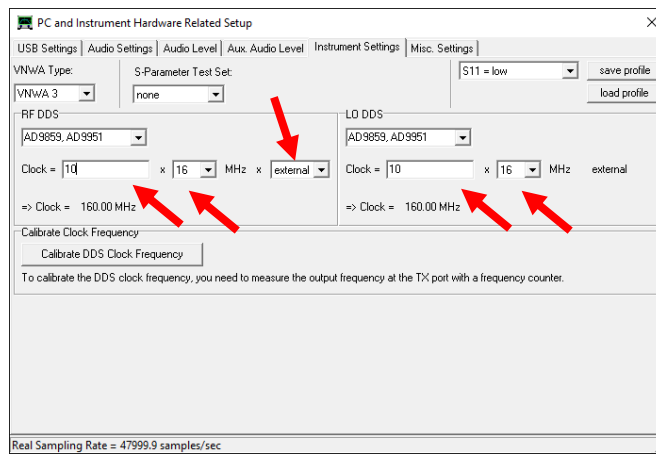


Preface:

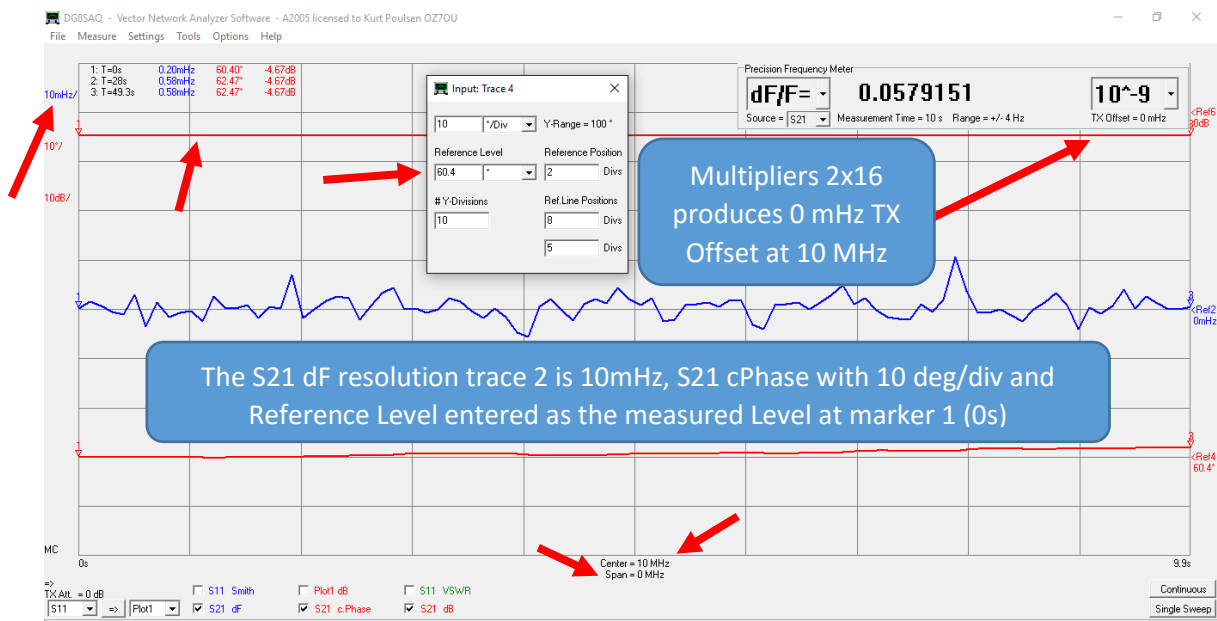
For optimum performance the VNWA frequency meter requires an external stable clock as reference signal of at least a magnitude better frequency accuracy that the device you want to measure. The Frequency meter can measure a frequency within a second to the utmost accuracy that no frequency counter can match. The resolution is down to uHz and accuracy only depend on the external reference input, which can have a level up to more than +20dBm and even +30 dBm has been tested. The only limitation is the frequency difference between the VNWA selected frequency at **0 span** and RX S21 the source to measure must not be more than about 4Hz. The frequency meter is not a frequency counter but a real frequency meter.

