simplest of top cut circuits consisting of a 47 nF capacitor in series with a 10k control across the volume control.

On the short wavebands, especially when searching out a weak DX station on AM broadcast, there is no point in using wide bandwidths. The "Lowe" modification was tried and, as was to be expected, the selectivity was very sharp. By careful tuning, quite acceptable quality was obtained but selective fading distortion was much more noticeable. With the 12 kHz filter, converted VHF FM signals could be copied very well using slope detection.

Correlation between the analog and digital displays was satisfactory, all of the 100 kHz points on the former being within 3 kHz of the latter. It requires 20 turns of the VFO knob to tune the 1000 kHz. The analog dial can be set very simply to coincide with the digital reading.

A miniature jack socket is provided on the front panel providing 30 millivolts AF at 100k impedance for a tape recorder. This level is independent of the AF gain control setting. This facility was used to record the GB2RS news broadcasts for later playback. The "Timer" function was frequently programmed to switch the **R-1000** on and off for specific items such as current affairs programmes, using the "Remote" socket to switch a battery tape recorder on and off to make unattended recordings.

Conclusions

The Trio-Kenwood Corporation has certainly produced a fine, general coverage receiver. The **R-1000** is robust, stable, versatile and a pleasure to use. A radio amateur friend, part of whose job it is to check out many professional receivers, reckoned this receiver to rival several costing four and five times as much. The only real criticism is that the 20, 40, 60 dB attenuator seems too great. The reviewer would have preferred 15, 30 and 45 or even 10, 20 and 30 dB. Perhaps the dynamic range could be improved by using a different RF amplifier device. There is no doubt that this receiver represents good value for money. For anyone on the national average salary, its cost is about 3-4 week's earnings: can't be bad!

N.A.S.F.

MODIFYING THE HEATHKIT HW-101 FOR TOP BAND OPERATION

R. J. HARRIS, G30TK, AND J. H. STOCK, G3PKS

MODIFICATIONS to commercial equipment are not usually undertaken lightly, even by the experienced amateur, and doubtless many are deterred because the resale value of the equipment can so easily be reduced by bad workmanship. Further, if the modification does not prove successful there is the possibility that the equipment cannot easily be restored to its previous performance or appearance. This particularly applies if the modifications involves some re-alignment and panel changes.

One of the writers (G3PKS) has used a Heathkit HW-101 for many years but found the lack of Top Band operation a definite drawback, so much so that much time and effort have been expended on the construction of separate 160m. equipment. Serious thought was given towards the construction of a transverter such as that described in the *Short Wave Magazine* a few years ago[1].

A different approach was pursued when it was realised that by taking the difference frequency of the second mixer (instead of the sum) full 160m. band coverage was available from the transceiver IF. A modification was therefore undertaken to convert the HW-101 to Top Band operation without upsetting 80m. to 10m. operation in any way. It was decided that the modification had to meet three conditions;

a) Changes to be simple and reversible.
b) Performance on existing transceiver bands to be unaffected.
c) Appearance of the HW-101 (already neatly modified for optional IRT) not to be adversely affected.

The modification described fully meets these conditions and does so by ignoring the HW-101 PA and RF stages. Top Band frequencies are extracted from, and returned to, the IF with a single cable which connects the transceiver to an external linear amplifier and RF preselector.

In many ways, this is an ideal modification for the average HW-101 owner to carry out. Only one hole needs to be drilled (for a miniature toggle switch) and three PCB tracks cut; nothing is taken away, only a few components are added. There is no re-alignment of the original transceiver and, with the exception of the single hole, the modification can be 'undone' at any time. The external

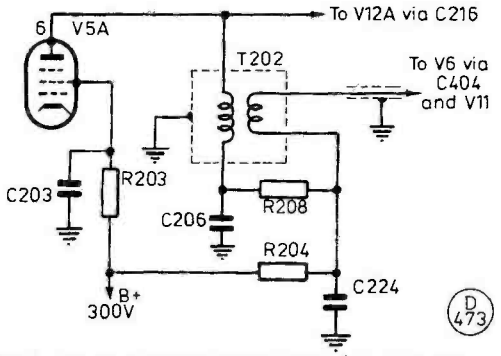

Fig.1 HW-101 SECOND MIXER INPUT/OUTPUT CCT.

linear amplifier and RF pre-selector circuitry can be to the individual owner's choice and component availability.

