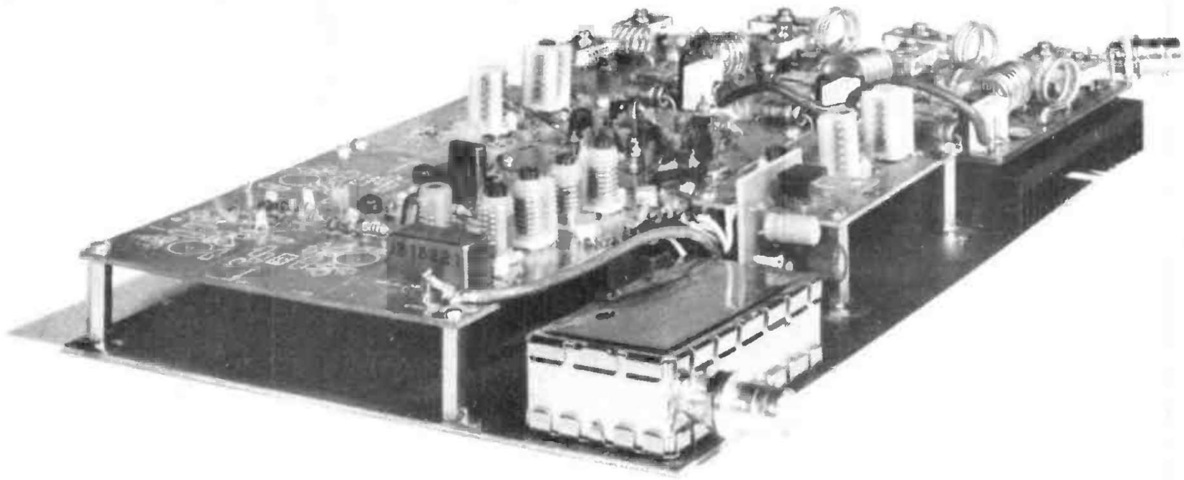


6 METRE BAND TRANSVERTER

A transmit/receive converter, designed by Graham Leighton, for frequencies in the range 50- 54MHz.

The 6 metre band has been used by amateurs in IARU regions 2 and 3 for many years. In most countries the frequency range is 50 to 54MHz. The RSGB/Home Office have announced that a limited number of experimental licences will be available in the UK. These will permit the use of 50 to 52MHz outside television hours. So, we are presenting a transceiver converter, based on modules previously published in **R&EW**, which will form the basis of a 6m station using a 144MHz tranceiver as the IF stage. Soon we hope to bring you a follow-up article describing a single board 144MHz to 50 or 28MHz transverter.

The heart of the system is a slightly modified multiband up- converter (*Ref. 1*). During the design of this unit, the possiblity of using it as part of a transmit converter was investigated. The hope was that it would be useable for the 10, 6 and 4 metre bands. The wideband amplifier, described in this issue, was designed with this in mind. In practice, however, the filtering needed for the 4m version became too complex and was difficult to set up.

THE DESIGN

The block diagram (*Fig. 1*) shows how the various boards have been combined to produce the transverter. The multiband up-converter uses a double-balanced diode mixer and a low pass filter which, since both are bi- directional, makes it suitable for use on transmit and receive. The low pass filter, used in the converter, has a cut-off frequency of about 65MHz (see *Fig. 2*). This may be reduced to about 58MHz by adjusting the coils. In order to keep the spurious output level as low as possible, the drive to the mixer (on transmit) must be limited to about -13dBm maximum. At this level the output from the mixer board is about -20dBm. The spurious output is low (-60dB below the wanted signal) but under overdrive conditions there is a spurious output at approximately ± 6MHz which is caused by the following mixing products:-

