

OPTICAL BEACON SOURCE

This beacon source uses a PIC configured as a simple DDS to generate a two-tone subcarrier which is applied to an open loop temperature compensated current-source driver for a 3W LED run at typically 600 – 800mA. A switch mode regulator has been included to improve overall efficiency. The voltage out from this can be increased for more series LEDs by inserting a resistor in series with the feedback to pin 6.

LED current is defined by a TL431 2.5V reference with two IN914 diodes thermally linked to the Darlington driver transistor to provide temperature compensation. This open loop design is much faster than a closed loop op-amp current source and has been tested at a modulation frequency of 1 MHz using the (obsolete) BDX42 shown, and shows promise of going much faster-still.

The PIC code for the DDS function was described in *Design Notes*, RadCom April 2011, and a modified version of that is used here. The frequency generated alternates between two values every 0.2 seconds. The PIC code (OPT_SC_BCN.ASM and .HEX) is contained in OPT_SCBCN.ZIP and as supplied, when used with a 19.6608MHz oscillator crystal, generates subcarrier tones that alternate between 25000 and 24800Hz (200Hz FSK) every 0.2 seconds to provide a characteristic signal for listening off air. There is very little filtering of DDS alias and spuri, because these don't matter! The alias product which for 25kHz generated as shown falls at 51.8kHz is more than 10dB down on the wanted component, which is sufficient to not abstract significant power from the main signal; all other spuri are < -20dBc.

Calculating the values for frequency and repetition rate

The tone frequencies and rate of their switching can be changed by altering the values in the PIC .ASM file and reassembling. Values are calculated as follows :

DDS clock, $F_{clk} = F_{xtal} / 256$ (for a 19.6608MHz crystal this gives $F_{clk} = 76800\text{Hz}$)

Then calculate $N = F_{out} / F_{clk} * 2^{32}$

Convert to Hex and insert as four bytes into the beginning part of the .ASM as shown below, after the " *FREQ de* " statement. Then do the same for the second tone

The repetition rate, T seconds, is defined in units of F_{clk} calculated above.

Calculate $M = T * F_{clk}$ Convert to hex and store as two bytes REP1 and REP0 as shown.

Worked Example :

$F_{xtal} = 19.6608\text{MHz}$.. $F_{clk} = F_{xtal} / 256 = 76800\text{Hz}$

Wanted tone 25000Hz

$N = 25000 / 76800 * 2^{32} = 1398101333$

Convert to hex = 0x53555555

Save as 4 bytes **0x53, 0x 55, 0x55, 0x55**

0.2s alternating:

$M = 0.2 * 76800 = 15360$

convert to high and low bytes = $60 * 256 + 0$

Save these in REP1 and REP0

Assemble the File and programme the PIC

Part of **Opt_SC_Bcn.asm** PIC code source file listing

```

                                     | | | | |
                                     | | | | |
FREQ de    0x53, 0x55, 0x55, 0x55    ;25kHz based on 76.8kHz clock
de         0x52, 0xAA, 0xAA, 0xAB    ;24.8kHz

                                     | | | | |
                                     | | | | |

REP1 =     d'60' ;Gives 0.2 second intervals
REP0 =     0    ; the format d'60' indicates it is stored as a decimal number

                                     | | | | |
                                     | | | | |
```

