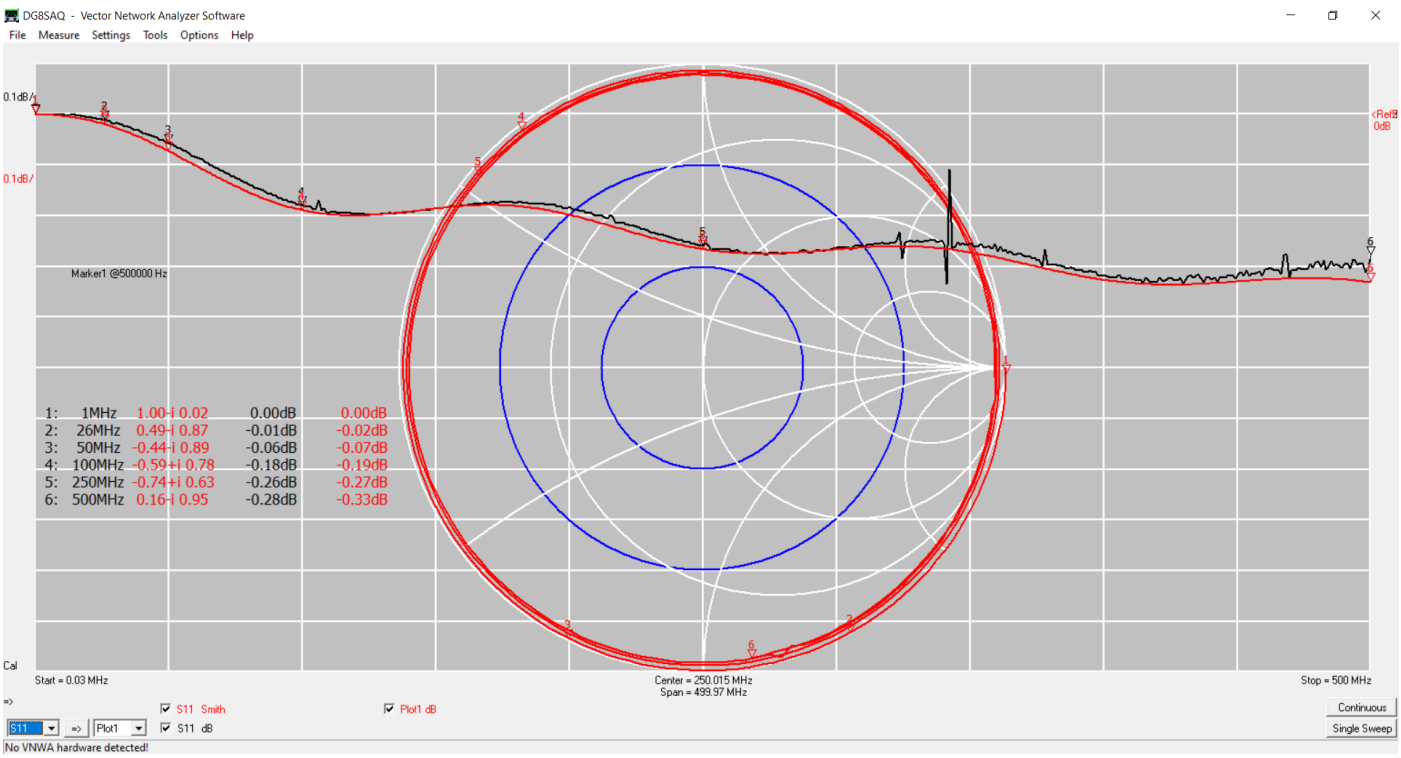
How To Test a Calibration using a Rigid line with known K factors

It is possible to test a calibration for any calibration kit by using a short rigid line and sweep it with the Smithchart enabled. As it runs along the circumference of the Smithchart it also means the return loss is close to zero so we also enable a trace with 0.1dB per division with reference position 1 lower that thee top, meaning for a standards setup at 9 division. The we see a oscillation trace with smaller amplitude as frequency increases.
On top of that we enable a plot trace also with 0.1dB/div at the same reference level as the sweep and load into the plot trace a s1p reference file for the line generated either by SimSmith or the VNWA using the Virtual VNA. Why a plot trace ?? simply because the plot trace is scalable so the number of points and frequency span for the s1p reference file is not important and will match the live sweep setting.
To generate such a s1p reference file you need to know the K factors the velocity factor and the Z0 for the line.
For my UT141A these are.
k0=0.2018 k1=0.3224 k2=0.763m or 763u VF=0.703 Z0=50
For how to produce such a reference s1p file see the document:
http://www.hamcom.dk/VNWA/How to top tune your SDR Kits male and female calibration kit of Rosenberger parts_rev2.pdf

Please note in this document the k factors differ from above as my UT141A line is no longer to purchase and then I used UT141A data from JYEBAO as well data for the RG402/U.

Below is seen how accurate such a test can be as I calibrated the VNWA from 0.03 to 500MHz with my 3.5mm HP85033C calibration kit directly at the Female SMA TX port and ran a sweep 52.1cm UT141A line. The length is from the male SMA calibration reference plane to the open end of the line. Above 500MHz a lot of noise is introduced as can be seen in the document I have provided a link for. The deviation about 0.01dB, although extremely small, can be explained by either the SMA male adaptor at the end of the line is not encountered for, as it produces a small loss or the k factors I found by using ZPlots might be a little incorrect. Still a super performance of the VNWA under the right and best possible condition.



28-07-2020 Kurt Poulsen