

CReSIS Anechoic Chamber

FUNDED BY THE NATIONAL SCIENCE FOUNDATION (NSF)

chamber@ku.edu • chamber.ku.edu • 785.864.2185

The CReSIS Anechoic Chamber is located at:

The University of Kansas

M2SEC building

1536 W 15th St

Lawrence, KS 66045

S₁₁ Manual

S₁₁ measurements

(Please note that S₁₁ measurements may not need to be performed in the anechoic chamber)

1. To open **EMQuest**, right click on the "EMQuest EMQ-100 Pattern Measurement Software" shortcut on the desktop, and then click on "Run as administrator".
2. Click on "File" – "New" to create a new parameter (.prm) file.
3. Expand the drop-down menu under "**Test Information**" and select "Lite Response Measurement" under "Response Measurements". A list of submenus will now appear under "**Test Information**" as shown in Figure 1:

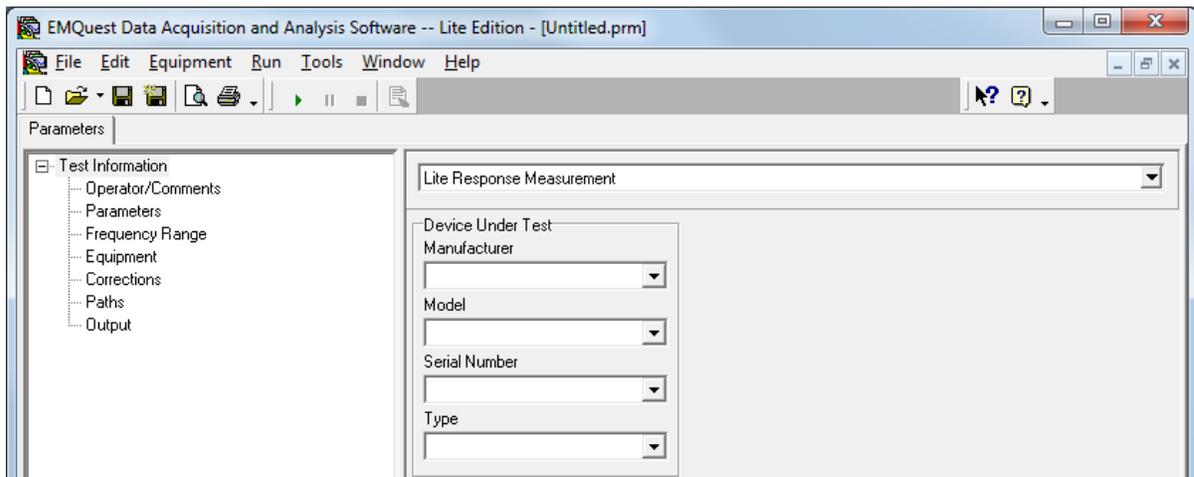


Figure 1. Test information menu tree.

4. Click on "**Operator/Comments**" and write your name in the **Operator** box. You may also use the **Comments** box to add additional notes (see Figure 2 below). It is advised that you include the date and time of your measurement for future reference (you will need to go back to this page to add the end time once your measurement is complete).

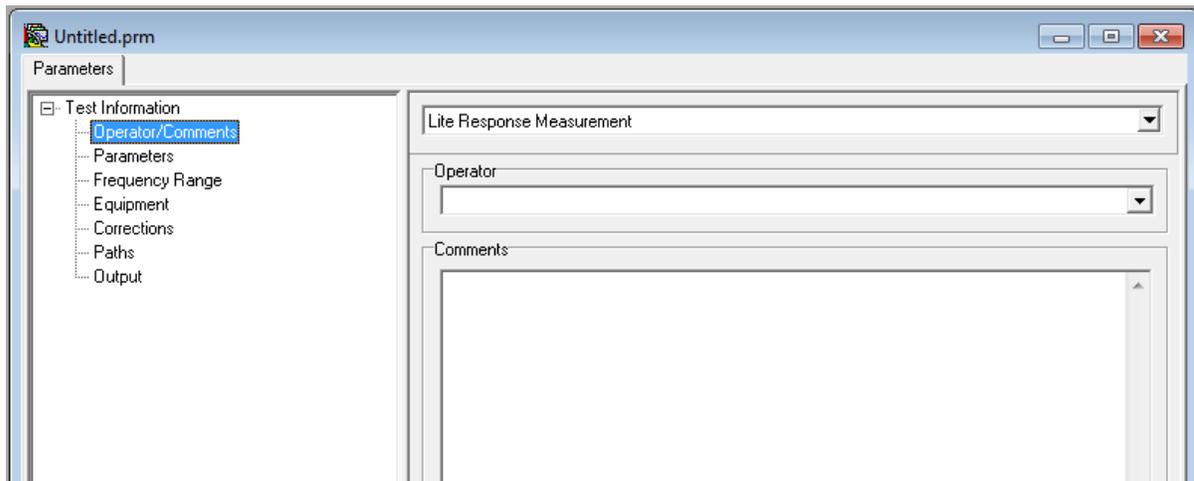


Figure 2. Operator/Comments tab (STEP 4).

