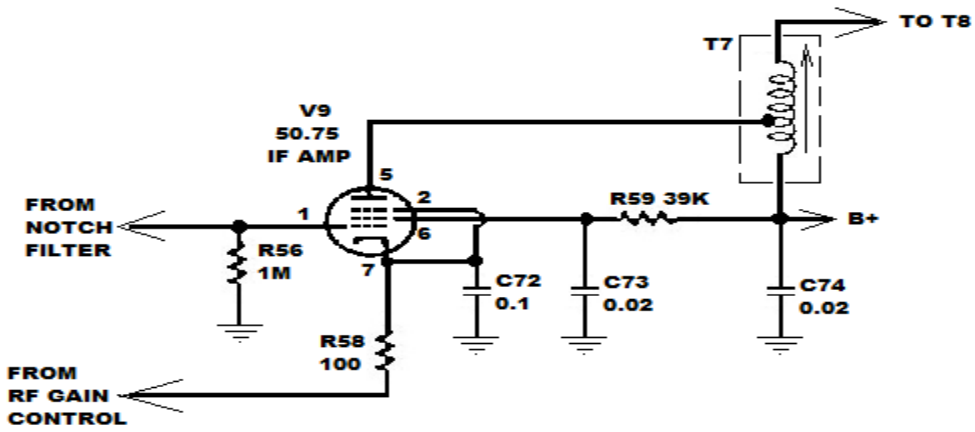
See section 7-6 for V7, 1650 IF voltage chart.

7-3, RF AMP SCHEMATIC & VOLTAGE CHART



PIN	1	2	3	4	5	6
RF GAIN MIN	0.39	15.8	6.3vac	0	174	169
RF GAIN MAX	0.39	1.8	6.3vac	0	154	113
MEASUREMENTS TAKEN WITH NO SIGNAL ON THE ANTENNA						

7-4, 50.75 KHz IF AMP SCHEMATIC & VOLTAGE CHART

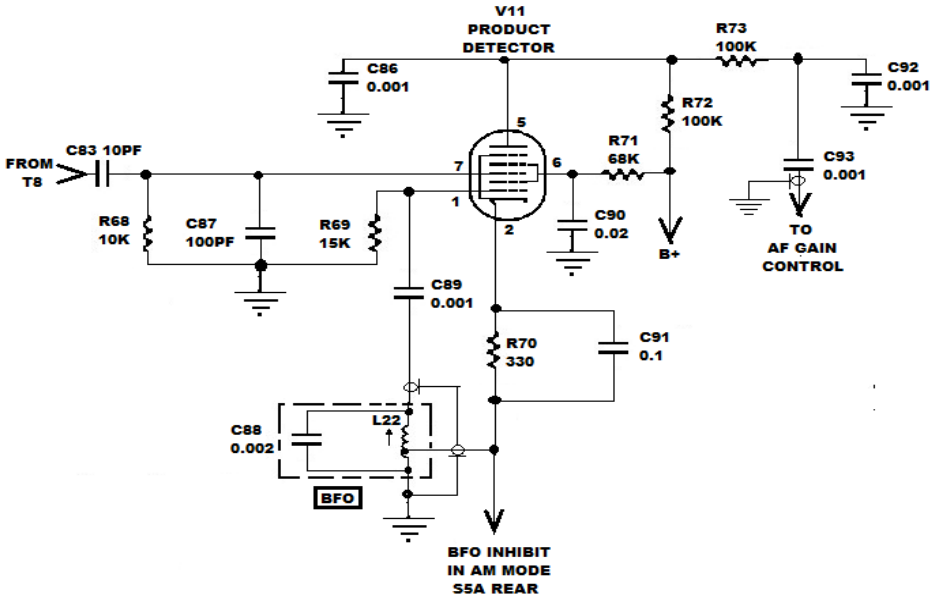


REF: B+=172V, SECONDARY B+=149V AND AUXILIARY B+=146V

MEASUREMENTS TAKEN WITH NO SIGNAL INPUT							
	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7
RF GAIN MAX	0	0.79	6.3vac	0	140	63	0.79
RF GAIN MIN	0	14.87			166	148	14.87

7-5, PRODUCT DETECTOR AND BFO

7-5-1, PRODUCTOR DETECTOR SCHEMATIC & VOLTAGE CHART



REF: B+=172V, SECONDARY B+=149V AND AUXILIARY B+=146V

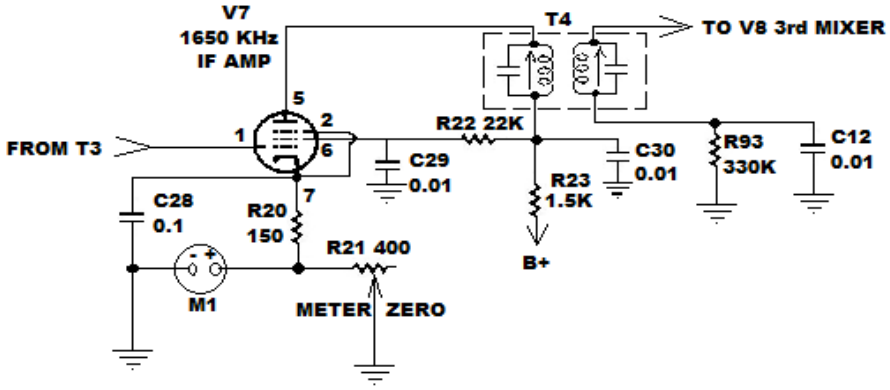
MEASURMENT TAKEN IN LSB MODE NO SIGNAL IN						
PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7
1.16	0.75	6.3vac	0	102	27.2	0

7-5-2 BFO TEST & EVALUATION

As stated in the Hallicrafters manual paragraph 6-11 the BFO frequency is set by the factory at exactly 50.0KHz.