Theory of Operation

The LSB carrier frequency of the HW-101 is 3.3936 MHz and is mixed with the 5.0 to 5.5 MHz VFO, the sum frequency giving the tuning range 8.3936 to 8.8936 MHz. This is then mixed with the output of a switched crystal oscillator to give coverage of the bands 80 to 10m. However, if the difference between the carrier and VFO frequencies is taken (rather than the sum) the tuning range becomes 1.6064 to 2.1064 MHz which includes the 160m. band. It should be noted the 'direction of tuning' is reversed, *i.e.* 1.8 MHz corresponds to about 300 on the dial and 2.0 MHz corresponds to about 100; the sideband selection is correct, LSB being selected for normal 160m. SSB operation.

The modifications to the HW-101 therefore consist of disabling the tuned circuit T202 in the anode of V5A and substituting another filter (T160) tuned to the difference frequency, centred on 1.9 MHz, and taking the output to the external linear and pre-selector. The operation is still true 'transceive', as both transmit and receive paths have the anode of V5A as a common point.

Because of the high level of RF in any transceiver, it is a great advantage to use DC control signals to perform switching functions since this will minimise the possibility of spurious RF feedback effects. To this end, diode switching has been used to select T202/T160 as required, all components being fixed to the underside of the Bandpass Circuit Board; the only alignment involves peaking T160 on 1.9 MHz.

Transmit/receive switching of the external circuits is controlled by a voltage fed through the coax cable which connects both units. This cable is the only interconnection.

The AGC in the 160m. mode operates on one stage only and so the S-meter appears to be much more sensitive. The RF gain control still operates as it is coupled to the AGC line.

Circuit Modifications

In order to emphasise the simplicity of the modification, the original circuit is shown in Fig. 1 and the modified circuit in Fig. 2. Diodes D1 and D2 perform the switching function under control of the toggle switch, S1, which is mounted on the front panel. V5A is cut-off on receive and R1 ensures that current flows through the appropriate diode continuously; R2, R3 and R4, R5 serve solely to limit the reverse bias applied to the diodes to about 50 volts. If low capacitance diodes with breakdown voltages in excess of 300 volts are available, then R2 and R4 can be omitted.

Table of Values
Fig. 2

R1 = 220K, 1w.
R2, R4 = 47K, ½w.
R3, R5 = 270K, 1w.
R6 = 680 ohm, ½w.
R7 = 10K, ½w.
R8 = 47K, 2w.
R9 = 8.2K, ½w.
D1, D2 = 1N4148 or equiv.

C1 = 100 pF 350v. silver mica.
C2, C3 = 0.01 μF 500v. disc ceramic.

T160 = Primary 80t, 34 s.w.g., in two layers; secondary 7t 34 s.w.g. on top of primary. 7.1mm dia. former *RS Components* no. 228-090. Core is *RSC* no. 228-107.
S1 = s/pole changeover toggle.