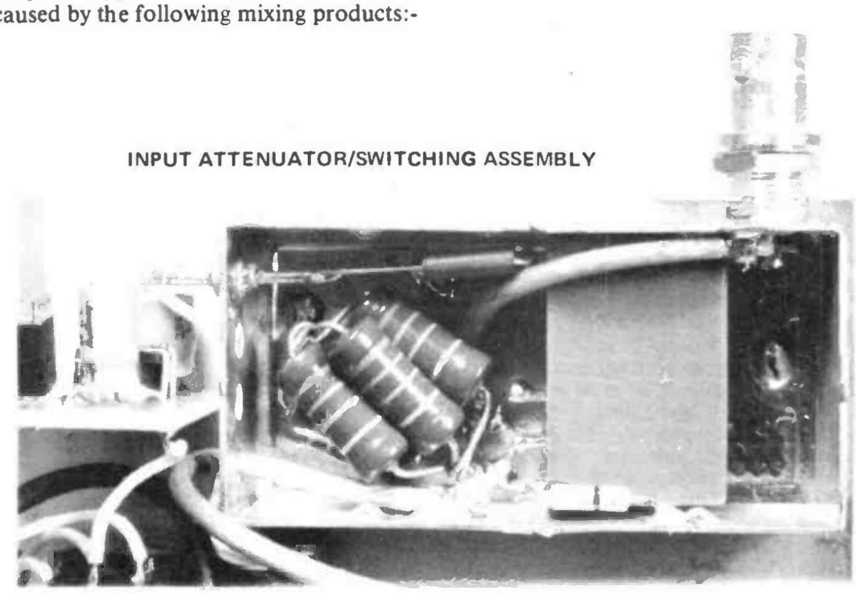
50-± (50 x 2) - 94 MHz

so, don't get too enthusiastic with the drive power.

The mixer board is followed by a wideband amplifier which brings the level up to about +21dBm. This stage does generate some harmonics. These, together with any other unwanted out-of- band signals, are reduced by the bandpass filter. This filter is based on the design used in the 6 metre preamp (*Ref. 2*).

