How to set up the SDR-Kits 2-Port Precision GPSDO External Reference Clock with the DG8SAQ VNWA Vector Network Analyzer

Some VNWA owners would like to use the 2-Port SDR-Kits Precision GPSDO (Mfg by Leo Bodnar Ltd) as an External Reference Clock instead of the Internal VNWA TCXO when taking VNWA Measurements.

When does it make sense to use an External High accuracy Reference Clock?

Whilst the Internal VNWA clock is more than sufficient for normal VNWA measurements above 100 MHz, it makes sense to use the SDR-Kits Precision GPSDO Reference clock (or any other high accuracy clock) instead of the Internal VNWA clock for the following measurement scenarios:

- GPSDO clock is mandatory for **high precision frequency measurements**. Please refer the Document How to properly set the VNWA for use of the VNWA Frequency meter by Kurt Poulsen OZ7OU

- The GPSDO clock is advantageous when measuring **high Q devices** like crystals or crystal filters. In this case it is advised to use low clock frequencies/low clock multipliers (not auto multipliers) for increased frequency resolution. The frequency resolution is Fclock*Multiplier/2^32.

Configuring the VNWA for use with the GPSDO External Reference Oscillator

1. Run the VNWA Application and configure the USB Codecs as normal (Setup – Audio Settings

2. Connect the GPSDO and VNWA each to an unused USB Port, capable of sourcing 500mA from a PC

3. Connect the GPSDO to the External Reference SMA connector on the rear panel of the VNWA with a RG223 Double Screened Cable fitted with a BNC Plug and a SMA Plug. A suitable cable is available from SDR-Kits.
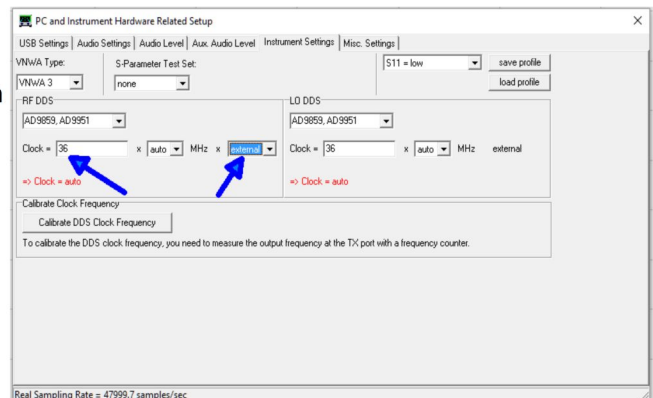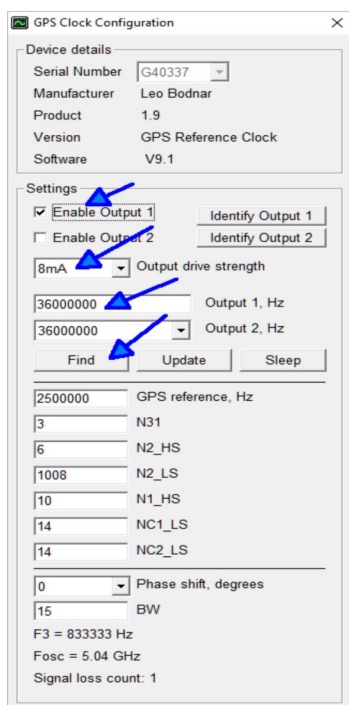

4. Select the Tab **Instrument Settings** and change the Clock source to **external**. Change the Clock from 12 to **36** MHz as shown in fig 1.

5. Run the Leo Bodnar GPSDO Clock Configuration Application and change the settings as shown in fig 2 on the left.

6. Press **Find** and the GPSDO should find the correct PLL settings typically within 10-20 seconds. Once PLL lock has been obtained the Red LED on the GPSDO will be lit continuously.

7. The VNWA is now ready to take measurements using GPSO external reference Source.

8. Measurements results should be similar compared to the built-in TCXO . The picture in fig 3 below shows a typical commissioning measurement taken with the external GPSDO as clock source compared to the same measurements those taken with the Internal 12 MHz TCXO (Mem1 and Mem2).

Switching from GPSDO External Clocking back to VNWA Internal Clock:

1. Select the **Instrument Settings** Tab and change the Clock source from **external** to **x3** or to **auto**. Change the Clock field shown in fig from **36 to 12 MHz.**

2. In GPSDO Clock Configuration Menu untick the box **Enable output 1** to avoid the GPSDO Reference Clock interfering with the VNWA internal Clock.

