

Hammarlund SP-600 Receiver Modifications

This section is provided thru the graciousness of Bruce Stock, AB7YD, and is used here with his permission.

The following modifications were produced in order to improve what the author feels are several shortcomings in the SP-600 receiver. My goal was to minimize the impact of the changes to the SP-600 to the point where they could be easily reversible if some future custodian of the receiver wanted to do so.

The areas where I feel the SP-600 needs help are the following:

1. The RF signal level meter is very non-linear and is not calibrated with S-units. It is useful only as a tuning indicator.
2. The AGC employs a large amount of delay, which is partially responsible for the non-linearity of the S-meter.
3. SSB detection with the existing circuitry is very poor, and the existing AGC is not suited for SSB reception.

In making the following modifications, I removed as little as possible from the SP-600 and left all original wiring in place. New wiring was done with a single color of easily recognizable modern wire for ease of identification by any future restorer.

These modifications are for an SP-600 JX1, so there may be minor circuit differences if you are working with a later model receiver. Since this will not be a "cookbook" set of instructions, you will have to know enough about your particular model to make your own decisions about the best way to incorporate each particular change.

I. The AGC modifications. It is best to start with the AGC modifications, because both the S-meter and product detector changes depend on them. There are three problem areas I wanted to address with the AGC changes. First, the bias applied to pin 5 of V14, the AGC detector, causes the receiver to remain at maximum sensitivity until quite strong signals are received. At that point the developed AGC voltage finally overcomes the bias and is fed back to reduce the gain of the appropriate stages. In my receiver, dropping the value of R66 in the AGC delay divider below a value of 4.7k caused some distortion to AM broadcast stations. So I settled on changing R66 to 4.7k, which reduces the amount of delayed AGC significantly.

A second problem with the AGC is that the existing filtering is insufficient to remove some of the variations due to audio modulation on the incoming carrier. This is easily corrected by adding a .002 ufd capacitor in parallel with C140. Note that instead of replacing C140 with a .003, I have left the original in place to make restoration easier.

Finally, some further reconfiguration of the AGC circuit is required to smooth a few further kinks in the AGC action. The final circuit is shown below. Wherever component parts list numbers are used, the original part is unchanged. Wherever part values are given, it is for a newly added part. If both are given, it means an existing part has been changed in value.

The 10 megohm resistors were added to provide for a slow discharge time constant which will be more effective on SSB reception. The 1nxx diode on the left ensures that when the RF gain control is reduced, thereby pulling the AGC line strongly negative, the new S-meter will not be pulled upscale. Instead, it will fall toward zero as the output of the AGC detector drops.

Note that R97 (3.3meg) is removed and S8, the AGC/Manual switch, has been rewired. The other half of S8 going to the old RF/AF meter switch is no longer used, so the wires can be disconnected and taped. Also, note that C139 is changed in value from 7 to 50 pf. This provides a stronger drive for the fast-attack AGC mod that will be added with the product detector. The rightmost 1nxx diode and relay contacts are not to be added until the product detector is installed. They are shown here only for clarity as to where in the circuit they are installed.

All the semiconductor diodes added for this project are garden-variety types, so I have used the 1nxx designator. Use whatever you have.

II. The S-meter. The only hard part of the S-meter modification is making a new meter scale for the existing meter. I'll describe the steps I took, and let you decide how best to proceed depending on your circumstances. First I removed the S-Meter dial face from my HQ-170 receiver and used a flatbed scanner to scan into my computer. There I cleaned up the image and prepared it to be printed out. I used my printer's scaling options to get the printed dial scale to approximate size. At this point I removed the dial scale from the SP-600 meter and superimposed the two, with a strong light behind to see how close to the needed size I was.

If you look at the original scale, you will see that the existing RF level meter swings through an arc of only about 60 degrees. There is plenty of leeway in the existing meter mechanism to accommodate about 80 degrees of swing, and I printed out the final version of my new scale to take advantage of this.

Since the meter scale is illuminated from the rear, a transparent plastic blank, identical in size to the original meter face was constructed. I used clear plastic from the lid of a small plastic box, then overlaid the original meter face and scribed the outline and screw holes. I used a router bit at low speed on a Dremel tool to remove most of the excess plastic, and finally used a file to bring the dimensions down to the size of the original scale. The paper scale was finally glued to this new transparent blank, yielding a nice looking, and translucent dial face. You may want to make several test alignments of the scale, the blank, and the meter movement to be sure you have it right before you finally glue the paper in place.

The original meter mechanical zero was uncoupled in order to be able to set the needle as far to the left as possible without physically contacting the meter pole piece. Finally, the original needle bumper strips were repositioned to allow the new wider needle swing, and the meter was reassembled and remounted on the front panel. All the leads to the original meter were removed and taped.

Note that when you remove the original wires from the upper end of the S-meter zero pot (R69), you must ground them. This is necessary to provide the correct DC return path for the audio detector.

The new S-meter amplifier circuit was built up on a small board that was conveniently mounted on the bracket that holds the rear of the selectivity switch. The circuit for the new S-meter amplifier is shown below.

The circuit uses a VM0300 P-channel, enhancement-mode, FET. The transistor is available from Active Electronics, Inc, and no doubt other parts suppliers as well. There is nothing unique about this part, and it is likely that any similar P-channel enhancement mode FET will work as well. The original S-meter zero pot is used to bias the FET to the point where it is just turning on with no signal input to the receiver. The cathode bias of the audio output tube is used to generate the needed positive voltage supply. A negative 8.5 volt supply for the drain is obtained by half-wave rectifying the receiver filament voltage. This supply is also used to power the relay I used to switch the new product detector into the audio amplifier.