A power amplifier may be included at

INPUT ATTENUATOR/SWITCHING ASSEMBLY



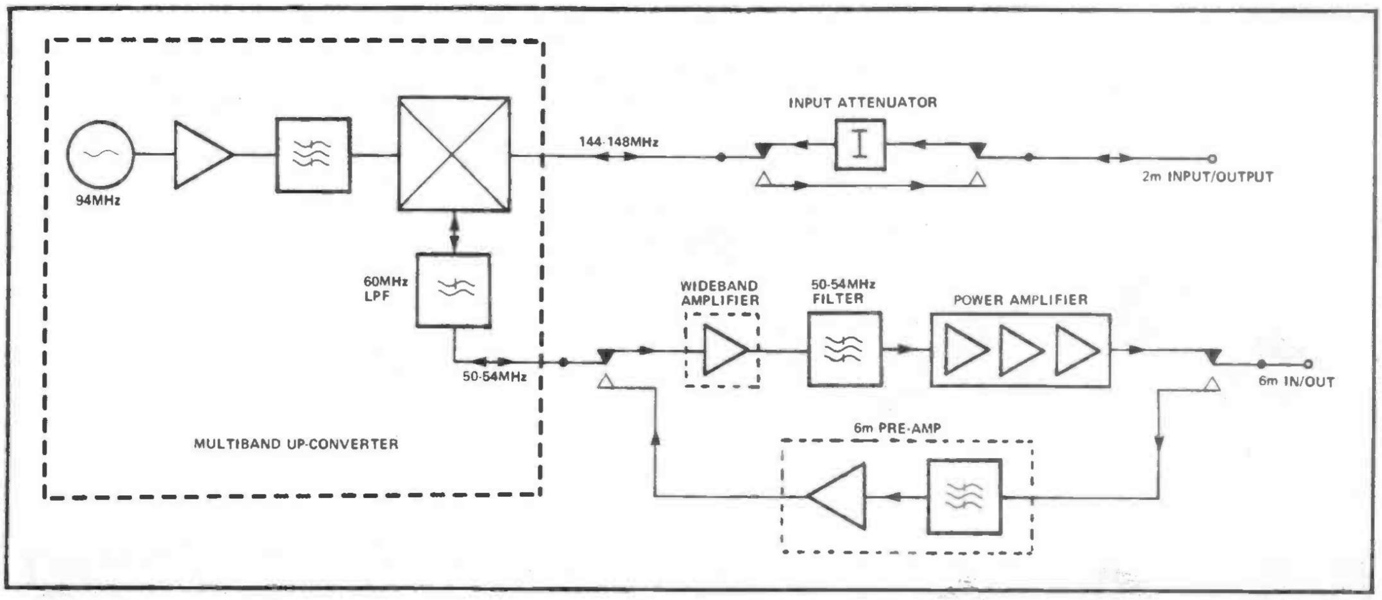


Figure 1: Block Diagram of 6M Transverter

this stage. The design we used works well, but is an experimental prototype. The gain of about 36dB, at 40 watts output, makes the 'system gain' far too high. Therefore a 10dB attenuator, between the filter and the power amplifier, is needed if the PA is not to be overdriven.

The input switching is carried out by a double pole relay which is housed in a screened enclosure together with the load resistors. *Figure 3* shows the circuit of this arrangement. The input attenuator relies on the coupling between the two parts of the relay to provide about 45dB of attenuation.

On receive, the signal is routed to the mixer board via a preamplifier (the design for the preamp was published in September **R&EW**, *Ref. 2*). A noise figure of 2.0dB was measured on the prototype of this amplifier, so the overall sensitivity should be quite adequate.

RL2, which switches the 50MHz side of the mixer board, is also used to switch the supply between the transmit and receive amplifiers.

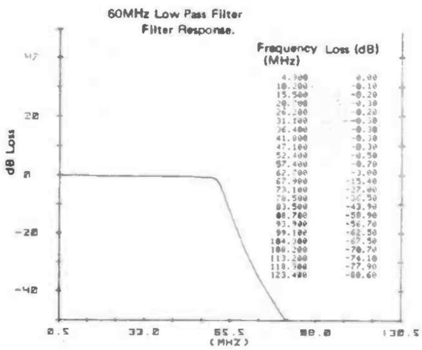


Figure 2: 60MHz low pass filter response

CONSTRUCTION

The pre-amplifier and transmit amplifier (*Ref. 3*) can now be built and tested. The mixer board (multiband up-converter) is built according to the article, except that the 60MHz filter is used instead of the 75MHz version. *Figure 4* shows the circuit of the 50MHz bandpass filter which is based on the one used in the pre-amp.

This can be conveniently built on a pre-amp PCB if desired.

The input attenuator and switching network, (Shown in the photograph), requires an input drive level of about 1 watt. If a higher drive power is to be used then a more elaborate system may be required.

As can be seen from the photographs, all the boards are mounted on an earth plane. This method is the most convenient for this type of modular design. Each board is fitted with tapped pillars which are then soldered to a piece of copper laminate board. Connect up all the individual boards, using screened cable for all RF

