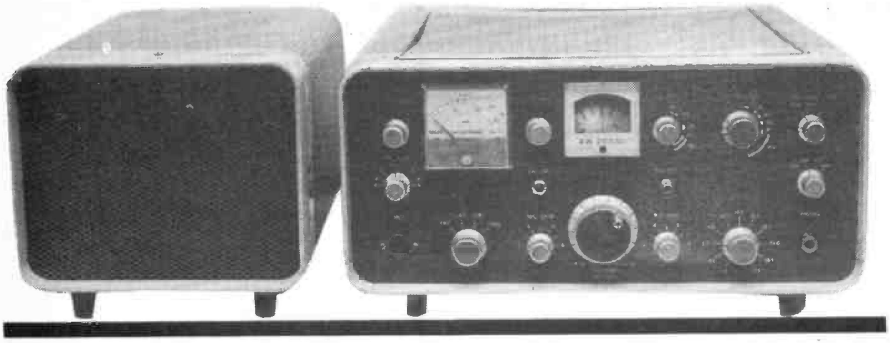
Upgrading the KW2000 series of HF transceivers



Part 6

Adding the new bands

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It may seem rather strange, but we start this month with a word of warning! The modifications required to fit the WARC bands require some dexterity and care as they involve a fair amount of 'digging around' in the front end and driver stages as well as the HF oscillator stage of the rig. However, with care it is possible to do the modifications needed in a few hours and this does give the advantage that, not only do the new bands become available, but extra portions of the existing bands can also be added. We have so far only tried the modifications on the *KW2000A,* but they should be equally possible with the other models in the series.

Modification procedure

First remove the PHONES socket from the front panel and link out the wiring from the socket so that the speaker is permanently connected. The socket can conveniently be re-fitted to the lower left hand side of the PSU front panel, making sure that the outer part of the socket is isolated from the panel in order to prevent hum being introduced into the headphone circuit by heater current flowing to earth via the headphone wiring. Next remove the links on the existing bandchange switch wafers, as shown in **Fig. 131,** not forgetting to remove the links on S2i wafer to disable one PA valve on 18 and 24MHz to comply with the current licence conditions! Next fit the coils L_A, L_B, and L_C listed in **Table 101** between the appropriate tags as in **Fig. 131,** remembering to keep the leads to the extra coils as short as possible, and also to position the coils so that access is possible to their ferrite cores during alignment. Now fit the new extra switch S1000 into the hole previously occupied by the headphone socket. Some care is required in this operation in order not to damage components in the HF oscillator compartment. You may well find, as the writers have, that it is easier to remove one or two components during the fitting of S1000, replacing them after the switch has been fitted. The wiring to the crystals is now modified as in **Fig. 132,** the extra sections of the existing bands may be fitted by adding extra wire ended miniature crystals to the contacts of S1000.

The wiring changes to the PA stage should be tackled next. First remove the links from S2E, and then

Table 101

Component	Details	KW2000 TUNING RANGE
L_A	3 off. 2 turns 22swg on 5mm dia with ferrite core. close wound.	
L_B	3 off. 3 turns 22swg on 5mm dia, with ferrite core. close wound.	
L_C	3 off. 11 turns 28swg on 5mm dia. with ferrite core. close wound.	
L_D	6 turns of 22swg Enam. Copper. Wound Directly on to ¼" dia. Iron Dust Core.	
L_E	10 turns of 22swg Enam. Copper. Wound Directly on to ¼" dia. Iron Dust Core.	
L_F	8 turns of 22swg Enam. Copper. Wound Directly on to 5/16" dia. Iron Dust Core.	
C_F	150 pF silvered mica.	
X19	Final o/p freq = 25.80MHz + 3.155MHZ = 27.95MHz ÷ 2 = 13.9775MHZ (XTAL FREQ) wire ended miniature crystal.	24.80-25.0MHz
X20	Final o/p freq = 18.0MHz + 3.155MHz = 21.155 MHz ÷ 2 = 10.5775MHz (XTAL FREQ). WIRE ENDED MIN.	18.0-18.2MHz
X30	Final o/p freq = 10.00MHz + 3.155MHz = 13.155MHz ÷ 2 = 6.5775MHz (XTAL FREQ) WIRE ENDED MIN.	10.0-10.2MHz
S1000	3 pole 6 way miniature switch. No particular make is specified but the writers made theirs up from RS components. *Maka — switch kits.* These just fit, but only just.	

