



Elcom CDFSL Synthesisers by Roger Ray G8CUB

**Local Oscillators for 10GHz upwards
9936 MHz, 10224 MHz, 12240 MHz etc.**

I purchased a pair of Elcom ILCDFSL-1295 synthesisers from 'art-in-part' on ebay. These were intended for a millimetre band project. However once I started looking at them, their potential use for 10 & 24GHz became apparent.

They use just a 12 and 8V supply, have a 10MHz reference and can be set to any frequency that is a multiple of 10/3 MHz. The ones purchased were described as new, they certainly had seals intact, and included a test report. On connecting the 12 & 8V supplies, the first unit came up on 12.6 GHz. The second unit for some reason was damp, when trying it, the supply currents fluctuated wildly, and there was no output. It was for this reason I unscrewed the multiple cover screws and dried it out. This was to prove the key to its use at 10GHz. Because while I was checking its operation, I discovered that the VCO was running at one fifth of the output frequency.

The normal output frequency range was 12.2 – 12.95 GHz. Would it be possible to use it on 4/5 frequency? A check with a calculator, showed that the sums worked. If set to 12420MHz, 4/5 frequency is 9936MHz (10368-432), if set to 12780MHz 4/5 frequency is 10224MHz (10368-144).

Initially I had not tried programming the unit, so I used the default 12.600GHz, and looked to see if I could get output at 10.080GHz. Internally there is some serious filtering to select the 5th harmonic of the VCO, so this would need re-tuning.

I tried the piece of ceramic 'trick' that I used on the Ceragon modules for 5.7GHz. With a little bit of size trimming, it worked more or less straight away!

The idea of using these modules came from the excellent article by Dave G4FRE WW2R. Dave had done the hard part in working out the programming, and then writing a PIC program that allows the frequency to be set.

I must admit I struggle with the digital stuff. This was one of the reasons that I was keen on the Alcatel synthesisers, that did not need any programming! My initial attempts to program a PIC went down the usual course for me, of being a failure. I bought a cheap JDM programmer from ebay. I then found that I could not use it with an USB / RS232 adaptor. When I eventually got an old PC with dedicated RS232 working, I found that the software did not work either. With advice from Dave, I got hold of a PIC Start + programmer, but that needed upgrading to work with the 12F675 PIC.

So what finally worked for me was the JDM programmer, a 1:1 RS232 lead, win pic programmer software, and MPLAB_IDE software to compile the hex code (both free on the web). Although later on I found the upgraded Pic Start + easier.

Now I could look at setting the frequency that I wanted. Following Dave's article, I set the frequency to 12.420 GHz. I edited the .asm program using Word Pad, putting in 37 260 (12,420 x 3). Programming the PIC gave the correct output frequency, then dropping on the pieces of ceramic, and moving them around with a trimming tool, I had 9936MHz at +12dBm output. The plots below show that both the close in and wideband spurious were very good.

