RF Lab Module #3 — Vector Impedance Measurements 2

Stephen Campbell

***Abstract*—In this lab, familiarity with the nanoVNA was gained. Further experience with the Agilent vector network analyzer was acquired while several components were measured and characterized across a broad frequency range. Specifically, a 50 Ohm Load, an antenna, and an attenuator examined.**

I. Introduction

THIS lab required expertise regarding the operation of the nanoVNA handheld vector network analyzer. The nanoSaver software was used to save touchstone files (s1p, s2p) so that the measurements could be plotted on a host computer. After the Agilent VNA and nanoVNA were SOLT calibrated, each test component was physically connected, examined, measured, and analyzed.

II. Analysis

The S-parameters of the devices are plotted with and without calibration on the nanoVNA and Agilent VNA.

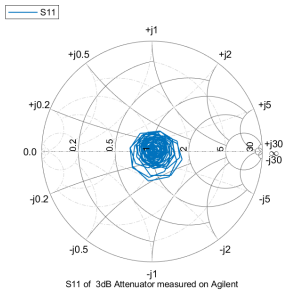

Fig. 1. $S_{1,1}$of 3dB attenuator measured on the Agilent VNA

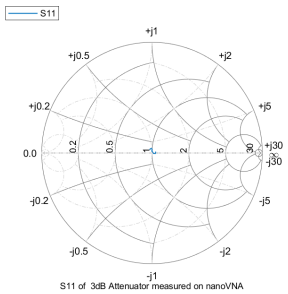

Fig. 2. $S_{1,1}$ of 3dB attenuator measured on the nanoVNA

Compare results between Agilent VNA and NanoVNA

The Agilent VNA and the NanoVNA had both had accurate results. In some measurements such as the load measurements, the Agilent was more precise and in some measurements such as the attenuator measurement the nanoVNA was more precise. This observation does not take into account the different frequency ranges that the Agilent and nanoVNA performed. Regardless of this note, the Agilent and nanoVNA show measurements which correspond to the theoretical values.

III. Discussion and Summary

A. Questions to Consider

Make some comments about the difference in calibrating the two VNAs and using them for measurements. Accuracy to your knowledge, ease of use, etc.

- **Calibration**
  The calibration of both instruments is straightforward and relatively easy to perform. One note is that the nanoVNA does not require the SOL on the second port which reduces the time required to calibrate it.
- **Accuracy and Capabilities**
  To my knowledge, the Agilent is not only more accurate than the nanoVNA, but it is also capable of performing accurate vector impedance measurements at a higher frequency.
- **Ease of Use**
  Because of the Agilent VNA is significantly heavier and larger than the nanoVNA, general handling of the nanoVNA is generally preferred. As far as interface easy of use, if both devices were connected and controlled by a laptop, there would not be a major distinction; however, because the Agilent requires a flash drive to more files the nanoVNA becomes considerably easier to use.

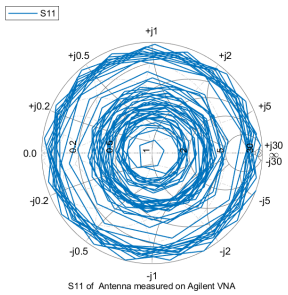

Fig. 3. $S_{1,1}$ of antenna measured on the Agilent VNA

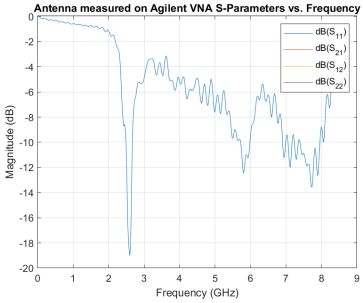

Fig. 4. $S_{1,1}$ of antenna measured on the Agilent VNA over frequency

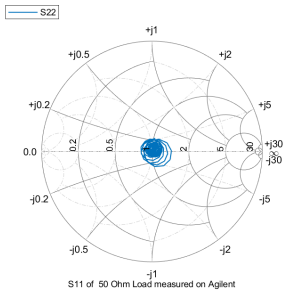

Fig. 5. $S_{1,1}$ of 50 Ω measured on the Agilent VNA

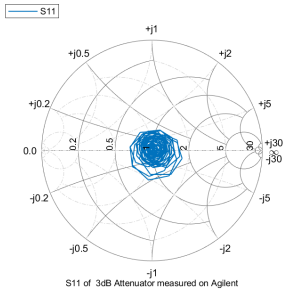

Fig. 6. $S_{1,1}$ of 50 Ω measured on the nanoVNA