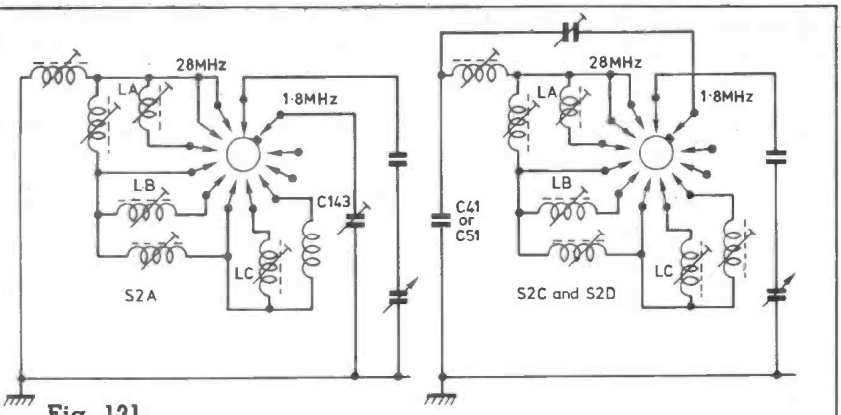


Fig. 131.

route additional leads to the pi-tank coil using PTFE covered copper wire as in **Fig. 133.** It is as well at this point to check the condition of the existing wiring to the PA coil, since we found that in some cases it had deteriorated to such an extent that the insulation actually fell from the wires when touched! At G3TNO it was found easier to carry out the above modification by first removing the sections of shaft coupling the bandswitch wafers to the front panel indexing mechanism and then, with great care, to remove each wafer in turn from the transceiver, so that it could be modified on the bench instead of in situ. Care should be taken when re-installing the wafers to make sure that the wipers of all switch sections are correctly aligned before refitting the shaft.

The wiring changes to the bandswitch will, of course, alter what this switch does in practice, so **Table 100** lists the old and new (ie. modified) band positions.

After carrying out the modifications, or any part of them, a complete re-alignment of the front end is needed as per the instructions in **Part 3** of this series. In addition, the new bands will need to be aligned. Ideally, the equipment used for this should consist of:—

1. Signal generator with *accurate* frequency calibration.
2. RF millivoltmeter with high impedance input.
3. General coverage receiver.
4. RF wattmeter/dummy load.
5. Absorption wavemeter.

Alignment of the new bands

This should be carried out *after* the complete procedure for alignment given in Part 3 has been performed.

1. HF oscillator: Select the 24MHz band and remove the crystal for that band. Connect the RF millivoltmeter to pin 1 of V9 and the signal generator to pin 1 of V10 (HF osc). Set the signal generator to 27.955MHz and adjust the core of L_D (additional coil mounted on S2H) for maximum reading on the millivoltmeter, making sure that the core is not screwed fully in or fully out. Reduce the signal generator output so that the millivoltmeter reading does not exceed 500 MV. and re-check the setting of L_D, again adjusting for maximum reading.

Next select the 18 MHz band and repeat the above procedure, this time setting the signal generator to 21.155MHz and adjusting L_E for maximum millivoltmeter reading as before. Finally select 10 MHz, set the generator to 13.155MHz and adjust L_F for maximum reading.