5. Select the “Parameters” pane. In the **Measurement Configuration** box, choose “S11 (Forward Reflection Response)” and “Log Magnitude” under **Data Format**.

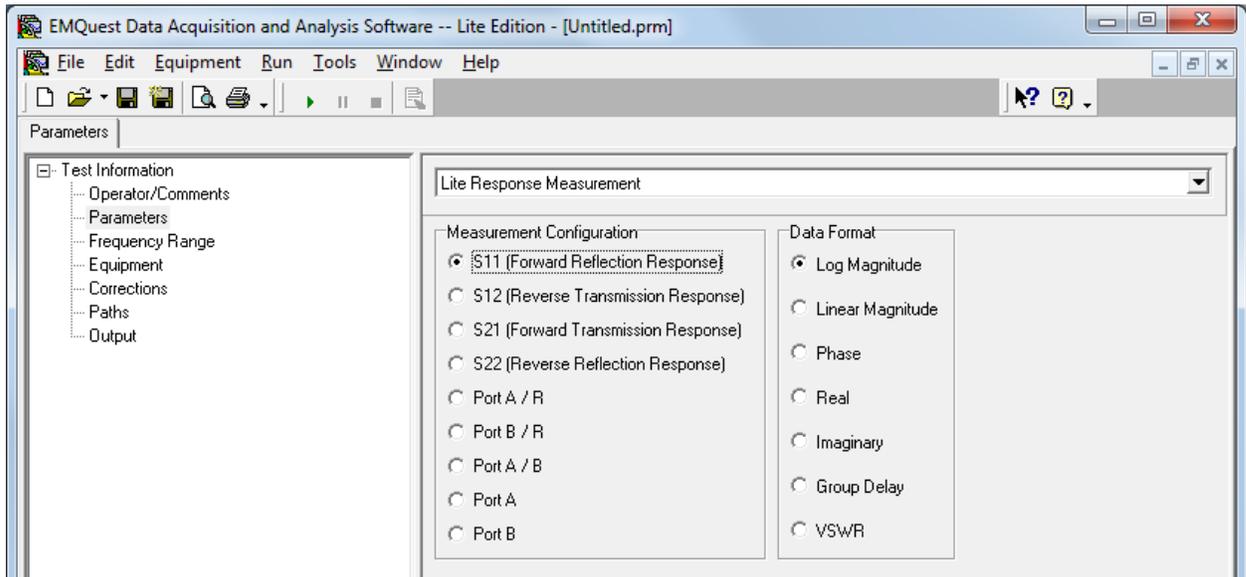


Figure 3. Parameters setup – Measurement Configuration and Data Format (STEP 5).

6. In "Frequency Range" pane, select "Linear frequency" which is the default format. Check the "User Defined" option in the frequency **Range Control** box and enter the start and stop frequencies (in MHz), according to your AUT, under **Frequency Range**. This will automatically adjust the center and span settings.