The exact difference between the USB and LSB crystal frequency needs to be 100KHz for a perfect USB/LSB BFO beat note. Before attempting any test and adjustment of the BFO check the SSB oscillator. When the SX117 was born the SSB replacement crystals were sold as matched pairs. Matched pairs are not available now, unless they are special ordered from a crystal manufacture. Good luck with that one. So, if you get a perfect zero beat adjustment, great. If you don't, and the error is slight you will most likely never detect it in normal radio operation. The 6BE6 pentagrid converter V11 has two functions. First, it is the product detector for SSB operation. It is also the BFO. The cathode (pin 2) and grid 1 (pin 1) form an oscillator. The frequency of the oscillator is determined by C88 and L22. It provides the injection signal for the SSB product detector and it functions as the CW BFO. The test and alignment of the BFO subsystem is found in section 6-11 of the factory OPERATING AND SERVICE INSTRUCTIONS manual. That procedure is simple and there are no short cut methods. If the BFO does not function there will be no SSB or CW operation. There are 5 most probable parts to consider if there is a BFO fault; The tube (V11), C88, L22, C89 and S5A rear.

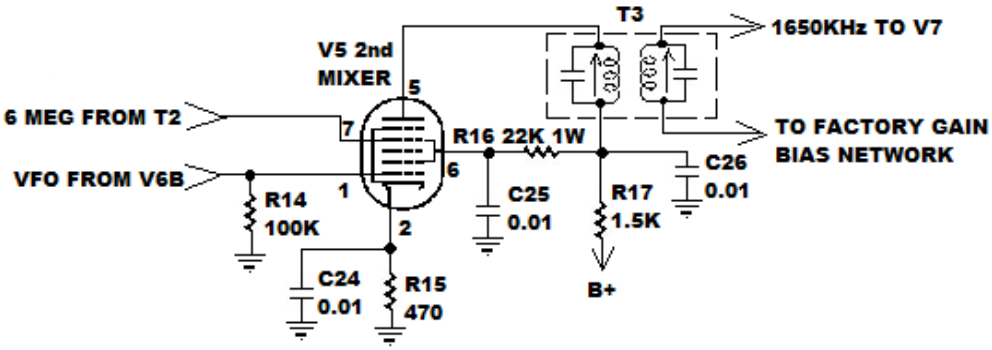
7-6, 1650 IF AMP SCHEMATIC & VOLTAGE CHART



REF: B+=172V, SECONDARY B+=149V AND AUXILIARY B+=146V

MEASUREMENTS TAKEN WITH NO SIGNAL IN						
PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7
1.23	2.35	6.3vac	0	145	81.8	2.35

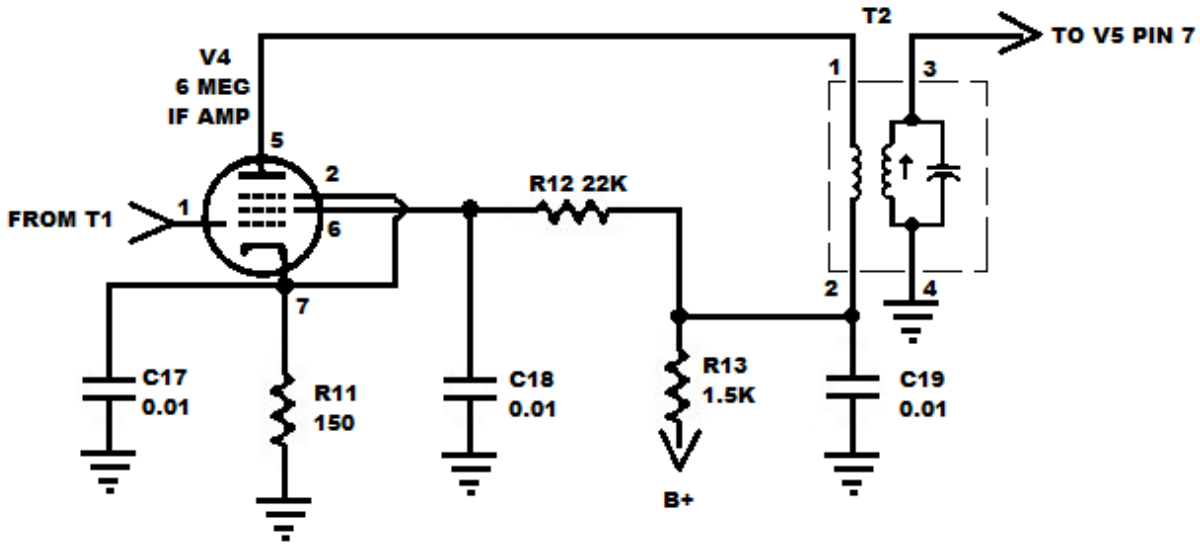
7-7, SECOND MIXER V5 SCHEMATIC & VOLTAGE CHART



REF: B+=172V, SECONDARY B+=149V AND AUXILIARY B+=146V

MEASUREMENTS TAKEN WITH NO SIGNAL IN						
PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7
0	2.39	6.3vac	0	157	70	0

