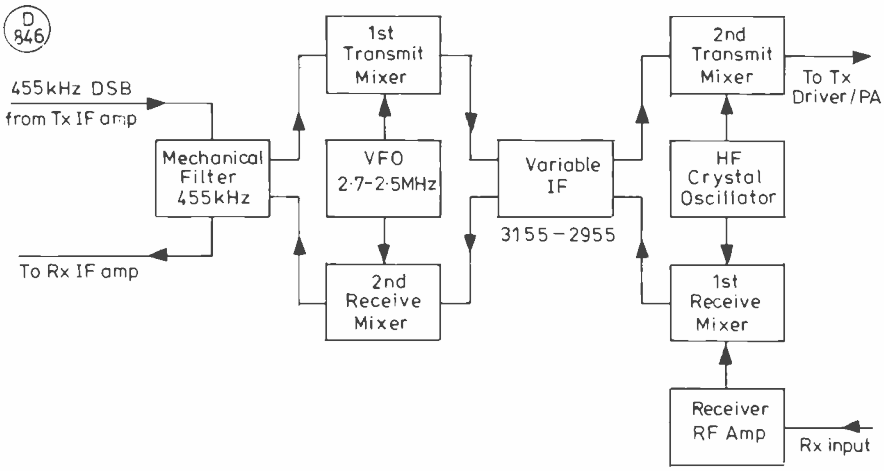
MODIFYING THE KW-2000A TRANSCEIVER FOR 10 MHZ

P. C. COLE, G3JFS

THE modifications to be described were devised as a cheap and easy way to convert the station KW-2000A transceiver so that it could be used on the new 10 MHz band. Few circuit changes are needed to effect the conversion and as these are in no way permanent the equipment may be reverted to its original state quite easily if it is ever required to do so. This is an important consideration as even equipment as old as the KW-2000A has a considerable resale or trade-in value which could be greatly reduced by the presence of non-standard modifications.



Band	Xtal freq	Osc output
1·8-2	4955	4955
3·5-3·7	6655	6655
3·7-3·9	6855	6855
7-7·2	10155	10155
14-14·2	8577·5	17155
14·2-14·4	8677·5	17355
21-21·2	12077·5	24155
21·3-21·5	12227·5	24455
28-28·2	15577·5	31155
28·4-28·6	15777·5	31555
28·6-28·8	15877·5	31755

Fig.1 BLOCK DIAGRAM SHOWING THE FREQUENCY CONVERSIONS OF THE KW2000A

The KW-2000A

Fig. 1 is a simplified block diagram showing the essentials of the frequency conversion process used in the KW-2000A. The transceiver uses double conversion circuitry based on a fixed IF of 455 kHz and a variable IF of 3155-2955 kHz, to give coverage of eleven 200 kHz wide sections of the various HF amateur bands as selected by the bandswitch. Basically, the only changes needed to alter the coverage of any of these 200 kHz wide bands are to fit a suitable crystal in the HF oscillator and to retune the transmitter and receiver RF circuits as necessary. Thus with the tuning range possible with the 3 x 260 pF variable capacitor used for the preselector tuning it seemed that the 7.0-7.2 MHz range would be usable on 10 MHz by changing crystal X4 and retuning the preselector and PA panel controls.

Unfortunately, although there was enough latitude in the 7.0-7.2 MHz range preselector tuning to cover the 10 MHz band, this idea did not work too well in practice because of problems with PA instability and poor tracking of the RF tuned circuits. This was largely due to the unorthodox neutralising circuit used in the KW-2000A which, as shown in Fig. 2, is very frequency conscious as it is dependent on the setting of C40c.

The RF tuned circuit arrangements are also somewhat unusual and the operating principle of these can best be understood by considering the Rx input tuned circuits as shown in Fig. 3. For operation on the 3.5 MHz band the secondary of the input transformer L1 is tuned by the variable capacitor C40a. On all the higher frequency bands L1 is still used as an input transformer but the resonant frequency of its secondary is increased by shunting L1/C40a with a smaller inductor selected from the series connected coils L5-L2. For Top Band C143 is switched into circuit and this lowers the resonant frequency.

