Conversion
PYE Westminster

John Whetstone G4OUB converts the PYE Westminster PMR for 51MHz FM

Large numbers of redundant Pye Westminster PMR transceivers have appeared on the surplus market. Many, suitably modified, have been tweaked for the 70MHz band. It is possible to modify this model to operate in the FM 51MHz section of the 6-metre band, helping to promote much needed F3E activity there.

Since the time when a large number of surplus Low Band Pye Westminster PMR transceivers started to appear, a fellow amateur, G1DNZ, asked me if it was possible to convert one of these to the 51MHz band. He like many others was keen to use FM on the six metre band, recognising the potential of the band to take some of the weight off 2 metres. After a lot of thought and checking the various differences between a standard Westminster and an export model, which I owned, already on 51MHz, I was able to make a list of the necessary modifications that would be required to the standard 68MHz model. Basically, these are as follows.

In the receiver section I left the receiver multiplier as a times two device and ran the local oscillator at 10.7MHz above the receive frequency. No modification would be needed to the local oscillator board, so that the only board in the receiver section to need modification was the rf amplifier mixer board.

The transmitter multiplier board as it stands is ×24. This would have to be modified to ×12 and the PA and harmonic filter appropriately modified.

Receiver front-end

Locate L1, lift off the screening can and note there are two capacitors across this coil, one a 47pF and the other a 12pF. Remove the 12pF and put in its place a 39pF. Next, locate L3, lift off the screening can and note a 1000pF capacitor (1n) and an 8.2pF capacitor. Remove the 8.2pF capacitor and fit in its place a 22pF capacitor. Then locate T1, lift off the screening can, note a 1000pF capacitor (1n) and a 10pF capacitor. Remove the 10pF capacitor and put a 22pF capacitor in its place. Locate L4, lift off the screening can and note 100pF capacitor and an 8.2pF capacitor. Remove the 8.2pF capacitor and put a 22pF capacitor in its place. Next, locate T2, lift off the screening can and note a 1n capacitor and a 10pF capacitor. Remove the 10pF capacitor and replace with a 22pF capacitor. See **Fig.1** for layout.

Finally, replace all the screening cans. This completes the modification to the rf amplifier and first