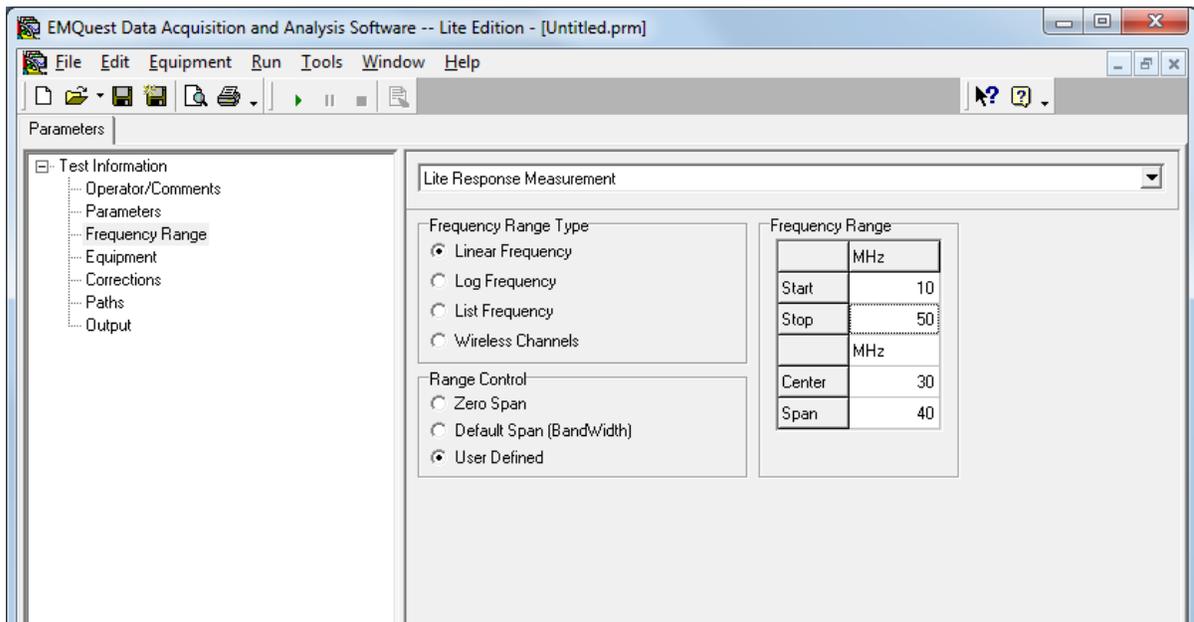


Figure 4. Frequency range" pane (STEP 6).

7. Click on “**Equipment**” and select the “Agilent PNA-L Series” network analyzer, as shown in Figure 5.

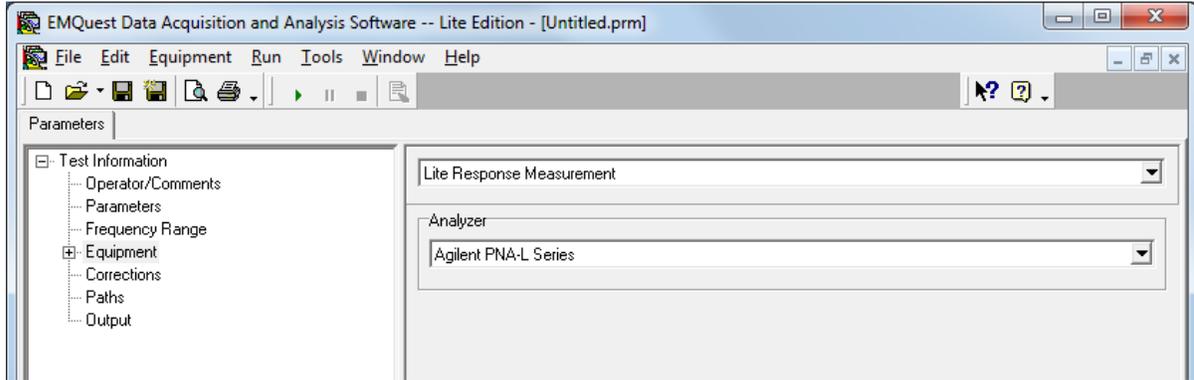


Figure 5. Equipment pane: network analyzer (STEP 7).

8. Click on the “+” sign next to the “**Equipment**” to expand the menu tree, and then click on the “**Agilent PNA-L Series**” item. The network analyzer (NA) calibration and other parameters can be specified here. Make sure all settings match those shown in Figure 6 below. Under **Trace Information**, you may smooth the measured data using the functions there. The value in “Points Per Trace” sets the number of frequency points that will be taken within the frequency range selected in STEP 6. The measurement “Output Power” level can be used to select the source power level; this can be adjusted in a second measurement if the noise level is unacceptable. This control should be used with caution to prevent overloading the input, and it is recommended to keep the output power level as low as possible, and never above 15 dBm.

