General Description: Portable radio receiver with 10 transistors and 1 crystal diode. Aerial, 10 in. ferrite rod. I.F., 470kHz. Output, 1·5W. Speaker: elliptical, 15Ω. Batteries, 2 × PP9. Quiescent battery current, 18mA approximately.

Wavebands: M.W.: 185–580 metres. L.W.: 1070–1840 metres.

Circuit Description (Tuner): Signals are picked up on the ferrite rod aerial tuning L3 (a and b) by GC1 and TC1 on medium wave, and L4 by GC1, C4 and TC2 on long wave. They are fed to the base of T2 (AF117) via C7. ·01 mfd. T1 operates as local oscillator with L5, C9 GC2 on medium wave supplemented by C10 and TC4 on long wave. L6 is the first I.F. transformer. AGC is applied to T2 via R5 from CR1. If signals appearing at the base of T3 (AF117) are amplified and fed to L7 which in turn feeds T4 (AF117) the first I.F. amplifier. L8, the third I.F.T. incorporates CR1 detector and after filtering by C20, R14 and C22, the audio signal is passed to the volume control via the tape output socket and C11/R17. The D.C. component provided by CR1 is used as AGC and fed via R11 and L6 also R5 to control the gain of T2 and T3.

Circuit Description (Amplifier): The circuit employs 6 transistors D.C. coupled with a high A.C. and D.C. feedback loop. The amplifier is operated in Class B single ended push–pull output. Phase inversion is achieved by the complimentary output pair. Overall feedback both A.C. and D.C. is applied to T2 via potential divider networks R9, R7, C8 and R7, R8 and RV3 respectively. T1 is direct coupled to T2 with D.C. feedback derived via RV3 and R1. Frequency compensation is achieved between T1 and T2. H.F. by frequency selective feedback C4 and RV1. L.F. by loss network R5, C6 and RV2. The signals are fed to the amplifier via pin 4 of SK1 to 5 pin socket on the amplifier board. The speaker impedance is 15 Ω and a safety resistance (R16) is included in the external speaker circuit to avoid damage by an accidental short circuit occuring in the external speaker leads.