The meter zero pot is adjusted so that the meter needle just rises off the low end of the scale. The sensitivity pot is adjusted so that the strongest received signals will just cause the meter to peg on the right hand side.

III. The Product Detector. The product detector uses the circuit from the SX-101A receiver. I've installed it in several other receivers, with very good results in all cases. Since V12, the BFO buffer, will not be required, it is not necessary to drill any new holes for the product detector tube.

Begin by clearing the unneeded components from the V12 socket. In my receiver, several parts which feed both V12 and V11 were terminated on V12. They must be moved over to V11 first, so that it will continue to operate properly. The BFO injection pot is no longer needed.

To switch from AM to SSB, the audio amplifier input must be switched from the output of the AM detector to the output of the product detector. You can do this by running shielded leads to the front panel Mod/CW switch, S7, but I chose to use a Radio Shack 12vdc DPDT relay instead. The relay is mounted near the AM and product detector location, so long shielded leads are not necessary. S7 now energizes the relay, which switches the audio amplifier over to the product detector output. It also completes the circuit for a diode I placed across R60, to give a faster attack AGC characteristic on SSB (refer back to the AGC schematic for a better view of the diode location). The product detector circuit is shown below.

Originally, S7 also had a second set of contacts used to switch in C137, a .22 ufd capacitor, to slow the AGC time constant for CW/SSB reception. I preferred the flexibility of having the AGC time constant independently selectable from the AM/SSB mode. Sometimes I want long AGC time constants on AM when there is rapid fading or controlled-carrier modulation. For this reason, I removed the original RF/AF meter switch and replaced it with a SPST switch that connects a .1-uf disc ceramic capacitor to ground from the AGC buss. This gives an adequately long time constant for SSB or fast fading AM conditions. The new switch becomes the FAST/SLOW AGC selection.

When the new product detector is connected to the V13 BFO, it will change the center frequency of the BFO somewhat. Be sure to readjust the BFO center frequency, by adjusting L44, to coincide with the center of the receiver pass band.

You will select upper or lower sideband by setting the front panel BFO frequency knob to between 1 and 1.5 khz above or below, respectively.

Hammarlund SP-600 Dial & Gear Train Alignment

This section is provided thru the graciousness of Andy Moorer, and is used here with his permission.

Manually rotate the shafts until you are at the lowest possible frequency. That will be when the vanes of the main tuning capacitor are fully enmeshed - that is, you can't get the moveable vanes any further into the static vanes. The little rotating brass piece that has the stop peg has to be up against the stop that is on the right-most brass gear. You have to fiddle with the gears until these things happen at the same time - capacitor fully closed and the rotating peg against the stop. If you are really adventurous, you can check it by winding all the way to the other extreme - the high-frequency stop should be when the capacitor is fully open.

Note that it won't want to stay there. Here is where it takes 3 hands. Rotate it back to the low-frequency position, against the stop, capacitor fully closed. At this point, the fiducial (the little black pointer up top that bolts onto the faceplate on two hex spacers) and the frequency disc should be positioned so that it points right to a little mark on the disc to the left of the lowest frequency. Note that BOTH the disc and the fiducial (pointer) have some freedom and can be moved around some amount. Put the disc on with the screws loose - put the fiducial on with the screws loose. Holding the peg up against the stop, move each around to align them.

Note that you might not be able to align them - that is, there may not be enough motion on the tuning disc. If this happens, you have to re-fiddle the gears. It means that the hub that the tuning disc bolts to needs to be rotated. You have to disengage it from the other gears and move it around a bit. Then go back to the beginning and get the stop, the capacitor, and the tuning disc and the fiducial all in the right place at the same time. After the third try or so, have a beer and come back tomorrow. It will go together the first time tomorrow. The vernier (the right-hand disc) lines up with its fiducial at zero at this same alignment position. The vernier dial doesn't have a special alignment mark - you just position it to zero when the tuning dial is at its alignment mark. Since that is the one with the stop on it, you generally don't have any problem with the hub being in the wrong position. Note that you have a fair amount of flexibility as to when the capacitor is fully "closed." That is, it doesn't have to be really, really closed. You are going to follow this whole thing with an alignment, which will adapt the rest of the receiver to whatever you end up with as the low-frequency position. It is more important to get the dial alignment mark to line up with the fiducial at the place the stop engages. That is, you don't want the operator to be able to tune lower than the alignment mark. If it does, you might not be able to get the high frequencies to align properly.

Hope this helps. The instructions are often more confusing than helpful. If you get the disc, the stop, and the capacitor to all end up in the right place, then the radio can be aligned and everything will be wonderful. All other considerations are secondary.

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Repairs to Hammarlund SP-600 J-11

Receiver was purchased from Peter Dingley on 29 Sept., 2008 for \$250.
The date of manufacture on back of panel is September 22, 1952.

29-09-2008

Cleaned all valve socket contacts with CRC-226. Checked dial calibration on WWVH 2.5Mhz - OK; 5.0Mhz - 5.050; 10.0Mhz - OK.

30-09-2008

Replaced minature AVC/Man switch with standard DPDT toggle switch.
Cleaned selectivity switch contacts.

C-102 replaced with .022mfd 400v Philips polyester.