Note: All the above items obtainable from *RS Components*

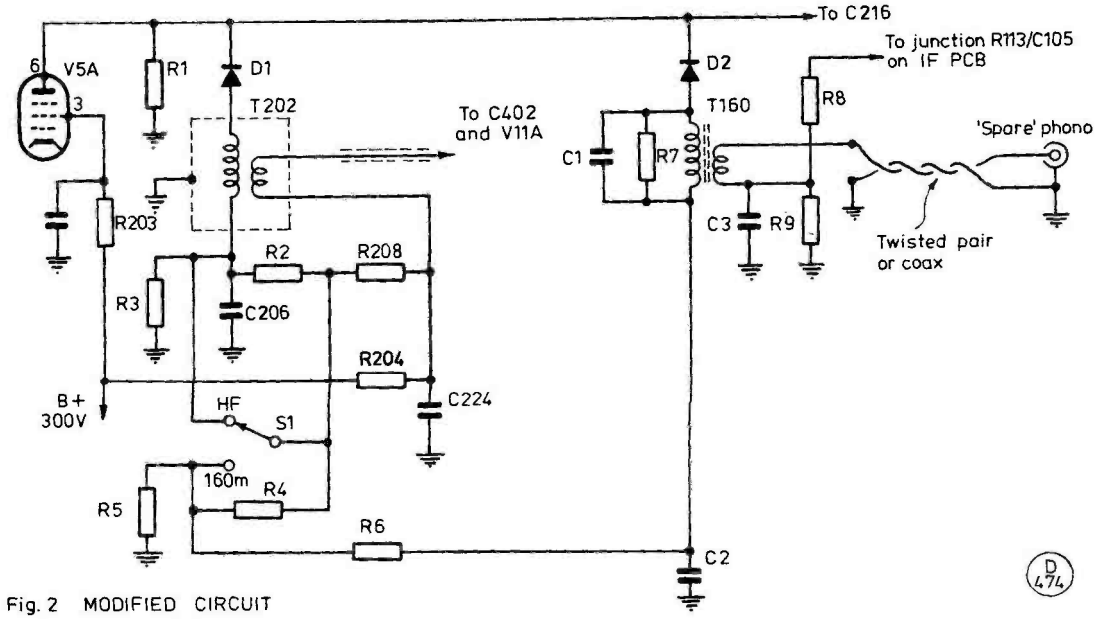

Fig. 2 MODIFIED CIRCUIT

The bandwidth of the 160m. tuned circuit is designed to about 200 kHz (by the addition of R7) and so the circuit does not require peaking when the transceiver frequency is changed from one end of the band to the other. The output is taken to the 'spare' phono socket on the rear apron of the transceiver and a voltage for controlling the selection of the linear and pre-selector, derived by R8 and R9, is also carried by this socket.

Fig. 3 shows the style of modification used. Three cuts are made to the tracks and the components added. The common point of R5, R6 and R4 is 'up in the air' as is the coil former which is supported by components. Mechanically, this is far from ideal but has proved satisfactory in practice. A twisted pair of wires takes the 160m. signal to the 'spare' phono socket and the transmit/receive control voltage components are mounted in the vicinity of this socket. A hole must be drilled in the front panel to accommodate the control switch and will be 0.25 inches diameter if a miniature toggle switch is used (if the transceiver does not have a CW filter fitted, then it may be possible to use the SSB/CW filter switch to select 160m. operation and the complete modification can be made without any holes being drilled).

Preselector and Linear Amplifier

The selectivity of the 160m. filter (T160) in the transceiver is insufficient to prevent breakthrough of strong signals on other frequencies, notably in the passband of the crystal filter. Therefore an external preselector must be used to

