AN HF TO VHF RECEIVE CONVERTER

By G0CWA DEC. 2012

After suffering a relapse in my health I decided I needed a bit of “retail therapy” to improve my mood. For some reason I have always liked the Yaesu FRG-9600, I must be mad!

The set although reasonable as is, lacked coverage below 60MHz and I therefore applied some ideas from my earlier designs to make a receive converter which I could use with it. (Note this will work with any of the current generation of VHF / UHF receivers and RTL SDR based receivers)

The pictures below show the front and rear panel arrangements

The converter is designed to convert 25KHz to 60MHz input to a 100.025MHz to 160MHz output using an SBL-3+ double balanced mixer and 100MHz crystal oscillator module.

Broad specifications

12-20V dc supply

Input 25KHz to ~70MHz

Output 100.025MHz to 170MHz at 50Ohm

Ant 1 50 Ohm (e.g. matched 50 Ohm)

Ant 2 50 or 450 Ohm (e.g. matched 50 Ohm or random long wire)

RF pre-amplifier of up to around 15dB gain.

Specialist parts list

Relays 1 to 4 OMRON G6CK-2117P-US two pole latching relay

Relays 5 to 9 OMRON G6F-2F-Y 12V

SBL-3+ dbmixer (SBL-1 will work with a 500KHz minimum frequency)

100MHz crystal oscillator * see text

Mar-6 MMIC amplifier

Circuit Description

The circuit can be split into four main areas as described below:-

The switching logic, for simplicity not all the components are shown D14 to D17 are duplicated on the second winding of the latching relays and are mounted under the PCB directly across the coils R2-R9 are chosen to suit the indicator LED's used.

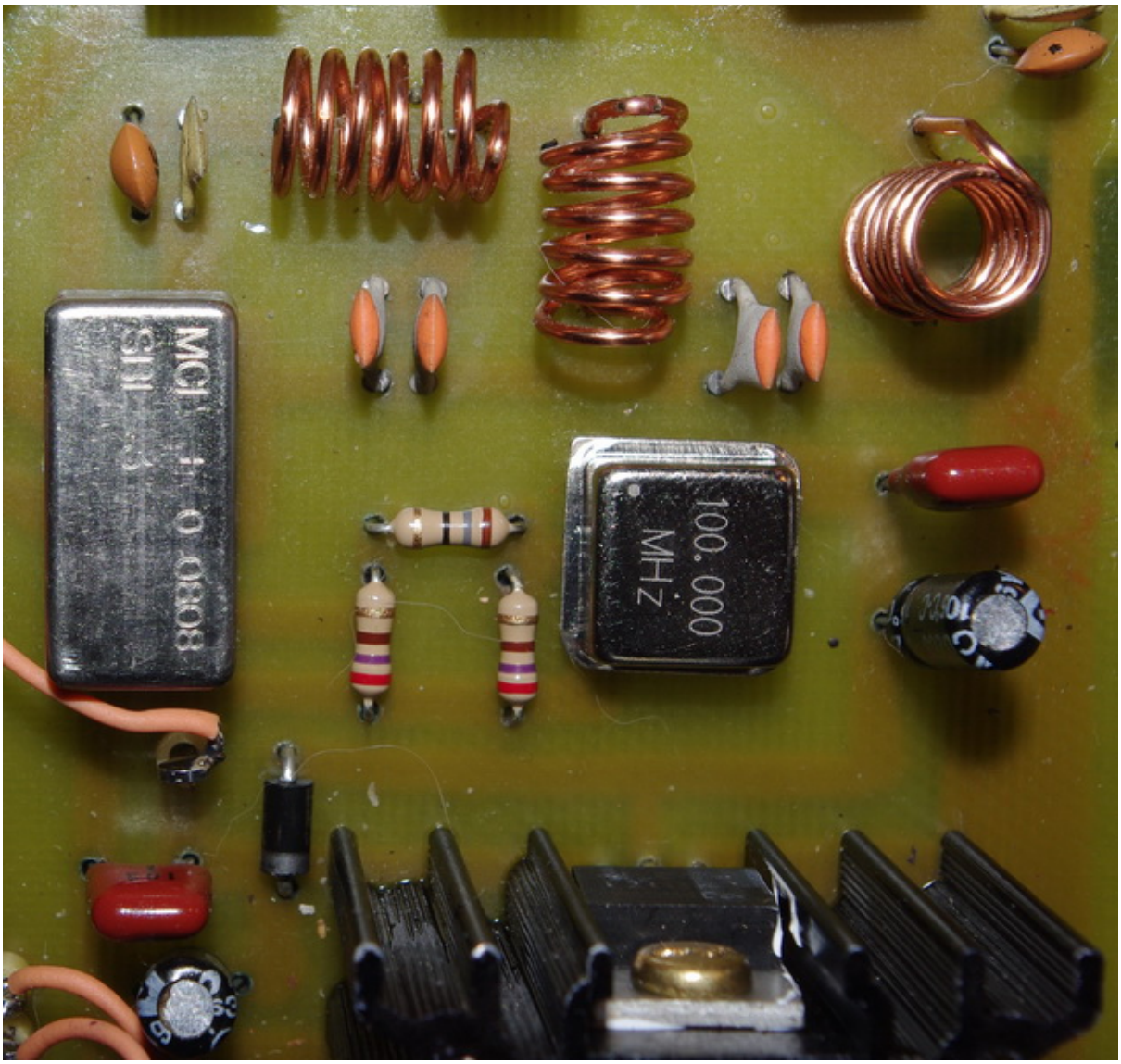
The choice of using the two pole latching relays for control is they provide a "memory" of the last set up used. If the unit is switched off the rf signal passes straight through from antenna 1 to the radio (or dongle). All these relays can be replaced with switches if preferred.