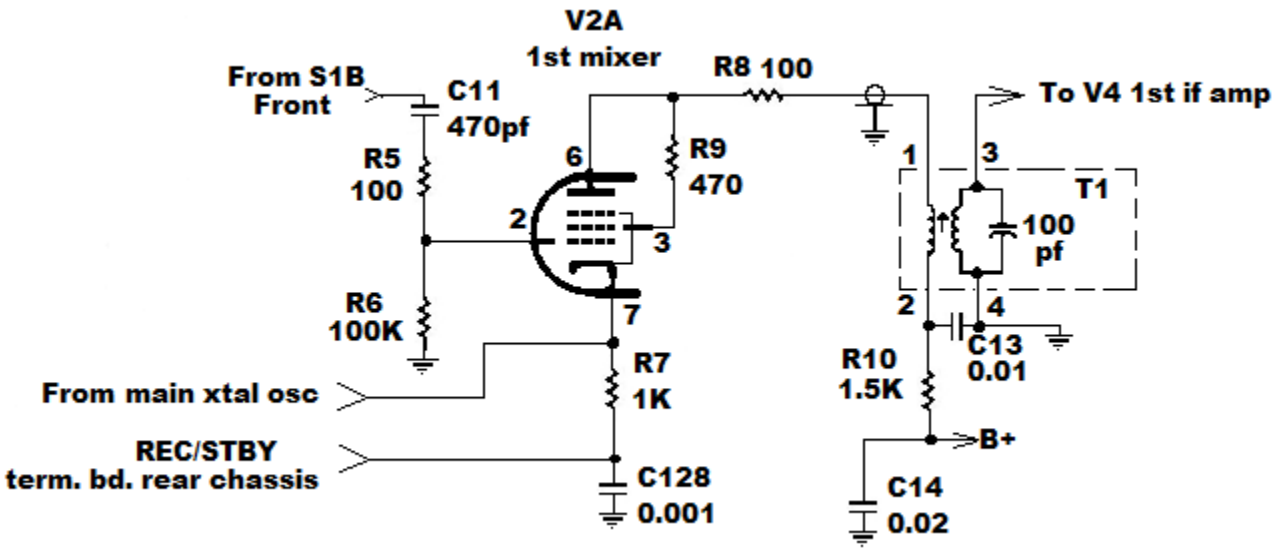
7-8, 6-MEG IF AMP V4 SCHEMATIC & VOLTAGE CHART



REF: B+=172V, SECONDARY B+=149V AND AUXILIARY B+=146V

MEASURMENTS TAKEN WITH NO SIGNAL IN AND **RF-GAIN** SET TO MIN.						
PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7
0	1.76	0	6.3 vac	152	79	1.76

7-9, FIRST MIXER V2A SCHEMATIC & VOLTAGE CHART

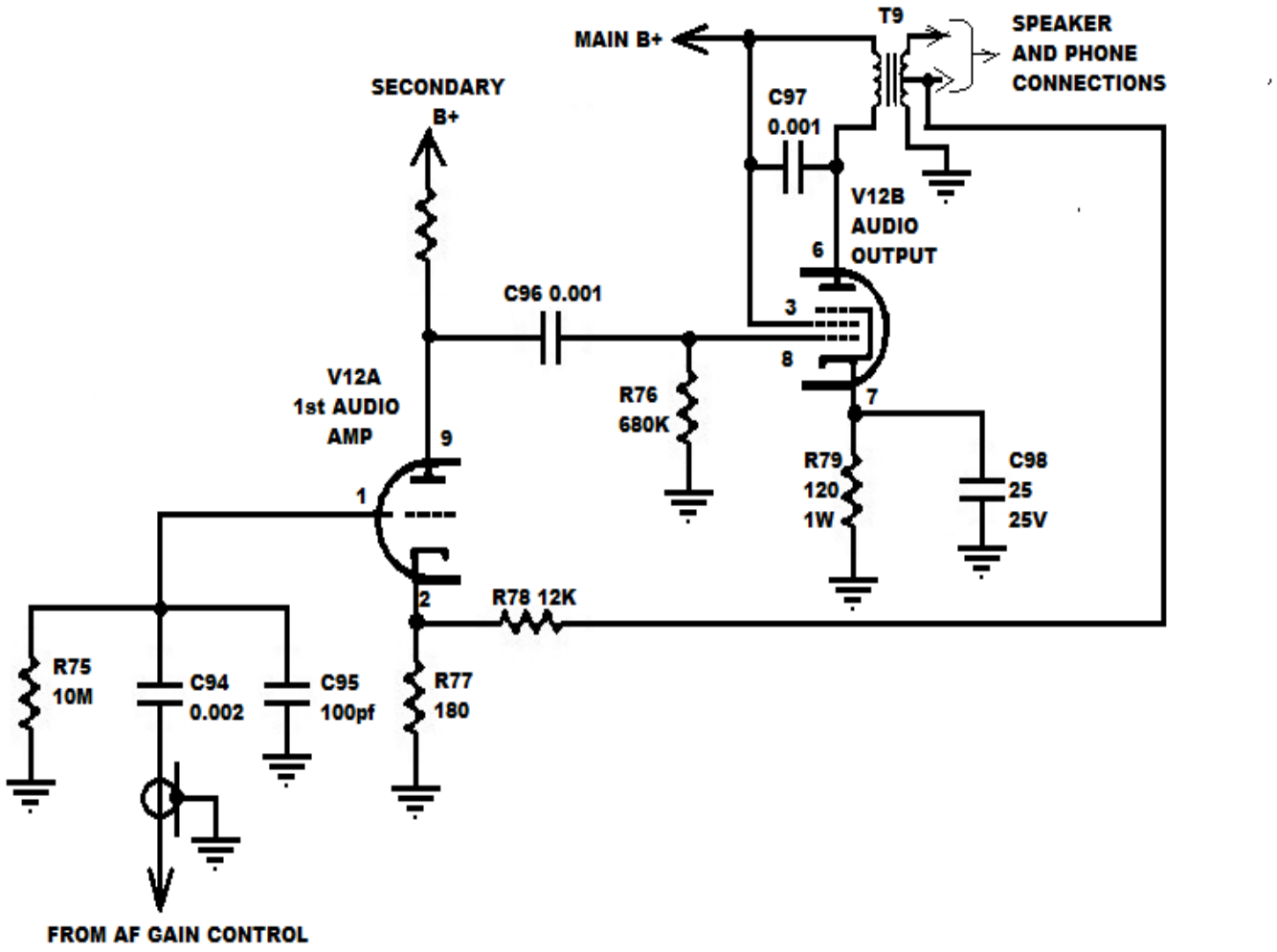


REF: B+=172V, SECONDARY B+=149V AND AUXILIARY B+=146V

Measurements taken with no signal in at the antenna. REC/STBY grounded.								
PIN 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	PIN 8	PIN 9
162	0	0.25	0	6.3vac	160	2.8	5.0	0

Pins 1, 8, and 9 are V2B cathode follower for the main xtal oscillator.