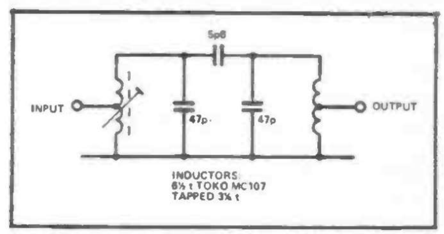


Figure 4: 50MHz filter circuit

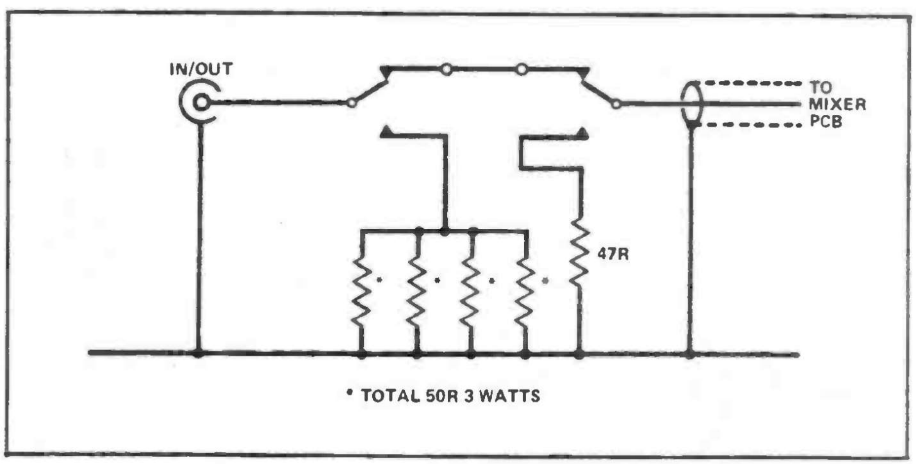


Figure 3: Input switching circuit

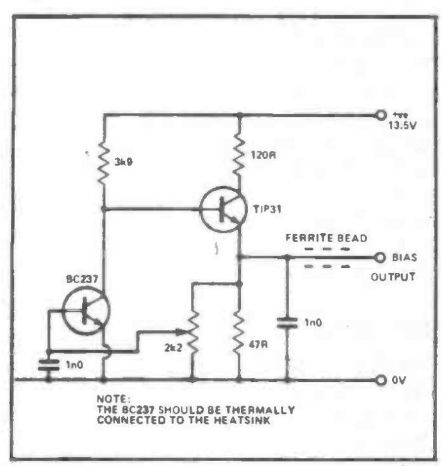


Figure 5: Power transistor bias circuit

connections. Once this has been done the low power transverter should be ready for use. The only part which may need further adjustment is the bandpass filter. In the absence of other test gear the filter may be adjusted for maximum power output.

Make sure that neither a high RF power level nor a DC voltage is applied to the mixer, or irrepairable damage may result!

POWER AMPLIFIER

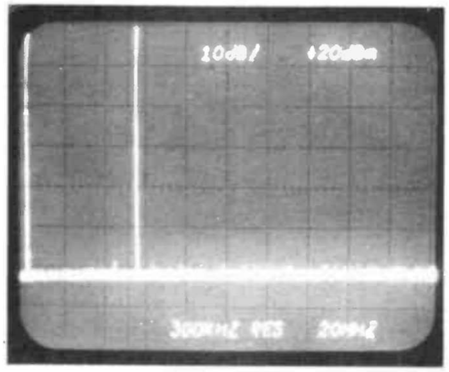
The three stage 40 watt amplifier has been included in this article to give you a starting point. As already mentioned, a refined version will appear in a later issue of **R&EW**.

In the power amplifier, each stage is operated in class AB, the bias being controlled by an individual active network. This bias network (*Fig. 5*) provides a stable low impedance output which is fed to the base of the RF power transistor. A BC237, when thermally connected to the heatsink compensates for any temperature rise. The RF matching has been kept as simple as possible whilst allowing a wide in the prototype, low VHF band transistors were used. HF SSB parts should also be suitable- some experimentation may be necessary. Make certain that you follow the usual assembly precautions when fitting the RF power transistors (see *Ref. 4*). Ensure adequate heatsinking - the photo shows the heatsink that we used - our one had to be cooled using a fan.

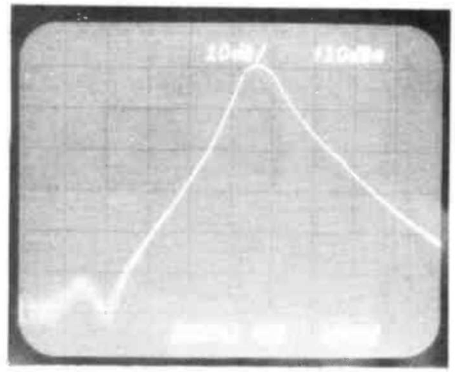
When setting the bias, do so one stage at a time. In each case, set the variable resistor to the end of its travel (connected to the TIP31 emitter). Adjust the bias current to the following levels: 1st stage 25mA; 2nd stage 75mA; 3rd stage 150mA or as requried by the devices actually used.