Antenna selection, this is controlled by RL5 the only clever bit is the 3:1 balun wound on a T37-2 ferrite core on antenna 2 allowing either a 50 Ohm or 450 Ohm random long wire antenna to be used, very useful.

Receive converter, this is basically the same as used in my MK2 SDR project with two exceptions:-

The use of an SBL-3+ double balanced mixer rather than an SBL-1 this allows "normal" pin connections to be used while retaining the tuning range, approximately 25KHz to 70MHz, with full performance.

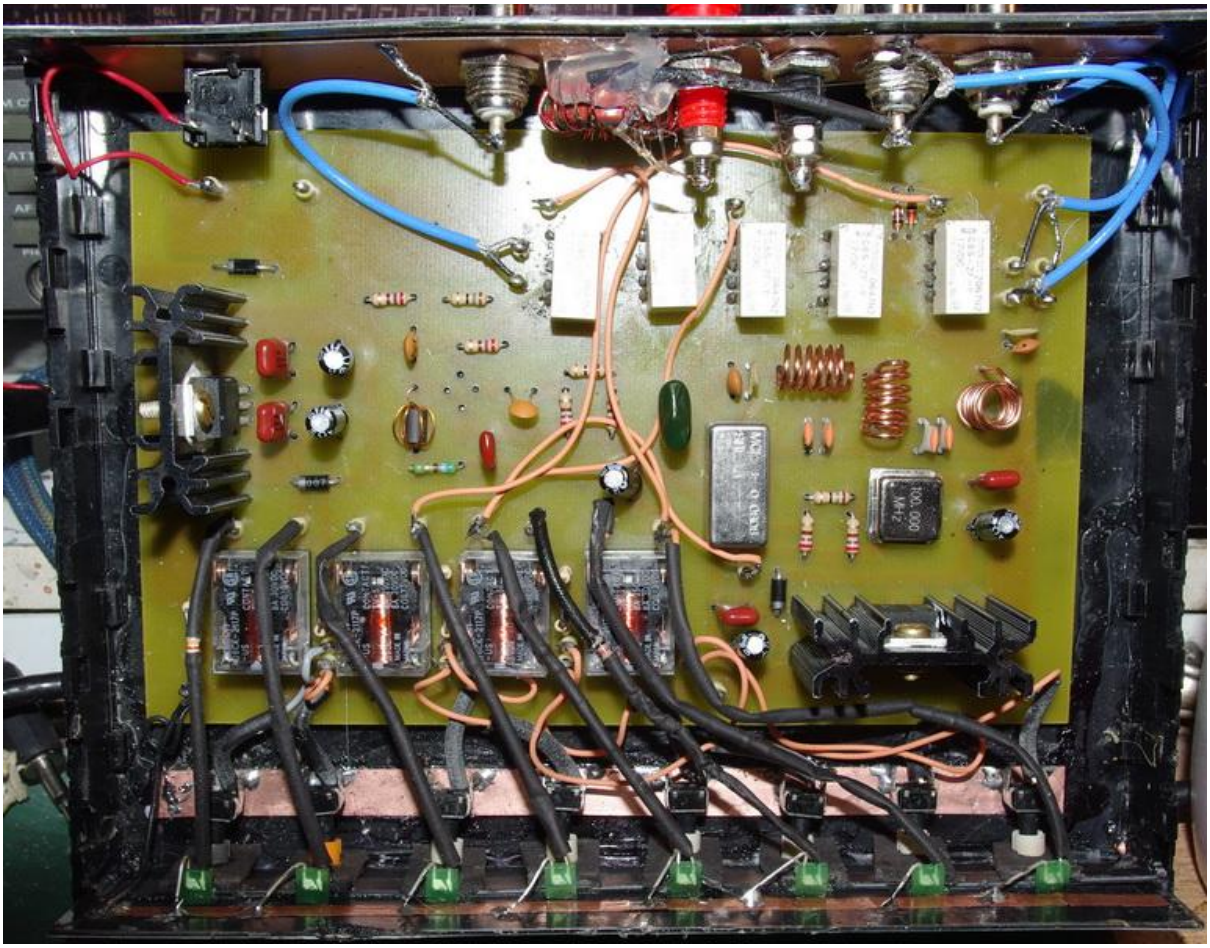
