Make Your Own SMA Calibration Kit For a VNA

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Recently I jumped on the NanoVNA bandwagon and ordered one of my very own. It arrived with several cables and a small SMA calibration kit which included a male short, open, and load. In order to properly use the NanoVNA you need to perform a simple calibration for the desired frequency band using the provided components. As I performed calibrations I soon realized how easy it might be to lose one of those little SMA Pieces and with it the ability to make accurate measurements.

I started looking at the possibility of making some kind of inexpensive calibration kit where the short, open, and load where combined into one piece and where the size and shape would make it harder for me to lose. I found IN3OTDs web page, https://www.qsl.net/in3otd/electronics/VNA_calkit/calkit.html, with a lot very useful information on how to build an effective SMA short, open, and load. While Claudio did a great job I wanted to take his idea one step farther and try to package the three components together. So what you see in Figure-1 is my version of a homemade short, open load (SOL).

Figure-1, homemade VNA calibration kit

I decided to lay out a pc board for this project using ExpressPCB (www.expresspcb.com) as I've done on some past projects. The edge mount male SMA connectors were chosen to interface with the NanoVNA which has female SMA connectors on it. The total cost for the project was just under $30, refer to Table-1 for a list of the parts.

QTY	Part Number	Description
2	132366	Amphenol, RF Connector, End launch, Plug, for 0.062 PCB
2	754-RG3216P-1000-BT5	Susumu, Thin film resistor, ¼W, 100Ω, 0.1 % tol, SMD 1205, 25 ppm
1	N/A	PCB

Table-1, Parts list

Figure-2, Installation of the two resistors

The pc board was easy to assemble except for the two 1206 SMD resistors (See Figure-2). The prototype was tested using a Keysight E5061B network analyzer and 85052D calibration kit. Figure-3 shows a comparison between my homemade load and the original load that came with the NanoVNA. I was shocked to see how bad the original load that came with the NanoVNA really was.

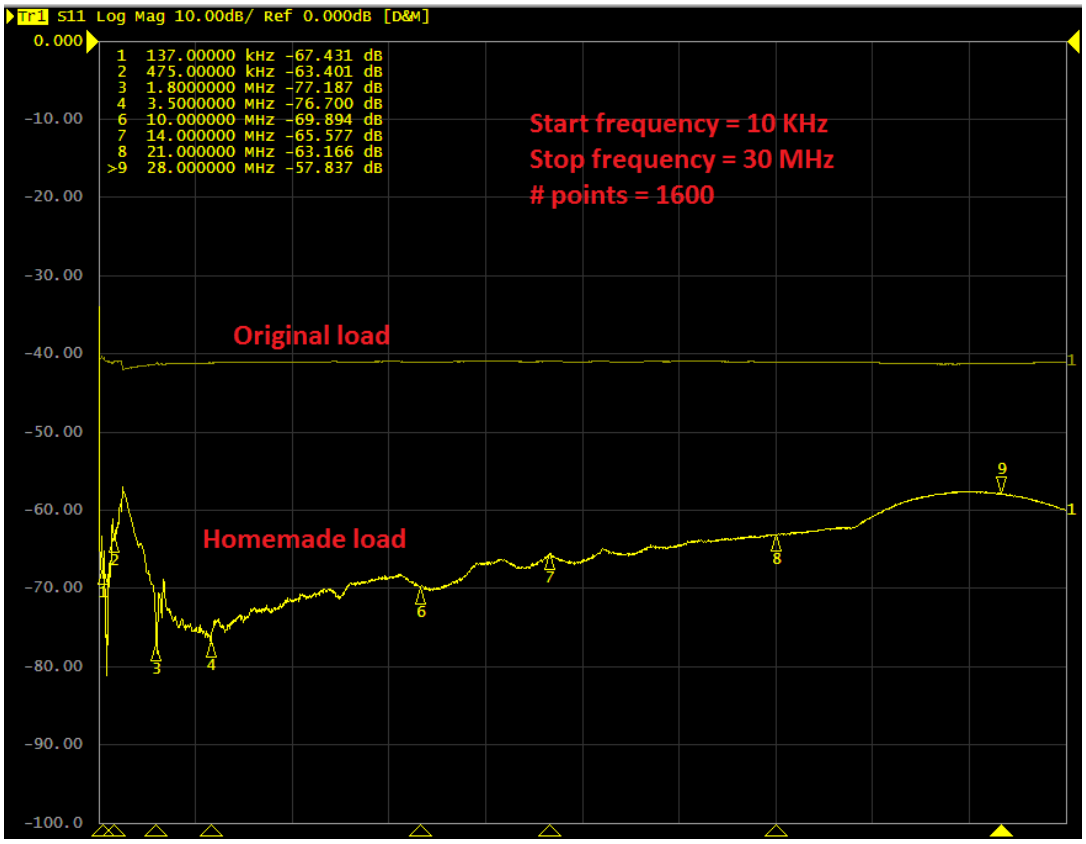

Figure-3, Homemade load Vs Original

I also compared the homemade load to the load found in the Keysight 85052D calibration kit and found very good correlation between the two up to about 300 MHz (refer to Figure 4A & 4B). I also tested my short comparing it to the short in the 85052D kit and found good correlation (refer to figure 5A & 5B). And while I did test my homemade open the results were identical to the open from the 85052D kit.