If you do not have, and cannot borrow a high impedance RF millivoltmeter it is possible, with great care, to align the HF oscillator using a general coverage receiver tuned to the frequencies listed above. The receiver should be coupled lightly to the HF oscillator as in **Part 2** of this series, using a piece of wire wrapped around the glass envelope of V10, and L_D, L_E and L_F should be adjusted on the appropriate bands for maximum signal. If you do not have access to a decent signal generator (or worse still any at all!), it is possible to align L_D-L_F by using the

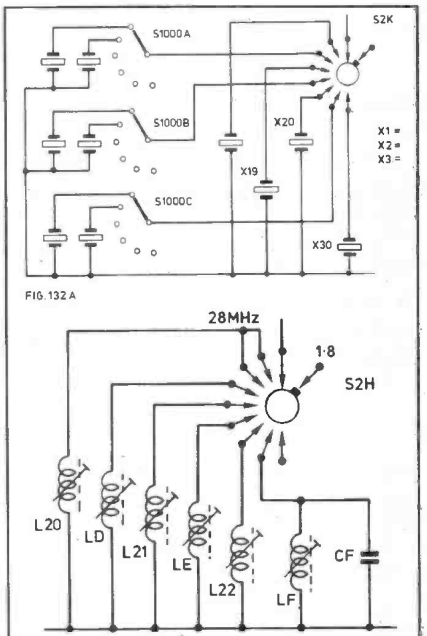


Fig. 132.

Table 100

Band select positions before modification	Band select positions after modification
28.6-28.8MHz	29.4-29.6 (OSCAR DOWNLINK)
28.4-28.6MHz	28-30MHz (Depends on settings of S1000 and XTALS CHOSEN)
28.0-28.2MHz	24MHz band
21.3-21.5MHz	21.0-21.5MHz (Depends on settings of S1000 and XTALS CHOSEN)
21.0-21.2MHz	18MHz band
14.2-14.4MHz	14-16MHz (Depends on settings of S1000) Note XTALLED FOR 14.0-14.6 and 15.6-16. For use with 144MHz transverter
14.0-14.2MHz	10.0-10.2MHz

All other switch positions remain unchanged

Table 103

Band	Position of new taps on PA tank coil
24MHz	Midway between existing 21 and 28MHz taps
18MHz	Midway between existing 14 and 21MHz taps
10MHz	Midway between existing 7.0 and 14MHz taps

Note: The above taps will work satisfactorily but it is worth trying the position of the taps a turn or so either way, for optimum loading and output. We have modified for *KW2000* so far and the 10MHz tap is one case needed 3 more turns for optimum performance.

appropriate crystals as fitted in the modifications, but do make *sure* that you have tuned the coils to the correct harmonic of the crystals!

2. RF and driver stages: If you have fitted the crystals for the new bands during the previous stage of the modifications, first remove them again!

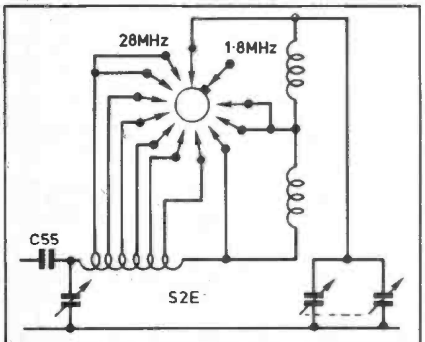


Fig. 133 Pi tank circuit. See table 103 for details of new taps required.

Select 24MHz, inject a signal at Pin 2 of V7, and set *KW2000* to INT MOX. Connect the output of the tranceiver to a dummy load. Adjust the PRE-SELECTOR so that the pointer lies midway between the 28 and 21MHz markings. Set the signal generator to a frequency in the middle of the 24 MHz band, and to an output of approximately one volt. Adjust L_A (S2d) for a rise in PA anode current. Tune and load the PA for a shallow dip into a dummy load/wattmeter, and then re-adjust the alignment of L_A, reducing the output from the signal generator if necessary to keep the PA current below 100mA on the *KW2000*, or 200mA for other versions.

Once the driver anode circuit has been aligned, remove the signal generator from V7 grid and connect it to Pin 2 of V5 (second transmit mixer). Proceeding as above, align L_A (S2c), which is in the anode circuit of V5.