The use of a 100MHz crystal oscillator module which means the output is from 100.025 to 170 MHz allowing the standard frequency display of the radio to be used, it is far easier to subtract 100 from the display than 125. This unfortunately does lead to slight problems from local FM broadcast band stations breaking through directly but is well worth the price paid. Also note the coil positions for best performance of the filter. The coils are all 6.5 turns of ~1mm diameter copper wire 0.25 inch diameter by 0.4 inch long



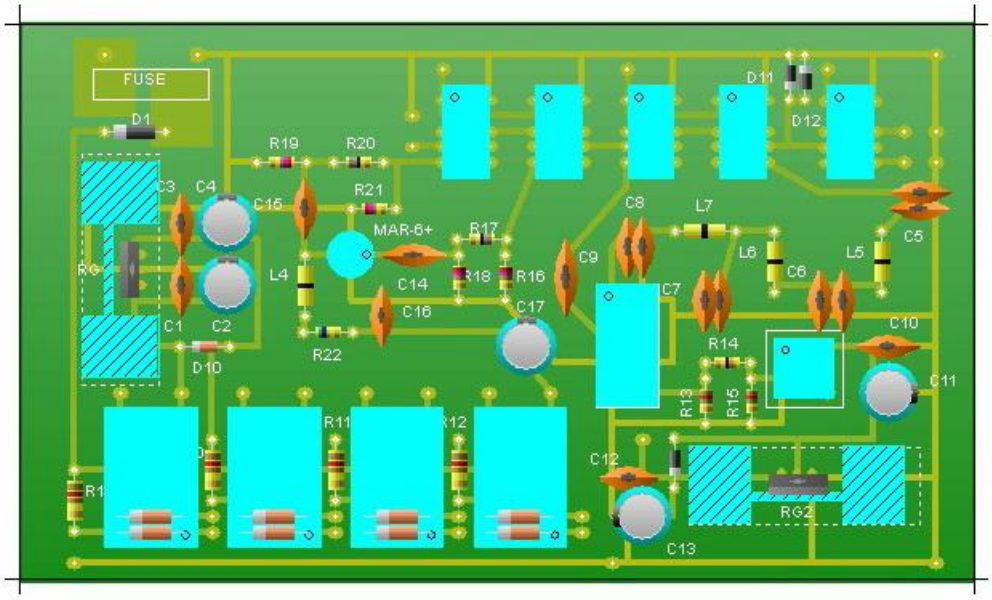
Note if used with the RTL dongles use a 125 MHz module for better results.