1-10-2008

C-137 replaced with .27mfd 400v Philips polyester.

2-10-2008

C-149 audio coupling replaced with .005mfd 600v Mylar capacitor.
Removed RF sub-chassis for component checking and replacement of FET to restore V-4 6C4 HFO as originally fitted.

C-75 100pf - OK

C-79 5pf - OK

3-10-2008

Removed tuning gang, clean and remove solder from terminals. Lubricate wiper contacts with CRC-226. Re-assembled and fixed poor coupling link with Araldite to reduce backlash.
Remove V-4 valve socket to extract FET wiring, repair socket and replace for 6C4 installation.

4-10-2008

Repairs to RF sub-chassis cont'd

C-74 .01mfd 400v replaced with polystyrene .01mfd 630v

R-22 47k replaced

R-26 510k (original value) replaced with 560k .5w

R-27 150ohm .5w replaced

R-28 6k8 OK

5-10-2008

C-18, C-25 100pf OK C-22, 23, 24 .01mfd mylar 400v OK

L-48 2.0 ohms DC Ok

R-1 510k (original value) existing 560k OK
R-2 10k OK
R-3 33k replaced with 33k 2w
R-4 1k OK
R-5 500 ohms replaced with 470 ohms 2w
R-6 1k OK
R-11 24 ohms OK
R-12 10k OK
R-13 510k (original value) existing 560K OK
R-14 33k replaced burnt one with 33k 2w
R-15 470 ohms replaced

RF sub-chassis wiring code changes from original

Thick red	now orange	Yellow/black	now blue
Red/white	now green	White/black	now red
Blue	now black		

6-10-2008

Re-align isolantite contact base to mixer subassembly.
Prepare RF subchassis with rust kill and apply etching primer.
Make cover plate for T-1 first mixer unit.

7-10-2008

Re-wire dial lamps and fit 12v .25amp lamps.
Paint RF subchassis in "mid grey"
Remove choke L-51 to access T-1 mixer unit.
Check choke, rust kill and prime base. DC resistance = 163.2 ohms (150)
C-70 .01mfd "black beauty" 400v replaced with Philips polyester 400v.
R-31 2k2 ohm replaced with 1 watt.

8-10-2008

C-67 85pf 2% replaced with polystyrene 5%, 85.8 ohms measured
C-69 220pf 2% replaced with polystyrene 5%, 220 ohms measured
Both replaced mica capacitors actually checked 100%

Re-mounted RF unit.

9-10-2008

Re-connect 12 leads from RF unit to tuning condenser.
Wired up T-1 connections.

10-10-2008

Remove RF sub-chassis, and provide missing connection which enabled 6C4 oscillator plate voltage to be restored. Re-assemble and check operation. Single conversion operation was restored to bands 1, 2 and 3 only. There was no response on second conversion operation of bands 4 - 6 however.

11-10-2008

Aligned 455kc IF transformers, BFO and 3,955kc IF transformers following procedure in manual.

12-10-2008

T-6 BFO unit No capacitor change needed.

R-76 100k within 10% tolerance (109k)

R-77 47k OK

Remove and etch IF, BFO, xtal filter and 3.5MHz xtal oscillator cans.

13-10-2008

T-2 IF unit (L-33, L-34)

C- 98 .022mfd replaced with Philips 400v polyester

C-157 .022mfd replaced with Philips 400v polyester

R-35 100k OK

T-3 IF filter unit No capacitor needed

T-4 IF unit Components already replaced

T-5 IF unit Components already replaced

T-9 3.5MHz xtal osc. unit

C-103 .022mfd replaced with Philips 400v polyester

C-104 .022mfd replaced with Philips 400v polyester

R-38 100k OK

R-40 20k (2x 39k in parallel one was open the other 68k)

Replaced with 20k 2.5w

C-136 .022mfd replaced with Philips 400v polyester

C-163 .25mfd 600v tested OK

Correct wiring to speaker terminals and phone jack.

Apply jumper leads at rear of chassis.

Fit new power flex.

14-10-2008

V-8 3.5MHz xtal Oscillator

Voltage to pin 5 above 7.4Mhz is correct at 31 volts.

V-7 IF Gate

All components checked and following replaced:

C-105 .01mfd 250v replaced

R-32 510 ohm OK

R-33 1k5 replaced

R-37 2k2 OK

R-39 33k OK

R-112 390 ohms replaced

15-10-2008

Selectivity Switch

R-45 240 ohms OK (244 ohms)

R-46 1k1 OK (1.142k)

R-47 18k OK (18.21k)

V-9 first IF

R-42 10 ohms OK (10.5)
R-43 100k OK (113.6k)
R-44 10k OK
R-48 33k OK (34k)

R-99 360 ohms (6V6 cathode)
C-114 10mfd 150v elect. (6V6 cathode) **Check this** ✓
C-150 .0025mfd replaced with 630v mylar (OP trans., pins 7-8)
C-162 .022mfd 400v replaced with Philips poly. (V-14, pin 5)

16-10-2008

Check all wiring to and from T-1 against circuit diagram.

