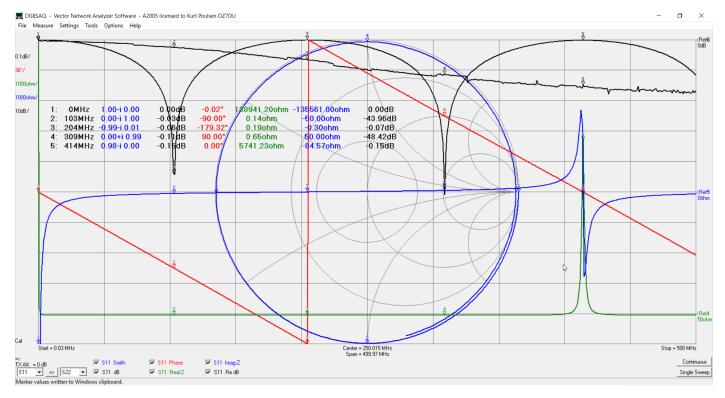
Test of the load from SDR-Kits BNC calibration kit compared to a calibration with HP 85033C calibration kit

and using a SMA female to BNC female adaptor.

The VNWA first calibrated with the SDR Kits male BNC using the supplied calibration kit file (direct download based on serial number). A SMA female to BNC female adaptor fitted to the VNWA. The same adaptor used later when the VNWA calibrated with the HP85033C SMA male kit.

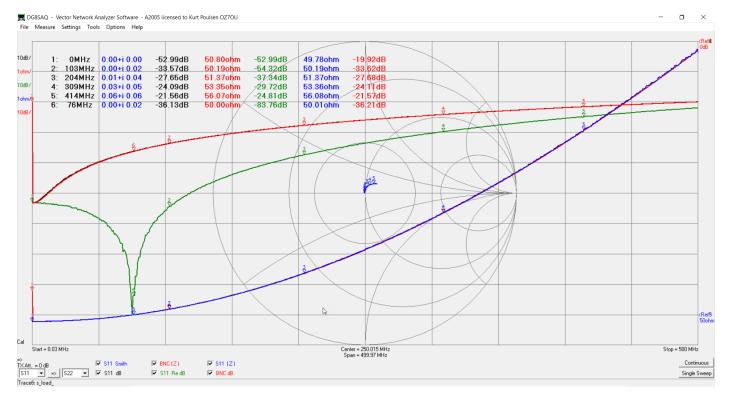
Below screen shot is a sweep of a 30cm long BNC semirigid cable after BNC calibration and observe a perfect trace along the circumference and the also observe the dB trace with 0.1 per division show a trace without oscillation, so a perfect calibration of short and open and for that matter also for the load calibration. Markers placed at short (West) and open (East) position and also for +j1 (North)and -j1 (South).



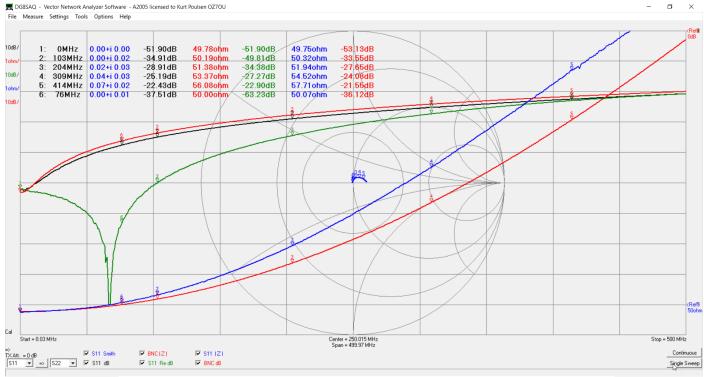
A custom trace generated to simulate the load with derived data from the slip attached to the supplied kit or picked from the calibration kit file (the simple model). In the next sreen dump this custom trace is named BNC and are trace 3 and 6 showing |Z| and dB