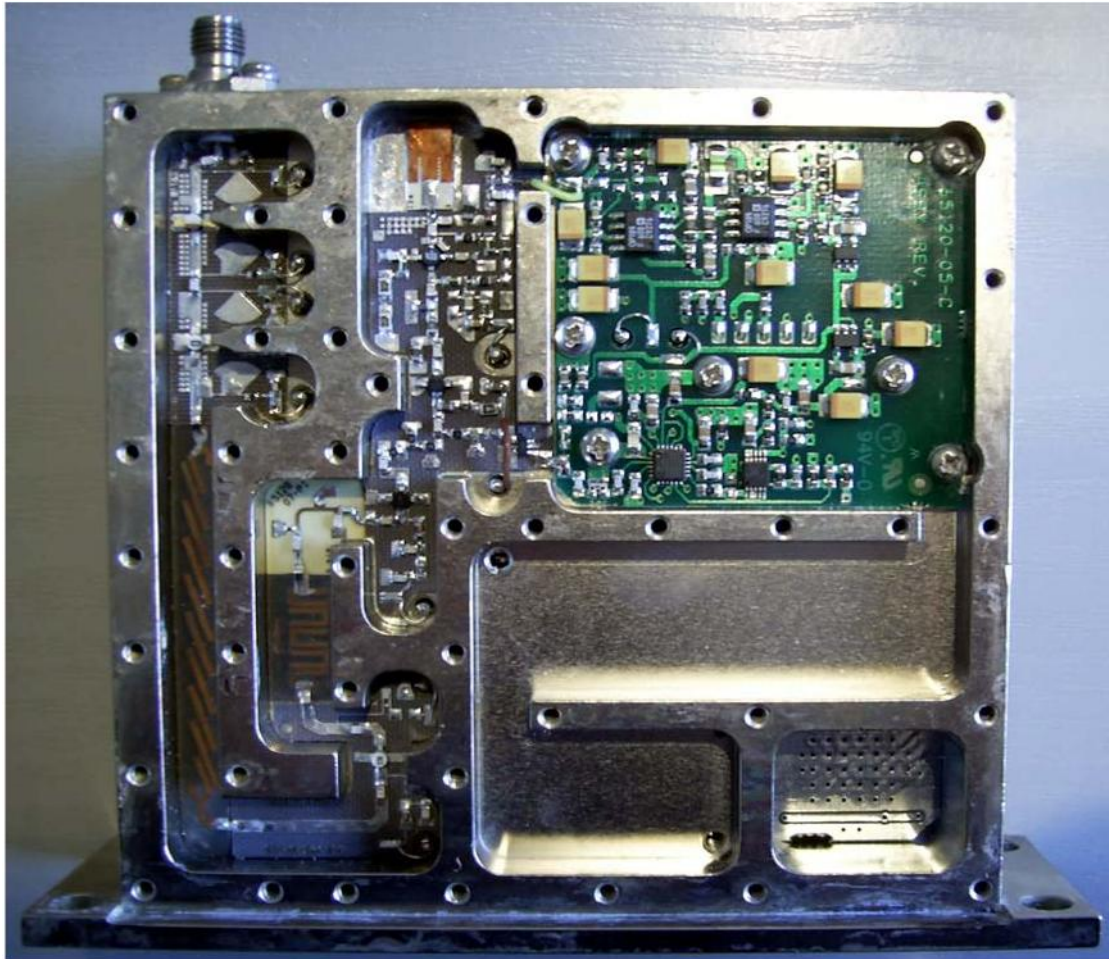
Using the KE5FX software to make a phase noise plot gave an excellent result, some 20dB better than the original Alcatel synthesiser, when compared at final frequency. The result of 81.6dB at 1kHz offset, would require >122dB at around 100MHz in a oscillator multiplier combination (phase noise increases 20dB/decade). The plot was taken using the internal 10MHz reference. Surprisingly this reference looks adequate for 10GHz use, once set on frequency! Although this was tricky, as it really needs a small square trimming tool. Frequency shift against time was measured as 1.2kHz for the first 30 minutes, and less than 100Hz over the next 2 hours. The addition of a miniature relay driven from one of the unused connector pins, would make a neat system to later add an external 10MHz / GPS locked reference if desired. Further operational use has shown the internal reference to be very good both noise and stability wise. It is useable after a minute or two warm up!

Supply requirements:

+8V 260mA typ. (+7V min.)

+12V 120mA typ. (+11V min. (+12V for optimum performance))

Pin-out is as per the references - 8 way in line Molex connector, or 15 pin D-type



RF side of the synthesiser showing the hairpin and stripline filters at the bottom left.

Some useful frequencies CDFSL-1201 (11.2 – 12.0GHz)

