Improving The Heathkit HW-101 Transceiver

The HW-101 is probably one of the most popular s.s.b. transceiver kits and, despite its relatively low price, it is an excellent performer when properly put together and operated.

This article has been written in an attempt to describe a few improvements carried out by the author which can add in performance without detracting from its appearance and basic design either electrically or mechanically. Naturally, it is assumed that the kit has been assembled as per the instruction book and that it performs reasonably well to begin with.

After using the HW-101 for several months the writer felt that some items could stand some improvement; these items are listed below, together with the appropriate comment and procedure.

I.F. SCREEN VOLTAGE

The screen voltage dropping resistor at V_4 (2nd i.f. amplifier) identified as R_{113} in fig. 1 is 1K, which seems too low and should be changed to 10K ½ watt. This improves the operation of the i.f. chain somewhat in that it lowers the gain some, bringing about better product detector action and a lower heat dissipation at V_4, thus avoiding its early failure. The overall gain may still be too high and can be lowered further as will be seen later.

BANDPASS TRANSFORMER RE-ALIGNMENT

The bandpass transformer T_{202} is a constant-K network using three toroid coils (see fig. 2) and comes adjusted from the factory. Nevertheless, it is possible for it to drift out of adjustment during shipment or after prolonger use. If this is suspected, it can be checked as follows: connect the transceiver antenna connector to a 50 ohm non-inductive resistor, set the bandswitch to the 3.5 to 4.0 MHz band, turn the calibrator on and check the S-meter readings, keeping the preselector peaked for maximum throughout the band. If the readings are within one S unit from one end to the other, the transformer is probably OK. If not, it should be adjusted by removing the shield temporarily and peaking all trimmers found inside with the set tuned to 3.75 MHz (a signal generator is needed for this adjustment, but it can be approximated using the calibrator at either 3.7 or 3.8 MHz mark). After the adjustment, replace the shield and check to see

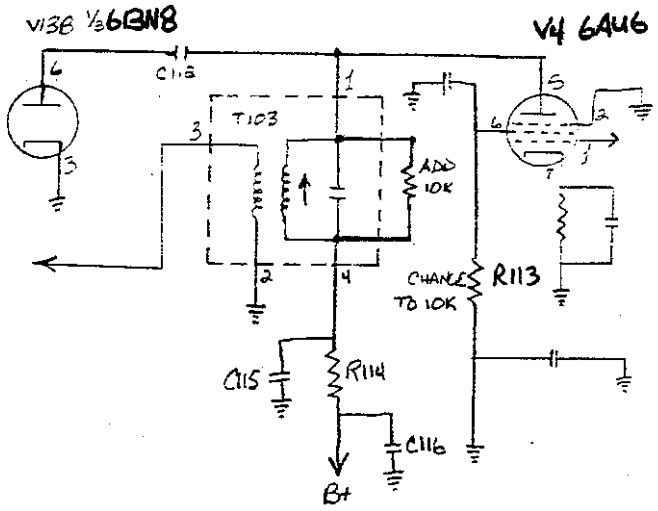

Fig. 1—Changes to the second i.f. amplifier stage, V4, reduce overall gain of the HW-101 to useable levels and make S9 meter readings 50 μV.

that the calibrator signal readings hold through the band. It is important to use an insulated tool for this adjustment.

REPLACING V10 and V11

The HW-101 specifies 6HS6 tubes for the receiver r.f. and first mixer stages (V_{10} and V_{11}), these are very high transconductance tubes and will provide an excellent signal-to-noise performance; however, they are rather susceptible to cross modulation and blocking effects when operating near very strong signals from local stations. Also, in this set they are operated very close to their maximum rated plate

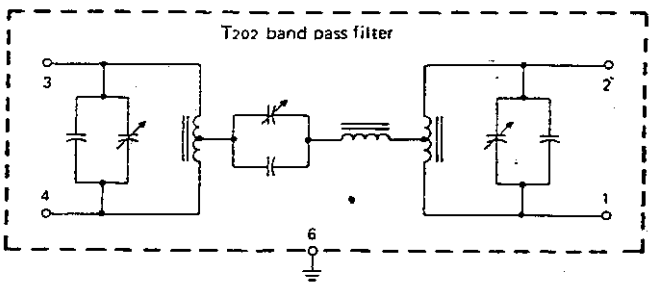

Fig. 2—Bandpass filter T_{202} may require re-adjustment after long use. Peaking the three trimmers at the center of the 80 meter band should provide flat coverage across the entire band.