For proper operation the two DDS multipliers must be set to a suitable multiplication factor.

In the Options/Setup/Instrument settings below is a good starting point for measuring frequencies below 70MHz where the entry 10 MHz is for the external reference frequency and for both RF and LO DDS the multipliers are set to 16 which produces a clock of 160MHz. We must not approach half the clock as the chosen input frequency

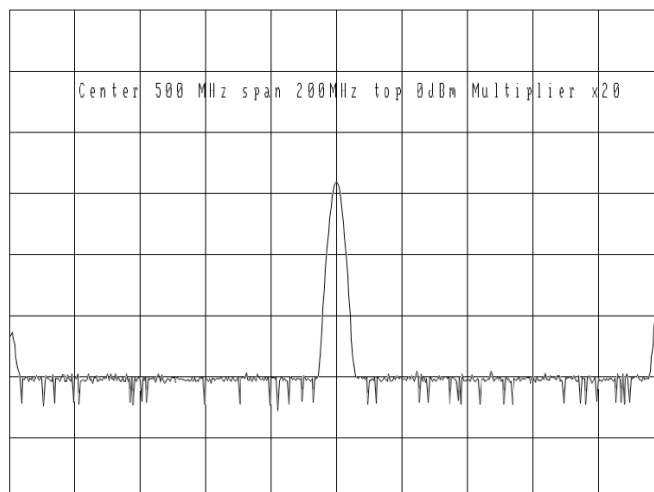
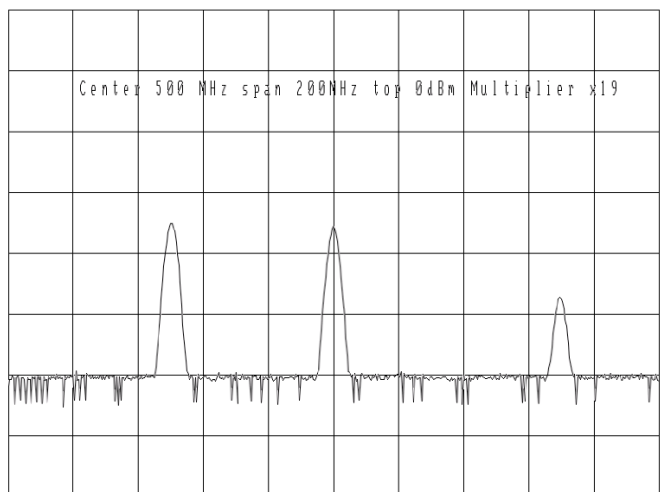
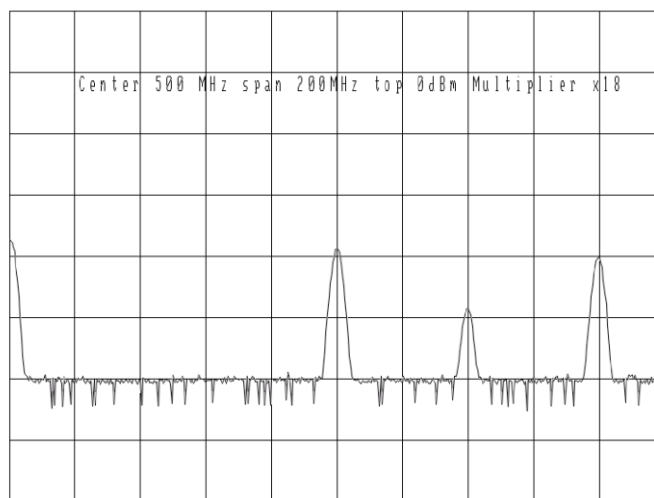
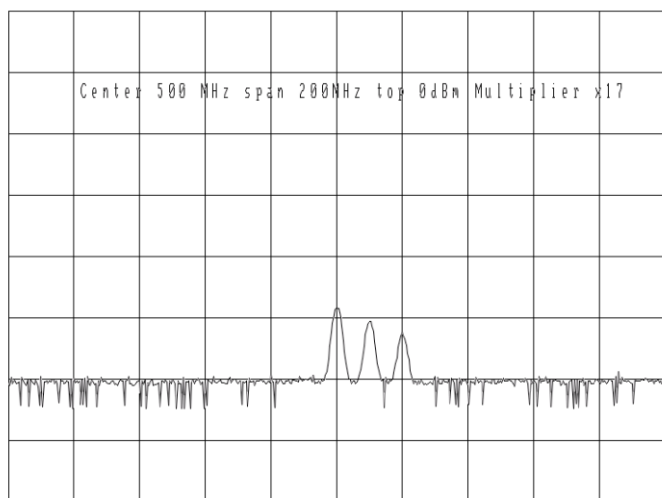
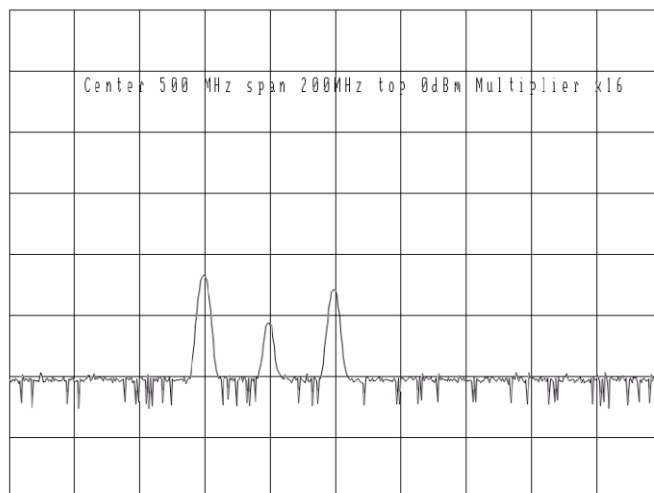