7-10, AUDIO AMP AND OUTPUT V12A & B SCHEMATIC AND VOLTAGE CHART



REF: B+=172V, SECONDARY B+=149V AND AUXILIARY B+=146V

MEASURMENTS TAKEN WITH **AF GAIN** AT MIN								
PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
-0.287	0	172	6.3vac	0	165	3.9	0	76

8, PRODUCTION RUN DETERMINATION

There were 5 production runs for the SX-117.

PRODUCTION RUN	SCHEMATIC #	RADIO SERIAL #
1	O89-002852	XXXXX0 XXXXXX
2	O89-002852B	XXXXX1 XXXXXX
3	O89-002852C	XXXXX2 XXXXXX
4	O89-002852D	XXXXX3 XXXXXX
5	O89-002852E	XXXXX4 XXXXXX

8-1, CHANGES RUN 1 TO RUN 2

Production run 2 involved only two changes. First R29 was changed from 10K to 22K. This change is recommended for all run-1 radios.

The second change involved replacing the FUNCTION switch and rewiring of the crystals for the SSB oscillator. However, the part # of the new function switch was not changed. No documentation has been found to explain this. There seems to be no change in function or performance, so this change is not recommended.

8-2, CHANGES RUN 2 TO RUN 3

This production run change is quite extensive. Refer to section 9-5 for detailed instructions. **At the very minimum all first and second run SX-117 radios should be upgraded to this level. First run radios also need R29 changed from 10K to 22K.**

8-3, CHANGES RUN 3 TO RUN 4

This change involved only one part. C15F was changed to ceramic trimmer. See section 9-2 for details.

8-4, CHANGES RUN 4 TO RUN 5

This change results in cutting off the first mixer during transmissions when paired with the HT-44. See section 9-4, SERVICE BULLETIN RUN-5 CHANGE

For more information go to:
http://k9axn.com/_mgxroot/page_10848.html
http://k9axn.com/_mgxroot/page_10789.html

A must read:
http://k9axn.com/_mgxroot/page_10882.html

9, APPENDIX

9-1 BULLETIN 1964-4

Service Bulletin

Hallicrafters

BULLETIN 1964-4
June 1, 1964

ADDITIONAL NOTES ON THE TRANSCEIVE (SLAVE) OPERATION OF THE HALLICRAFTERS HT-44 COMMUNICATIONS TRANSMITTER AND SX-117 RECEIVER.

There are several changes in the original circuitry of the HT-44 which improve the performance of this equipment when operated in Transceive with the SX-117. These changes, and their purpose, are shown on the attached errata sheet. Also shown are two revisions in the output meter circuit that will correct specific complaints as noted. These modifications are incorporated in all HT-44's on which the first six digits of the serial number are 344001 — although it would be well to check for them in cases where it might be deemed necessary.

In the SX-117, the muting change listed in Note 1 under paragraph 7-2 in the HT-44 manual is a must for transceive operation, and each set should be checked even though it is above the 117001 number mentioned in the book. This is actually a typographical error and should be serial number 117005. To provide further isolation we are now also going to cut off the first mixer tube by lifting the cathode resistor R7 from ground and returning it to the muting line, schematically at the junction of R24 and R25. Physically this can be accomplished by removing R30 from the terminal strip directly behind the V2 socket. The other end of R30 remains connected to pin 9 of the V2B socket, and the free end dressed up in the air so that it is available as a test point for alignment purposes. One end of R7 is lifted from ground and reconnected to the terminal lug freed by moving R30. Also from this same lug a .001 mfd 500-volt ceramic disc capacitor is run to the ground terminal on the same terminal strip. Another lead is connected from the terminal lug junction of R7 and the .001 capacitor to the receive/standby terminal lug on the rear of the chassis. This requires a lead approximately 9 inches long and makes the most direct connection. SX-117's with this latter change will bear serial numbers with 117006 as the first six digits.

There is one other note that might be of benefit. In the receiver the most critical factor is the adjustment of the crystal-controlled first conversion oscillator. The method of making the adjustments is explained in paragraph 6-5 of the receiver manual. If any doubt exists, these circuits should be checked with a voltmeter as explained.

If the connecting cables between the two units are other than supplied with the Hallicrafters CA-44 cable assembly, it is imperative that they be made of Type RG-62/AU coaxial cable 28 inches long. This is 92-ohm cable with very low capacity. Even if CA-44 cables are used, each cable should be checked individually to see that it is grounded at both ends of the shield if unusual or spurious oscillations are experienced.

Operation of the HT-44 and SX-117 in the three different modes (HT-44 alone, transceive with the transmitter VFO, and transceive with the receiver VFO) will probably require different settings of the "RF Level" control in CW and AM or the "Mic Gain" control in sideband. When these controls are properly adjusted for the mode being used, the output from the transmitter will be within less than 1 db in all three methods of operation.

9-2 ENGINEERING CHANGE C15E

ENGINEERING BULLETIN FOR COMMUNICATIONS RECEIVER MODEL SX-117

PURPOSE

The following modification instructions have been prepared for owners of Hallicrafters' Model SX-117 Receiver. This modification serves to improve the frequency stability of the VFO.