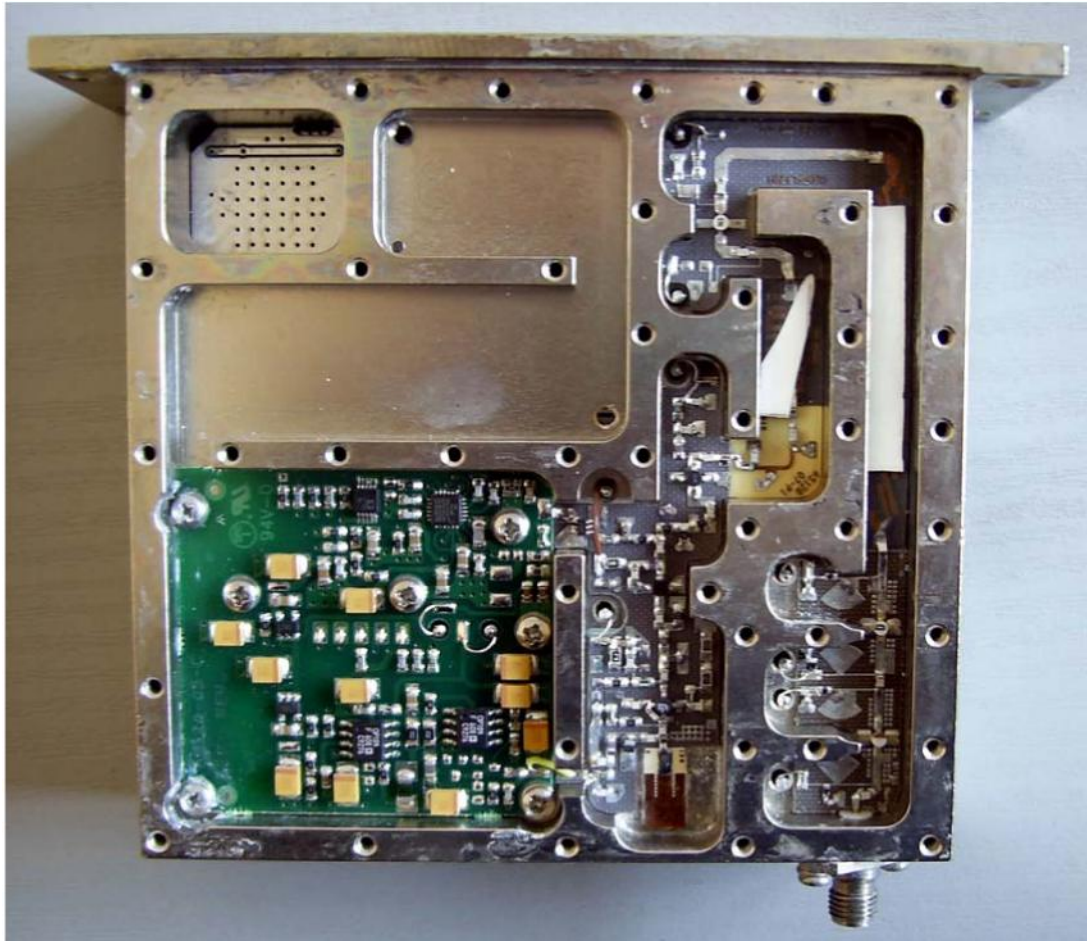
Frequency	Freq. set	Modify	Code (fx3)	Use
11880 MHz	11 880		35 640	47088+432 / 4

Some useful frequencies CDFSL-1295 (12.2 – 12.95GHz)

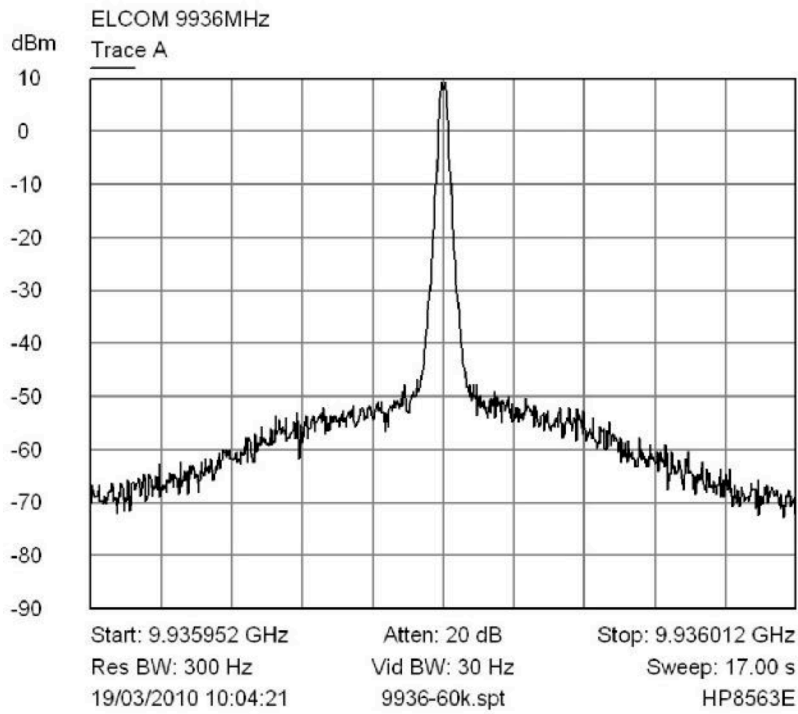
12240 MHz	12 240		36 720	24048+432 / 2
9936 MHz	12 420	x	37 260	10368 - 432
10224 MHz	12 780	x	38 340	10368 - 144