17-10-2008

Re-align 455kc IF's and BFO coil.
Check 3.5mc oscillator by connecting frequency counter to pin 1 of V-6
6BE6 2nd mixer valve. The frequency was exactly 3.5mc and stable.
Re-align 3.955mc IF's

Band 2 coil units 1.35-3.45mc

R- 7 51 ohms (52.2) OK
R-17 51 ohms (53.7) OK
R-103 27k (26k) OK
R-104 27k (25.5) OK

C- 3 .01mfd replaced with polystyrene 1kv
C-27 .01mfd replaced with polystyrene 1kv
C-47 .01mfd replaced with polystyrene 1kv

20-10-2008

R-37 2k2 (2k4) OK
R-50 10 ohms (22 ohms) replaced
R-85 2k5 12w OK
R-95 82k (99k) replaced
R-96 22k OK

C-122 .01mfd (.001) replaced
C-151 10mfd (6V6 bias) replaced with 22mfd 63v electro.
C-156 .02mfd replaced with .015mfd polystyrene.

22-10-2008

✓ Check wiring at RF gain control from terminal board L-13, pin 5
Still to sort out this

Set IF gain to recommended 5 volts by fitting 680 ohm resistors at cathodes of V-9 and V-10.

Fitted 6J6 in place of 6C4 VFO. Voltage checked at 130v for pin 1 and pin 6.

23-10-2008

R-32 510 ohms replaced with 470 ohm
R-37 2k2 replaced
R-42 10 ohm replaced
R-122 20k OK

C-106 .01mfd replaced with .015mfd (original was .02mfd)

24-10-2008

C-129 A,B .05mfd 600v replaced with .05mfd 630v tubulars.

Check resistance of lower blue/black winding of L-31 (.1-.2 ohms) OK
Check resistance of lower green/white winding of L-32 (.9 ohms) OK

25-10-2008

C-128 10mfd 100v electro. replaced with 10mfd 50v (measured voltage 12)
C-161 A,B,C 20mfd 450v replaced with rebuilt unit in original can.

26-10-2008

C-158, 159, 160 10mfd 100v electros. Replaced with 10mfd 450v units.

R-86, R-89 47K wrong values. Replaced with 68k as per J-11 manual.
R-87 120k replaced
R-88 120k OK
R-90, 91, 92 10k replaced all.

28-10-2008

Fit the new 22mfd 450v electros into the original can and re-assemble.
Replace wiring as necessary.

Check filter chokes for leakage to ground - both quite OK at present.

29-10-2008

Removed RF deck for further checks.
Checked inductance of chokes L-7, L-14 and L-24.
All three checked, L-14 and L-24 measured 189 μ H and 192 μ H respectively.
Fit omitted C-155 with .01mfd 300v polystyrene to pin 3 6BE6 1st mixer.
Fit omitted C- 43 with .01mfd 400v polystyrene (V-2 plate circuit decoupling).

30-10-2008

R- 1 replaced 560k with 470k 2 watt (original value was 510k)
R-13 replaced 560k with 470k 2 watt.

1-11-2008

Further voltage checks: (figures in brackets are from manual)

V-6 6BE6 Pin 5 230.5 (260) Above 7.4 mc, RF Gain at minimum
 Pin 6 89.0 (105)
 Pin 7 -1.12 (-1)

V-6 6BE6 Pin 5 226.4 (260) Below 7.4 mc, RF Gain at minimum
 Pin 6 .86 (nil)
 Pin 7 -1.12 (-1)

V-8 12AU7 Pin 1 31.5 (28) Above 7.4 mc
 Pin 2 -8.53 (-4.5)
 Pin 6 197.7 (185)
 Pin 8 7.7 (7.5)

V-8 12AU7 Pin 1 .785 v (nil) Below 7.4 mc
 Pin 2 -236mv (nil)
 Pin 3 nil (nil)
 Pin 4 nil (nil)
 Pin 5 nil (nil)
 Pin 6 -.868 v (nil)
 Pin 7 -.578 v (nil)
 Pin 8 1.8mv (nil)
 Pin 9 6.3v ac

C-163 replaced with .22mfd 630v

HF Oscillator coil code numbers

0.54 - 1.35mc	31385	7.4 - 14.8mc	31394
1.35 - 3.45mc	31388	14.8 - 29.7mc	31397
3.45 - 7.40mc	31391	29.7 - 54.0mc	31403

2-11-2008

Removed wiring directly associated with the EXT AVC switch for "local" to "diversity" operation.

Rear chassis terminal strip wiring:

Pin 1 6.3v ac
Pin 2 earth
Pin 3 AVC - from choke to pin 5 of under chassis terminal strip; then
 to pin 2 of V-14 AVC circuitry.
Pin 4 load
Pin 5 Det.

3-11-2008

Remove front panel and take in for re-paint

6-11-2008

Continue cleaning up gear train by removing grease and dirt. Clean up dial scales and all front panel components. Check AVC-MAN switch for correct wiring. Clean all controls with CRC-226.

17-11-2008

Filled in engraving after panel re-paint.

18-11-2008

Panel re-fitted. Checked alignment of first 3 bands.

20-11-2008

Removed Osc. coil 31394 (L-28), 7.4-14.8 mc and checked following:

*Former
Tracking
adder* C-87 120pf 2% 500v mica. (tested 119.2pf and voltage at 475) OK
C-88 12pf 5% 500v mica tracking (missing), have fitted 12pf ceramic
C-89 190pf 1% 500v mica. (tested 188.6pf and voltage at 475) OK

Also removed short wire connected across top end of coil winding which was effectively reducing length of original coil.

22-11-2008

C-170 .001 mfd mica 500 volt replaced

R-119 470k (475k) OK

R-121 1k2 OK

R-122 20k (19.3k) OK

23-11-2008

R-62 100k (107.5k) OK

R-63 27k (25.1k) OK

R-66 100k (106k) OK

24-11-2008

Made up and fitted new clamping washer for panel meter.

