Postscript to 'Installing a 500KHz Crystal Calibrator Unit in an Eddystone S.940' – Gerry O'Hara, VE7GUH

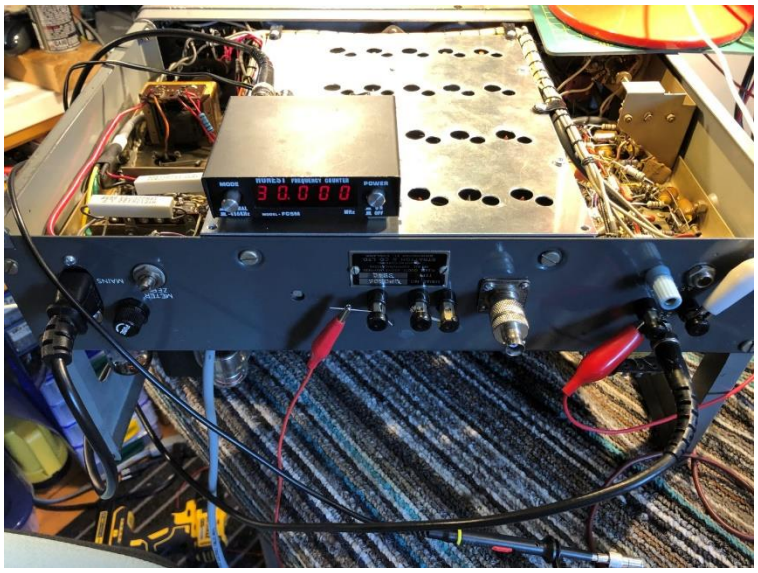
Back in April 2020, I installed a crystal calibrator unit (ex S.730/4) into my S.940. This works great and allows much-better confidence in tuning accuracy. I decided to leave the S.940 on the corner of my workbench as a daily 'listen to' receiver as a change from the usual Eddystone 1570/1 or my funky Drake MSR2, the latter sporting a rather cool amber Nixie tube readout, ok, ok, so its not an Eddystone...

What – more 'Junk'?

I have been working my way through storage boxes in my garage recently and came across a small box labelled 'Honest DFM Model FC5M' - a digital display for receivers. I recalled buying this from '[Mullard Magic](#)' in the UK several years ago – it dates from the late-1970's and is a neat self-contained DFM unit meant to be used to provide a digital frequency readout to an analogue radio with a 'standard' IF frequency of 455KHz. It has two inputs: one reading the actual input frequency and the other subtracting 455KHz from the input frequency and hence providing direct readout of the tuned frequency of a set with a 455KHz IF tracking high of the signal frequency. I had tested the unit when it arrived from the UK, but had never got around to fitting the unit to a radio. It occurred to me that as my S.940 has a nominal IF of 455KHz (not the 450KHz as standard, as I used a 455KHz crystal for the crystal filter), it may be a good candidate to try this out on.

Experiments with the S.940 and the DFM

The 'Honest' DFM needs an input signal of a few tens of mV for reliable operation. This is normally taken from the Local Oscillator, either directly or via a buffer amplifier. I opened up the S.940 and experimented by loosely-coupling the input of the DFM to the stator of the Local Oscillator section of the tuning gang with small capacitors (1pF – 50pF). This worked, but lower values, which 'pulled' the oscillator least, worked intermittently as the oscillator output varies considerably with frequency as does the efficiency of the coupling, and higher values of capacitor, while providing reliable operation of the DFM, pulled the oscillator frequency considerably, especially on the higher bands. Encouraged by these experiments, I decided to try to tap into the local oscillator signal at the input to the Mixer stage in the coilbox. The local oscillator signal is connected to grid 3 of the heptode section of the 6AJ7 (ECH81) Mixer via a 50pF tubular



ceramic capacitor passing through a hole in the coilbox wall between the Local Oscillator and Mixer compartments. It also couples to the grid of the (unused) triode section of the 6AJ7, the anode of which is grounded. I considered using the triode as a buffer for the oscillator feed to the DFM, but decided to first try simply connecting the DFM input to the Mixer side of the 50pF coupling capacitor, via a small value capacitor, as the signal level here is much stronger than on the tuning gang and is isolated from the Local Oscillator somewhat by the 50pF coupling capacitor. By trial and error, I found that a 3pF capacitor provided reliable operation of the DFM and hardly pulled the oscillator frequency at all, and only noticeable on Bands 1 and 2 – easily corrected by a slight tweak of the trimmers on those bands.

Installing the DFM

This S.940 already has an additional hole in the rear apron in the IF/AF compartment – filled by a blanking grommet. A BNC socket was installed in this hole and a length of miniature coax was connected to this and passed into the mixer compartment of the coilbox by threading it through the same hole as the coax lead from the Mixer anode to the first IF transformer passes through - so no additional holes needed to be drilled, thus passing my criteria of 'any mods must be easily reversible'. The miniature coax was run through the Mixer compartment alongside the larger coax (arrow on photo, above), its outer conductor grounded at the valve socket and the 3pF capacitor installed between its inner conductor and the 50pF coupling capacitor (arrow on photo, left). The DFM was then connected to the BNC socket with a short length of coax. The Local Oscillator was tweaked slightly to bring the dial alignment 'up to snuff' and hey-presto, I now have an S.940 with a digital readout. The DFM sits on top of the S.940 case and looks quite neat (photo, page 3 – set tuned to WWV on 10MHz.

Conclusion

The DFM reads around 1KHz out, as the actual IF of this S.940 is not exactly 455KHz, but is set to the actual crystal filter frequency, which is around 750Hz off this. However, this is not a problem in practice and the convenience of the DFM readout is very useful. Yes, I know, it makes fitting the crystal calibrator somewhat redundant, but having the calibrator fitted is still useful, as the DFM unit can be disconnected easily and used with another set (or as a regular DFM in the shack if needed), still leaving the S.940 with the calibrator to check frequency against. A brief demo video of the DFM in action with the S.940 can be viewed here.

I did contemplate providing the DC power for the DFM from the S.940 as well, eg, using the spare 6.3vAC tap on the power transformer. The DFM can operate from either 5vDC or 12vDC, so it is pretty flexible. However, in the end I opted for an external small 'wall wart' 5vDC supply as this would be more convenient if I used the DFM on another set in the future. I did install a couple of additional smoothing capacitors and a protection diode in the DFM as a precaution though, the latter as the DC connections on the DFM are just screw terminals and could be reversed by accident.

I also decided to replace all the remaining original resistors in the IF/AF compartment of the S.940 while I had the case off the set – photo, right, which also shows the location of the BNC socket for the DFM output signal (arrow).