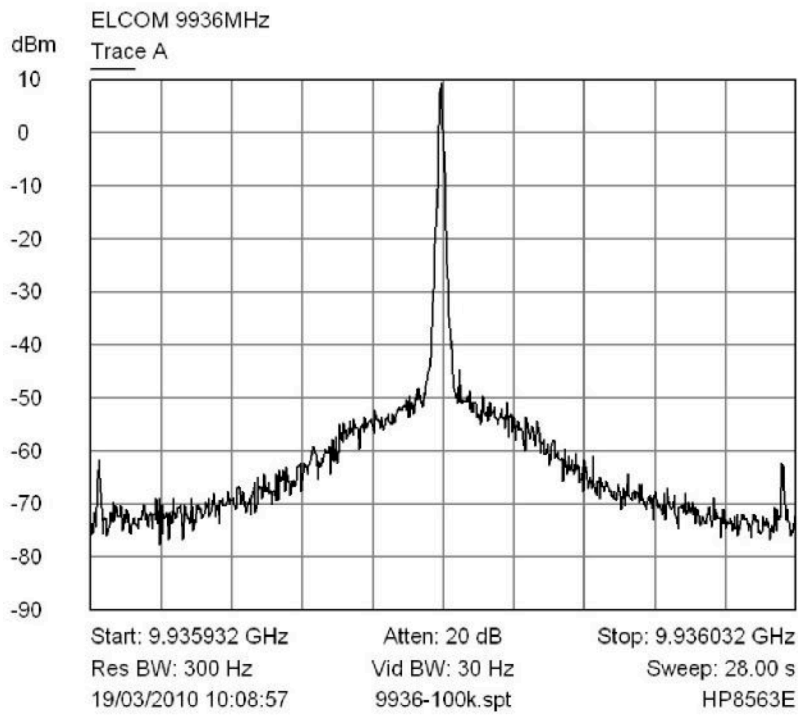
Reference / DC side of the synthesiser. The track at the extreme left of the reference TCXO upward carries the 10MHz signal. Connect into the capacitor at the top of the track when using an external 10MHz reference. Removing the +5V supply to the internal TCXO at the same time is probably a good move.