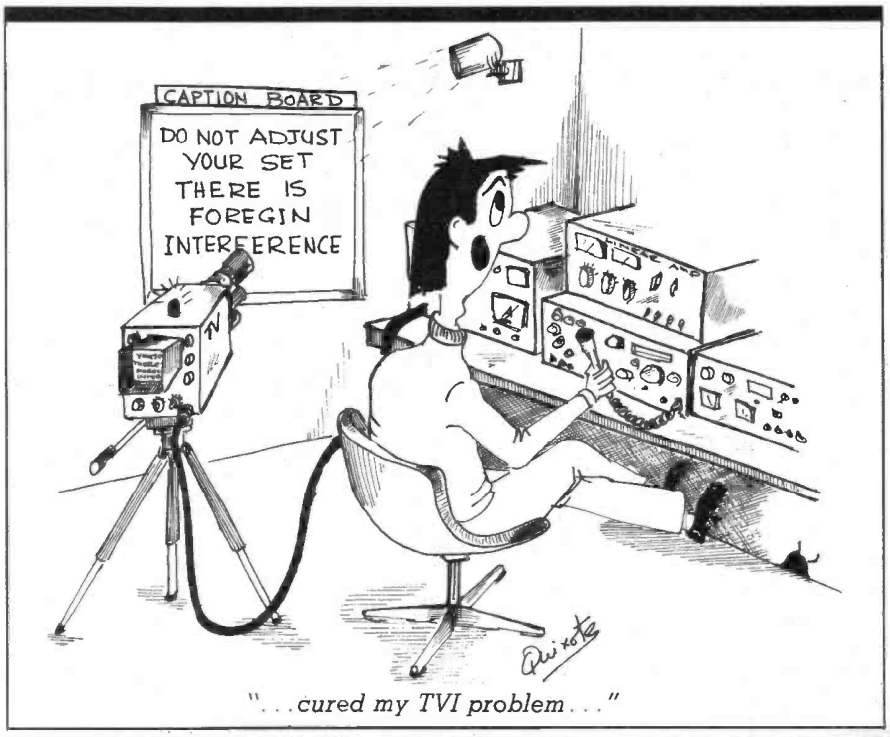
Now change bandswitch to 18MHz, set the pre-selector to midway between the 14 and 21MHz segments, and set the signal generator to the centre of the 18 MHz band. Remove the 18MHz band HF oscillator crystal, and then align L_B (S2d) and L_B (S2c) following the procedure given for the 24MHz band, not forgetting to tune the PA correctly into a dummy load. Finally repeat the procedure for 10MHz, setting the pre-selector midway between the 7 and 14MHz segments and adjusting L_C (S2d) and L_C (S2c).

Now refit all HF oscillator crystals. Set the bandswitch to 24MHz, switch to TUNE and adjust pre-selector and PA as in the instruction manual. *Without altering* the pre-selector setting, switch to receive and connect the signal generator to the aerial socket of the rig. Set the generator to about 24MHz and adjust its tuning until its output is heard on the *KW2000*. Ensure that the signal from the generator is centred in the receiver passband, and then adjust L_A (S2a) for maximum S meter reading, reducing the output level of the generator if necessary to keep the S meter reading below S5. Repeat the procedure on 18 and 10MHz in that order, adjusting L_B (S2a) on 18MHz and L_C (S2a) on 10MHz. The temptation to use off-air signals for this should be resisted, since your aerial may not present the correct 50 ohms impedance to the rig, which will affect the setting of the front end tuned circuit. For the same reason, do not re-adjust the setting of the front end coils after carrying out the adjustment with the signal generator as described above.

Modification for 10MHz only

It is, of course, possible that, like one of the writers, you may only wish to fit the 10MHz band and not the other bands, at any event in the initial case. In this case, of course, a single pole two position switch can be used in the S1000 position, and of course only the extra coils appropriate to the 10MHz band need be fitted!

The next article in this series will cover the improvement of the front end performance on the lower frequency bands, and provision for a separate outboard receiver, and separate receive and transmit aerials.



"...cured my TVI problem..."