When tuning the amplifier, increase the drive level slowly whilst tuning each stage. Monitoring the current drawn by each stage is helpful during the tuning process, as is checking for oscillations by listening on a nearby receiver.

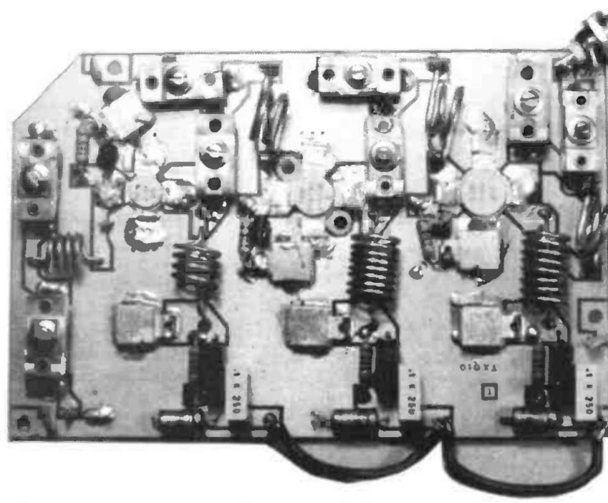
A low pass filter should follow the amplifier to reduce the level of harmonic output.



Low power transverter output spectrum



50MHz bandpass filter response



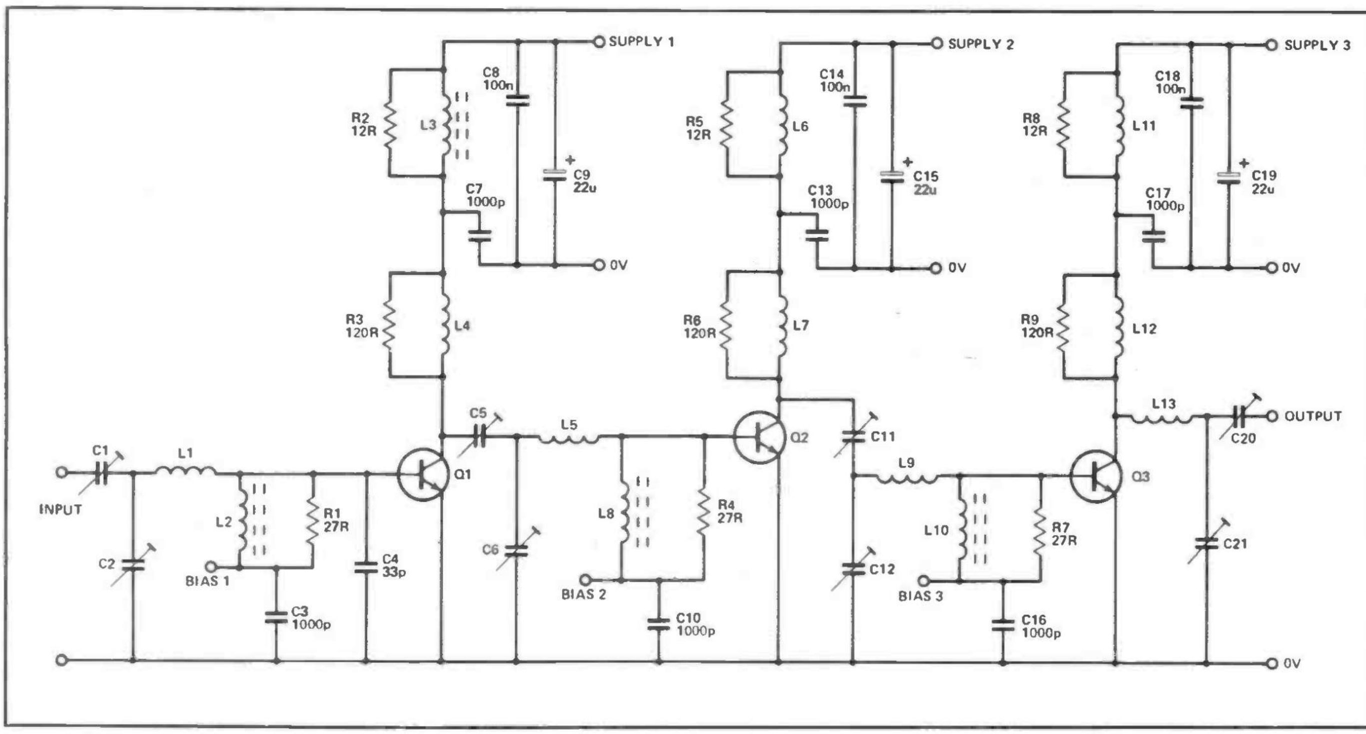
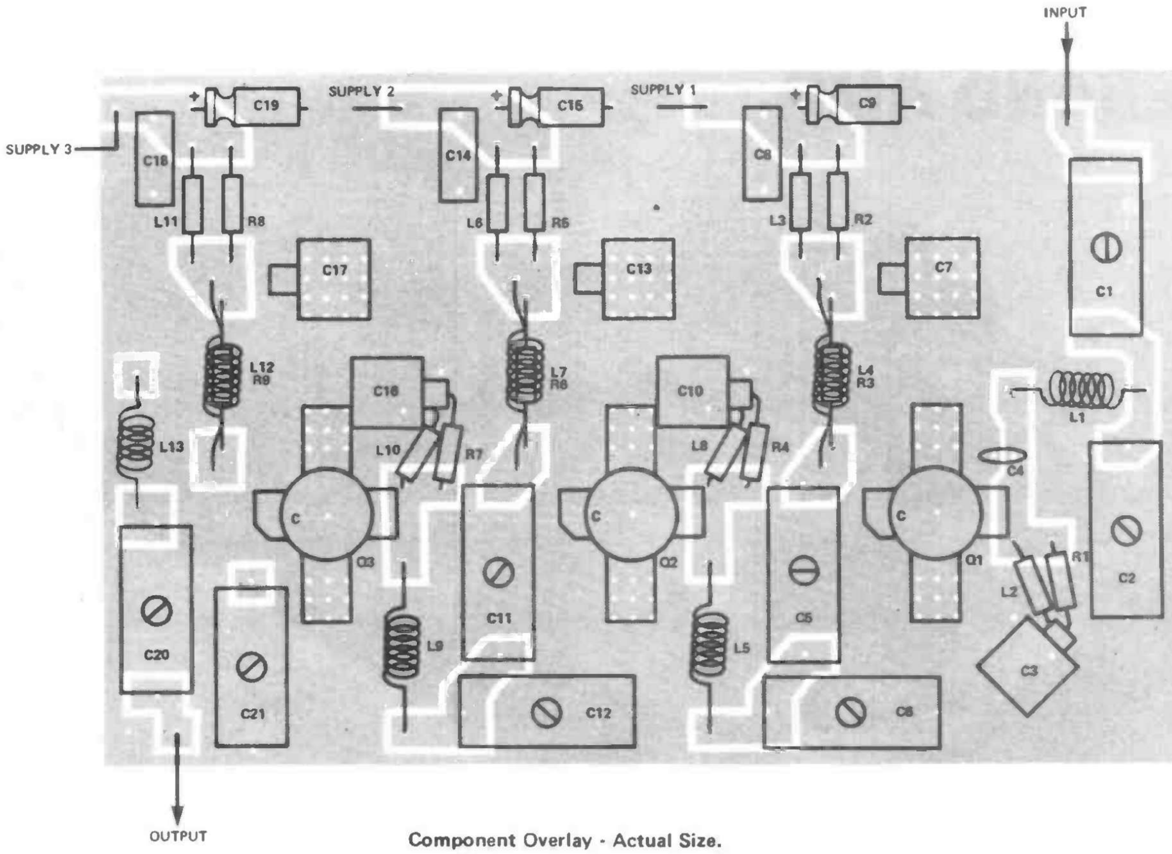
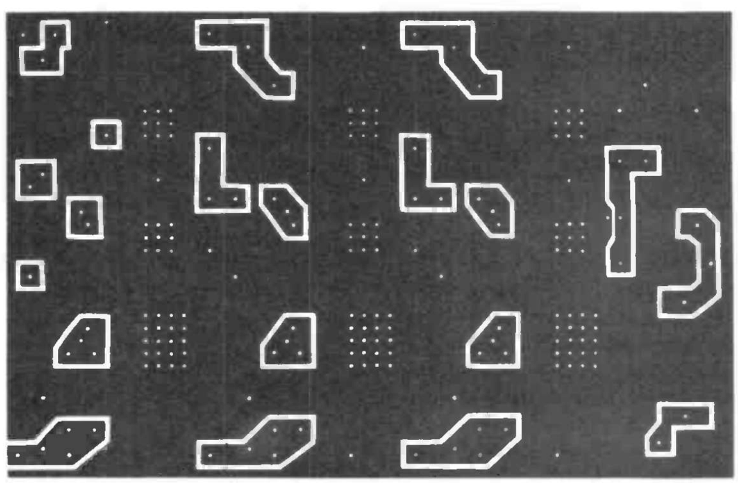