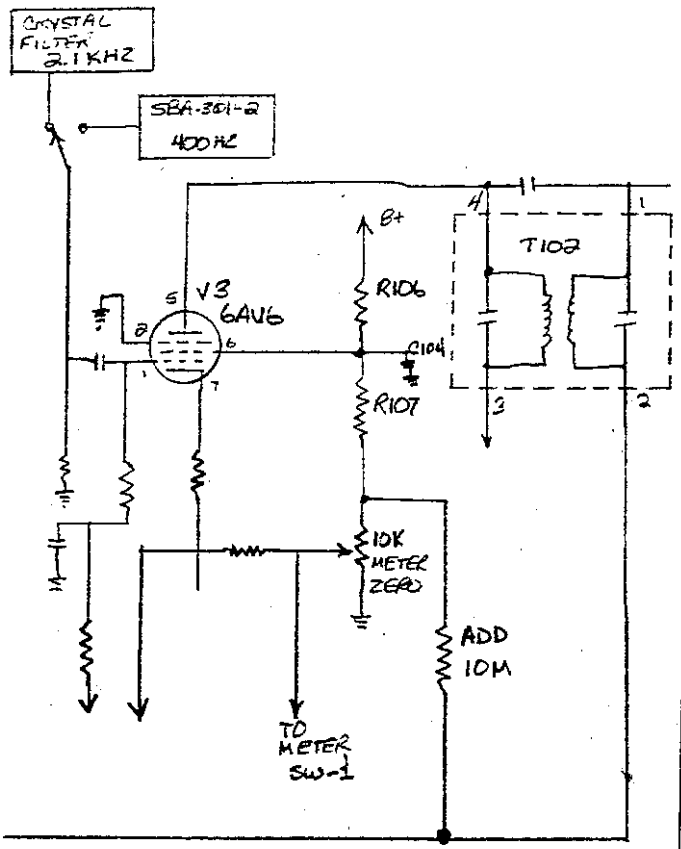

Fig. 3—Adding a 10 meg resistor as shown will raise the zero point of the meter when reading a.l.c. voltage.

dissipation and in fact may even exceed it at times. Therefore they get extremely hot and consequently do not last very long. These tubes can be directly replaced by 6AU6 without any modification and it is up to the individual operator to decide which is more suitable to his needs. If they are replaced, it is necessary to peak the "Driver" and "Mixer" coils for each band, following the Heath recommended procedure as stated in the manual.

VFO STABILITY

The v.f.o. coil (L_{941}) is a ferrite core, adjustable inductor with two windings in series. When properly set up, the frequency stability is excellent, but if the core is positioned towards the high side (hot end) of the frequency determining part, the stability will be degraded and the warm-up drift will be in the vicinity of 2 kHz or more. To correct this, the slug should be positioned near the ground end of the winding and the dial re-calibrated. The v.f.o. trimmers will probably have to be readjusted and it is possible that C_{951} may have to be lowered in value, but keeping the same temperature coefficient; a value of 10 pf (N750) has been found suitable. The total drift will be less than 1 kHz this way.

ALC/S-METER ZERO

During transmitting, the S-meter measures the a.l.c. action when the meter switch is set to a.l.c. However, the zero setting offsets considerably, keeping the indications at very low values. This is easily corrected by adding a 10 meg ½ watt resistor between lug 3 (hot end) of the zero adjusting potentiometer and pin 2 of T_{102} where the a.g.c. is connected to. This compensates automatically between transmit and receive with no ill effects except that the a.g.c. discharge time is shortened slightly. The potentiometer action is less critical now and more towards the middle of the range. If a large discrepancy remains in the zero settings it is probably due to gassy tubes in the a.g.c. stages. For proper modulation, the mic. gain should be adjusted so that the a.l.c. swings up to about S-6 (with the meter in the a.l.c. position). Refer to fig. 3.