3. Optionally remove the RG223 Cable from the VNWA.
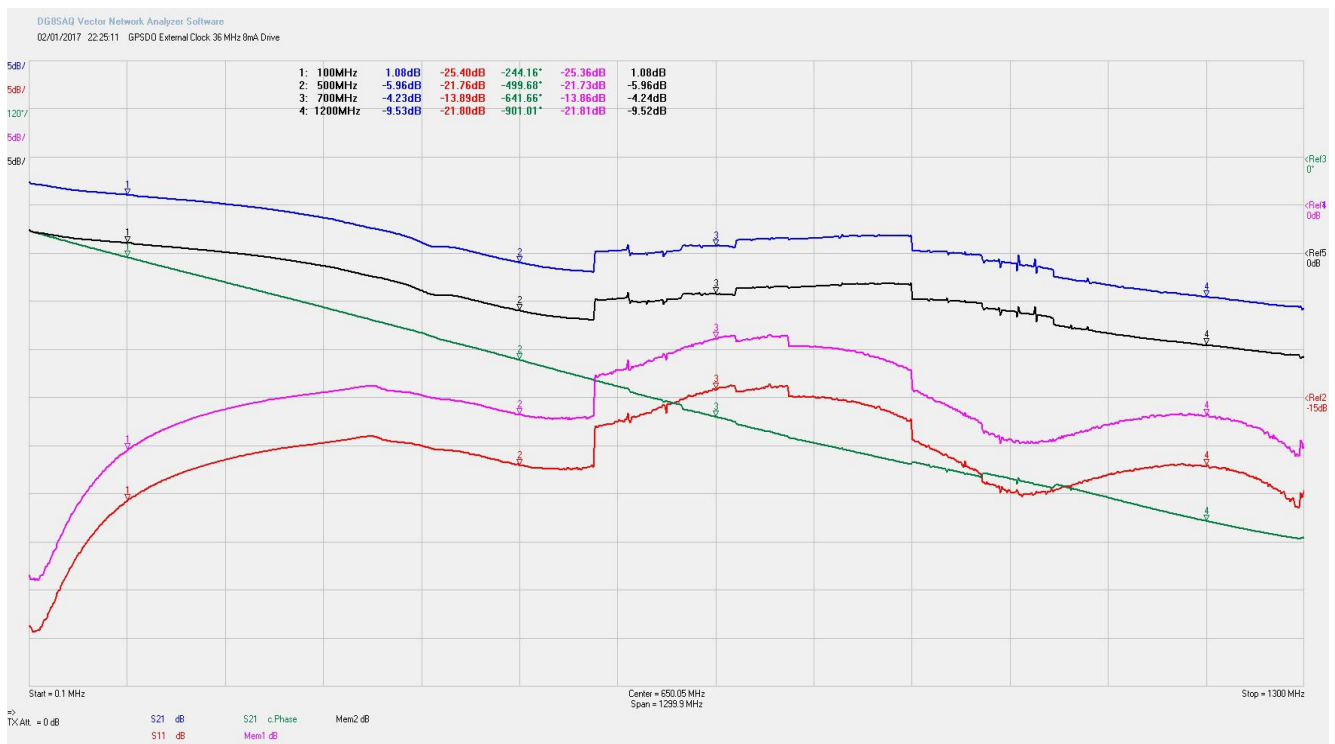
Measurements taken with the External GPSDO clock should be similar compared to the built-in TCXO with the Pre-multiplier set to x3 . Fig 3 typically shows Commissioning test results taken with the external GPSDO as clock source against those taken with the Internal 12 MHz TCXO.
Trace 1: Blue S21 and Trace 2: Red - S11 measurements taken with GPSDO as External 36 MHz Reference Clock set to level of (**8mA**)
Trace 4: Pink S11 Mem 1 and Trace 5: Black S21 Mem 2 were taken using the 12 MHz Internal TCXO clock with pre-multiplier set to x3 (=36 MHz). Not shown is that the S21 noiselevel are similar within a few dBs.

Link to Leo Bodnar Confguration Software: http://www.leobodnar.com/shop/index.php?main_page=product_info&cPath=107&products_id=234&zenid=ecdc4c27692e1918c6d78bc28a4faa3c

Jan Verduyn SDR-Kits – Revision 1 Updated 20 April 2018