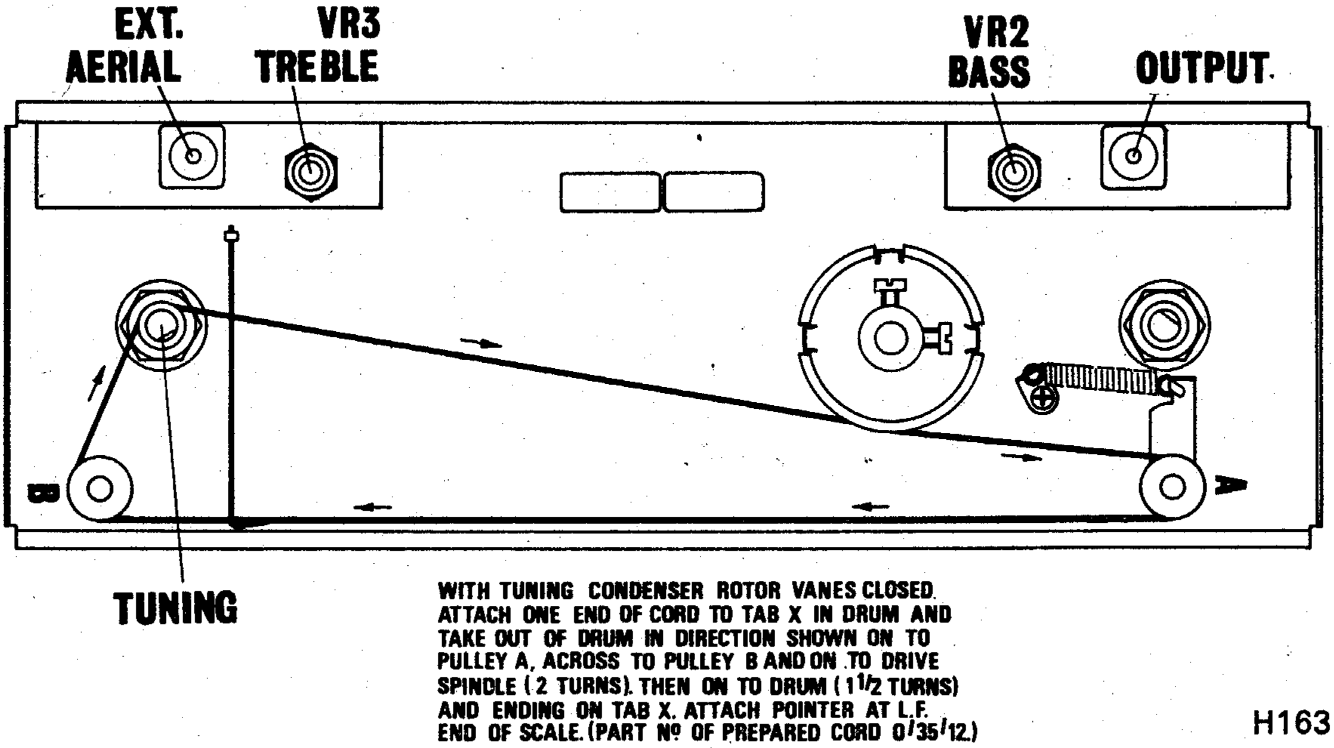
Removal from Case: Open back by pushing top edge outwards with the thumbs and remove the batteries. Lay receiver face downwards on a soft, level surface. Remove handle by pushing downwards from vertical position. Pull out the 5-pin plug from the amplifier socket and unplug speaker leads. Then take out the special handle fitting screws from outside of case and also the two 4BA screws retaining chassis to inside of case, taking care not to lose the washers. The main chassis may now be removed from the top without difficulty. If necessary, the amplifier can be taken out by removing the two 4BA retaining nuts and washers. It is necessary to remove the amplifier before the speaker can be removed. Do not overtighten speaker nuts when re-assembling as damage can easily be caused to the high density speaker which has a very small speech coil gap.

Replacement of Push-Button Switch: This component is of rigid design and should give little trouble. If replacement is necessary, considerable care must be taken in removing the switch to avoid damage to the printed circuit board. It is necessary to remove all solder from the connecting pins before attempting to take the switch out. This operation is facilitated by the use of a solder "sucker". It is very important to position the new switch correctly on the printed board and a spacing jig consisting of a small piece of 16 gauge aluminium or brass giving a clearance of $\frac{1}{16}$ in. which will ensure that sufficient spacing is left between the body of the switch and the circuit board.

Replacement of Ferrite Rod: Replacement of this item must always be followed by R.F. re-alignment, an important feature of which is correct positioning of the coils on the ferrite rod. The correct position of the M.W. coil is such that the tags of the coil are in the physical centre of the rod, i.e. 5 in. from the end.

Replacement of I.F. Transformers: When any I.F. transformer is replaced I.F. re-alignment will be necessary. The I.F. transformers are aligned visually in the factory and therefore should not just simply be peaked for maximum output. Instability is likely to result if the circuits are peak tuned.

Replacement of Speaker: Extreme care must be observed in replacing the speaker to avoid damaging the cone. Damage such as jammed speech coils or damaged cones are normally due to bad handling.



(H163) Drive Cord Assembly—Model RP35

Static Voltages (R.F./I.F. Panel): Static voltages measured with respect to H.T.+ (18V), i.e., at positive terminal of C21. Voltmeter, Avo 8. Supply voltage 18V. Receiver switched to M.W.