24-11-2008

Removed Osc. coil 31403 (L-30), 29.7-54.0 mc and checked following:

Trimmer C-95 42pf 1%, 500 volt. Replaced with polystyrene 41pf, 475 volt test.
Padder C-96 610pf 1%, 500 volt. (tested at 615pf and voltage at 475) OK

The coil has been tampered with and part of the winding had been cut off and replaced with a heavier gauge wire spaced away from the remaining turns. Trimmer screw slot is now marked at half mesh on base of unit.

✓ Check this out when received is operating in double conversion mode.

Removed Osc. coil 31385, .54-1.35 mc and checked following:

Trimmer C-77 3300pf 2%, 500 volt. (tested at 3290pf and voltage at 475) OK
Padder C-78 404pf 1%, 500 volt. (leaky). Replaced with 393pf + 10pf = 401pf polystyrene tested at 475 volts. OK
L-25 primary, 1.15 ohms. (measured at 1.3 ohms) OK
secondary, 6.8 ohms. (measured at 7 ohms) OK

Removed 2nd interstage coil 31386, .54-1.35 mc and checked following:

C-27 .01mfd tubular. Replaced with .01mfd polystyrene, 1kv.
R-17 51 ohms (tested at 53.7 ohms) OK
R-104 27k (tested at 26.25 ohms) OK
L-15 primary, less than 1 ohm. (measured at .1 ohm) OK
secondary, 9.2 ohms. (measured at 9.6 ohms) OK

Removed Osc. coil 31391 (L-27), 3.45-7.4 mc and checked following:

Trimmer C-83 10pf 10%, 500 volt. (leaky). Replaced with 10pf polystyrene tested at 475 volts. OK
Trimmer C-85 1200pf 2%, 500 volt. (leaky). Replaced with polystyrene 1035pf + 250pf = 1178pf tested at 475 volts. OK
L-27 primary, less than 1 ohm. (measured at .1 ohm) OK
1000 pf + 280 pf = 1280 pf ✓

25-11-2008

Check and replace faulty voltage regulator OA2 which then gave 148 volts at the single and double conversion settings.

Checked voltage on pin 1 of V-4 (6C4 VFO), which was correct for the 6C4 at 130 volts on the lower bands but incorrect on the upper, double conversion bands at 114 volts being a drop of 16 volts.

Measured resistance between the regulated 150 volt line and pin 1 of V-4 which gave a reading of 1.994k on all ranges being made up of 1k + 1k + 180 ohms = 2.18k.

Removed the 6C4 and injected into its socket pin 6 a frequency of about 13.955mc. The Hammarlund receiver was set to approximately 10mc which produced a good signal.

Using back-up receiver RF-3100 fitted with wire extension from antenna socket and loosely coupled to 6C4; band 2 was selected on Hammarlund and tuned to 3.0mc. The back-up receiver was tuned to 3.455mc which

produced a signal. Then the Hammarlund was set to 10.0mc on the double conversion band and the back-up receiver set to 13.955mc. No signal was produced.

Removed osc. coil unit for 3.45-7.4mc band. Removed osc. coil unit for 7.4-14.8mc band and placed this in the location of the 3.45-7.4mc osc. coil. A signal was found on the back-up receiver at about 5.0-6.0mc which indicated that the 7.4-14.8 mc osc coil was OK.

28-11-2008

Removed Osc. coil 31397 (L-29), 14.8-29.7 mc and checked following:

*Original
Added
Added*
C-91 91pf $\pm$ 2%, 500 volt. (tested 102.5pf and voltage at 475) OK
C-92 51pf $\pm$ 1%, 500 volt. OK
C-93 379pf $\pm$ 1%, 500 volt. In parallel with C-92, 379+51=430pf.
(tested total of 440pf and voltage at 475) OK

30-11-2008

Oscillator coil test results

Using an external 6C4 test oscillator as shown on page 62, fig.26 of manual. With a 192 μ H RF choke fitted and two 68pf capacitors used as substitutes for the main tuning capacitor, the following results were obtained via a frequency counter:

Osc. coil 31385,	.54-1.35 mc	gave a reading of	1.204 mc
Osc. coil 31388,	1.35-3.45 mc	gave a reading of	2.460 mc
Osc. coil 31391,	3.45-7.40 mc	gave a reading of	5.310 mc
Osc. coil 31394,	7.40-14.8 mc	gave a reading of	13.268 mc
Osc. coil 31397,	14.80-29.7 mc	gave a reading of	20.540 mc
Osc. coil 31403,	29.70-54.0 mc	gave a reading of	126 mc approx.

These tests were repeated with similar results using a 2.5mH choke in place of the 192 μ H one.