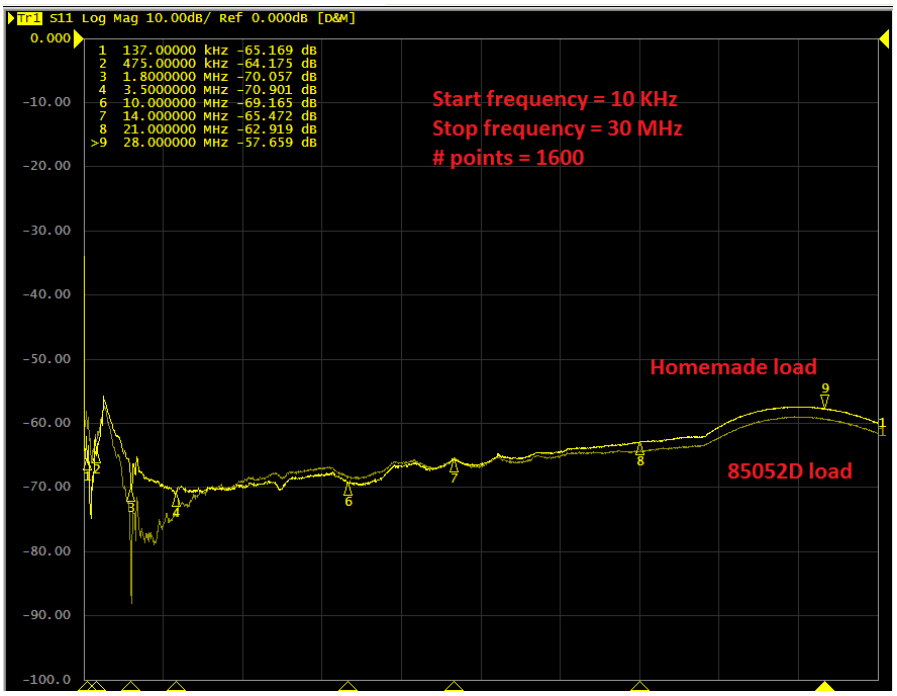

Figure-4A, Homemade load Vs 85052D load (10 KHz – 30 MHz)

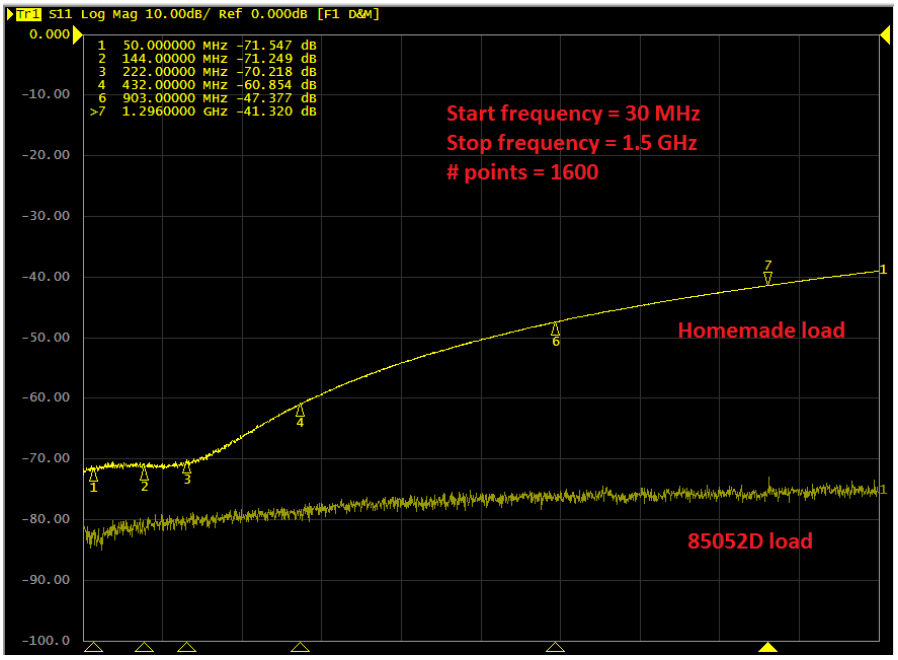

Figure-4B, Homemade load Vs 85052D load (30 MHz – 1.5 GHz)

