A general coverage synthesised HF transceiver Part 2

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Perhaps it is a little ambiguous to refer to the 'receiver' because, in reality, there is much common circuitry between both transmit and receive modes. The IF board, block diagram Fig. 11 and schematic Fig. 13, acts as both an SSB generator and receiver at a spot frequency of 9MHz. It can be regarded therefore as a single channel crystal controlled SSB transceiver. The onboard Schottky ring mixer couples up to the synthesised local oscillator described last to transvert the signal onto the desired working frequency. But first, the preselector/preamplifier circuitry, the heart of any decent communications set.

Preselector

The incoming signal from the aerial changeover relay requires routing to the balanced mixer on the IF board via the preselector (**Fig. 9**) and possibly the pre-amplifier (**Fig. 10**) if it is too week for satisfactory reception without the pre-amp. The function of the preselector is to remove unwanted signals which fall within the image response of the main mixer (the Schottky ring on the IF board). I suspect that most people who read this will understand the term 'image response' but let's take nothing for granted.

Supposing you wish to receive a signal on exactly 7MHz, then the LO (local oscillator) will have to provide a frequency of 16MHz to provide an IF signal of 9MHz, the one frequency which the main transceiver board (**Fig. 11**) can accept. Why 16MHz? The mixing is always subtractive in this design so that 16MHz (LO frequency) — 7MHz (signal frequency) = 9MHz (IF frequency).

Unfortunately, the on board mixer will produce a 9MHz output (and hence a response from the receiver) whenever the difference between the frequency of the LO and an input signal is 9MHz. This 16MHz — 9MHz = 7MHz (the wanted signal) but 16MHz + 9MHz = 25MHz. Without the preselector, the receiver would be as sensitive at the image frequency as it is at the signal frequency. Thus the preselector filter allows through the wanted signal frequencies but blocks off image frequencies. As an aside, the ratio between receiver sensitivity at both signal and image frequencies is termed the image rejection ratio. If a set was quoted as having a rejection ratio of 80dB, then it would require an image signal of 10mV to produce the same output as a wanted signal of just 1uV. The design given here achieves at least this level of performance over the major proportion of its frequency coverage. When used in conjunction with a typical amateur aerial tuning unit (ATU) the rejection ratio approaches 100dB, a flawless performance.

Design

The design differs substantially from accepted practice in that it is lowpass rather than bandpass. I have a particular hatred of banks of tuned circuits, each requiring tuning and tracking adjustments over the frequencies of interest. Furthermore, this synthesised transceiver is a general coverage design and the typical sort of preselector circuit which tends to get published in lesser magazines just wouldn't do for this project. **Fig. 9** shows the circuit detail in all its elegant simplicity — three toroids and a twin gang tuning capacitor such as you will find in the junk box. L7 and C39, L8 and C40 are IF traps tuned to 9MHz series resonance. They are 10.7MHz IF transformers with the associated internal capacitors wired for series connection, together with a few extra turns added on the former to bring the resonant frequency down. RFC2 simply provides DC bypass to remove static voltages on the aerial system.

The operation of the preselector and the response for various settings of VC1 is best displayed graphically, **Fig. 13**. As the capacity reduces the preselector response transforms from lowpass with slight ripple, through an intermediate stage of wide bandpass to fairly narrow bandpass at minimum capacity.

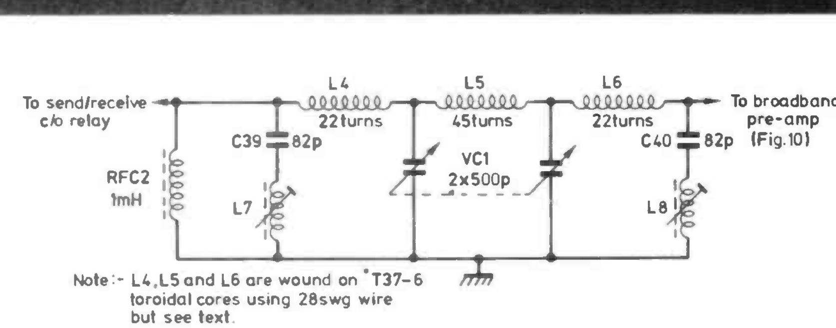

FIG.9. Preselector circuit.