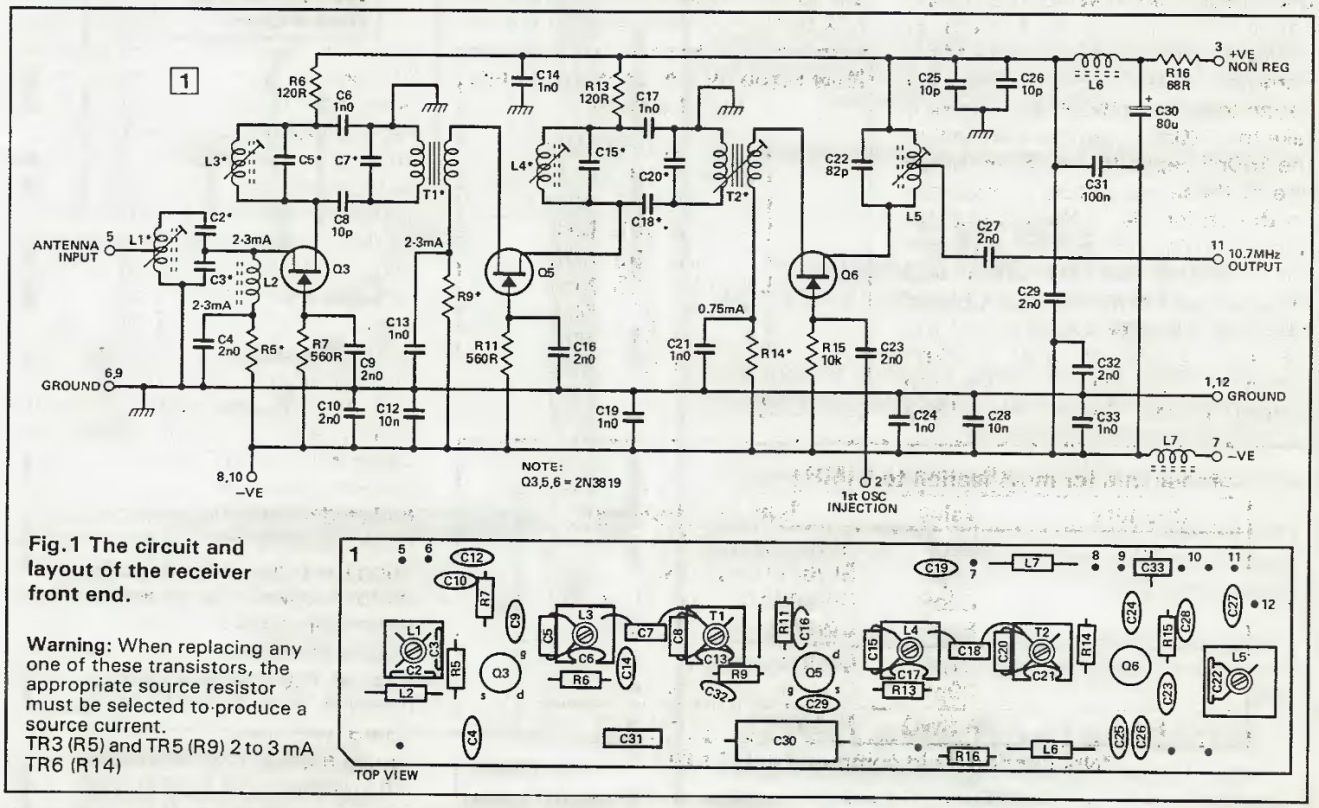


Fig.1 The circuit and layout of the receiver front end.

Warning: When replacing any one of these transistors, the appropriate source resistor must be selected to produce a source current.
TR3 (R5) and TR5 (R9) 2 to 3 mA
TR6 (R14)

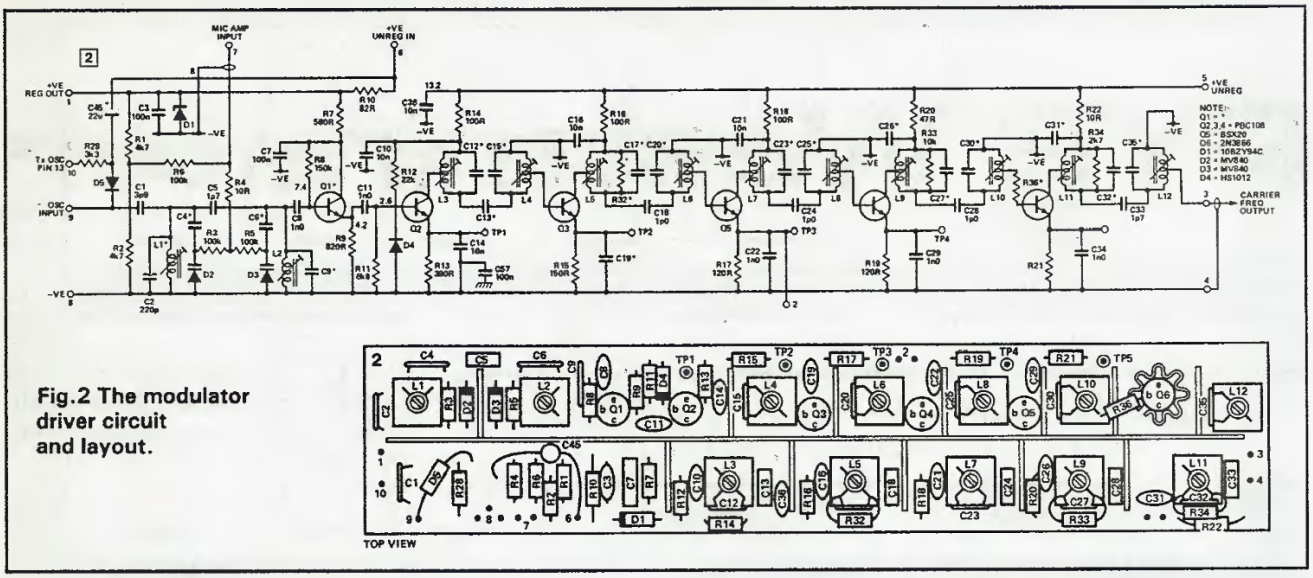


Fig.2 The modulator driver circuit and layout.

mixer unit board.