		C	B	E
AF117	T1	−8·0	−1·25	−1·1
AF117	T2	−8·0	−1·0	−0·9
AF117	T3	−8·0	−1·05	−0·9
AF117	T4	−8·0	−1·7	−1·5

Oscillator Drive: Measured with valve voltmeter between T1 emitter and chassis. M.W. (80–100mV) and L.W. (60–80mV.)

Alignment and Sensitivity Checks: *Test gear required:* (1) A.M. signal generator covering 470kHz, 600kHz, 1000kHz, 1500kHz, 174kHz, 260kHz. (2) Valve voltmeter. (3) Wobbulator covering 470kHz). (4) Oscilloscope. (5) Shielded radiating loop.

The latter item consists of a length of copper or brass tube of a diameter suitable to clear 3 strands of 20swg P.V.C. wire or similar. The tube is bent into a circle of approximately 10 in. diameter and the two ends pass through a copper or brass box approximately 2·5 in. square, the latter having one open side. The tube is insulated at one end and from the box by a suitable rubber grommet and the other end soldered to the box. The lead from the signal generator should be screened and the braid soldered to the same point to which the tube is soldered. Three turns of 20swg P.V.C. wire or similar is then fed through the tube and one end also soldered to the box. The other end must go via a 405 Ω 1 per cent resistor to the inner of the screened lead from the generator. The loop should be placed at 90° to the ferrite rod aerial in the receiver with approximately 24 in. between centres for all R.F. alignments.

I.F. Alignment: Connect oscilloscope across V/C and inject wobbulator and marker signals (470kHz) across L3 (medium wave aerial coil). Switch receiver to M.W. and close gang. Adjust instruments to give reasonable display on the oscilloscope, making sure that the input is kept as low as possible in order to avoid overloading and the effect of A.G.C. action. Adjust the cores of L6, L7 and L8 to obtain an even response curve with $\pm$3kHz approx. 4dB down at either side of the centre frequency of 470kHz.

R.F. Alignment:

1. Check pointer datum. The centre of the pointer must coincide with the edge of the right-hand end of the frequency scale when the tuning gang is just brought up to the fully enmeshed position from open. It is important that the adjustment is checked before alignment of the R.F. circuits is commenced.
2. Fix L3a in the centre of the ferrite rod so that the start of the coil is 5 in. from the end of the rod.
3. Switch the receiver to M.W. and set pointer to 600kHz (500 metres). Inject a signal from A.M. generator via loop at 600kHz and adjust core of oscillator (L5) to give the maximum signal as indicated by oscilloscope or output meter connected to output. (Be careful to avoid overloading by using excessive input signal.)
4. Inject via the loop a signal of 1500kHz and tune the receiver to the 1500kHz (200 metre) mark on the scale. Adjust TC3 for maximum output. Repeat 3 and 4 until calibration is accurate.
5. Inject via the loop at 600kHz signal and with the receiver tuned to the 600kHz (500 metre) mark on the scale adjust the position of the M.W. coil L3b on the ferrite rod to give maximum output.
6. Retune receiver and generator to 1500kHz (200 metres) and adjust TC1 for maximum output. Repeat 5 and 6 until no further improvement can be obtained.
7. Switch the receiver to L.W. Tune in the B.B.C. 2 on 200kHz (1500 metres) and adjust TC4 for maximum output.

8. Inject, via the loop, a signal of 174kHz (1718 metres) and tune the receiver to this frequency. Adjust the position of the L.W. coil (L4) on the ferrite rod, for maximum output.

9. Inject, via the loop, a signal of 260kHz (1154) metres) and tune the receiver to this frequency. Adjust TC2 for maximum output. Repeat 8 and 9 until no further improvement can be obtained.

10. Fix the coils carefully in position on the ferrite rod with adhesive tape.

I.F. Sensitivity: Measured with receiver switched to M.W. and gang closed. With signal generator (10 Ω source) adjusted to 470kHz (30 per cent modulation at 400 Hz) connected across L3b (M.W. aerial coil) and valve voltmeter connected across VR1, adjust generator output to give 24mV on valve voltmeter. The generator output to give the reading should not exceed 30 μV.

