Simple 80m VFO

By G8MNY (Updated May 09)
(8 Bit Graphics use code page 437 or 850)

This is based on the requirement to calibrate a VFO, as a radio practical task in the UK intermediate ham course (for 50W 2E Licences). The circuit I used is similar to the published design the RSGB course book. (but this one works 1st time with different Cap values & higher Q coil!)

VFO CIRCUIT

```
                                                ┌─────────┬─100Û──o +9V
                                     FET   d    │         │  R1
                            120pF    UC734 ├────┘    C6 ===
   ┌───────────┬─────────┬──────┤├──────┬──────────>│s    10n │
   │           │         │        C3    │      │    g├────────────)──1k───(o) Output
   │           │         │              │ 1n ===   - ┬ -       │  R2      │   BNC
   │           │         │              │  C4  │     │   │     │          │
 _ │      /\│ Pre-      │  Preset       │      ├─────)───┤     │          │
|\│150   === set     )│/\ L1         _│_     │     │   )     │          │
 === pF    │\ C2     )│  22    \_/ D1  === 1n   │   ) 1mH │          │
C1│\       │ 60pF  /)│ turns   ‾│Ge     │ C5   │   ) L2  │          │
   │           │         │              │      │     │   │     │          │
   └───────────┴─────────┴──────────────┴──────┴─────┴───┴─────┴──────────┤
                                                                         _│_
```

HOW IT WORKS
This is a Copitts oscillator type with a split capacitor C4 & C5 across L1 via capacitor C3. The split capacitor enables the FET amp to drive the circuit into oscillation (2x AC voltage on FET gate than on FET source).

As the oscillation builds up the Germanium diode D1 (1MÛ//silicon diode can be used instead) rectifies positive voltage to ground, thus producing a more & more negative gate voltage that reduces the FET's AC gain. This AGC action maintains a constant low distortion RF output level, independent of tuned circuit Q & loading. Feeding the output via R2 a 1k ensures the loading is always very small & can be fed directly to a transceiver for an S9+30-signal.

The frequency is set by the value of L1 in parallel with all the capacitors, approx 180pF from C1-C5 network. Capacitors C1 & C3 form a band spread so that just 3.5 - 3.8MHz is covered. Capacitor C2 limits the minimum tuning C, so it is used for setting the 3.8MHz scale position. L1 sets the main resonance & is very course, it is used for setting the 3.5MHz scale position. (An alternative to that is to make C3 a preset if a fixed coil is used).

CONSTRUCTION

```
                         C Trim (compression type)
  _________________________V___
 /      ||                ___  \      L1 Large 6mm type ferrite core
│       ||  _________  ,=[___]==│     inductor with 22 turns of thin
│       || │   C1    │/\   C2   │     enamelled copper wire wound on
│  PP3  || │ TUNING  │ │        │     & stuck down to the former with
│  BATT || │    @    │ │        │     heat glue. It is bolted to the tin.
│       || │_________│  \ _____Ì│
│       || C4  │_./'   ,/│______  < Trim
│ - - - || L2'C5____  C3    L1  Ì│ L Core
│    ┌R1───┴──────T-   \_        │        T      __n__   1  Case earth
│    │ -R2────────┴C6_ D1_       │      UC734   /1   2\  2  Drain
 \______________________________/      Bottom  │       │ 3  Source
     ││                                 View    \3___4/  4  Gate
     │_│BNC
```

I used a "tobacco tin" for the box, after finding I had a suitable C1 air spaced tuning capacitor that would just fit inside. Then I drilled all the holes for C1 mounting & its shaft. I found the lid (bottom) slightly fouled C1's bearing, so I dented the lid a bit to miss it.

Then I drilled holes for.. C2 trimmer access, L1 mounting & adjustment access & for the output BNC. When drilling with C1 mounted be careful.

A PCB/tin can barrier is put in to keep the 9V PP3 battery at one end.

With the "tobacco tin", the components can just be soldered in place where they will fit. I use heat glue to hold in place a insulation tube over R2, & to steady the connection of C3/C4/L1 on the body of L1 after testing!

TESTING
The circuit draws only 0.5mA when oscillating, but 5mA when it is not, so that is a good guide if you have no oscilloscope etc. Using a counter or a Rx, I found to get the required frequency bandspread, C3 had to be 120pF, you may find it different depending on the value C1 & other stay effects. If the frequency is too high with maximum L1 core in place, add some more turns, if too low remove some.

STABILITY
No attempt was made to improve the stability with..

1/ a more sold box
2/ power rail regulation
3/ output buffer amp
4/ temperature compensation

Even so with this simple oscillator, it is was easy to use it as a BFO with an AM Rx on 80m to resolve CW & SSB OK.

SPECTRUM
This is quite a clean oscillator for just 1 transistor, it's 2nd harmonic @ 7MHz was about -55dBc & higher ones weaker still.

STUDENT CALIBRATION PRACTICAL
For the course I needed to be able to remove paper dial scales per student, & have the L & C adjustment holes clearly marked up. So the tin was cleaned up with wire wool & spray painted so the sticky paper labels would stand out.

The dials scales were marked out on paper with 0 & 180° base line reference & about 10° from each end the scale was marked with the wanted 3.8 & 3.5MHz band ends (which ends are high & low depends on C1 construction). The 3.6 & 3.7 left off & copies then made for the students to use, a pair of sticky tabs (removable price labels) hold each scale in place for the practical.

```
          _.-""""""-._
       ./'     3.6   '\.
     /'3.7      |       '\
   .'   \    ___         `. Completed Students'
  .'      ./'  `\.       '.    Paper Scale
  |       /         \       |
 |       |           |       |
 | 3.8_ |             | _3.5 |
|       |   Punched   |       |
|______|      (_)      |______|
|0°           hole        180°|
|_____________________________|
  TAB                     TAB
```

The students' task is to place the scale on the unit, put the knob on, aligning it to get the mechanical 0 & 180° range. Then adjust the L1 & C2 (use ferrous & non ferrous tools to show the effects) to get the oscillator matched to the 3.5 & 3.8MHz scale, (too & through tests with a pre-calibrated Rx via attenuator) then once those are accurately set up, mark off 3.6 & 3.7MHz positions on the scale.

For the students to see what was possible, I made a paper label with clear protective cover, scale marked at each 10kHz.

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73 De John, G8MNY @ GB7CIP