Enter Expression 5 for trace 3:												
Expression:												
z2s(Z	z2s(Zload)*exp(i*w*delay)											
Global Subexpressions (available in all expressions, subexpressions may use other subexpressions from above):												
Name	Alias	_	Expression									
Sub1 =	Zload	=	(49.78+i*w*(3.22*1e-9))									
Sub2 =	delay	=	-269.32e-12									
Sub3 =		=	1									
Sub4 =		=	1									
Sub5 =		=	1									
Sub6 =		=	1									
Sub7 =		=	1									
Sub8 =		=	1									
Sub9 =		=	1									
Aliases	:		,			Caption:						
S21 =		]	S11 =	S12 =	S22 =	BNC						
Mem1 =		1	Mem2 =	Mem3 =	Mem4 =	Mem5 =						
Mem6 =		1	Mem7 =	Mem8 =	Mem9 =	Mem10=						
[	k				Save	Load						

## The load measured after calibration and the measurement and model trace BNC are perfectly on top of each other

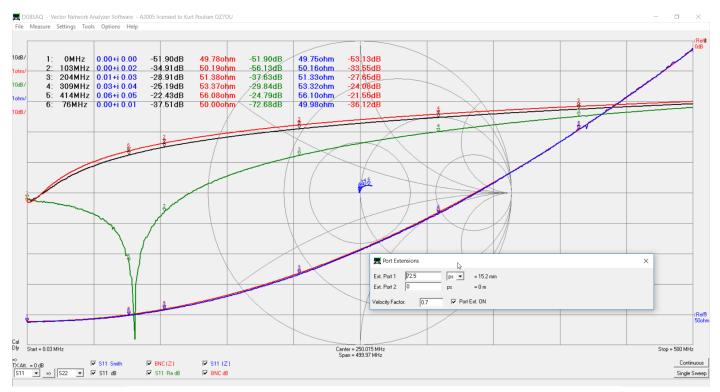


Next the VNWA is calibrated with the HP85033C female kit and the SMA female to BNC female adaptor fitted followed by a measurement of the male BNC load. The difference is due to impedance transformation and added delay in this adaptor. As seen the |Z| rises by 10hm at high frequencies.

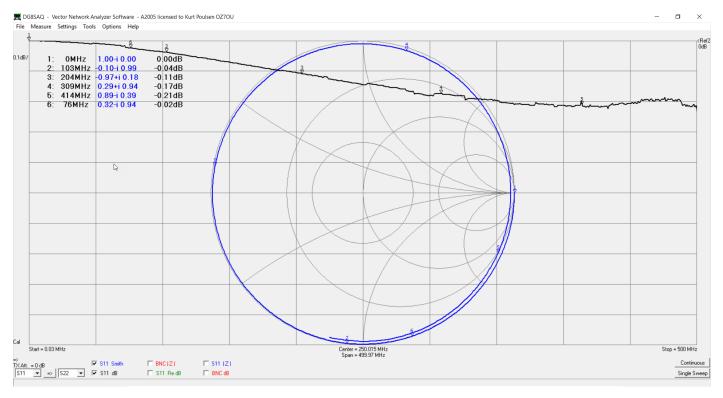


To investigate whether it is the delay or the characteristic impedance of the adaptor causing this problem we use the extension port delay.

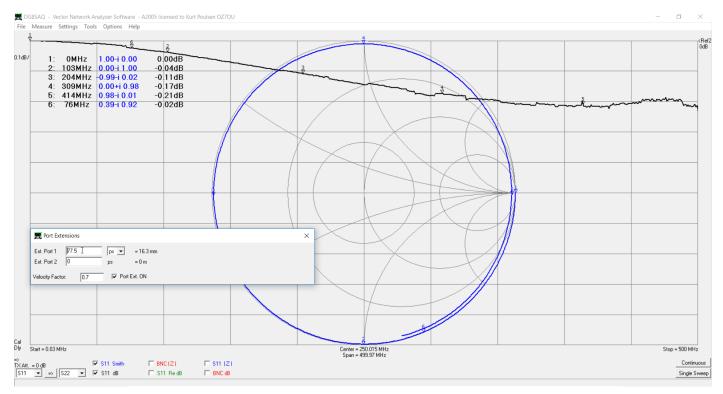
An extension port delay added so the two |Z| fits and thus the adaptor delay found to be 72.5ps. The dB trace does not fit exactly so some impedance transformation take place. Remember a port extension is based on ideal 50 ohm. Anyway the difference is minimal.