R.F. Sensitivity: For the same valve voltmeter reading (25 mV) a signal at R.F. (30 per cent modulation at 400 Hz), injected into the car aerial socket via 400 Ω dummy aerial should require not more than the following input levels: M.W.: 600kHz (23 μV), 1 MHz (9 μV) and 1500kHz (4·5 μV). L.W.: 174kHz (32 μV) and 260kHz (10 μV).

Amplifier Checks: *Test Gear required:* Avo 8, A.F. generator, output meter (15 Ω non-inductive load) and oscilloscope.

Amplifier Static Voltages:

		Vce	Vcb	Vbe
BC108	T1	9·6 V	—	0·525 V
BC108	T2	8·5 V	7·6 V	0·625 V
OC71	T3	0·28 V	0·25 V	—
AC128	T4	9·2 V	9·0 V	0·125 V
AC176	T5	9·2 V	9·1 V	0·13 V
AC128	T6	8·8 V	8·55 V	0·13 V

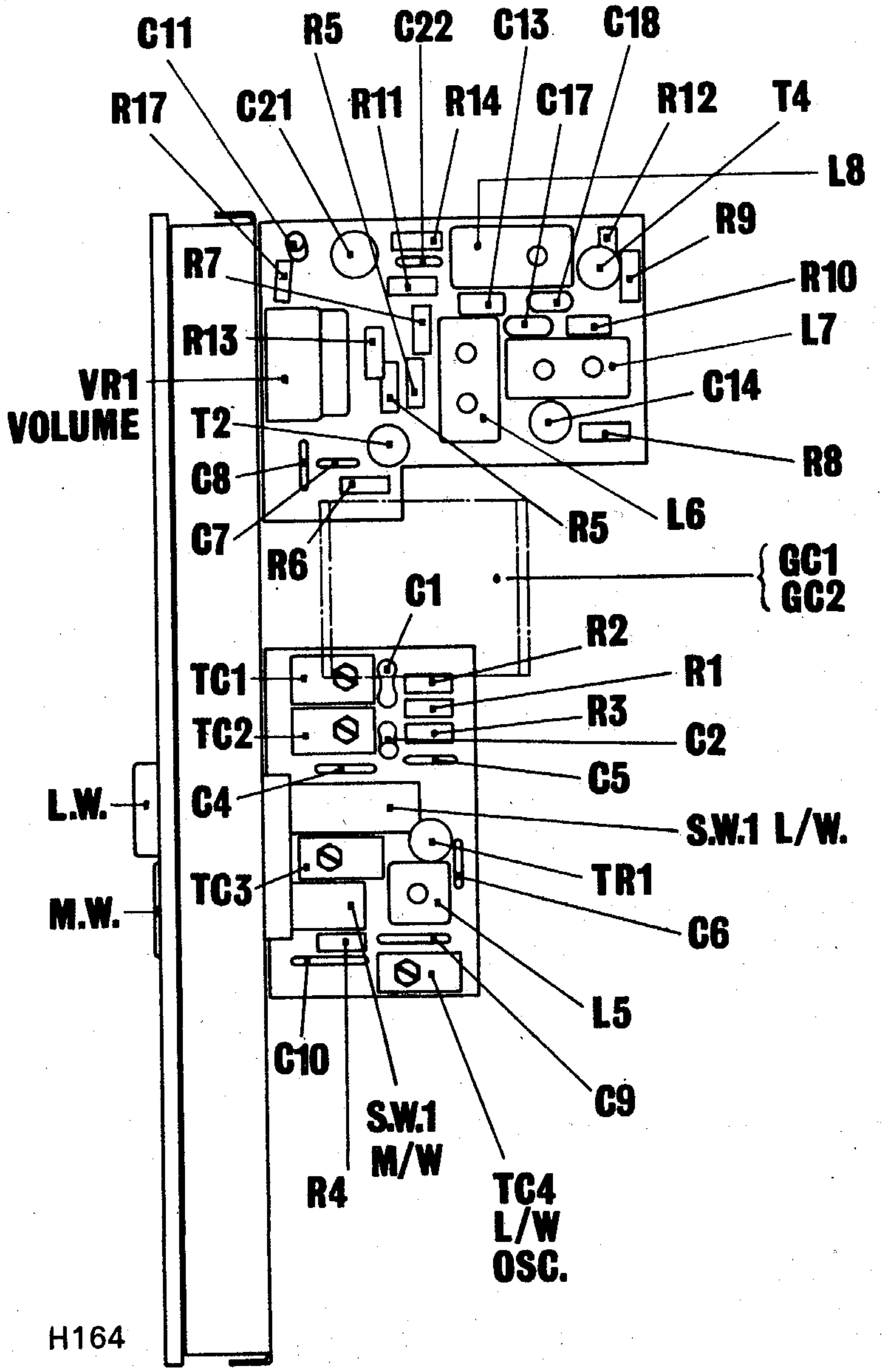
Note that total amplifier current is equal to 13¾ mA approximately.