TOOLS REQUIRED

Cutters
Screwdriver
Soldering Iron or Gun

COMPONENTS REQUIRED

One Ceramic Trimmer,
Hallicrafters' Part Number
044-000430

MODIFICATION PROCEDURE (Refer to figure 1)

1. Locate the center section of the tuning capacitor, C15. Locate the brass trimmer (C15D) on top of this section.

2. Solder C15D to the stator where the trimmer and the stator join in the front of the center section.

3. Remove the trimmer screw holding trimmer C15F to the front section of C15 and clip out C15F flush with the stator at the rear of the front section.

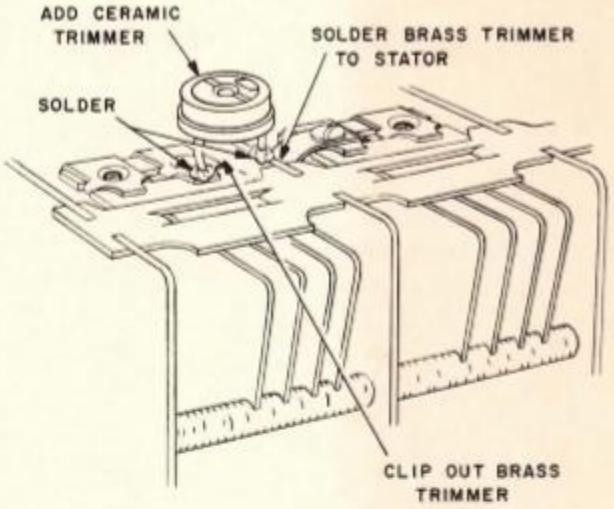


Figure 1. Illustration of Tuning Capacitor, Showing Change.

4. Solder the ceramic trimmer to the stator and to the screw terminal which formerly held C15F in place.

5. This completes the modification. The tuning gang should appear as shown in figure 1.

ALIGNMENT

Alignment is the same as specified in paragraphs 6-8 and 6-9 of the SX-117 Manual except that the ceramic trimmer should be adjusted wherever reference is made to adjust C15F.

The recommended ceramic trimmer was found to be too sensitive to tune easily. So I replaced it with a glass piston 15 turn 2-18pf capacitor

HALLICRAFTERS

AMATEUR RADIO BAND RECEIVER SX-117 TEST SPECIFICATION

The following is the mid-production test specification. It does not reflect the improvements in performance that occurred over the lifetime of SX-117 production. Latest update May 1963 halfway through its production life.

the hallicrafters co.

4401 WEST 5TH AVENUE

Chicago 24, Ill.

SX-117

CODE IDENTIFICATION NO. 26916

MATERIAL OR METHODS SPECIFICATION

SPECIFICATION NO. - 093-801634 RELEASE DATE 5 June 1962

MODEL NO. SX-117 RELEASE MEMO DW-27305

TITLE PERFORMANCE SPECIFICATIONS

PREPARED BY P Jackson

APPROVED BY [signature]

Date 6/6/62

CODE IDENT NO. 26916

REVISION SHEET

TITLE SX-117 PERFORMANCE SPECIFICATIONS SPEC. NO. 093-801634

Issue	Description of Revision	Memo No. & Date
A	RELEASED FOR PRODUCTION	DW 27365 5 June 62
B	REVISED PER CR-H13,411	C-1558 7 SEPT. 62
C	REVISED PER CR-H13,751	C-1783 16 OCT 62
D	REVISED PER CR-H14965	C-2168/20 MAR 63 19 MAR 63 WS
E	REVISED PER CR-H15384 O.L.	C-2225 7 MAY 63 6 MAY 63 WS

THE FOLLOWING TEST CONDITIONS APPLY UNLESS OTHERWISE SPECIFIED:

I. General

A. Power requirements 117 volts, 60 cycles, 70 watts.

B. Measurements made with HP 606A generator using unterminated 50 ohm coax.

C. Antenna input impedance 50 ohsm (nominal).

D. Output impedance 3.2 and 500 ohms.

E. RF and IF signals modulated 30% @ 400 cycles.

F. IF frequencies are 6.500 mc to 6.000 mc (variable), 1650 kc and 50.75 kc.

G. First crystal oscillator (amateur or auxiliary) operates 6.000 mc above high frequency end of band. Second oscillator (VFO) operates from 4.850 mc to 4.350 mc (1650 kc below first IF).

Third oscillator (Crystal) operates at 1600 kc (LSB) or 1700 kc (USB).

Fourth oscillator (BFO) operates at 50 kc.

H. Receiver to be supplied <u>without</u> WWV crystal (16.000 mc), segments 1, 3, and 4 of 10 meters (34.500, 35.500 and 36.000 mc), 6EA8 general coverage oscillator tube

I. WWV and segments 1, 3, and 4 10 meter oscillator coils are to be adjusted to give normal operation when appropriate crystal is inserted.

J. Calibrator circuitry shall give normal operation when calibrator assembly is inserted.

II. Controls to be set as follows:

A. RF and AF gain controls full on.

B. Selectivity at 2.5 kc.

C. Bandswitch on 80M.

D. Function switch in AM position.

* E. Notch off

F. Noise limiter off.

G. Crystal selector switch in normal position.

III. I.F. Bandwidth limits at 50.75 kc.

	6 db	60 db
Position #1	.65 kc max.	3.5 kc max.
Position #2	2.5 kc ± 20%	11.0 kc max.
Position #3	5.0 kc ± 20%	19.0 kc max.

IV. R.F. Sensitivity limits to be as follows: (Preselector peaked)

A. 1 microvolt input on any band shall cause the receiver to deliver 500 milliwatts audio output (300 milliwatts on 80 meters).