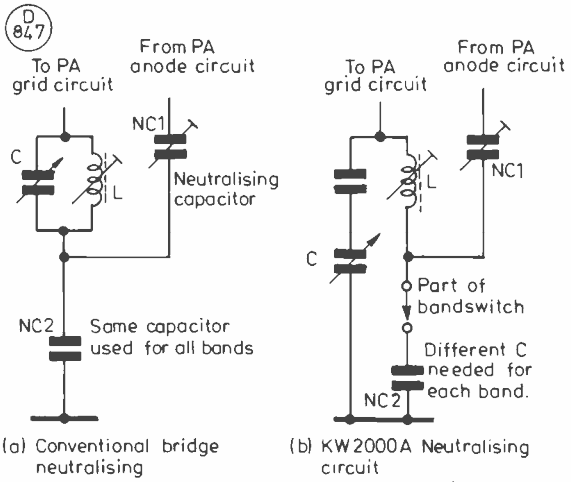


Fig. 2 Comparison of a conventional bridge neutralising circuit with the KW2000A system.

Modifications

After considering various possibilities it was decided to modify the existing 3.7-3.9 MHz range by fitting a new crystal and new coils suitable for 10 MHz. This range was chosen because it involved the least amount of disturbance to the transceiver wiring. Also 3.7-3.9 MHz operation would still be possible by fitting the 6855 kHz HF oscillator crystal in the X2 position.

The required output frequency for the HF conversion oscillator is 3155 kHz above the low frequency end of the band to be covered (or 2955 kHz above the HF end). A tuning range of 10-10.2 MHz, requiring a crystal of 13.155 MHz, would be a good choice as it fits the dial calibration and also allows reception of the standard frequency transmissions on 10.0 MHz. However because the new band covers only 50 kHz from 10.1-10.15 MHz, crystals of

Fig. 2*(a)*. Neutralising feedback is determined by the potential divider action of Nc1 and Nc2. The adjustment holds over a wide frequency range until stray capacities and/or lead inductance upset the balance. Fig. 2*(b)*. Because one side of the tuning capacitor is earthed Nc2 is shunted by L in series with C so that neutralising feedback is affected by the tuned circuit adjustments. In practice, it has been found impossible to maintain *really accurate* neutralising over the 28 MHz band with this circuit.