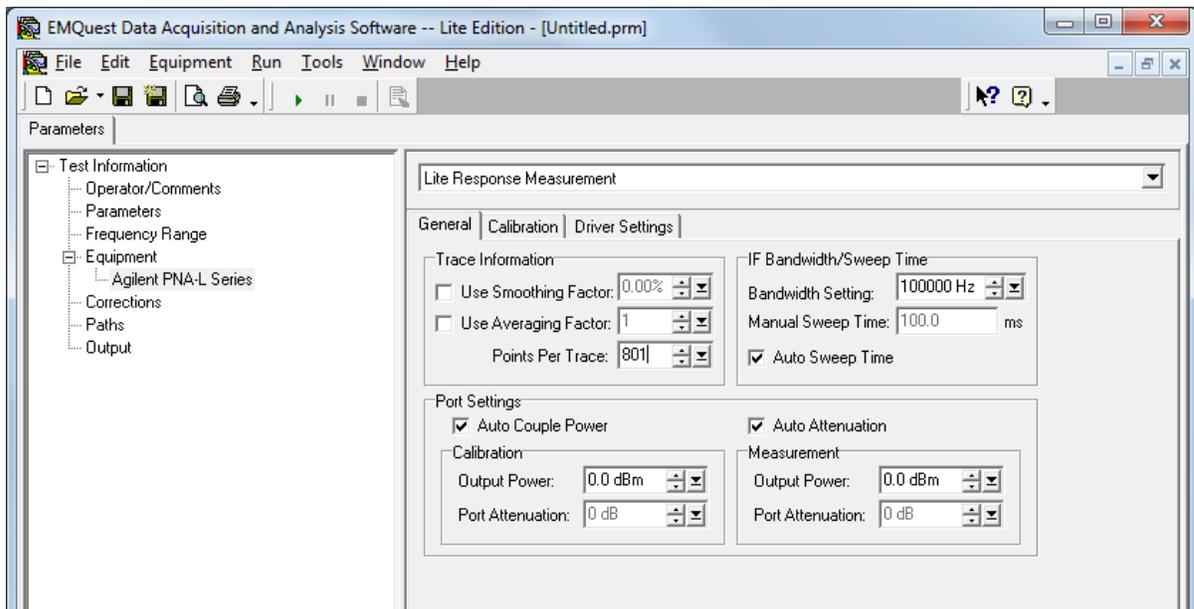


Figure 6. Network analyzer settings.

In the “Calibration” tab, you can select the calibration kit available in the NA that you want to use as well as the type of calibration to be performed for each port. In this case, the settings shown in

Figure 7 will override the calibration process. Using the settings shown in Figure 8, a full-port calibration will be performed on "Port 1". Note that this is a manual calibration where the user will need to follow some steps and connect open, short, and 50-Ohm loads as prompted by the software. If you want to use the electronic calibration kit (recommended) available in the cabinet under the NA, just check the "Use Electronic Calibration Module" option (Figure 9) and follow the instructions once the test is running.

You can also edit the "Driver settings" in the corresponding tab, or you can revert to the pre-configured settings shown in Figure 10 below by right-clicking on the tab itself.

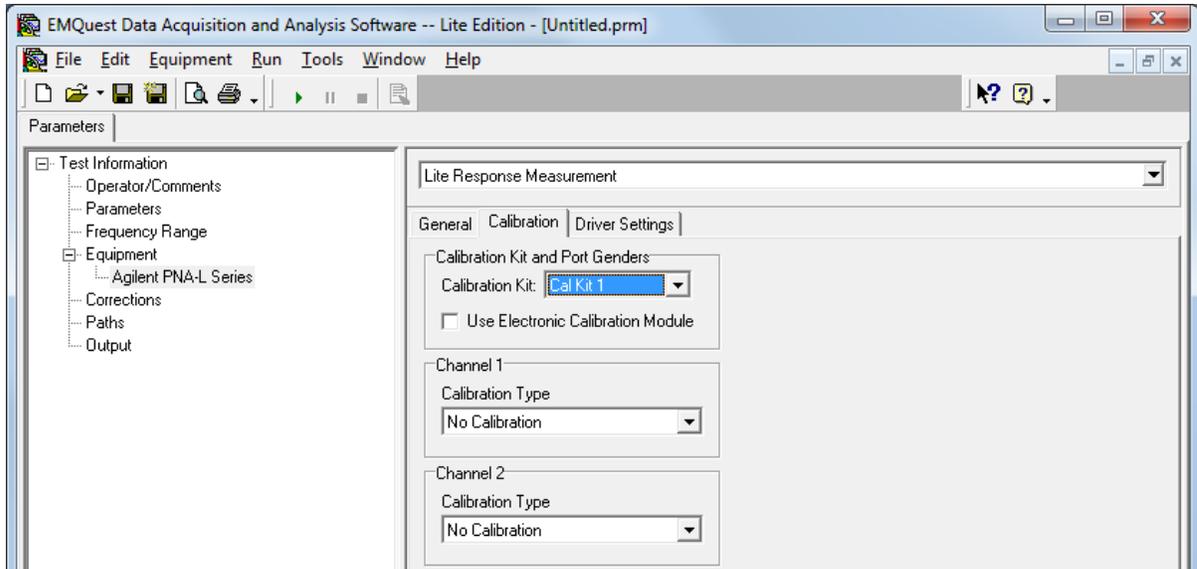


Figure 7. Calibration settings (no calibration performed).