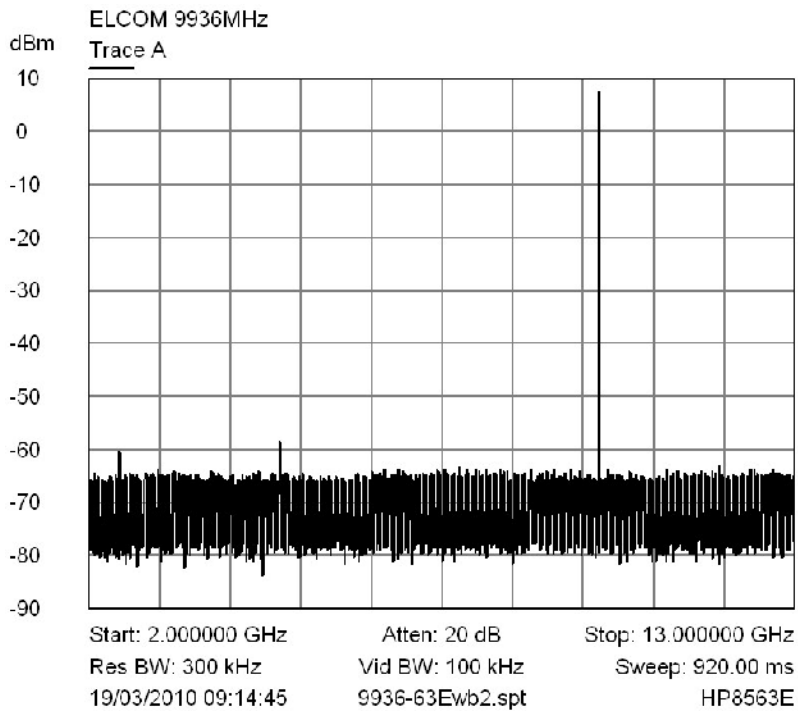
Modified RF side – ceramic in place on the filters. After this picture was taken, the ceramic was glued in place with araldite.



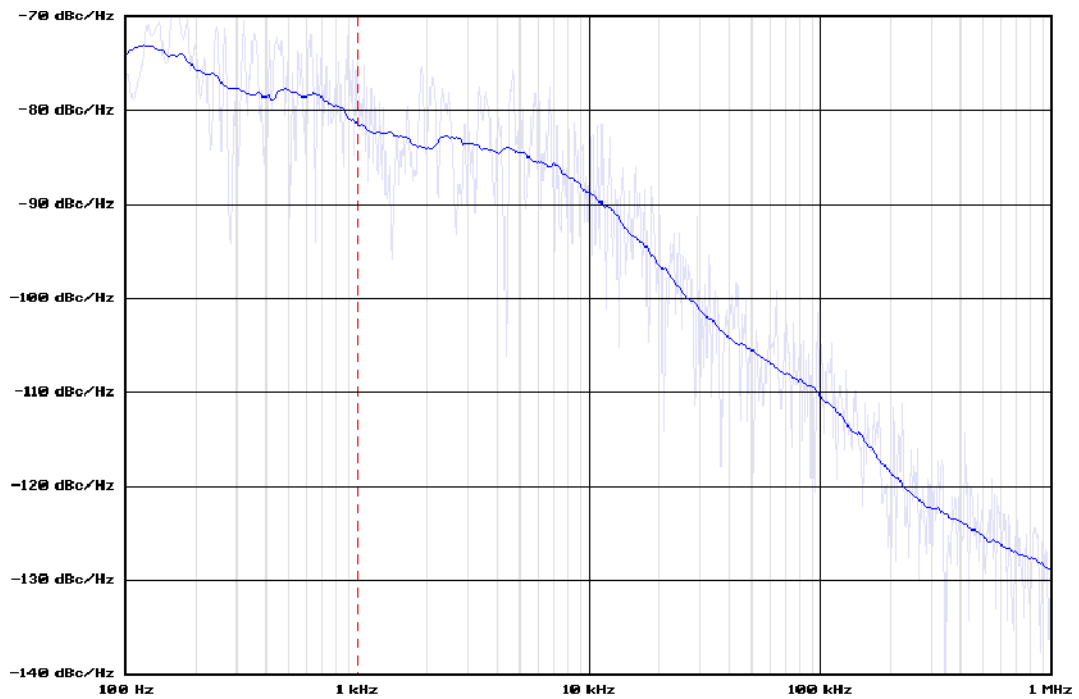
Spectrum Plot with 60kHz Span



Spectrum Plot with 100kHz Span



Wideband spectrum plot 2 – 13GHz



Trace	Carrier Hz	Carrier dBm	dBc/Hz at 1000 Hz	RF Atten dB	Instrument
ELCOM 9936MHz	9 936 003 900	10.00	-81.6	10	HP8563E

Phase Noise plot using KE5FX program

References:

<http://g4fre.com/dfs1201.htm>

Note: When using the older DFS 1201 or DFS 1301 units, the regulated supply should be 6.0V not 8.0V. Also the programming on the 1301 is x2, ie 5MHz steps!