Note if you wish to use this to receive VLF frequencies reliably add further filtering as appropriate.

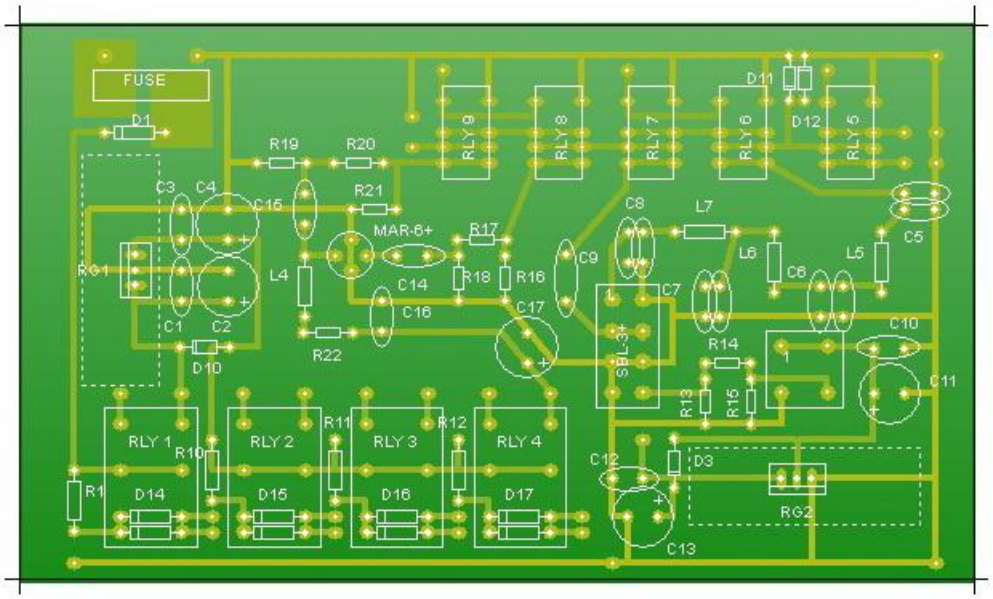
Pre-amplifier, This is a simple unfiltered design using a MAR-6 MMIC amplifier mounted on the track side of the board. The -3dB pads are to ensure matching of the converter, amplifier and radio to 50 ohms. If over loading of the radio front end occurs due to excessive signal levels increase the attenuation of the output pad (R19, 20 and 21) to reduce the overall gain. From experience I have found that a net gain of 9dB seems a good compromise. The coil is 5 turns of wire on a ferrite bead.