Transmitter modulator driver

Remove the transmitter modulator driver (**Fig.2**) board completely. It is most important that all the coils are numbered L1-L12 on the formers, to remind the experimenter which goes where. Take C2 and C9 out completely. If a grid dip oscillator is available tune L1 and L2 to approximately 4.3MHz. Note that L3 has two capacitors on it (150pF and 120pF); take 120pF off leaving the 150pF capacitor on, but, if a GDO is available, peak it at about 8.6MHz. Remove L4 and note it has two capacitors on it (150pF and 120pF); take the 120pF capacitor out leaving the 150pF capacitor on. (Sometimes one of these capacitors is mounted on the underside of the board.) Put this coil in place of L6, remove L5 and put this coil in place of L7, removing the resistor R32 from the coil (L5) and also take the 39pF capacitor off the coil and replace it with a 22pF capacitor. Put strap in to link the missing stages. This will link C13 to L4 which is in its new position (see **Fig.3**).

Take the old L6 coil and put this in place of L8, altering the capacitor from 39pF to 22pF at the same time. Then put the coil that was in L7 in place of L9, changing the capacitor on L7 at the same time from 47pF to 27pF.

Remove L10 and fit the coil that was L8 into L10 position and change the capacitor on it from 47pF to 27pF. Discard the original L9 and L10 (these will not be needed). On L11 leave the 2.7k resistor in place but change the capacitor value to 56pF. On L12 take the coil out, discard the capacitor and fit a 56pF to the coil; replace the coil.

Now replace the thin feeder cable which goes from the output of the board, (pin 3 and pin 4) with a longer piece of RG174 feeder cable. This new cable must be long enough to reach board 2 of the power amplifier unit instead of board 1. Now replace the modulator drive board in position, and re-connect all cables.

New resonant frequencies of coils for 51.51MHz

L1	=	4.2925MHz
L2	=	4.2925MHz
L3	=	8.585 MHz
L4	=	8.585 MHz
L5	=	25.755 MHz
L6	=	25.755 MHz
L7	=	51.51 MHz
L8	=	51.51 MHz
L11	=	51.51 MHz
L12	=	51.51 MHz

Components for modification to 51MHz

Quantity	Value	Type of component
4	100pF	Silver mica (350V)
3	68pF	Silver mica (350V)
6	22pF	Ceramic or silver mica
2	56pF	Ceramic or silver mica
2*	27pF	Cerami or silver mica
1*	39pF	Ceramic or silver mica
Reel	18 SWG	Enamelled copper wire

*Not needed if old components are used

The PA board

The PA board is made up of four separate boards on one heatsink. Disconnect the wire strap which goes from the first PA board to the second one (pin 2 to pin 1). This will completely isolate the first board (which we do not need in this version). Discard the old RG174 feeder cable. Connect the now longer cable to the second board of the PA unit, pin 3 for the braid, pin 1 for the centre conductor. Next, remove board 2 from the heatsink after first unsoldering the transistor base (Q2) plus resistor and choke from the board. Add a 100pF silver mica capacitor to the underside of each trimmer capacitor, put back the board and solder back the components, and then squeeze the four-turn coil to bring the turns nearer together. Next, remove board 3 and add a 100pF capacitor beneath each trimmer. Then put back the board and solder back and components. Next, remove board 4, remove coil L10 from the board and wind another one of a similar diameter but with enamel wire (18 standard wire guage), so that the

