ALL MODE TRANSCEIVER Part 3: Synthesised VFO

Part three of this major series concerns the PLL Synthesised VFO module, the Digital Frequency Display, and a receive only SSB adaptor. With these modules, OMEGA becomes a 10 band SSB/ CW receiver.
For all those who have built any of the G4CLF or G3ZVC designs, this VFO can be easily adapted to work with a 9MHz IF and provides an excellent companion unit. Details are given in the text.
In fact, most of the remaining OMEGA modules can be used with such 9MHz designs, filling the gap of published modules needed to turn them into complete Transceivers.

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Critical area

A VFO/LO system should possess a handful of obvious qualities. It should cover any/all bands, offer a stable reference source irrespective of the band in use and provide facilities such as IRT. In addition, it should deliver enough drive for use with modern high level mixing systems and — preferably one supposes — a digital readout of the operating frequency.

The average Japanese box offers all of these qualities. The average magazine design has some of them. Generally, though, the story ends there. The invisible, and therefore neglected, side of the coin is spectral purity. This is not just some idealistic goal for those who would blind others with science, it has real significance in the crowded conditions of the HF bands. There are two kinds of purity which the LO (local oscillator) circuitry should possess: minimal noise sidebands within a few kilohertz of the nominal carrier (or local oscillator) frequency, and insignificant spurious products several MHz out from the operating frequency.

The need for these stringent demands may perhaps not be immediately obvious. One may imagine that SSB/CW receiver selectivity is totally dependent on the crystal filter used in the IF strip. You shell out £24 or whatever and confidently expect that the crystal filter will provide the 90 or 100dB of selectivity specified by the manufacturer. Not so.

Reciprocal mixing

Say, for instance, that you are trying to copy a weak signal around the S1 mark. You want to hear it because it's exotic DX. At the same time, a broadcast station is operating 10kHz away (yes, we are talking abut 40m!) which, on tune, produces a signal of S9+40dB. Assuming that the receiver system incorporates all the latest buzz gimmicks such as a Schottky ring high level mixer and 10 poles of IF crystal filtering, you might reasonably expect to copy the DX. The chances are that you won't because the wanted signal will appear to be swamped with noise, even though the manufacturer may quote 100dB+ of dynamic range for his equipment.

What happens is this. The two signals may differ by 90dB in signal strength although the noise content of the LO signal may only be 60dB down on its on-channel output 10kHz away from its nominal frequency. This noise flank on the main LO signal mixes with the strong broadcast station to produce a random pattern of noise — in-channel — which could be up to 30dB stronger than the wanted DX. In this rather extreme example the