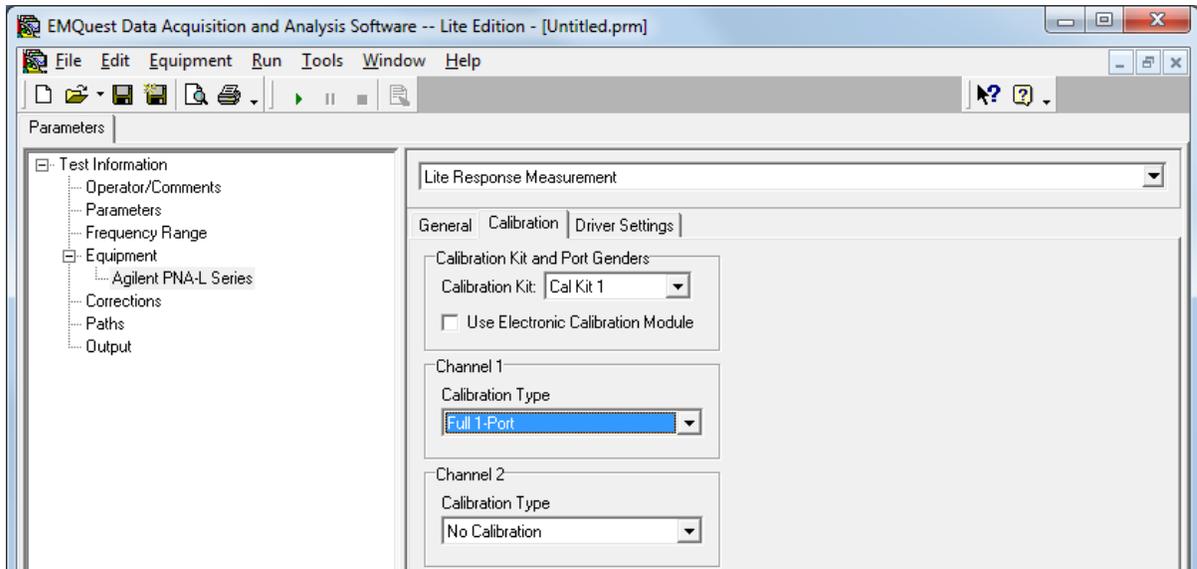


Figure 8. Calibration settings for manual calibration of Port 1.

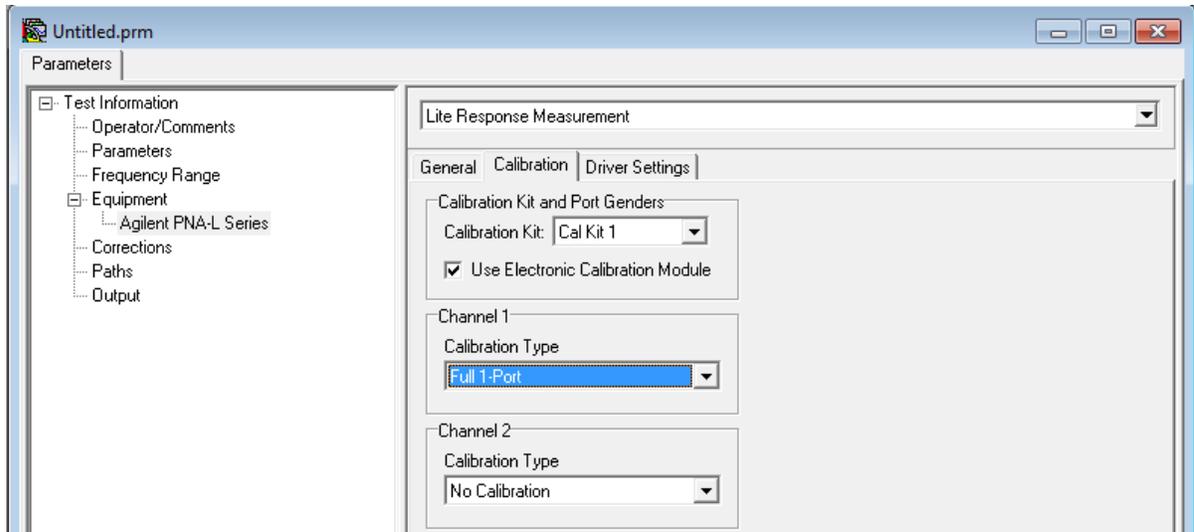


Figure 9. Calibration settings for calibration of Port 1 using the electronic calibration module.