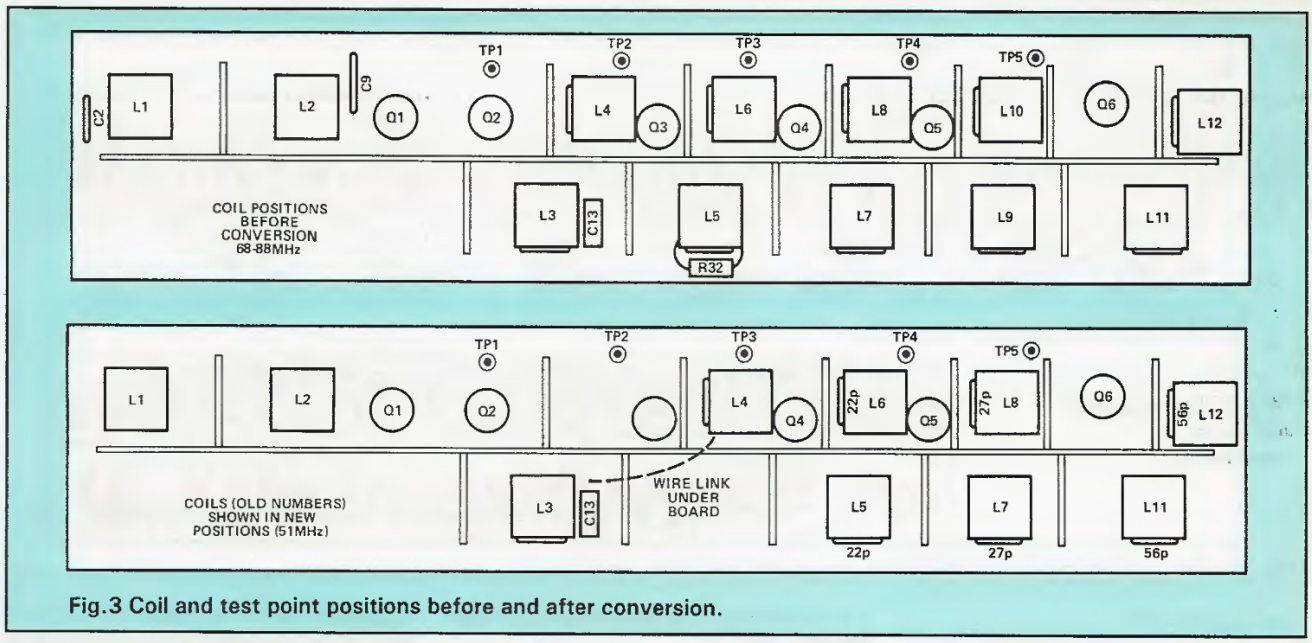


Fig.3 Coil and test point positions before and after conversion.

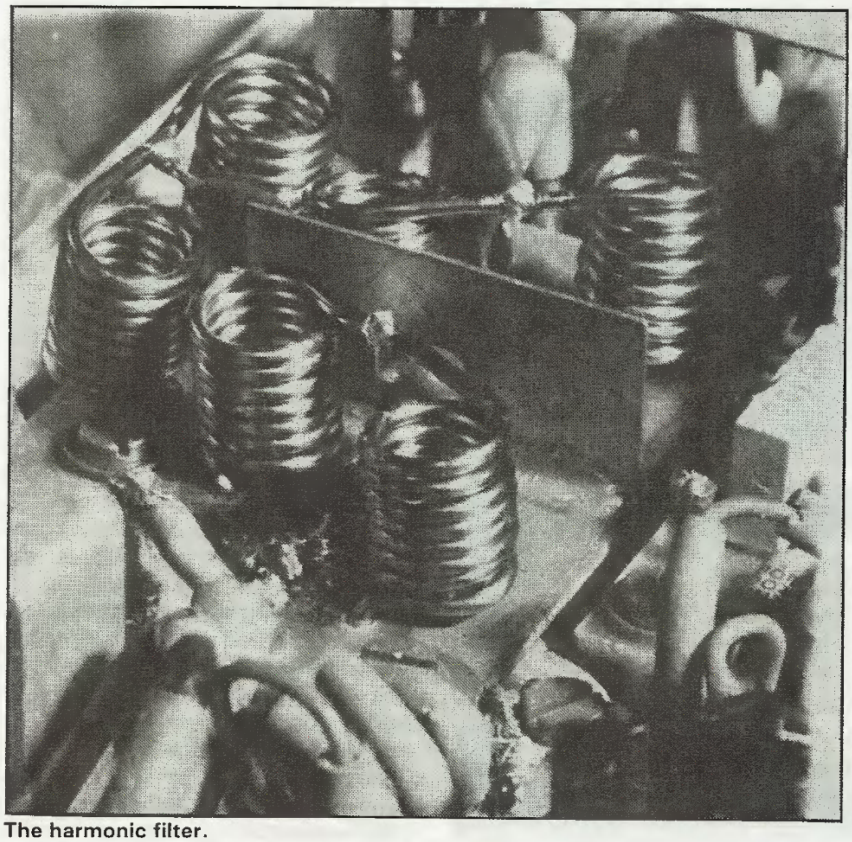
turns do NOT short to each other. This coil should have six turns on it rather than four. Now solder it in position; reposition the board and then solder back the components.

To remove board 4 you may have to take out the complete PA assembly, because the power stand-off holding down one corner of board 4 is secured by a nut underneath. The PA assembly is removed by unscrewing the four pillar supports, one on each corner.

This completes the PA modification.

Harmonic filter

Take out the harmonic filter (**Fig.5**) (four screws) and remove the coax cable from each of the filters.