A repeated sweep of the same 30cm semirigid cable indicates "perfect" calibration but the marker positions are of course shifted due to the added delay and the loss is slightly increased from 0.17 to 0.2dB at 500MHz due to the presence of the SMA to BNC adaptor



Using the extension port delay to shift the markers back to original positions requires a delay of 77.5ps. This proves adaptors are troublesome and both added delay and impedance transformation take place as the adaptors do not have exactly 50 ohm impedance from input to output.



Next doing some VNWA Custom plotting. Go to next page

Using the VNWA Custom plotter to show the relationship between the S11 imag and real part of the load measured with SMA calibration and the SMA to BNC adaptor in comparison to the model

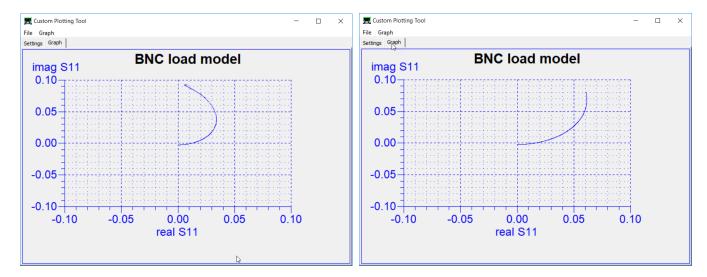
The measurement of the load saved into S11 and the S11 model loaded into MEM1

🛒 Custom Plotting Tool	_		$\times$							
File Graph										
Settings Graph										
_X-Axis										
x = imag(S11)	linear	-	-							
Caption = real S11	x-axis color =									
Numbers = fixed point  Fixed x-grid from -0.1 to 0.1	back color =									
Y-Axes										
z = a+j b = re(S11)										
Left = a Lin 💌 Caption = imag S11	left axis color =									
Numbers = fixed point  Fixed left grid from -0.1 to 0.1										
Right = b Off  Caption =	right axis color =									
Numbers = fixed point  Fixed right grid from 1 to 2	-		-							
,, ,										
General		_								
✓ draw data lines     line width = 1     ▼     title = BNC load model	title color =									
☐ draw data points ✓ draw grid										
draw guide line to left axis: $a(x) = 1-x$	guide line color =									
Compiler messages										
no Errors										

BNC load measurement plotter settings

BNC model plotter setting

Custom Plotting Tool	_		Х
File Graph Settings Graph			
rX-Axis			
x = mag(MEM1)	linear		•
	Juncon		
Caption = real S11	x-axis color =		
Numbers = fixed point V Fixed x-grid from -0.1 to 0.1	back color =		
,,		L	
TY-Axes			
z = a+j b = re(MEM1)			
Left = a Lin 💌 Caption = imag S11	left axis color =		
Numbers = fixed point V Fixed left grid from -0.1 to 0.1			
Right = b Off  Caption =	right axis color =		
Numbers = fixed point 💌 🔽 Fixed right grid from 1 to 2			
General			
	title color =		
I draw data lines line width = 1			_
✓   draw grid			
draw guide line to left axis: $a(x) = 1-x$	guide line color =		
Compiler messages			
no Errors			



This is a demonstration of two of many – many advanced facilities in the VNWA software. Any VNA owner will benefit from this totally free software to download from SDR Kits homepage.

7-12-2018 Kurt Poulsen