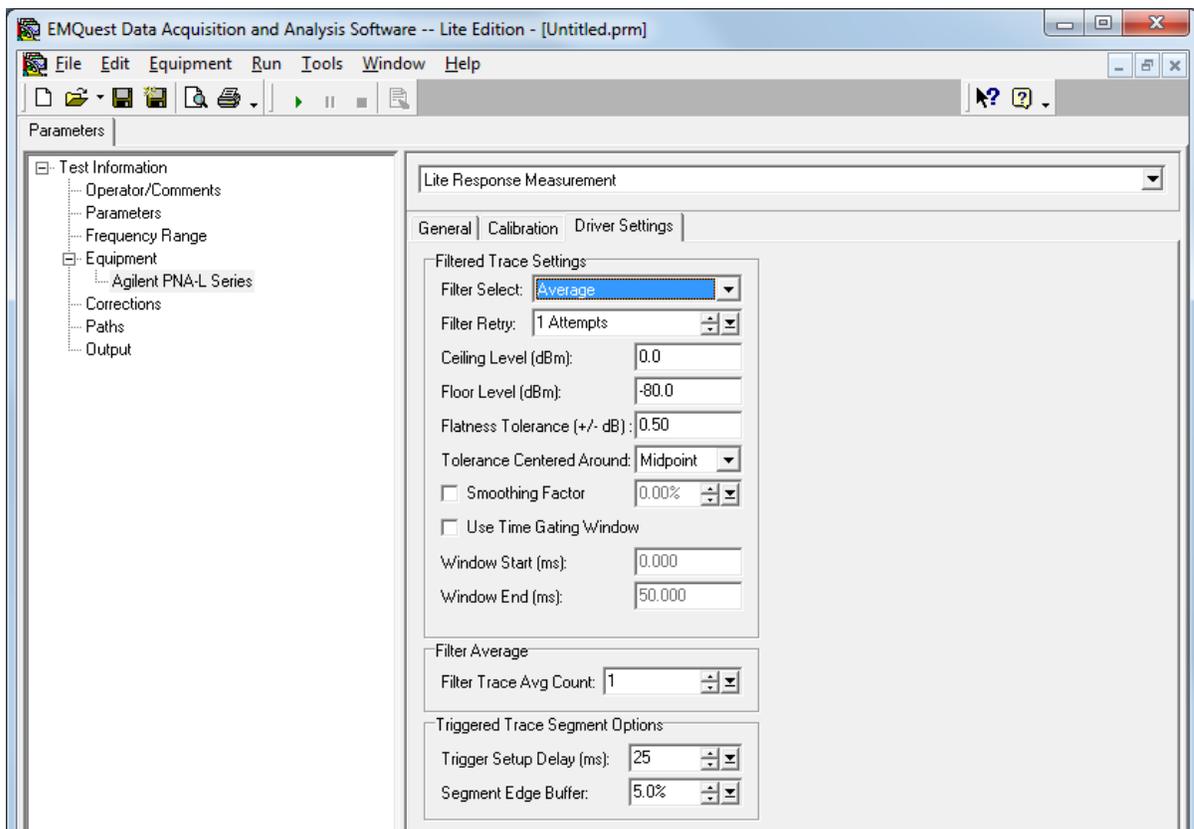


Figure 10. Agilent PNA-L Series driver settings tab.

9. Select the "**Corrections**" pane to enter any corrections that you want applied to measured data. The "Corrections" list box in each tree element (see Figure 11) shows a list of response file names for frequency dependent corrections, where a "+" or "-" sign in front of the file name indicates that the corresponding data will be either added or subtracted from the results. The buttons on the right can

be used to edit this list. The "Constant" box can be used to enter a single constant correction to all data points.