Amplifier Static Current Adjustment: Short circuit the input to the amplifier by a link between Pin 4 and 5 of SK1. Cut the test link and insert a 0–10 mA meter. Connect supply. Adjust RV4 to give a current reading of 3 mA. Connect a 0–10 V meter between the mid-point voltage test point (which is the junction of R14 and R15) and Earth (negative to Earth). Adjust RV3 to give a mid-point voltage of 8·9 V. Disconnect supply. Remove meters, replace link and remove short circuit from input.

Amplifier Sensitivity Measurement: With bass and treble controls set to minimum, connect oscilloscope and output meter (15 Ω N.I.L.) to the output terminals of the amplifier. Inject a signal of 1000 Hz into the amplifier input (pins 4 and 5), sufficient to produce an output of 1·2 W without serious distortion as indicated on the oscilloscope. The input necessary to give this output should be approximately 36 mV (±2 dB).

Note: It may be noticed that some uneven clipping of the waveform occurs near the rated power output, if so, adjust RV1 slightly to produce even clipping.

Amplifier Frequency Response: With conditions the same as for the sensitivity test, reduce audio signal generator output to give amplifier output of 10 mW (Odb). Changes in input frequency should produce the following results: 1 kHz (0 dB), 100 Hz (minus 1 dB) and 20kHz (minus 1·25 dB).