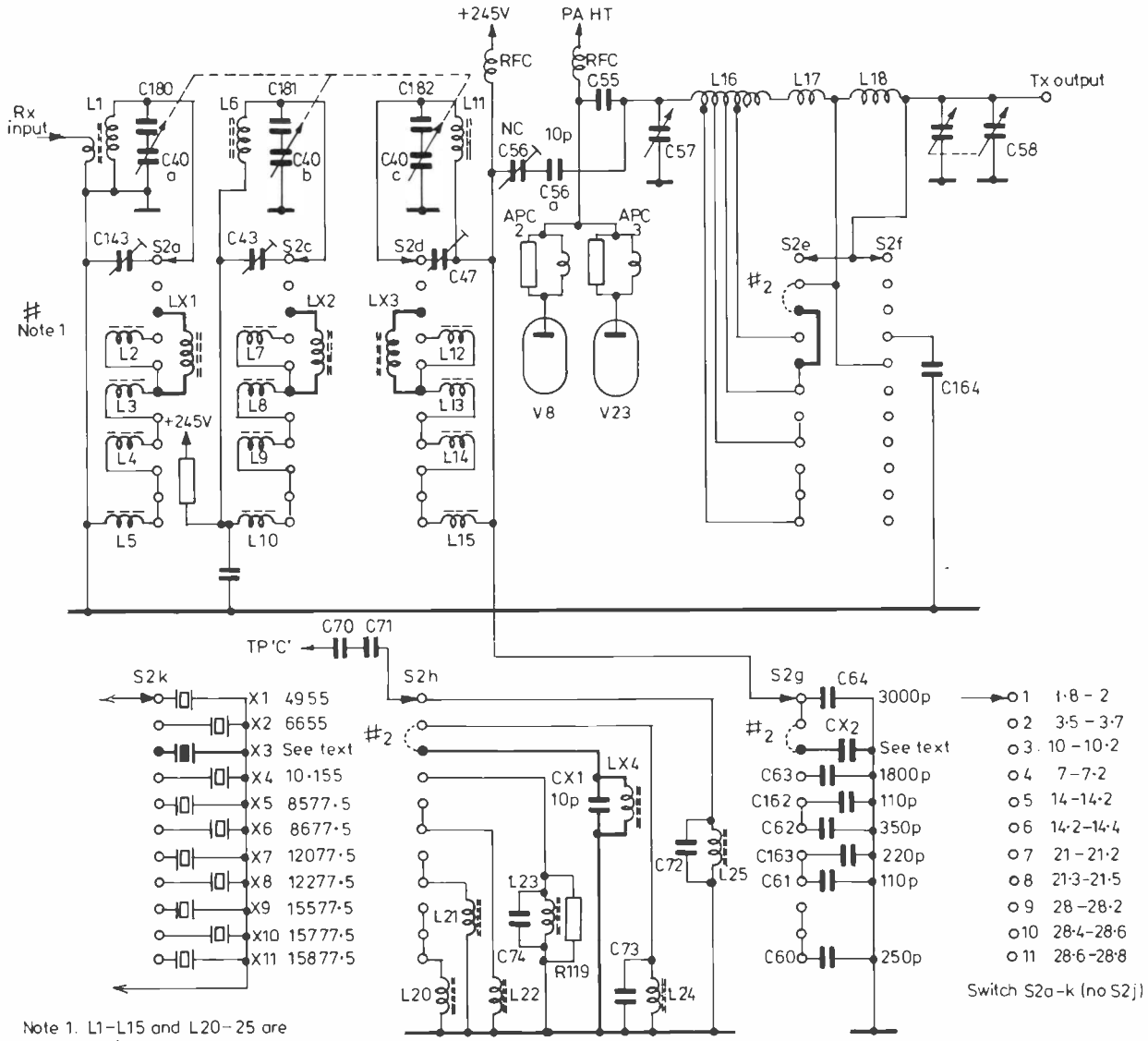


Fig. 3 CIRCUIT DIAGRAM SHOWING THE ESSENTIAL DETAILS OF THE KW2000A RF TUNED CIRCUITS

Component values and circuit references of existing components are as in the KW-2000A handbook. *New components:* **Cx1 = 10 pF ceramic or silver mica. Cx2 = 1500 pF poly or similar, but see text. Lx1 to Lx4 = 10 turns of 20 s.w.g. enamel covered wire close-wound on a 7mm. dia. dust cored former; these coils, like the existing ones, are supported on their leads and should be positioned so that they do not short to anything when the covers are replaced. X3 = 13.105 – 13.225 MHz crystal (if ordering a crystal it is recommended that a crystal of 13.155 MHz, 30 pF load, parallel resonance is used).**

13.105-13.225 MHz can be used and it is quite possible that a mature junk box will yield a suitable item. Odd value crystals of course have the disadvantage of equally odd dial calibration but this is only a minor inconvenience as it is easy enough to make a small calibration chart on a piece of graph paper.

All of the circuit changes required are shown in Fig. 3 and it is recommended that these are done in a logical sequence, such as the step-by-step procedure below.

Procedure

1. Remove covers and check transceiver alignment in accordance with the handbook instructions. Give particular attention to the neutralising procedure.
2. Disconnect mains power.
3. Replace the 6855 kHz HF conversion crystal X3 with a crystal suitable for 10 MHz operation (13.105-13.225 MHz).
4. Place the transceiver upside down on the workbench.
5. Identify switch wafer S2h which is the second wafer from the front panel. Set bandswitch to the 3.7 MHz position and identify contact number 3 of S2h — the one now engaged with the moving contact.
6. Remove the wire link between contacts 2 and 3 of S2h.
7. Connect new coil Lx4 and capacitor Cx1, 10 pF, between S2h contact 3 and the earth busbar.
8. Switch on power to the transceiver and with a wavemeter or monitor receiver check that the crystal is oscillating at the proper frequency.
9. Adjust the core of Lx4 for maximum output as measured on

a VTVM connected to test point 'C' (*see* Fig. 3). The handbook recommends a reading of 1.5-2.0 volts at this point but it does not seem to be at all critical. If necessary reduce the level with a damping resistor across Lx4.

10. Disconnect mains power.
11. Identify switch S2a, the third wafer from the front panel and connect the new coil Lx1 between contacts 3 and 6 of S2a.
12. Identify switch S2c, the fifth wafer from the front panel and connect the new coil Lx2 between contacts 3 and 6 of S2c.
13. Identify switch S2d, the sixth wafer from the front panel and connect the new coil Lx3 between contacts 3 and 6 of S2d.
14. Identify switch S2e, the wafer nearest to the rear panel. Remove the link between contacts 2 and 3 of S2e and transfer the red-sleeved black lead from pin 3 to pin 2. Link contacts 3 and 5 of S2e.
15. Identify switch S2g, the seventh wafer from the front panel. Remove the link between contacts 2 and 3 of S2g. Connect temporarily (because it may need to be changed) new capacitor Cx2, 1500 pF, between contact 3 and earth.
16. The wiring changes are now complete. The HF crystal oscillator was checked and aligned in steps *8* and *9* so all that remains to be done is to align the transmitter and receiver.