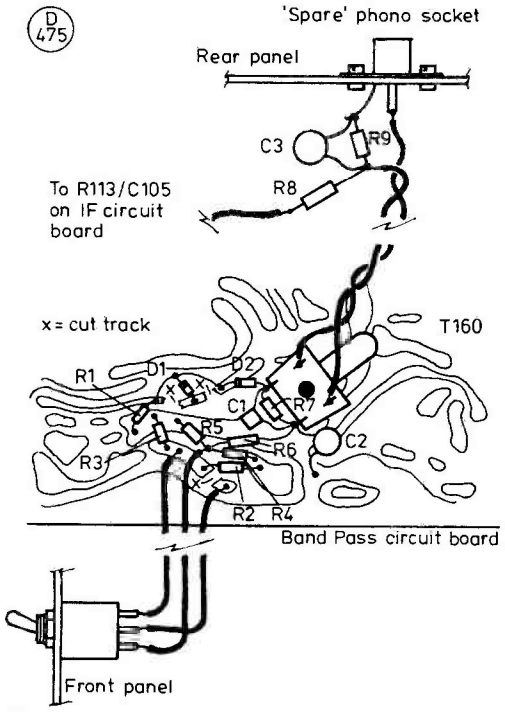

Fig. 3 MODIFICATION DETAILS TO BAND-PASS CIRCUIT BOARD

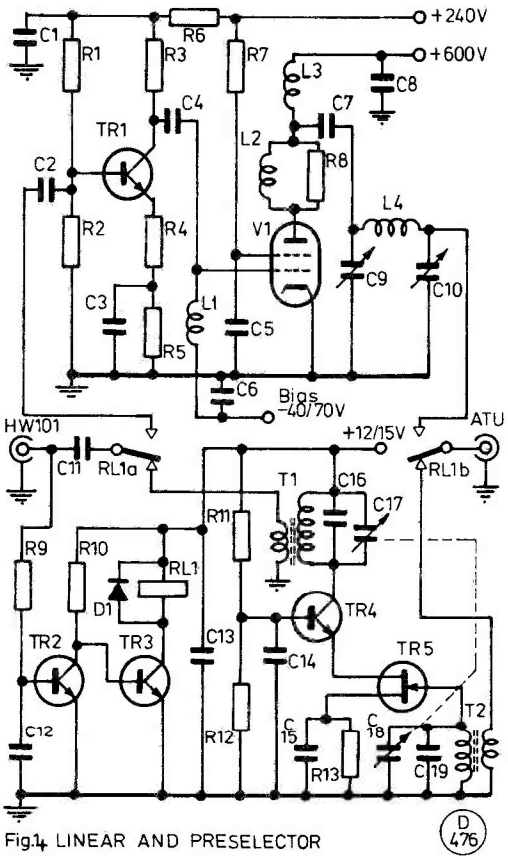

Fig. 4 LINEAR AND PRESELECTOR

Table of Values
Fig. 4

R1, R2, R9, R10 = 22K
R3 = 6.8K
R4 = 22 ohm
R5 = 15K
R6 = 1.8K
R7 = 1K
R8, R13 = 100 ohm
R11, R12 = 100K
C1, C2, C4, C5, C6, C11, C12, C13, C14 = 0.01 μf 500v.
C3, C15 = 0.1 μF 250v.
C7 = 1000 pF 4kV
C8 = 0.01 μ 750v.
C9 = 250 pF var.
C10 = 4-gang 500 pF var. (in parallel)
C16, C19 = 56 pF 350v. s/m
C17, C18 = 2-gang 100 pF var.
L1 = 1 mH miniature choke
L2 = 10t 34 s.w.g. wound on R8
L3 = 2.5 mH RFC
L4 = 40t 18 s.w.g. close-wound on 2-in. dia. former.
T1, T2 = as for T160
TR1 = MJE340 (Motorola)
TR2, TR4 = BC182
TR3 = BFY 51
TR5 = 2N3819
D1 = 1N4001
RL1 = 2-pole changeover relay, 12v. coil.
V1 = 5B/254M

Note: All resistors are ½-watt rating.

improve front end selectivity. Because the output of V5A on transmit is only a few milli-watts, a buffer amplifier is necessary to increase the power level to that suitable for driving a linear amplifier. There are many circuit configurations which could be used and the one shown in Fig. 4 is included as a typical example. The actual circuit used will probably depend upon the contents of the builder's junk box.

TR1 forms a simple amplifier using a high voltage transistor and drives the PA which is operated in the passive gride mode[2]. A 5B/254M was chosen because several were available but a 6146 should prove equally suitable. L2 is wound on R8 and forms an anti-parasitic choke. A conventional pi-tank output circuit is used.