(H164) LAYOUT DETAILS—MODEL RP35

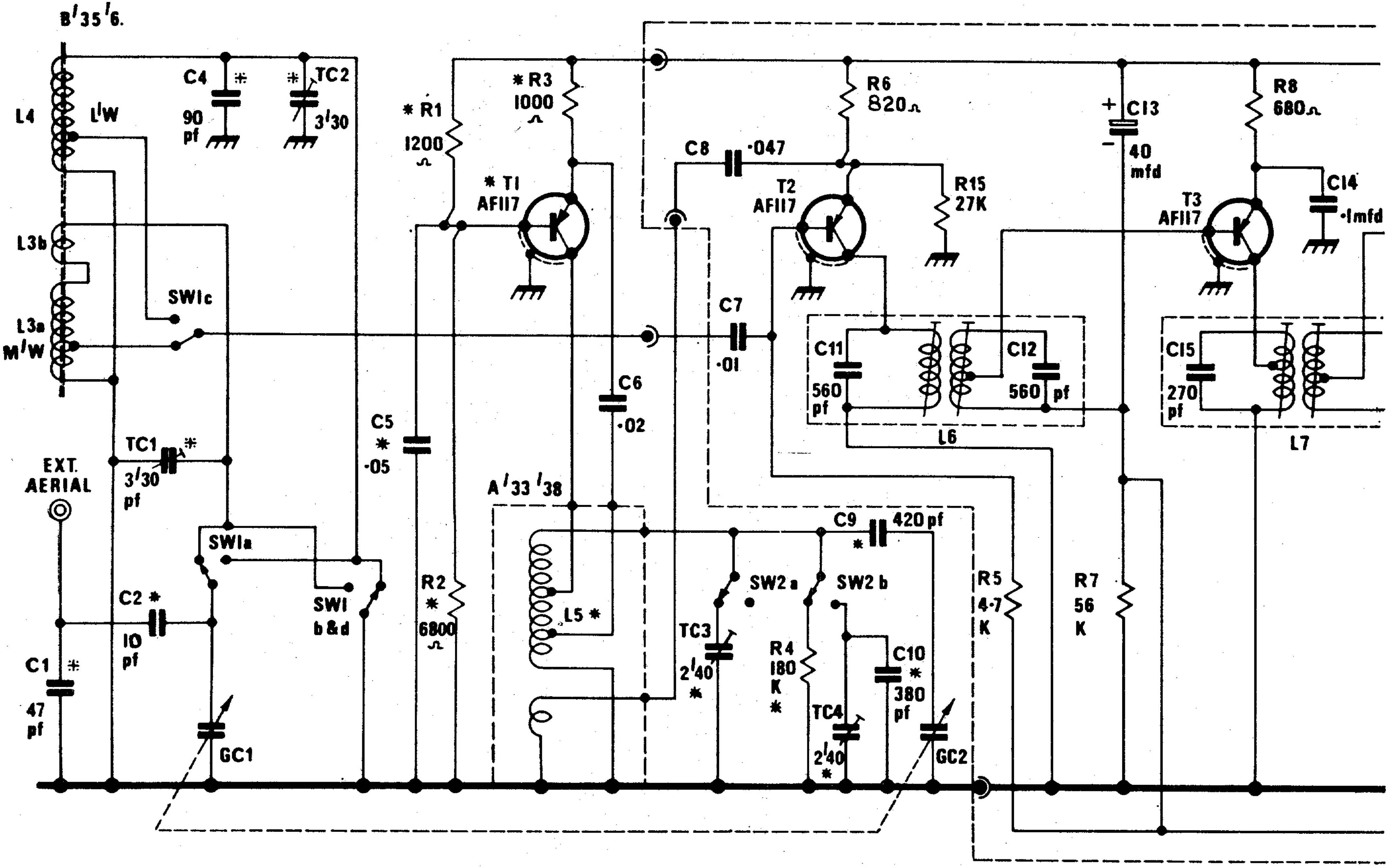
Amplifier Treble and Bass Control Checks: The tone controls provide bass and treble lift only. With conditions as in previous test, rotate treble control to maximum (bass at minimum). Change in input frequency should produce the following results: 20kHz (plus 14dB), 10kHz (plus 14·5dB), 6kHz (plus 10·75dB), 2kHz (plus 4dB) and 1kHz (0dB).

Now rotate bass control to maximum (treble to min. position). Change in input frequency should produce the following results: 1kHz (0dB), 500Hz (plus 2·5dB), 200Hz (plus 10·75dB), 40Hz (plus 10dB) and 20Hz (plus 3dB).

Note: 0dB = 10mW output.