Receiver Alignment

Apply mains power and allow the transceiver to warm up. Set the preselector pointer so that it is midway between the 7.0 and 14 MHz calibration points and adjust the cores of Lx1, Lx2 for maximum receiver output at a frequency of about 10.1 MHz. Ideally a signal generator should be used for this adjustment but it is also possible to use the built-in crystal calibrator, on-the-air signals, or noise.

Transmitter Alignment

Connect the transmitter *via* an SWR/power meter to a 50 or 80 ohm dummy load. Keep the preselector tuning as above, switch function switch to TUNE and slowly advance the MIC GAIN control until the PA current starts to increase. Adjust Lx3 core to peak the PA current, using the mic. gain to keep this current below 59 mA.

PA Neutralising

Adjust the mic. gain for an off-resonance current of 130 mA and load up the transmitter for a cathode current of 120 mA at dip. Check that maximum power output coincides with the PA dip. If it doesn't, move the PA TUNE condenser either side of the dip and note which side of dip the output increases. If it is on the LF side then *increase* the value of capacitor Cx2 and *vice versa*, repeating the procedure as necessary until maximum output is obtained at the dip.

This method of making the neutralising adjustment may seem a bit inconvenient but it was used because there is not really enough space in which to fit a trimmer capacitor. Fortunately the capacitor value is not too critical and accurate neutralising can be achieved quite quickly if a good selection of capacitors is available. It is of course possible to use a capacitor which is too small in value and pad it up with additional capacitors.

Once the neutralising is correctly adjusted the transceiver is ready for use on 10 MHz simply by connecting a suitable aerial and operating in the normal manner. It should be noted that to avoid having to make a new tapping on the PA coil the 14 MHz winding is used for 10 MHz operation. This has been found to be quite satisfactory in practice and control settings when feeding an 80-ohm load are: PA TUNE — near the HF end of the 40 metre calibration; PA LOAD — 6.

Results

During the first day of operation on 10 MHz contacts were made with twelve different European countries, mostly with 599 reports both ways. Several VK/ZL stations were heard but apart from an incomplete contact with a VK3 the competition was too much for the signal put out by the writer's short indoor dipole. However the results achieved are sufficient proof that the modified rig works and they also give a good indication of the potential of the new band.

The modifications should be equally applicable to the KW-2000 which was the forerunner of the 'A' model and which had a single 6146 PA stage only, but the writer cannot comment on the later models as he has no knowledge of their inner workings.

• • • SWL • • • SHORT WAVE LISTENER FEATURE

By Justin Cooper

HELLO again! We've quite a large clip this time, with some 'duplicate' reports — the first letters just not arriving in time for the last column.

New Names

First off we have a letter from *M. Toms (Barking)* who was a regular years ago but dropped out for various reasons. He has now come back to the game again and indeed is well into it; he has a FT-101EE from the estate of the late G3BBU, and his previous receivers have gone away to make room for the nice new FR-101. Certainly HPX 'knack' is still there, as a listen on Ten during the ARRL contest showed. To log the first 200 prefixes on that band took just 3 hours 40 minutes; the final tally after five hours being 218, in 66 countries.

Next we come to *H. Blackburn (Edinburgh)* who has become interested in us by way of a Panasonic DR-49 receiver bought from a friend. Horace has two queries, of which the first is "where's the local radio club?" — and not too hard to answer. There are two: the Edinburgh Radio Club and the Edinburgh Repeater Group (which we guess also acts as a club in itself). Neither have updated very recently, but for the former you could try a phone call to GM3RFQ on 668-1749 for the details of the sessions at the City Observatory, Calton Hill; for details of the latter club, ring GM3GBX on 447-2611. The second question is that Horace wants to know simply "what *is* HPX?" A quick answer would be to call it an activity in which you aim your listening to the hearing of amateur stations, and record all the prefixes heard; when you get 200 — with no duplicates — then you can have an entry at the bottom of the Annual Ladder. Rules for all this were last printed in the March issue. You'll soon get the hang of it, and it does add a little competitive spice to listening.

Finally, Horace doesn't get about too well through arthritis, so