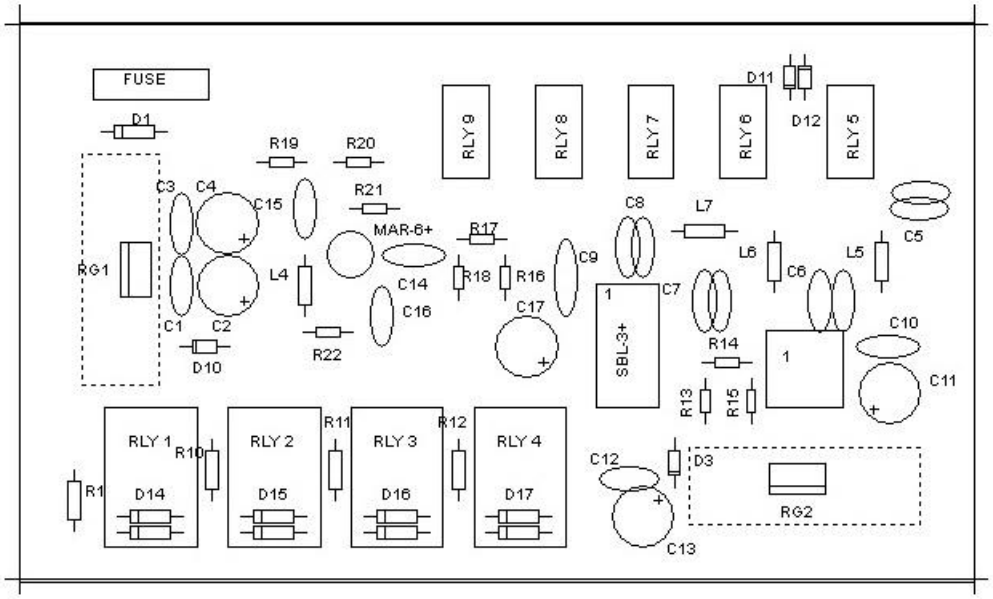
General assembly



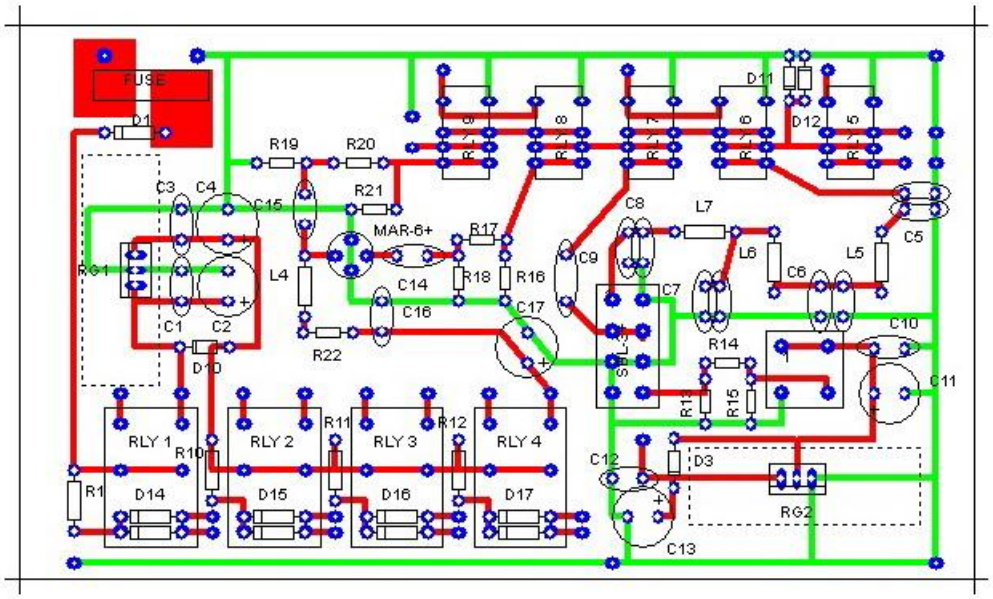
General Assembly 2



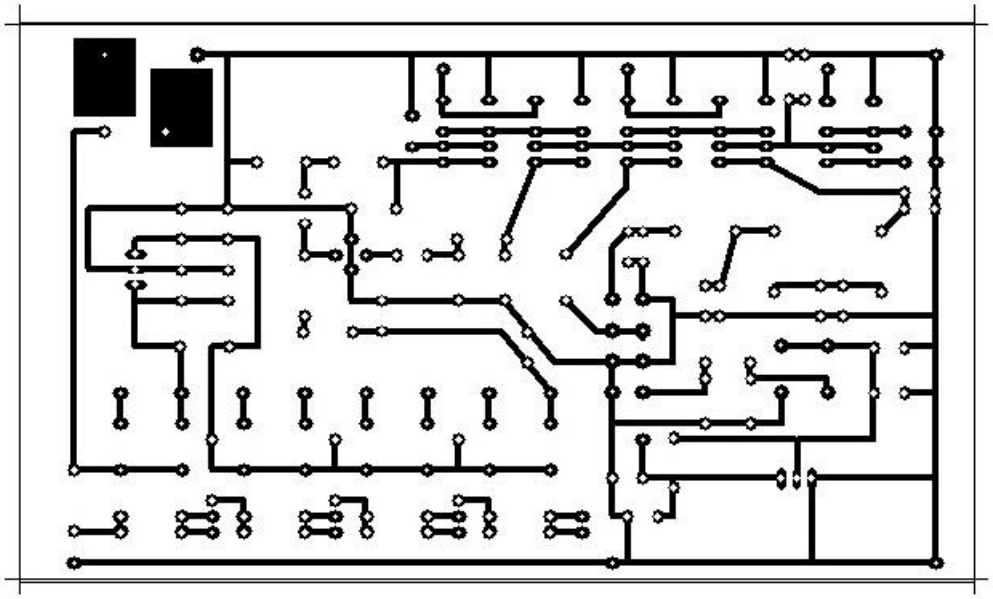
Unpopulated board



Silk Screen

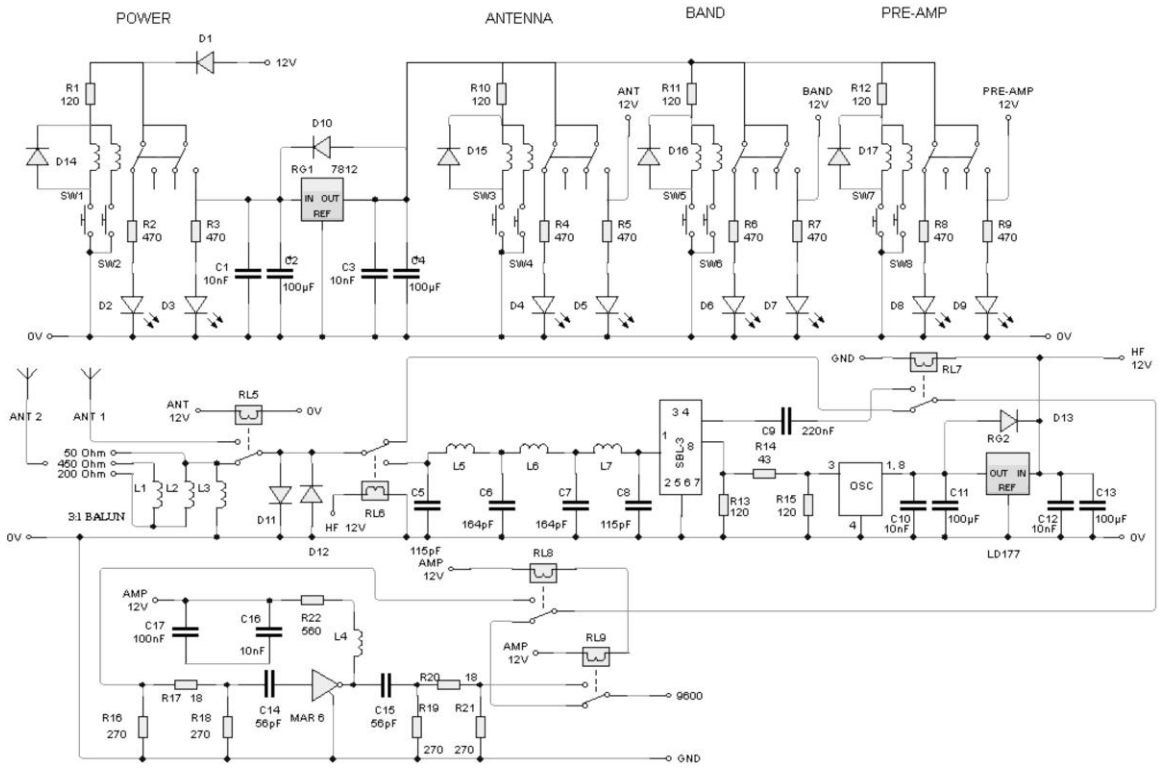


Component placement



PCB track pattern (Remember to mirror image if needed)

Please note the final PCB measures 6.2 by 3.6 inches, I have had reports that the images in my PDFs are not true size so scale accordingly.



Circuit diagram

Finally I apologise if this write up is not to my usual standard but I have had a major relapse in my health but I can still be contacted with any problems via either the Radio board or QRZ forums or by E-mail at n.strong@hotmail.co.uk. Please be patient for replies as I am not back to my normal self and won't be for quite a while.

Please only contact me via these routes if you have any questions, I can't guarantee to reply otherwise as I can't see every reference to my sets.

Enjoy the design 73 for now Nick G0CWA