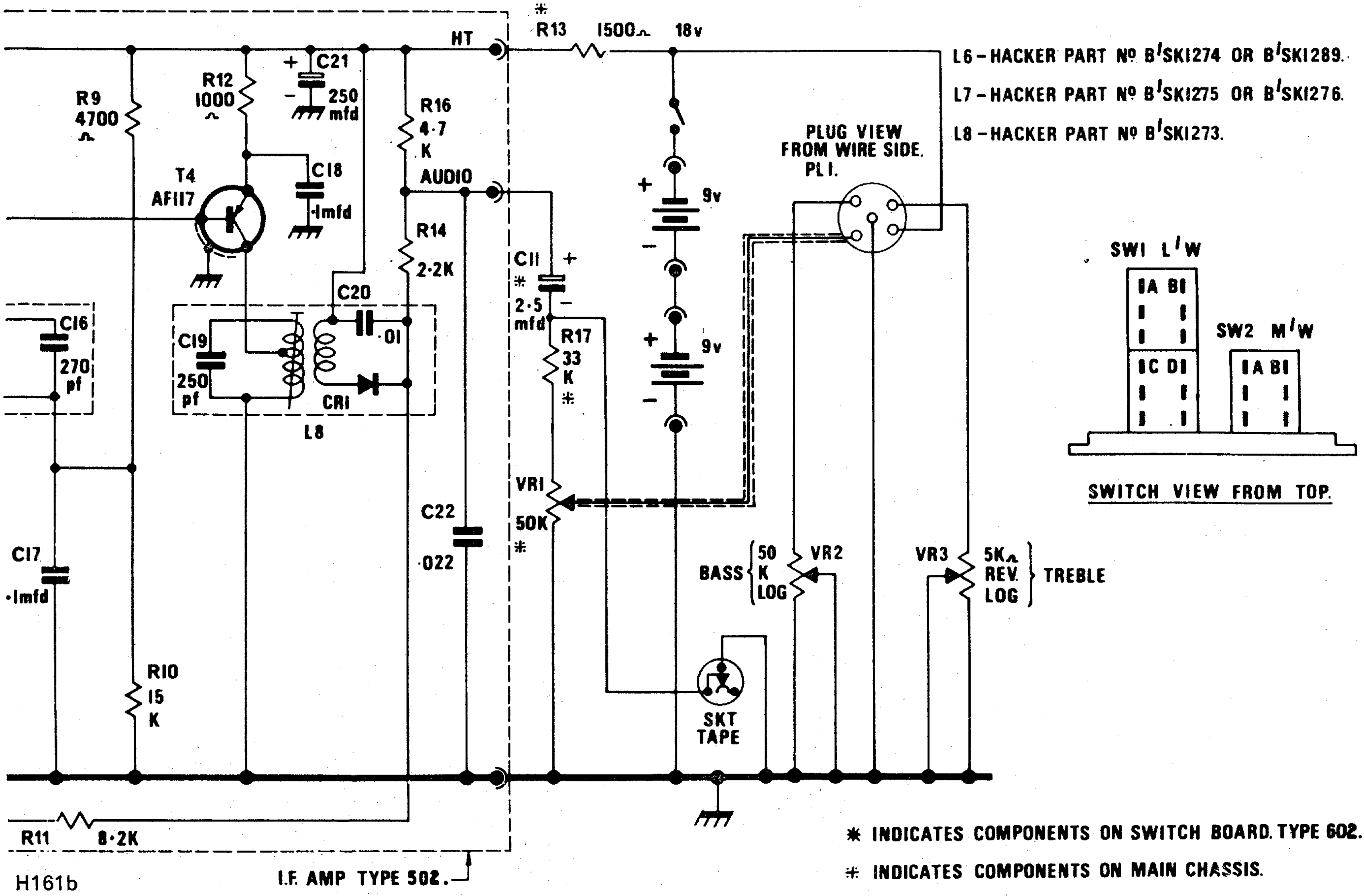
Amplifier Noise: With bass and treble controls set to maximum with input open circuit, the figure is greater than —60dB on 1·2W.

Amplifier Stability Test: With no input to the amplifier but with output meter or speaker connected, connect oscilloscope to output terminals and note that no spurious oscillations are visible on trace.