* Notch control max. CCW position for this check.

B. 1 microvolt input on any band shall give at least 10 db signal/noise ratio. (50 milliwatt level).

C. Signal/noise ratio to be checked approximately 25 kc in from upper and lower calibration limits on dial on each 500 kc segment (preselector peaked).

D. Gain variation across any 500 kc segment shall not exceed 3 db (preselector peaked). 6 db on 40 M.

E. .5 microvolt unmodulated input with function switch in USB or LSB position shall increase receiver output .5 watt (minimum) above internal receiver noise as receiver is tuned through signal (check at one spot on any band).

F. Gain variation shall not be greater than 3db when switching from USB to LSB. Use imicrovolt unmodulated signal, 80M band.

VI. Audio Performance

A. Hum level shall be less than 2 microwatts with audio gain control at minimum.

B. Distortion shall not exceed 10% at 750 milliwatts output with 10,000 microvolts input at antenna terminals, 4 mc, noise limiter off, selectivity at 5 kc and function in AM position.

VII. I.F. Rejection

After the I.F. trap has been nulled at 6.5 mc (receiver tuned to 7.00 mc) the following checks are to be made:

REC. TUNING	GENERATOR FREQUENCY	REJECTION BELOW 1 uv
7.0 mc	6.5 mc	50 db
7.5 mc	6.0 mc	

VIII. SPURIOUS RESPONSES.

A. All frequencies other than the fundamental shall be down at least 55 db on all amateur bands (except I.F. Rejection at 7 mc).

B. There shall not be any indication of spurious oscillation in 1st crystal oscillator as bandswitch is rotated from band to band (no frequency jump).

IX. TWEETS

All "tweets" or "birdies" within the amateur bands shall be less than .5 microvolt equivalent CW signal.

X. CW/AM RATIO.

A. Receiver tuned to 3.5 mc, USB, 2.5 kc, 1 microvolt input, preselector peaked, tuning adjusted for maximum beat note. (CW signal) (50 milliwatt level).

B. Switch function to AM and apply 100%, 400 cycles modulation to generator and retune for maximum audio output. The difference in audio output over that measured in Step A shall not exceed 4 db.

XI. BFO Performance

A. Frequency range not less than ± 1500 cycles.

B. CW signal must maintain zero beat when switched from USB to LSB without resetting pitch control more than 1/16" from indicator line.

XII. Notch Performance

A. The notch knob and slug shall be set at "off" at the maximum clockwise stop.

B. Tuning range--50 to 54 kc (minimum).

C. The notch depth control shall be adjusted for maximum notch depth.

XIII. AVC Figure of Merit

A. Receiver tuned to 14.3, USB, 2.5 kc, preselector peaked.

B. Set generator for 5 microvolts unmodulated and tune for maximum audio output (50 mw).

C. Increasing signal input level 80 db shall not increase audio output more than 10 db.

XIV. Meter Calibration

A. Adjust factory gain control for S9 reading with 50 microvolts input (unmodulated) at 14.3 mc, 2.5 kc, notch off, preselector peaked, tolerance ± 3 db.

XV. Dial Calibration

A. Error between adjacent 100 kc check points shall not exceed one pointer width.

B. With the Calibrator Reset adjusted at the low frequency end of the dial (3.5-7 mc), the total error at any 100 kc check point on the dial shall not exceed $\pm$3 kc.

C. Band to band calibration error shall not exceed $\pm$2 kc.

XVI. Overall Drift

A. After 15 minute warmup, total drift in 1 hour shall not exceed 500 cycles.

XVII. Mechanical Stability

A. There shall be no evidence of instability or microphonism under any condition of normal use.

XVIII. General Coverage Crystal Oscillator

A. Use 6.5 and 20 mc type CR-18/U test crystals in sockets 1 and 2. Either crystal shall oscillate on its fundamental frequency and provide 1 volt R.M.S. minimum at the XTAL. OSCILLATOR OUTPUT jack.

B. Use 20.5 and 34.5 mc type CR-23/U test crystal in sockets 3 and 4. Either crystal shall oscillate only at its indicated frequency and shall provide .5 volt R.M.S. minimum at the XTAL OSCILLATOR OUTPUT jack.

XIX. VFO as Locked Oscillator

A. Insert 4.5 mc type CR18/U test crystal in socket on VFO plate.

B. Set VFO dial at 375 kc cal. mark and determine oscillator frequency.

C. Tuning VFO ±10 kc shall not change VFO frequency more than 500 cycles.

XX. VFO Output

A. The VFO output, measured at the VFO OUTPUT jack with an HP 410B shall be greater than 1 volt and shall not vary more than .5 volt across the 500 kc range.

XXI. LF Input

A. The LF INPUT circuit shall be checked for operation in the following manner.

1. Insert 7.0 mc crystal in auxiliary socket 1 or 2 and set XTAL SELECTOR switch to that position.
2. Set bandswitch to LF
3. Plug 15' antenna into LF jack and check for normal broadcast reception.

XXII. Preselector Range and Calibration

A. The preselector shall pass through resonance at 3.0 mc with bandswitch in 3.5 position and through resonance at 30 mc with the bandswitch in the 29.5 position.

B. The pointer shall fall within the appropriate block at resonance at any frequency in each amateur band.

XXIII SIDE BAND REJECTION.

With the BFO set for zero beat in both Upper and Lower sideband, 1 microvolt input @ 14.3 MC and Preselector peaked, tune receiver for 1000 cycle beat note.

When switched to the opposite side band, the audio output must drop 20 db minimum. (Check in 2.5 KC position).