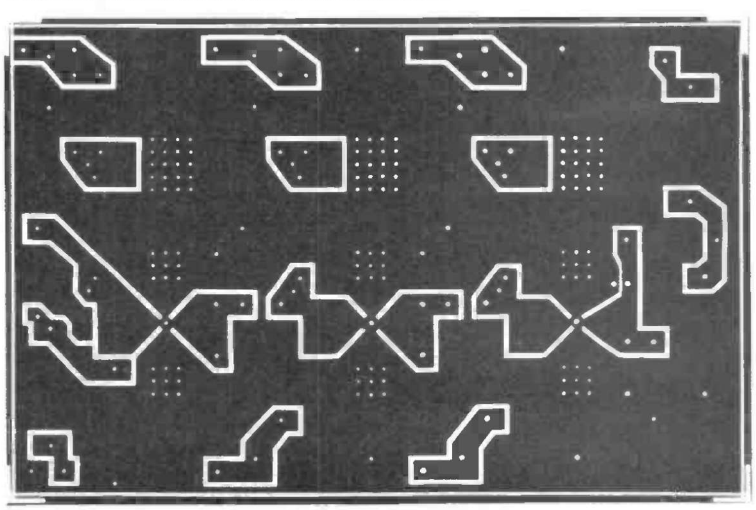
Figure 6: Power amplifier circuit



Component Overlay - Actual Size.



PCB Foil Patterns shown at 70% of actual size.



COMPONENTS LIST (low power transverter)

Mixer Board - Multiband Up-converter fitted with 60MHz LPF and 94MHz oscillator.
6 Metre preamp board
Wideband amplifier board
Bandpass Filter - as modified pre-amp board shown in circuit diagram.

Miscellaneous

Screening box, 3 off OMI relays, BNC sockets, Load resistors, LM317 regulator etc.

References

1) Multiband Up-Converter R&EW August 1982.
2) 10/6/4M Pre-amp R&EW September 1982.
3) Wideband Amplifier R&EW December 1982.
4) 2M Power Amplifier Ray, R. R&EW June 1982.
5) TRW RF Semiconductors Data Book (European Edition).

Your Reactions......	Circle No.
Excellent - will make one	45
Interesting - might make one	46
Seen Better	47
Comments	48