1-12-2008

Removed 2nd interstage coil 31404, 29.7-54mc and checked following:

C-59 51pf $\pm$ 2%, 500 volt. (tested 51.3pf and voltage at 475) OK
L-20 primary, less than 1 ohm. (measured at .2 ohm) OK

Removed 1st interstage coil 31404, 29.7-54mc and checked following:

C-39 51pf $\pm$ 2%, 500 volt. (tested 53.2pf and voltage at 475) OK
L-13 primary, less than 1 ohm. (measured at .1 ohm) OK

Removed input coil 31405, 29.7-54mc and checked following:

C-15 15pf $\pm$ 5%, ceramic 500 volt. (not tested)
C-17 1500pf $\pm$ 2%, 500 volt. (tested 1491pf and voltage at 475) OK
L- 6 primary, less than 1 ohm. (measured at .1 ohm) OK

Removed 2nd interstage coil 31398, 14.8-29.7mc and checked following:

C-57 100pf $\pm$ 2%, 500 volt. (tested 104pf and voltage at 475) OK
L-19 primary, less than 1 ohm. (measured at .4 ohms) OK

Removed 1st interstage coil 31398, 14.8-29.7mc and checked following:

C-37 100pf $\pm$ 2%, 500 volt. (tested 105pf and voltage at 475) OK
L-12 primary, less than 1 ohm. (measured at .4 ohms) OK

Removed input coil 31399, 14.8-29.7mc and checked following:

C-12 7pf $\pm$ 1%, ceramic 500 volt. (not tested)
C-14 1000pf $\pm$ 2%, 500 volt. (tested 1006pf and voltage at 475) OK
L-5 primary, less than 1 ohm. (measured at .1 ohm) OK

2-12-2008

Removed 2nd interstage coil 31395, 7.4-14.8mc and checked following:

C-53 33pf $\pm$ 5%, 500 volt. (tested 33.4pf and voltage at 475) OK
C-55 1500pf $\pm$ 2%, 500 volt. (tested 1505pf and voltage at 475) OK
R-20 22 ohms 10%. (measured 23.6 ohms) OK
R-110 27k 10%. (measured 26.22k) OK
L-18 primary, less than 1 ohm. (measured less than .1 ohm) OK

Removed 1st interstage coil 31395, 7.4-14.8mc and checked following:

C-33 33pf $\pm$ 5%, 500 volt. (tested and replaced with 31pf polystyrene
original showed leakage on voltage test)
C-35 1500pf $\pm$ 2%, 500 volt. (tested 1490pf and voltage at 475) OK
R-10 22 ohms 10%. (measured 22.9 ohms) OK
R-109 27k 10%. (measured 25.9k) OK
L-11 primary, less than 1 ohm. (measured less than .1 ohm) OK

Removed input coil 31396, 7.4-14.8mc and checked following:

C-9 33pf $\pm$ 5%, 500 volt. (tested 31.6pf and voltage at 475) OK
C-11 1500pf $\pm$ 2%, 500 volt. (tested 1517pf and voltage at 475) OK
L-4 primary, less than 1 ohm. (measured less than .1 ohm).
suspect as re-wired, check performance. ✓

3-12-2008

Removed 2nd interstage coil 31392, 3.45-7.4mc and checked following:

C-50 20pf $\pm$ 5%, 500 volt. (tested leaky). Replaced with 22pf, 475 volt
tested polystyrene. (measured 21.5pf) OK
C-52 2400pf $\pm$ 5%, 500 volt. (tested 2390pf and voltage at 475) OK
R-19 24 ohms 5%. (measured 25.1 ohms) OK
R-108 27k 10%. (measured 25.8k) OK
L-17 less than 1 ohm. (measured .1 ohm) OK

Removed 1st interstage coil 31392, 3.45-7.4mc and checked following:

C-30 20pf $\pm$ 5%, 500 volt. tested leaky). Replaced with 22pf, 475 volt tested polystyrene. (measured 21.1pf) OK
C-32 2400pf $\pm$ 5%, 500 volt. (tested 2400pf and voltage at 475) OK
R- 9 24 ohms 5%. (measured 25.4 ohms) OK
R-107 27k 10%. (measured 25.37 ohms) OK
L-10 less than 1 ohm. (measured .1 ohm) OK

Removed input coil 31393, 3.45-7.4mc and checked following:

C-6 20pf $\pm$ 5%, 500 volt. tested leaky). Replaced with 22pf, 475 volt tested polystyrene. (measured 22.3pf) OK
C-8 2400pf $\pm$ 5%, 500 volt. (tested 2410pf and voltage at 475) OK
L-3 less than 1 ohm. (measured .1 ohm) OK

4-12-2008

Removed Osc. coil 31388, 1.35-3.45mc and checked following:

adder C-82 820pf 2%, 500 volt. (tested 818pf and voltage at 475) OK
L-26 Primary measured .6 ohms, secondary 1.05 ohms. (measured 1.4 ohms)

Removed 2nd interstage coil 31389, 1.35-3.45mc and checked following:

C-49 .01mfd. Replaced with polystyrene .01mfd 1kv. OK
R-18 51 ohms 5%. (measured 52.4 ohms) OK
R-106 27k 10%. (measured 26k). OK
L-16 primary, less than 1 ohm. (measured .1 ohm) OK
secondary, 1.25 ohms. (measured 1.5 ohms) OK

Removed 1st interstage coil 31389, 1.35-3.45mc and checked following:

C-29 .01mfd. Replaced with polystyrene .01mfd 1kv. OK
R-8 51 ohms 5%. (measured 53 ohms) OK
R-105 27k 10%. (measured 25.7k) OK
L-9 primary, less than 1 ohm. (measured .1 ohm) OK
secondary, 1.25 ohms. (measured 1.9 ohms) OK

Removed input coil 31390, 1.35-3.45mc and checked following:

C-5 .01mfd. Replaced with .01mfd polystyrene .01 1kv. OK
L-2 primary, less than 1 ohm. (measured .2 ohms) OK
secondary, 1.4 ohms. (measured 1.4 ohms) OK

Removed 2nd interstage coil 31386, .54-1.35mc and checked following:

C-47 .01mfd tubular. Replaced with .01mfd polystyrene 1kv. OK
R-17 51 ohms 5%. (measured 53.7 ohms) OK
R-104 27k 10%. (measured 26.25 ohms) OK
L-15 primary, less than 1 ohm. (measured .1 ohm) OK
secondary, 9.2 ohms. (measured 9.6 ohms) OK

Removed 1st interstage coil 31386, .54-1.35mc and checked following:

C-27 .01mfd tubular. Replaced with .01mfd polystyrene 1kv. OK
R-7 51 ohm 5%. (measured 53 ohms) OK
R-103 27k 10%. (measured 26.8k) OK
L-8 primary, less than 1 ohm. (measured .1 ohm)
secondary, 9.1 ohms. (measured 9.2 ohms) OK

Removed input coil 31387, .54-1.35mc and checked following:

C-3 .01mfd tubular. Replaced with .01mfd polystyrene 1kv. OK
L-1 primary, 1.3 ohms. (measured 1.43 ohms) OK
secondary 9 ohms. (measured 9.4 ohms) OK

Further Check of components in Osc. section of RF deck:

C-75 100pf $\pm$ 2% 500 volt. Fitted 100pf polystyrene (93.3pf) replacing original which tested at 6.3pf and was a little leaky. This was preventing operation of the upper, double conversion bands.
C-79 5pf $\pm$.25pf 500 volt ceramic. Replaced very leaky original with 5pf tubular ceramic.
C-80 5pf $\pm$.25pf 500 volt ceramic. This was missing and a 5pf tubular ceramic was fitted.
Replaced 192 μ H RF choke in Oscillator section with 2.5mH choke.
Cleaned wiper contacts on base of RF deck.

5-12-2008

Re-installed RF deck after replacing faulty and missing capacitors as above. Receiver now works on all bands. Did preliminary alignment of all bands and noted that some coil inductances did not peak when adjusters were fully extended. **These faults need attending to.** ✓

6-12-2008

Did preliminary oscillator and RF alignment on all bands.

7-12-2008

Checked IF alignment followed by oscillator and RF coil alignment.

Replaced 100pf capacitor C-57 in 2nd interstage coil 31398, 14.8-29.7mc with an 82pf polystyrene which enabled proper peaking of the inductance core. This previously was fully extended without peaking. This change allowed the inductance core in the 1st interstage coil to be peaked without having to change the 100pf, C-37 capacitor.

8-12-2008

Modification to .54-1.35mc 1st and 2nd interstage coils.

The jumper lead was removed from pins 1 to 2 and a 430pf polystyrene capacitor was fitted to each coil. This enabled the inductance cores to be peaked successfully.

Removed all unnecessary sockets and wiring at rear of chassis.

9-12-2008

Replaced R-88 120k to V-20, 6AL5 bias rectifier.
Replaced R-90 10k and cleaned up wiring around V-20.

Checked bias wiring circuitry and voltages which were correct at -51.7 and -10.65.

Modification to 7.4-14.8mc 1st and 2nd interstage coils.

The jumper lead was removed from pins 1 to 2 and a 430pf and 470pf polystyrene capacitor was fitted to the 2nd and 1st coil respectively. This enabled the inductance cores to be peaked successfully.

11-12-2008

Removed selectivity switch unit to allow access to wiring below. Clean switch contacts ready for re-assembly.

Removed T-3 1st IF transformer and crystal filter unit and checked:

C-107 220pf $\pm$ 2%, 500 volt mica. OK and voltage test 475.

C-110 100pf $\pm$ 2%, 500 volt mica. OK and voltage test 475.

C-112 100pf $\pm$ 2%, 500 volt mica. OK and voltage test 475.

C-113 100pf $\pm$ 2%, 500 volt mica. OK and voltage test 475.

✓ Crystal filter, Bliley VXL 455 Kc $\pm$ 50 cps measured 454.87 Kc (454.95)

R-41 2k2 10%. Measured 4k7, replaced with 1 watt 5%.

12-12-2008

Checked wiring and components in area of selectivity switch.

R-51 100k replaced

R-52 10k 5% OK

R-43 100k replaced

R-44 10k 5% replaced

R-95 82k OK

R-96 22k OK

13-12-2008

Finished checking wiring and components in area of selectivity switch. Re-installed same and checked operation OK.

15-12-2008

Removed L-54 50mH RF choke

C-138 51pf $\pm$ 1%, 500 volt. Tested OK and voltage at 475

C-139 51pf $\pm$ 1%, 500 volt. Tested OK and voltage at 475

R-55 10 ohm (12ohm) replaced

R-59 2k2 ohms 1watt replaced

R-60 1 meg OK

R-61 1 meg OK

R-62 100k replaced

R-66 18k OK

R-68 100k replaced

16-12-2008

Made up bottom plate for receiver.