The signal to test is in this case a HP8664A signal generator with +6dBm level feed into the VNWA RX port via a 30dB SMA inline attenuator leaving a -24 dBm signal at the VNWA RX port. It is important to monitor the input S21 dB signal, such that it is a straight line and a proper level which displayed below as -4.67dBm with a reference level of 0dB at division 9 . Try to feed the VNWA TX port directly to the RX port and compare. The TX output is -17.1dBm and a suitable level for the RX port and as S21 thru is non calibrated it will only be close to the 0dB line. For a sweep of 100 100ms point a peak deviation is about 10mHz at 10MHz and average frequency measured to be close to 0.06 E-9 and less than 0.1 E-9 for a continuous sweep, but off course when the oscillator HP 8664 drift just 10mHz, which is its minimum frequency steps, that changes accordingly.



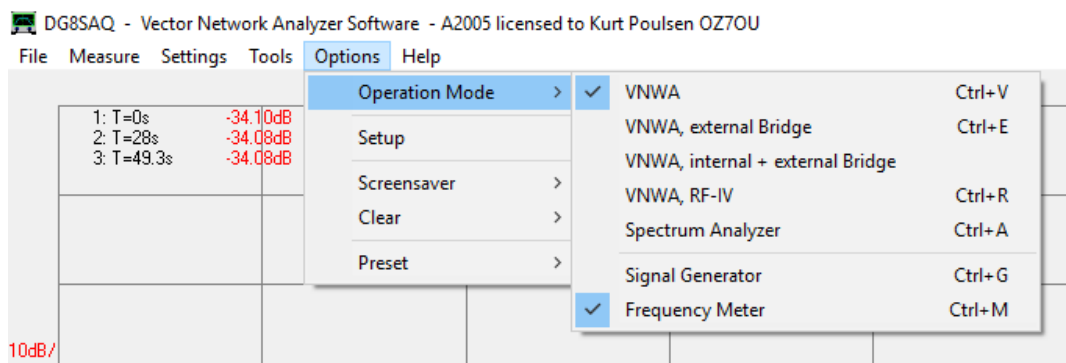
The DDS multiplier may very well be kept at 2x16 for frequencies up to 70MHz as at 80MHz an alias of same magnitude interferes. Just monitor the S21 dB level to be close to 0dB line, or change for other combinations of DDS Multipliers. At 500MHz below Spectrum Analyzer plot shows clearly the impact of the different settings. Below is explained the mechanism when to change the two DS multipliers and be careful not to reduce the inline attenuator in the RX port except when you know the exact levels not to be beyond -10dBm for linearity reasons. It is only the apparent level, which the S21 dB shows, because the internal DDS output for the mixer is reduced above 100MHz.