The harmonic filter.

Now remove all the coils and all the capacitors. Using 18 swg enamelled wire wind the coils (see **Fig.5**) on a ¼ in drill bit. As with the old harmonic filter there will be three double coils. Each leg of these three coils will have 7.5 turns closely wound on it. When the three double coils are mounted on the board, solder a 68pF capacitor to the middle of each double coil, taking the other end of the capacitor to earth. Now screw the board back in and solder the coaxial cable back on.

This completes the 51MHz modifications to the transceiver.

Receiver Alignment

Fit the crystals to the transceiver and locate the receiver local oscillator multiplier board (**Fig.6**). This is a fairly small board with three coils on it. Put the test meter on the 2.5 volt range and then put the negative lead of the meter on a negative supply point. Put the positive lead of the meter on test point 1 on the multiplier board (**Fig.6**). Tune L1 for maximum. Remaining on test point 1, tune L3 for a minimum dip. Now move the positive lead of the meter to test point 2 and tune L4 for maximum. Remaining on test point 2, tune L1 for maximum and then L3 for maximum. Finally, tune L1 for maximum. This completes the alignment of the ×2 local oscillator multiplier board. See **Table 1** for a list of crystal frequencies.

Next, locate test point 1 on the 455kHz IF board and feed a signal source into the receiver; tune L1, L3, T1, L4, T2 and L5 on the RF board for

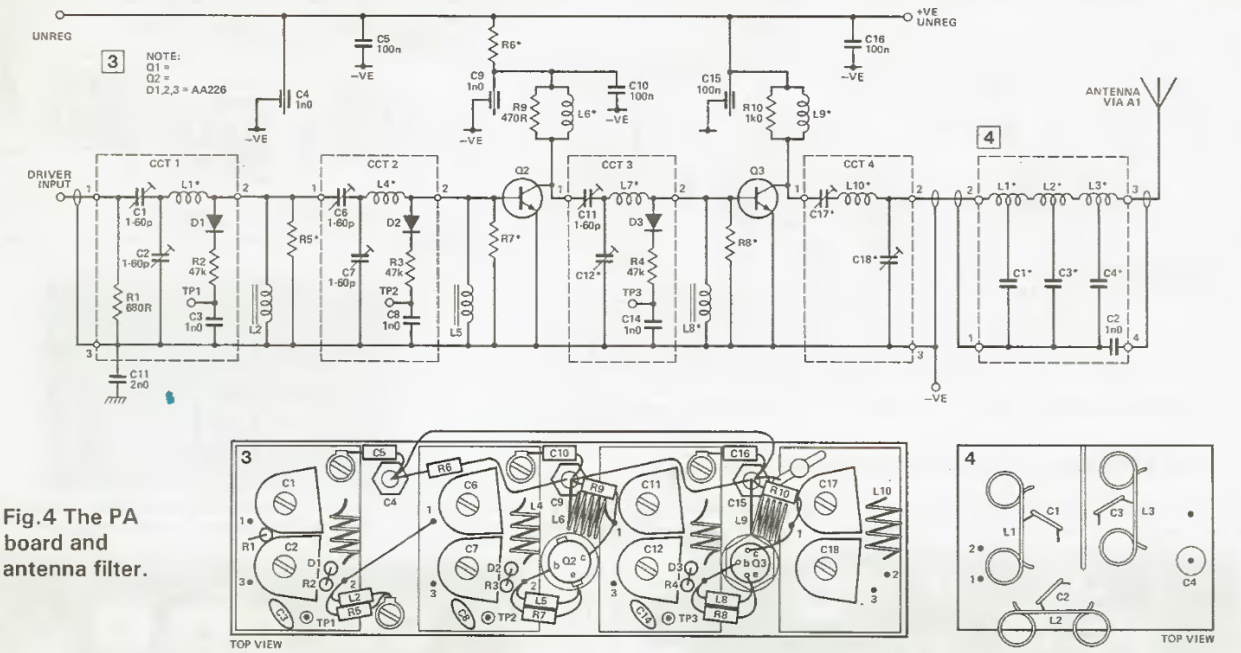


Fig.4 The PA board and antenna filter.

maximum signal reading on the meter, taking care to keep the signal source fairly weak. This completes the alignment of the receiver.