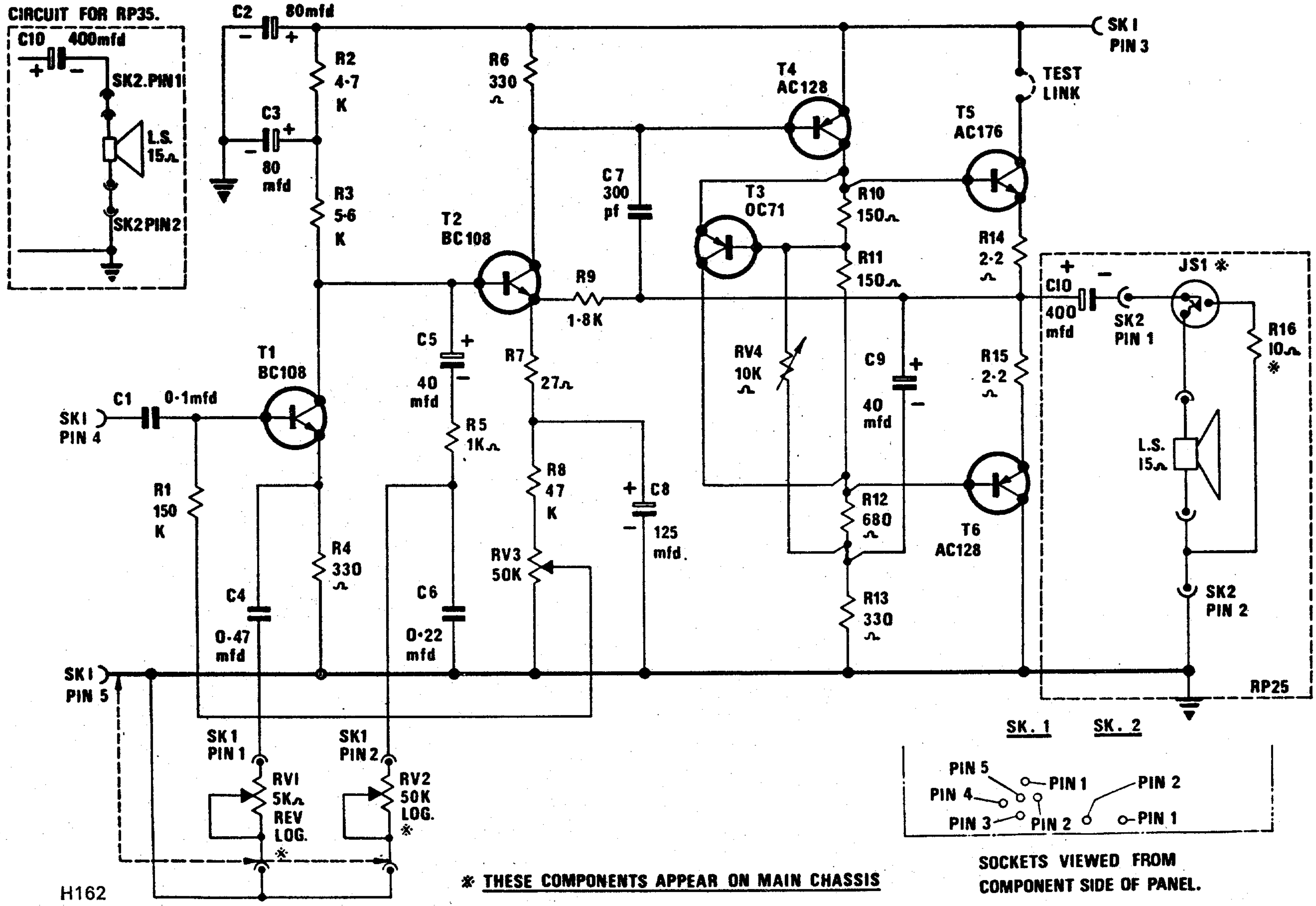


H161a

(H161a) Circuit Diagram of Tuner—Model RP35 (Part)



(H161b) Circuit Diagram of Tuner—Model RP35 (Continued)



(H162) Circuit Diagram of Amplifier—Model RP35