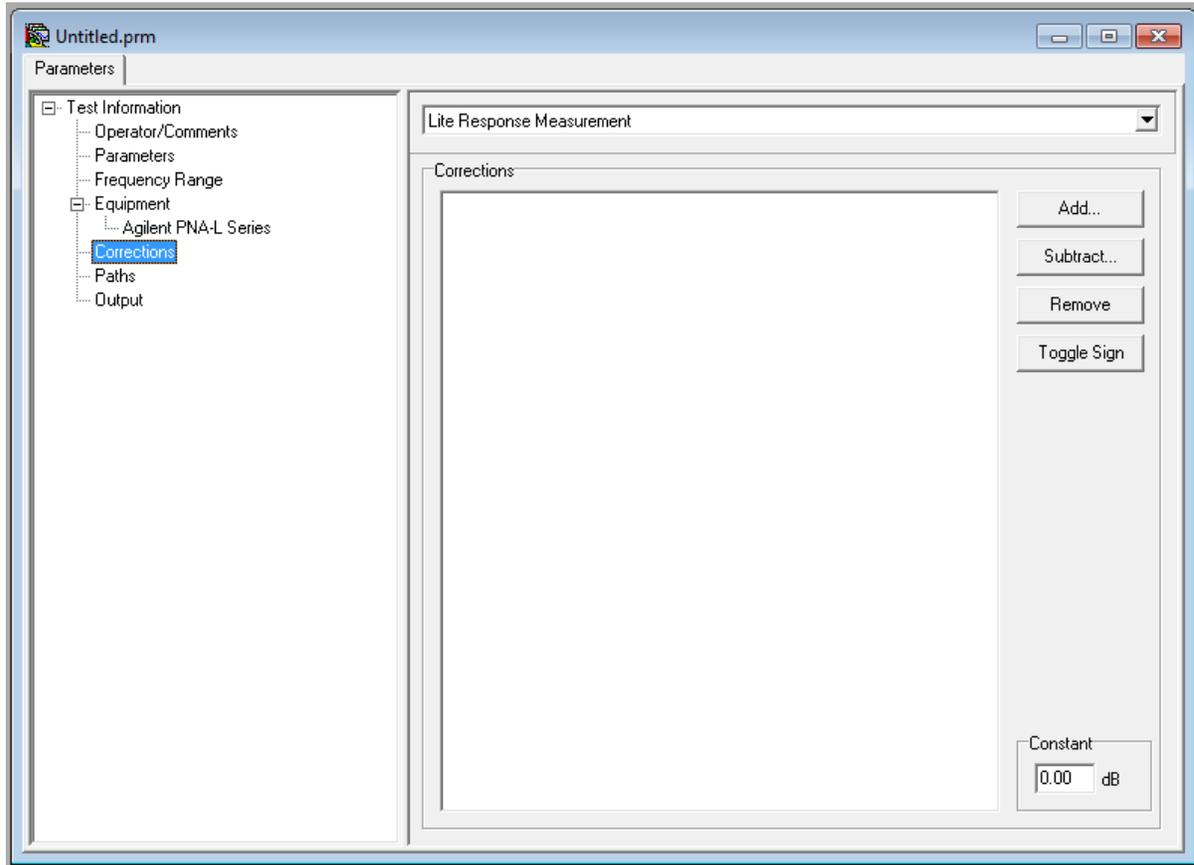


Figure 11. Corrections list box and options.

10. Once all parameters have been set and you are ready to start your measurement, make sure that all cables and equipment are properly connected, and that the chamber door is closed if you are using it for your measurement. Press the "Run" button and follow the instructions on the screen. A measurement progress box will show the current status of the test.

If you selected manual calibration, the calibration will start and the software will prompt for connecting the different terminations as shown in Figure 12 (a) through Figure 12(c):

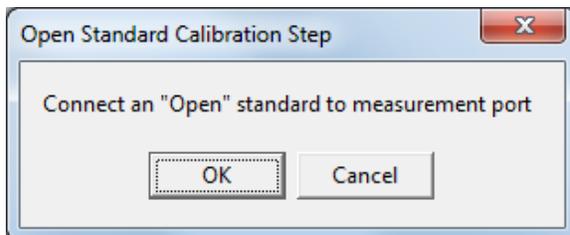


Figure 12a. Manual calibration (open).

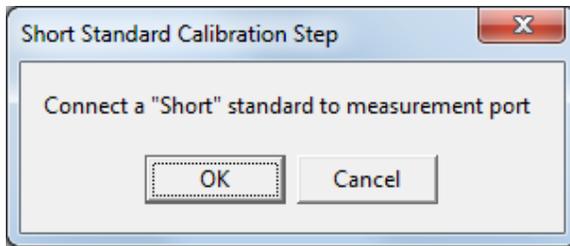


Figure 12b. Manual calibration (short).

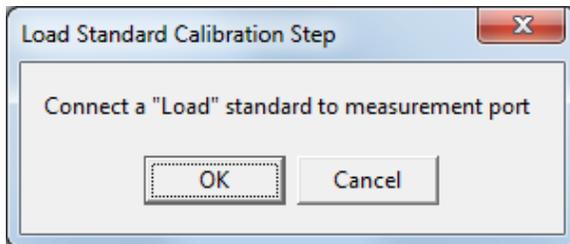


Figure 12c. Manual calibration (50-Ohm load).

If you selected "Use Electronic Calibration Module", you will instead be asked to connect the calibration module to your measurement port, i.e. the cable that you will later on connect to the antenna input port:

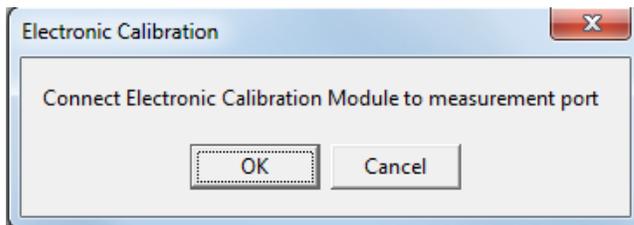


Figure 13. Electronic calibration.