For these Spectrum Analyzer plot is clearly seen the effect of the multipliers settings for the center frequency of 500MHz These settings was for the RF DDS and measured at the output of the TX port.
 up to 70MHz use both RF and LO DDS multipliers as 16
 Between 70 and 90MHz use 20 for for both RF and LO
 Between 90 and 100MHz use 16 for both RF and LO
 Between 100 and 110MHz use 18 for both RF and LO
 Between 110 and 180MHz use 20 for both RF and LO
 Between 180 and 230MHz use 16 for both RF and LO
 Between 230 and 260MHz use 18 for both RF and LO
 Change for the various frequencies such that you find maximum S21 dB level by swapping the RF DDS between 16,18 and 20 avoid to get close to 50% of the LO clock frequency.
 Observe the TX offset might be a small mHz value

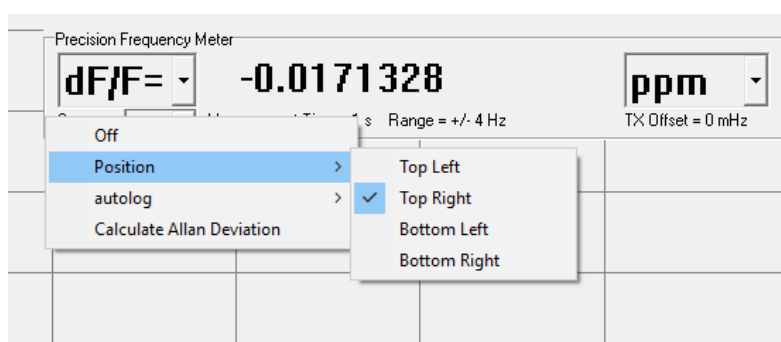


In above recommendation the multipliers was only even numbers. The odd number does work also but long ago Tom Baier recommended to use even numbers only.

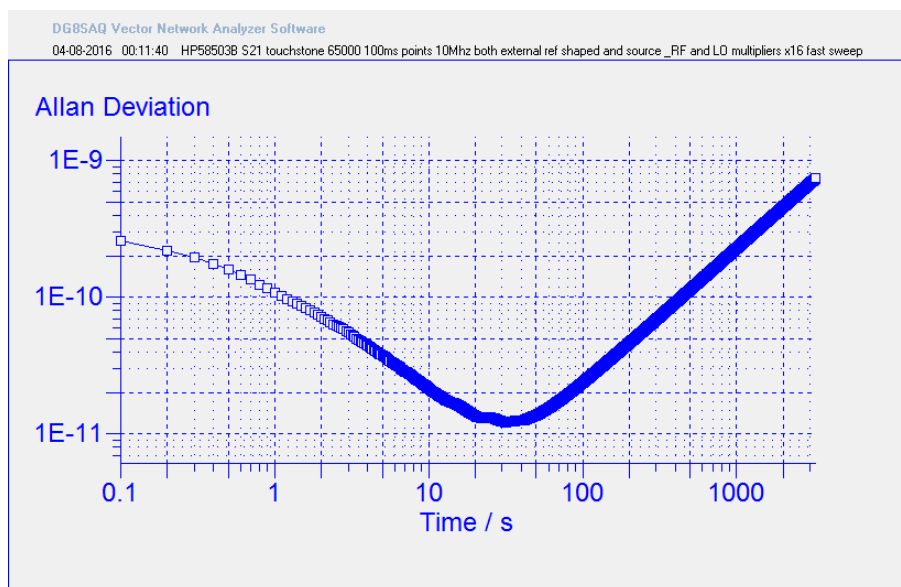
Selecting the frequency meter mode is done under Options/Operation mode



Position on the screen of the Frequency meter is selectable by a right click on the frequency meter window, as well to switch it off and enable autolog for long duration saving of continuous sweep and as well calculation of Allan deviation like shown below.



An example of an Allan deviation shown below for the HP8664A signal generator used in this report running 65000 100ms point at 10MHz with the HP58053B 10MHz GPS stabilized reference generator as external clock.



August 14 2016 Kurt Poulsen