XXIV. Mechanical Checks.

A. All controls shall operate smoothly, and without binding, throughout their travel range.

B. All rotary switches shall have positive detent action.

C. Knob movement in a vertical or horizontal plane shall be less than 1/32".

D. There shall not be any perceptible wobble or vertical movement in the tuning dial when viewed through dial window.

E. Dial and meter lighting shall be uniform and without bright spots.

F. There shall not be any mechanical hum or buzz.

G. There shall not be any indication of backlash in the tuning mechanism.

XXV LUBRICATION

A. VFO ASSEMBLY

1. Light oil ("3 in 1" Type).

a. Four nyliners (077-202301) located in bushings (077-002851)

b. Two nyliners (077-202301) located in pinion of dial disc. (026-001087).

2. Grease (093-000542)

a. Spur gears (026-001088) and (026-001089)

b. Gear bushing (077-002850)

c. Gear pinion (026-001087)

B. CHASSIS ASSEMBLY

1. Grease (093-000542)

a. BFO stop bushing (077-002872) and bearing bushing (077-002875)

b. "T" notch stop bushing (077-101346) and bearing bushing (077-002875)

c. Rear end of pre-selector outer shaft (074-002791-01) and pre-selector inner shaft (074-002756)

Service Bulletin

Hallicrafters .....

BULLETIN 1964-4
June 1, 1964

ADDITIONAL NOTES ON THE TRANSCEIVE (SLAVE) OPERATION OF THE HALLICRAFTERS HT-44 COMMUNICATIONS TRANSMITTER AND SX-117 RECEIVER.

There are several changes in the original circuitry of the HT-44 which improve the performance of this equipment when operated in Transceive with the SX-117. These changes, and their purpose, are shown on the attached errata sheet. Also shown are two revisions in the output meter circuit that will correct specific complaints as noted. These modifications are incorporated in all HT-44's on which the first six digits of the serial number are 344001 — although it would be well to check for them in cases where it might be deemed necessary.

In the SX-117, the muting change listed in Note 1 under paragraph 7-2 in the HT-44 manual is a must for transceive operation, and each set should be checked even though it is above the 117001 number mentioned in the book. This is actually a typographical error and should be serial number 117005. To provide further isolation we are now also going to cut off the first mixer tube by lifting the cathode resistor R7 from ground and returning it to the muting line, schematically at the junction of R24 and R25. Physically this can be accomplished by removing R30 from the terminal strip directly behind the V2 socket. The other end of R30 remains connected to pin 9 of the V2B socket, and the free end dressed up in the air so that it is available as a test point for alignment purposes. One end of R7 is lifted from ground and reconnected to the terminal lug freed by moving R30. Also from this same lug a .001 mfd 500-volt ceramic disc capacitor is run to the ground terminal on the same terminal strip. Another lead is connected from the terminal lug junction of R7 and the .001 capacitor to the receive/standby terminal lug on the rear of the chassis. This requires a lead approximately 9 inches long and makes the most direct connection. SX-117's with this latter change will bear serial numbers with 117006 as the first six digits.

There is one other note that might be of benefit. In the receiver the most critical factor is the adjustment of the crystal-controlled first conversion oscillator. The method of making the adjustments is explained in paragraph 6-5 of the receiver manual. If any doubt exists, these circuits should be checked with a voltmeter as explained.

If the connecting cables between the two units are other than supplied with the Hallicrafters CA-44 cable assembly, it is imperative that they be made of Type RG-62/AU coaxial cable 28 inches long. This is 92-ohm cable with very low capacity. Even if CA-44 cables are used, each cable should be checked individually to see that it is grounded at both ends of the shield if unusual or spurious oscillations are experienced.

Operation of the HT-44 and SX-117 in the three different modes (HT-44 alone, transceive with the transmitter VFO, and transceive with the receiver VFO) will probably require different settings of the "RF Level" control in CW and AM or the "Mic Gain" control in sideband. When these controls are properly adjusted for the mode being used, the output from the transmitter will be within less than 1 db in all three methods of operation.

9-5, ENGINEERING CHANGE #C -169

NOTE: C level units will have the serial # 117002 XXXXXX.

ENGINEERING INSTRUCTIONS -- FIFTH AVENUE

DATE: July 22, 1963

NUMBER: C-169

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NAME OF DEPARTMENT
(Communications)

CATEGORY (Indicate One)

( ) TEMPORARY USE OF OTHER THAN SPECIFIED PART OR MATERIAL
( ) TEMPORARY DEVIATION FROM PRINT SPEC
(XXXXX) FORMAL CHANGE REQUEST TO FOLLOW
( ) OTHER (Describe)

B/M NO. AFFECTED 001-004348

MODEL AFFECTED SX-117

PART NUMBER AFFECTED See attached sheets.

SERVICE MANUAL AFFECTED Yes

DESCRIPTION See attached modifications.

REASON

REQUESTED BY _____ AUTHORIZED BY _____

ENGINEERING _____

E. I. #C-169

SX-117 Modifications

1. Remove 330K 1/2 watt resistor (R9) from 6EA8 1st mixer and terminal strip, part number 451-252334, (pin 3)

   Remove .01 ceramic disc condenser (C12) from pin 3 to ground, part number 047-100224.

   Connect 470 ohm, 1/2 watt resistor from pin 3 to pin 6 of same socket, part number 451-252471.

2. Remove 3.3 mmf condenser (C68) connected between T5 and T6, 50.75 KC I.F. transformers, part number 047-200403-05.

   Replace with 2.2 mmf condenser, part number 047-200403-04.

3. Remove 3.3 mmf condenser (C78) connected between T7 and T8, 50.75 KC I.F. transformers, part number 047-200403-05.

   Replace with 2.2 mmf condenser, part number 047-200403-04.