VFO TUNING MECHANISM

The v.f.o. tuning system of the HW-101 works very smoothly when properly installed; however, with time, as with most v.f.o.s, some irregularities may show up due to either wear or oxidation. If scratchiness is observed, a little contact cleaner or penetrating oil (such as "Mystery" brand) may be put in the rotor wiper contact and in the spring loaded split gear of the variable capacitor. If excessive play or backlash is observed, it is usually due to the ball bearing drives. Spare ones can be obtained from the factory for replacement but in some cases it is possible to tighten them by squeezing the metal fingers that hold the assembly together. This is not really too recommendable since if too much pressure is put on the fingers, the mechanism may not work well and the drives will have to be replaced anyway. When removing and installing the v.f.o. assembly, it must be done very carefully so that the shafts are aligned exactly. If this is not done, the v.f.o. knob may be too hard to move in certain positions and too easy in others; a most annoying situation. Beware of using any oil lubrication in the drives, they use a special type of grease that should last the life of the drive. Also, one should be very careful about using any kind of spray cleaners or lubricants in the v.f.o. compartment as they might contaminate the frequency determining components and degrade the stability.

ERRATIC TRANSMIT/RECEIVE ACTION

This may be caused by carbon deposits between the contacts of the relay RL_2 and is simply cured by blowing this deposit away. The contacts may be burnished with a special tool or with a small strip of white bond paper passed between the contacts with the set off (there are dangerous voltages here). Do not use abrasives or oily substances to clean the contacts. However, a non-residual cleaner may be used sparingly. Another cause of instability may be caused by one or more of the circuit boards becom-

ing loose or developing a poor connection between the ground foil and the chassis frame. Re-tightening the screws that hold the boards to the chassis should suffice, but for a more permanent solution, adding a few #4 flat solder lugs held by the nuts and washers used to hold the boards and soldering them to the board's ground foil at various points, will insure a better ground.

S-METER READINGS

As stated before, the i.f. gain of the set is quite high, tending to make the S-meter readings a bit too generous (even after replacing the 6HS6 with 6AU6). Also, during reception of very strong signals there may be some distortion due to product detector overload. The above can be corrected by soldering a small (¼ watt will suffice) 10 K resistor across the primary winding of the last i.f. transformer T_{103}. This will bring the S-9 reading to correspond to about 50 microvolts and the value of each S unit to between 4 and 5 db. At the same time the audio will be cleaner with strong signals.

BIRDIES

Some birdies show up on reception at 3.65, 3.74, 14.24 and 21.2 MHz. Although they normally are of no consequence, most can be reduced considerably by adding a .01 mf capacitor between contact no. 2 and ground foil of the bandpass board. This is the point where three brown filament wires are soldered.

PILOT LAMPS

The assembly instructions and part list received by the writer called for the use of #44 pilot lamps (probably due to a printing error). This should be corrected to #47 lamps in order to maintain proper current balance in the filament circuits. The #47 lamps have brown identifying beads and draw .15 a. at 6.3 volts, each. The set should never be operated except with both these lamps on.

INCREASE OUTPUT GAIN

This can be done by removing resistor R202 (see fig. 4) and replacing it with a jummper wire. This change has been made by Heath in all new HW-101 being sold. Output gain will be noticeable mostly on 40-meters, but less noticeable on other bands.

STOP S-METER DRIFT

After some warm-up the S-meter will start indicating a lower reading in the receive mode. This is caused by resistor R107 (see fig 3 overheating and thus causing its resistence to drop. R107 should be replaced by a 100K 1-watt. Also resistor R106 should be changed to a 33K 1-watt, this reduces voltage feeding meter circuitry, thus causing less heat in R107.

BAD 6AU6 TUBES

Heath got a hold of a bad shipment of 6AU6 tubes. The problem is that they have 4 volt filaments. This causes the tube to overheat. If your rig was purchased between jan. 1976 and june 1977 and V3 and/or V4 have a brand name of EL-MENCO call Heath and they will send you two replacement tubes.