TR4 and TR5 form the basis of a cascode pre-amplifier. The input and output tuned circuits are tuned by a dual-gang capacitor. The relay is controlled by TR2 and TR3 using the DC voltage fed through the coaxial cable which connects this unit to the HW-101.

The writers built a PSU specifically for the unit because a suitable transformer was available. As an alternative, the HW-101 PSU could be used as it contains all the voltage rails necessary, with the exception of the +12 to +15 volt supply for the preselector and relay; this voltage rail can be obtained by rectification of the heater supply. The screen/buffer amplifier supply should be derived from a low impedance source and a zener-diode/emitter-follower combination is recommended. The negative bias line should be variable so that the PA quiescent current can be set.

Alignment

This is simplicity itself. Select 160m. operation of the transceiver, set the main tuning to about 200 on the dial and connect an aerial to the 'spare' phono socket. Peak T160 for maximum output of the H1FIX beacon on 1.9 MHz.

The external unit is aligned by connecting the HW-101 and plugging in an aerial. The preselector tuning capacitor is set at half-mesh and the cores of T1 and T2 adjusted for maximum output of the HW-101 at 1.9 MHz. A dummy load of 50 ohms should be used for checking the operation of the linear amplifier. The negative bias preset potentiometer should be set for maximum negative voltage and then adjusted until a standing current of about 30 mA is indicated. Drive can now be applied and the output checked.

Operating

On HF operation, the transceiver operates exactly as before. In the 160m. mode, the HW-101 preselector, PA loading and tuning controls are non-functional as is the band-selector switch. Although the HF aerial can be left connected to the transceiver when operating on 160m., there will be a small output due to the self-capacitance of D1 feeding a very small residue of the 'sum frequency' into the succeeding stages. This small output is detectable over the few hundred yards between the writers' respective QTHs. Operating is virtually identical to normal transceiver operation.

The standing dissipation of the linear amplifier is about 18 watts and so to remain within the terms of the licence when operating CW, the DC input must be reduced to less than 10 watts. This may be done by increasing the bias voltage of the linear.

Conclusion

The actual modification to the HW-101 IF circuit board was carried out by the authors in about one hour — some of which time was spent in deciding where to place the components. The performance has been found to be entirely adequate and has given many SSB contacts over the British Isles.

Since devising the modification, the circuit diagram of the HW-100 has been examined and is almost identical: therefore this modification should work well with the HW-100 transceiver.

References

(1) "Top Band Transverter for Transceiver Operation" by F. Powell, G3SEL, *Short Wave Magazine, March 1972.*
(2) *Radio Communication Handbook, Vol. 1.*

CLUBS ROUNDUP

By *"Club Secretary"*

Scotland and North

Dumfries & Galloway have the first and third Mondays of each month at the Cargenholm Hotel, New Abbey Road; but May 5 is down for a Skittles Night, with all XYLs, YLs and friends, at the Needles and Pins Bar, St. Michael Street, Dumfries, 7.30 for 8 p.m. May 17 they take part in a local hobbies exhibition in Dumfries Drill Hall, and on 19th, back at the Cargenholm, there is a tape-talk.

At **York**, they have Fridays *except the third one*, at the United Services Club, 61 Micklegate, York; and they have an extra event on May 17, when they put GB3YCS on the air at a gathering of Cub Scouts at Snowball Plantation, Stockton-on-Forest. Showing the amateur radio flag is a great hobby for the group during the summer months in particular.

Now to **Denby Dale** who are in — where else? the Denby Dale Pie Hall every Wednesday evening, with the even ones being given over to talks and other formal activities.

Scotland again, this time **Helensburgh** which is based on East Clyde Street school, on the first and third Wednesdays of the month; they are affiliated to RNARS by virtue of the number of visitors they receive from the RN types who come to the area in the course of their work.

White Rose have a fine QTH at Moortown R.U.F.C.,