If a 10.7 or 455kHz IF generator is available use it as follows: transfer the positive lead of the meter to test point 3 on the 455kHz board locate the discriminator coil (in the largest screen can on the board), and with a reasonable noise-quietened signal from the IF generator, tune the discriminator coil for 0V. Now the discriminator is balanced and should almost eliminate ignition interference.

Multiplier Board

Connect a SWR power meter and dummy load on to the transmitter antenna socket. Put the meter on the 10 volt range with negative lead on a negative point. Put the positive lead on test point 1 (**Fig.3**). Key transmitter and at once note the voltage on test point 1 before any tuning has been done. Tune L1 and L2 in sequence for maximum reading. Staying on test point 1, tune L3 for a dip in the reading. Next transfer test lead to test point 3 (test point 2 is not used) and change meter range to 2.5 volts. Tune L4 for maximum reading and them L3 for maximum reading. Remaining on test point 3 tune L5 for minimum. Transfer test lead to test point 4 and tune L6 for maximum, and then turne L5 and L6 in sequence for maximum reading. Next, keeping on test point 4 tune L7 for minimum. Now, transfer test lead to test point 5 and tune L8 for maximum. Then tune L7 and L8 in sequence for maximum, now tune L11 for a dip on test point 5. Move test lead to test point 2 of the PA board and tune L12 for maximum, then L11 and L12 in

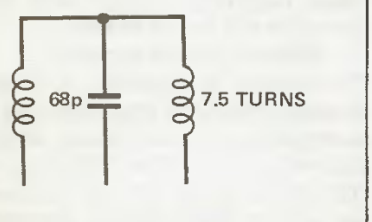
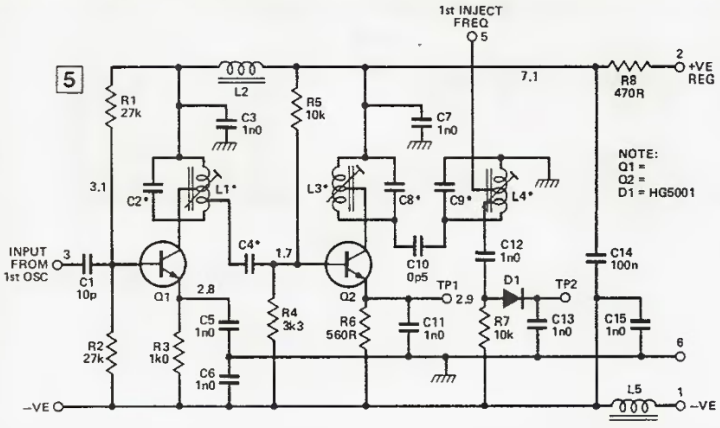


Fig.5 The harmonic filter.

Table 1

Frequency	Spec. of Xtal	Frequency of Xtal
51.41TX	T18	4.281667 MHz
51.41RX	T29C	31.055 MHz
51.43TX	T18	4.2858333 MHz
51.43RX	T29C	31.065 MHz
51.45TX	T18	4.2875 MHz
51.45RX	T29C	31.075 MHz
51.47TX	T18	4.2891667 MHz
51.47RX	T29C	31.085 MHz
51.49TX	T18	4.2908333 MHz
51.49RX	T29C	31.095 MHz
51.51TX	*T18	4.2925 MHz
51.51RX	*T29C	31.105 MHz
51.53TX	T18	4.2941667 MHz
51.53RX	T29C	31.115 MHz
51.55TX	T18	4.2958333 MHz
51.55RX	T29C	31.125 MHz
51.57TX	T18	4.2975 MHz
51.57RX	T29C	31.135 MHz
51.59TX	T18	4.2991667 MHz
51.59RX	T29C	31.145 MHz