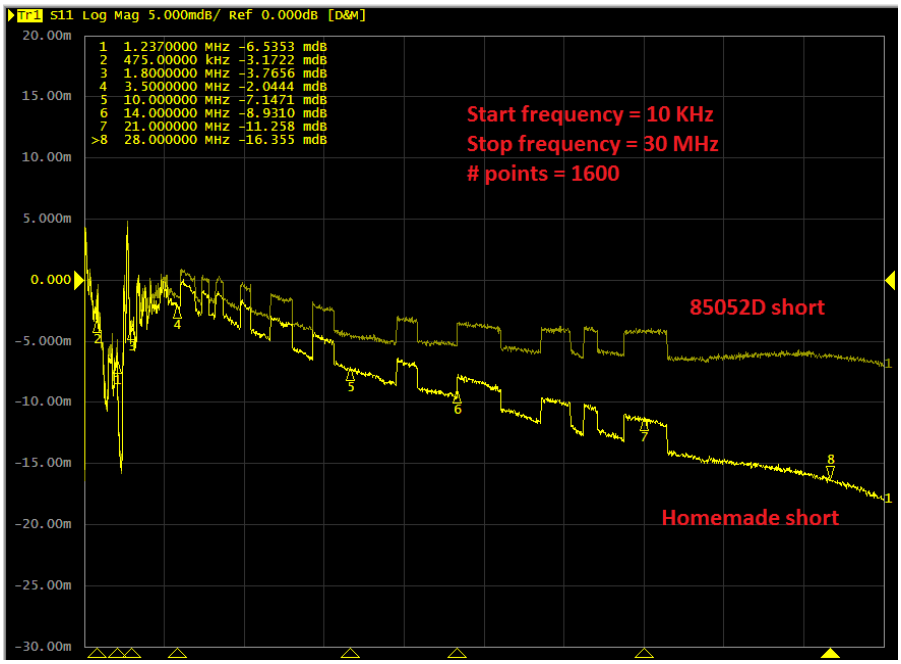

Figure-5A, Homemade short Vs 85052D short (10 KHz – 30 MHz)

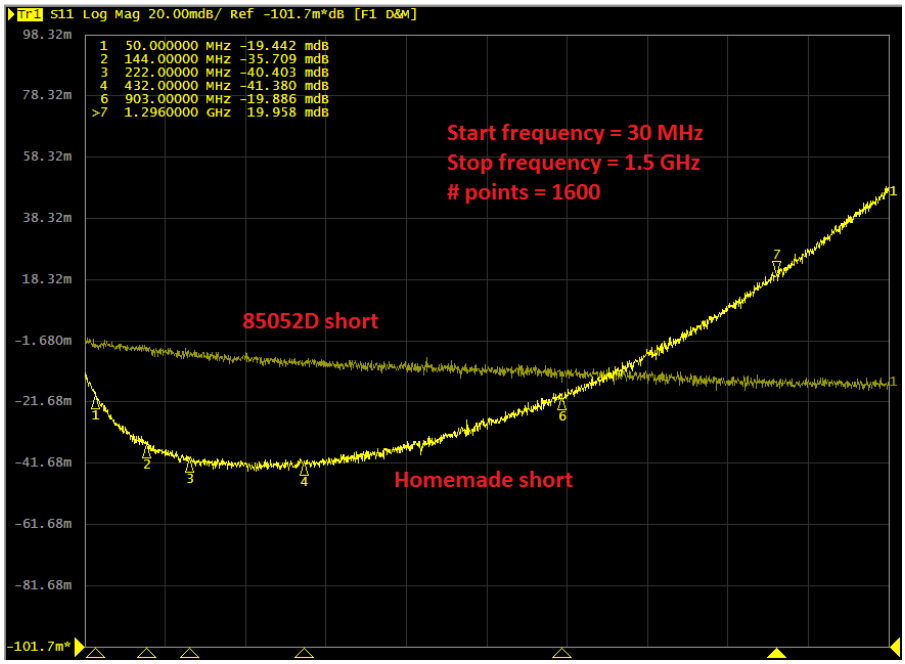

Figure-5B, Homemade short Vs 85052D short (30 MHz – 1.5 GHz)

So in conclusion it is possible to make you own homemade calibration kit that's both inexpensive and more difficult to lose then those traditional ones. And like I found your homemade calibration kit may be better than the one that came with your NanoVNA. If you interested in further information or a pc board to build your own feel free to contact me at n1sv@n1sv.com