Once the calibration has been performed, you are ready to start your measurement:

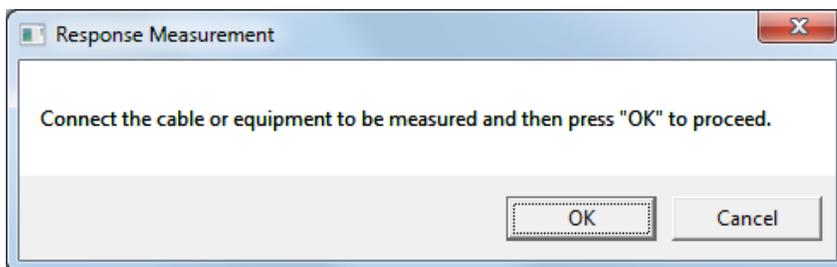


Figure 14. Click OK to start measurement.

11. The resulting plot is shown in Figure 15. You may also display the results in a table (Figure 16).
12. Save your .prm file and export the results for further processing.

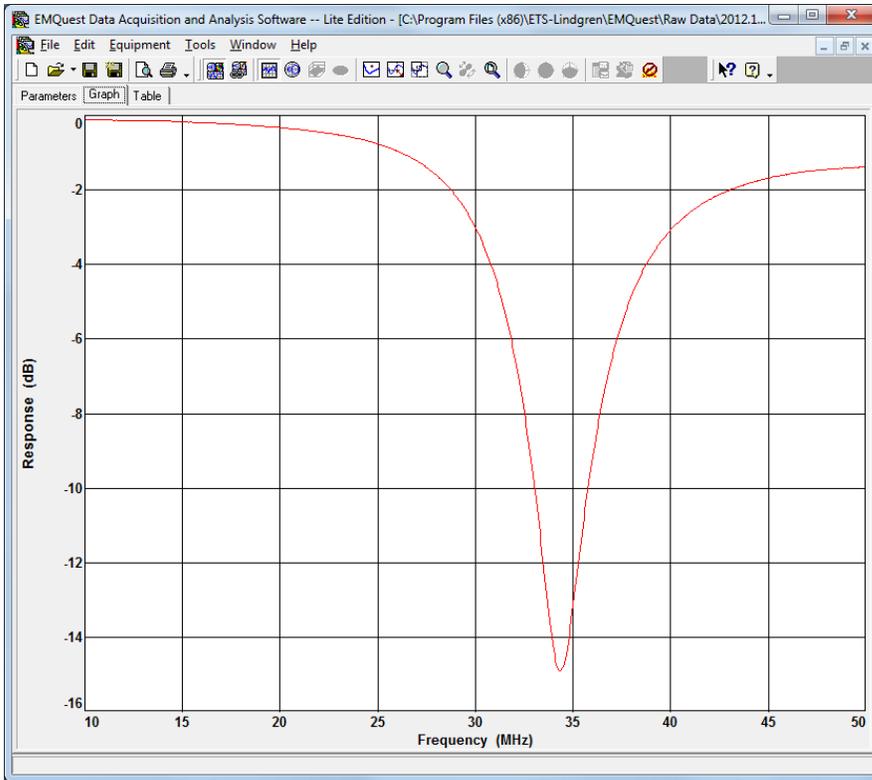


Figure 15. Measured magnitude of S11 (dB) vs. frequency (MHz).

The screenshot shows the 'Table' view of the software interface. The table contains the following data:

| Frequency (MHz) | Response (dB) |
|-----------------|---------------|
| 10 | -0.109139 |
| 10.05 | -0.109072 |
| 10.1 | -0.106378 |
| 10.15 | -0.111592 |
| 10.2 | -0.112975 |
| 10.25 | -0.110186 |
| 10.3 | -0.111018 |
| 10.35 | -0.111242 |
| 10.4 | -0.112142 |
| 10.45 | -0.111721 |
| 10.5 | -0.114974 |
| 10.55 | -0.111551 |
| 10.6 | -0.113451 |
| 10.65 | -0.113532 |
| 10.7 | -0.115873 |
| 10.75 | -0.116187 |
| 10.8 | -0.118033 |
| 10.85 | -0.114326 |
| 10.9 | -0.115205 |
| 10.95 | -0.119181 |
| 11 | -0.117362 |
| 11.05 | -0.124957 |
| 11.1 | -0.118508 |
| 11.15 | -0.124126 |
| 11.2 | -0.121213 |
| 11.25 | -0.122211 |
| 11.3 | -0.120917 |
| 11.35 | -0.124925 |
| 11.4 | -0.124889 |
| 11.45 | -0.12733 |
| 11.5 | -0.127077 |
| 11.55 | -0.129258 |

Figure 16. Results table.