*Calling frequency



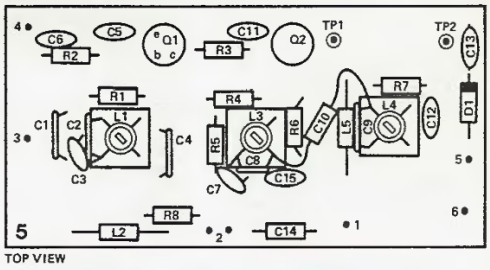
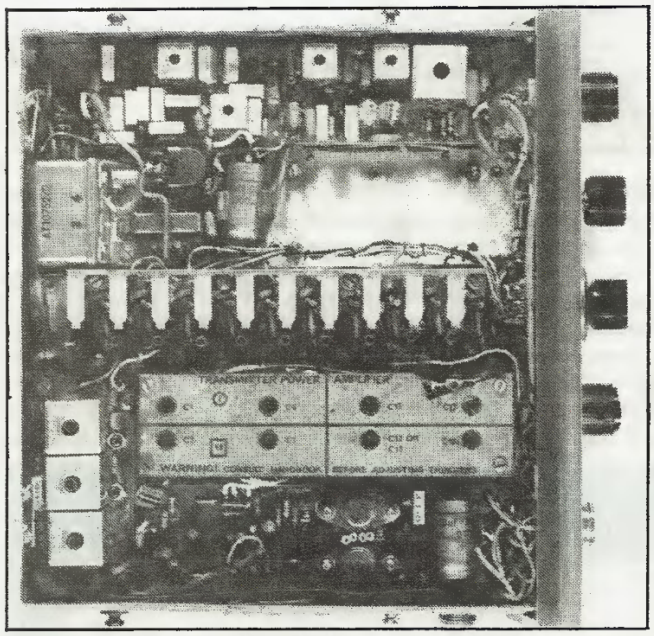
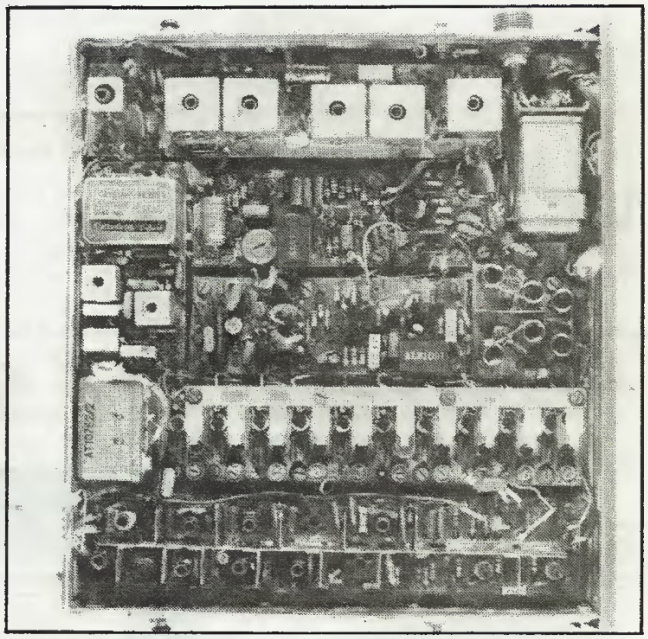


Fig.6 The oscillator multiplier circuit and layout.

MULTIPLICATION FACTORS			
CARRIER	Q1	Q2	TOTAL
68-108MHz	x2	x1	x2
79-101MHz	x2	x1	x2
148-174MHz	x3	x1	x3



The top view of the Westminster.



The underside view of the Westminster.

sequence for maximum. Now move the meter lead back to test point 5 of the multiplier board and re-peak L7 and L8. Now put test lead back on test point 2 of the PA board and re-peak L11 and L12. This completes the tuning up of the transmitter multiplier board.

PA Board

Capacitors C1 and C2 are not used, so connect the negative lead of the meter to a suitable negative point, and the positive lead of the meter on to test point 2 of the PA. Press to transmit. Tune C6 and C7 in sequence until maximum reading is obtained.

Now move the red meter lead to test point 3. Press to transmit and tune C11 and C12 in sequence for maximum power. This completes the tuning up of the PA.

At the time of writing the maximum power allowed for FM on six is 25 watts erp. Therefore, if an aerial of more than about 3dB gain is employed, it would be possible to exceed the power limit for the band with the 12-15 watt output of the transmitter. A modification was needed to reduce the output power to about 5 watts. This is simply done by disconnecting the base of the driver transistor and inserting a 47ohm, 0.5 watt resistor between where the base went and the base of the transistor, and re-tuning the PA board.

Now the reader has successfully got the transceiver on the 51MHz, I would urge him or her to invest in a good commercial low pass filter to insert between the transceiver and the aerial as it is most important to reduce the second harmonic to a minimum, since it falls in the local radio section of the band.

It may be of interest to readers in the East Midlands to know that on Friday nights at 7.30pm local time, there is a net on 51.41MHz.

Wishing you all success.

The author is grateful to Philips Telecom (formerly Pye Telecom) for permission to reproduce several diagrams from the Westminster instruction book and to his many friends for their advice, especially Jack G5UM.