4. Remove 2 470 ohm resistors from selectivity switch (R85 and R87), part number 451-252471.

   Replace with two (2) 390 ohm 1/2 watt resistors, part number 451-252391.

5. Remove 100 mmf condenser (C65) connected between pin 3 of T5 and rear wafer of selectivity switch.

6. Remove 1 meg. 1/2 watt resistor (R63) from 6BN8 socket pin 2 and terminal strip, part number 451-252105.

   Replace with 6.8 meg. 1/2 watt resistor, part number 451-252685.

7. Remove .001 ceramic disc condenser (C75) from terminal strip near center of selectivity switch, part number 047-100168 (note terminals).

   Connect 100 mmf condenser from previously used terminal nearest rear of chassis to terminal 2 of T6, 50.75 KC I.F. transformer, part number 493-110101-334.

8. Remove .47-200V condenser (C107) at rear of function switch, part number D046-001302-04.

   Replace with .22 - 200V condenser, part number 046-001298-05.

SX-117 Modifications (cont'd.)

9. Remove 4.7 mmf condenser (C61) connected between pins 7 and 9 of 6EA8 3rd mixer socket, part number 481-135047.

Remove 4700 ohm, 1/2 watt resistor (R51) connected from pin 7 of same socket and ground, part number 451-252472.

Replace condenser with 30 mmf connected between pins 7 and 8, part number 481-151300.

Replace resistor with 2200 ohm, 1/2 watt, pin 7 to ground, part number 451-252222.

10. Remove ground lead from terminal 1 of T4, 1650 KC I.F. transformer.

Replace with 330K, 1/2 watt resistor, part number 451-252334 and .01 ceramic disc condenser, part number 047-100224 both connected from I.F. terminal 1 to ground.

11. Remove .002 ceramic disc condenser (C93) directly behind BFO coil on terminal strip. Part number 047-100395 (product detector coupling).

Replace with .001 ceramic disc condenser, part number 047-100503.

N O T E

The 50.75 KC and th 1650 KC I.F. should be realigned after these changes are made.

It should be noted that the "S"meter will not indicate the selectivity of the I.F. pass band and will not indicate the notch null point.

9-6, ALTERNATE IF ALIGNMENT

Control setup:

BAND SELECTOR: As noted in chart.
RF & AF GAIN: Maximum.
SELECTIVITY: As noted on chart.
FUNCTION: As noted
NOTCH: off
OFF/ANL/CAL: OFF
BFO: 0 (center point)

Step	Signal Generator Connections	Generator frequency	Band & MODE	Audio Output AF GAIN @ Max	Selectivity
1	Pin 2 of V8	50.75 KHz CW	80 Meters LSB	1 watt	2.5KHz
	Injection level 10Kuv or less using a 1x scope probe. Adjust T5, T6, T7 and T8 for maximum audio output.				
2	Pin 7 of V5	1650 KHz 1000 cycles 30% mod	80 Meters AM	500mw	2.5KHz
	Injection level of 300uv. or less. Slowly tune generator through 1650KHz to determine center of IF passband. Set generator at center of IF passband. Adjust top & bottom of T3 & T4 for maximum audio output.				
3	Pin 2 of V2	6.050 MHz 1000 cycles 30% mod	80 Meters AM	500mw	2.5KHz
	Injection level of 200uv or less. Adjust receiver tuning until audio output is achieved at approximately 3.95 MHz. Adjust top cores of T1 & T2 for maximum audio output. Reduce generator as needed to maintain 500mw audio output.				
4	Pin 2 of V2	6.450 MHz 1000 cycles 30% mod	80 Meters AM	500mw	2.5KHz
	Injection level of 200uv. Adjust receiver tuning until audio output is achieved at approximately 3.55 MHz. Adjust trimmers C15b & C15d for maximum audio output. Reduce signal generator output as required to maintain 500mw audio output. Repeat steps 3 & 4 until no further increase is achieved.				

9-7, ALTERNATE PRESELECTOR ALIGNMENT PROCEDURE

This procedure was developed to eliminate the need for the two auxiliary crystals. It is critical that the frequency of the signal generator be very precisely set. If your generator does not have an accurately "calibrated" digital display, then use a frequency counter to set the generator frequency.

NOTE: If the I.F.'s are aligned, and there are no other faults, set up the following: Generator output to 3.0 microvolts. (More signal may be required if other faults exist in receiver.)

SELECTIVITY to 2.5
RF GAIN to max
CAL RESET to index dot
BFO to index dot
NOTCH off
OFF/NL/CAL to off

Step 1

a. Set generator frequency to 3.5MHz.
b. Set receiver TUNING dial to black scale 0.
c. Set BAND SELECTOR to 3.5.
d. Set preselector to 3. (On the inner 1 to 10 scale)
e. Connect generator to antenna input.
f. Set FUNCTION to LSB.
g. Adjust A.F. GAIN for 250 milliwatts audio out.

Adjust L5 (RF amp grid tuning) and L6 (RF amp plate tuning) for maximum audio output.

Step 2

a. Set generator frequency to 29MHz.
b. Set receiver TUNING dial to black scale 500.
c. Set BAND SELECTOR to 28.5.
d. Set preselector to approximately 9.5. (On the inner 1 to 10 scale)
e. Connect generator to antenna input.
f. Set FUNCTION to USB.
g. Adjust A.F. GAIN for 250 milliwatts audio out.

Adjust C3B and C3D for maximum audio output.

Repeat steps 1 and 2 until no further improvement is achieved.

Step 3

a. Set generator to 28.5MHz
b. Set receiver TUNING dial to black 0.
c. Set preselector to approximately 9.25. (On the inner 1 to 10 scale)

Adjust L2 and L7(antenna shunt and mixer shunt coils) for max receiver output.

Repeat steps 1,2 and 3 until no further improvement is achieved.

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