18-12-2008

Check following components:

C-142 100pf $\pm$ 10%, 500v. Tested OK and voltage at 475.
C-143 5100pf $\pm$ 5%, 500v. Replaced with .0047mfd, 630v mylar.
C-162 .02mfd 400v tubular. Replaced with .022mfd 400v polyester.
R-60 1meg replaced
R-64 47k replaced
R-65 22k replaced
R-66 18k replaced

20-12-2008 - 21-12-2008

C-129A .047mfd. Replaced with .047mfd, 630v.
C-138 7pf $\pm$ 1pf, 500v. Tested OK and voltage at 475.
C-140 430pf $\pm$ 2%, 500v. Tested OK and voltage at 475.
C-141 100pf $\pm$ 10%, 500v. Tested OK and voltage at 475.
C-148 .022mfd, 450v. Tested OK and voltage at 475.
C-164 430pf $\pm$ 2%, 500v. Tested OK and voltage at 475.
R-58 2k2 replaced
R-60 1meg replaced
R-63 27k replaced
R-67 100k replaced
R-81 100k replaced
R-82 10k replaced
R-83 1k OK
R-98 500k replaced
R-111 100k replaced

14-01-2009

Made up top plate for receiver.

17-01-2009

Modifications to Osc. coil 31394 7.4-14.8 mc

Corrected to file
To achieve accurate tracking C-89 (190pf) was replaced with polystyrene 155pf (~~150pf + 5pf 500v~~). C-87 (120pf) was changed to a polystyrene 100pf, 500v capacitor. This enabled inductance peaking at 7.4mc whereas previously the rod was fully extended without obtaining a peak.

18-01-2009

Modifications to 1st and 2nd interstage coils 31398 14.8-29.7mc

To enable the inductance cores to peak correctly C-37 and C-57 (100pf) were replaced with polystyrene 85pf, 500v capacitors.

To enable the variable trimmers (2.7-21.4pf) to peak at approximately half mesh, a 3.9pf silver mica was fitted in parallel to each trimmer in the two interstage coils 31398 and the oscillator coil 31394.

19-01-2009

Modifications to Osc. coil 31403 29.7-54 mc
Fitted 3.9pf silver mica capacitor across variable trimmer to enable
latter to peak at about half mesh.

31-01-2009

Tested all 6BA6 and 6BE6 valves. V-12 (6BA6 Buffer) was a bit low and
was replaced with a better used one. Replaced V-8 12AU7 with a 12AU7-WA.
All others tested 100% and most were new as supplied at purchase of
receiver.

7-02-2009

Power transformer was removed and repainted to match filter chokes.

16-02-2009

Output Transformer was removed for repainting.

The wiring was renewed and a new colour code used.

Pin 1	White - terminal 4	600 ohms	Pin 5	- Green to wiring loom
Pin 2	Black - terminal 2	jumper	Pin 6	- Green to earth at V-17
Pin 3	Black - terminal 3	jumper	Pin 7	- Blue to pin 3 6V6
Pin 4	White - terminal 1	600 ohms	Pin 8	- Red to wiring loom

Specifications: Grade 1, Class A
3 watts, HI-POT
Primary, 1500v RMS
Secondary, 500v RMS

17-02-2009

Repairs to BFO/AVC circuitry and replacement of the following:

C-137 .25mfd 200v Philips polycarbonate
C-172 .01mfd 630v Mylar
C-174 .01mfd 630v Mylar
R-75 100k, 1/2 watt
R-124 100k, 1/2 watt
R-125 470k, 1/2 watt
R-126 22k, 1/2 watt
R-127 10k, 1/2 watt

18-02-2009

Remove BFO coil and check all components.
Figures in brackets are measured values.

R-76	100k replaced	C-133	430pf (432pf)
R-77	47k replaced	C-134	51pf (54pf)
		C-130 + C-131	457pf (466pf)
L-44	2.58 ohms (2.4)		
L-45	2.5 ohms (2.3)		
L-46	1.31 ohms (1.4)		

24-02-2009

Performed voltage test on 5R4GY and compared with new 5R4GYB.

5R4GY 242.5v 204.6v 5R4GYB 253.5v 214.5v (pin-8, 316.5v)

27-02-2009

Replaced 68k resistors R-86, R-89 at 6AL5 (V-20) with 82k which restored correct voltages at pins 2 and 7 to -96.5volts. The voltages at pins 1 and 5 were a little low at 143 volts instead of 150 RMS.

28-02-2009

Performed final alignment check of IF transformers and coils.

Frequency checks against dial calibration points

Band-1 .54 - 1.3mc

LF end - 2YA 567kHz set to 567kHz on dial
Middle - Southern Star 909kHz read 915kHz
HF end - Newstalk ZB 1278kHz read 1278kHz

Band-2 1.35 - 3.45mc

LF end - Radio Kidnappers 1431kHz set to 1431kHz on dial
Middle - WWVH 2.5mHz read 2.522mHz
HF end - 3.40mHz read 3.41mHz

Band-3 3.45 - 7.4mc

LF end - 3.75mHz set to 3.75 on dial
Middle - WWVH 5.0mHz read 4.98mHz
HF end - 7.15mHz read 7.15mHz

Band-4 7.40 - 14.8mc

LF end - 7.5mHz set to 7.5mHz on dial
Middle - WWVH 10.0mHz read 10.025mHz (estimated)
HF end - 14.5mHz read 14.49mHz (estimated)

Band-5 14.8 - 29.7mc

LH end - WWVH 15.0mHz set to 15.0mHz on dial
Middle - WWVH 20.0mHz read 19.98mHz
" 21.5mHz read just under 21.6mHz
HF end - 29.0mHz read just under 29.1mHz

Band-6 30.0 - 52mc

LF end - 30.0mHz set to 30.0mHz on dial
Middle - 40.0mHz read 39.6mHz on dial
HF end - 52.0mHz read 51.8mHz

7-03-2009

Replaced existing phone jack with switching one and modified wiring to suit. This enabled the speaker to be off when phones were in use.

