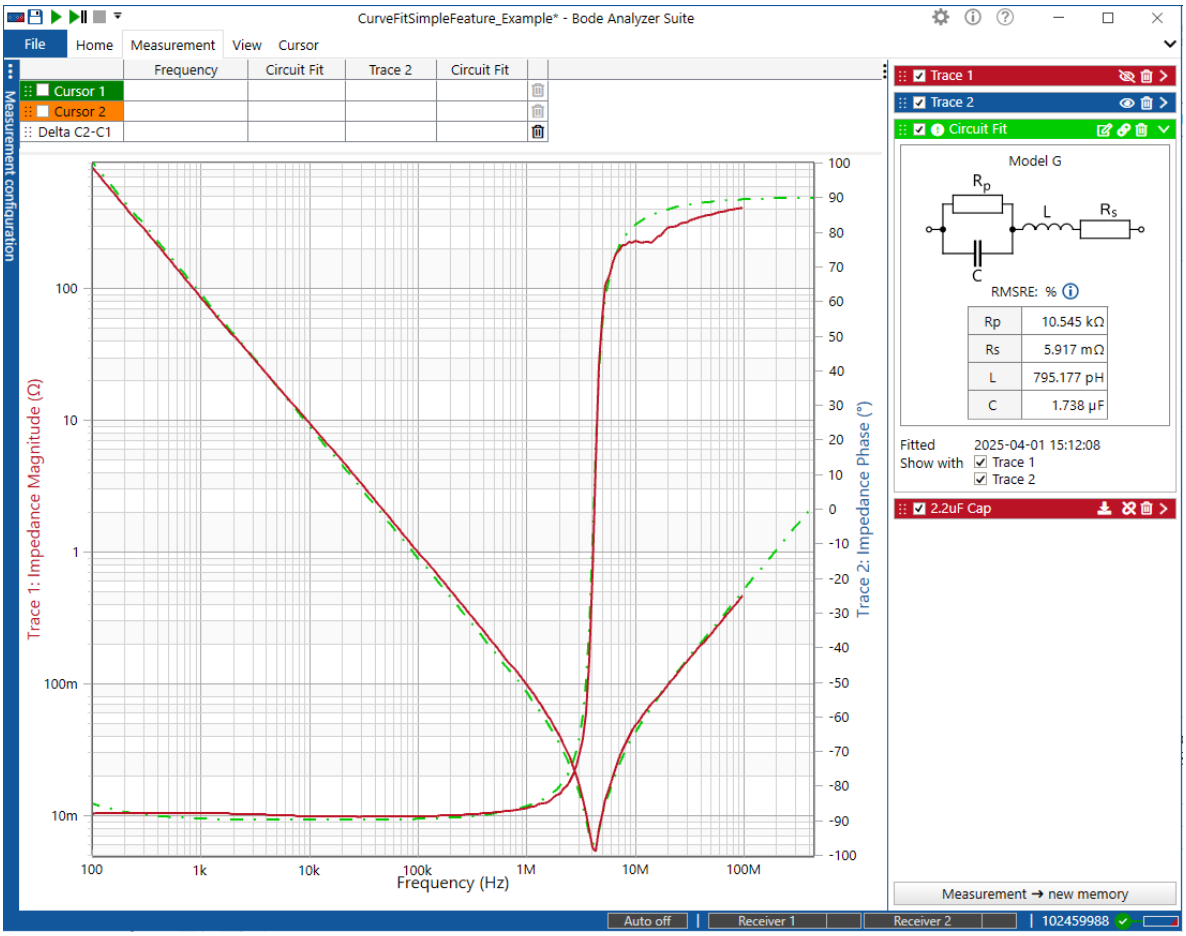
Bode Analyzer Suite – Information Note

Circuit Fit – Simple Model Guide



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Contact support@omicron-lab.com for technical support.

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Note: Basic procedures such as setting-up, adjusting and calibrating the Bode 100 are described in the Bode 100 user manual available at:
Bode 100, Bode 500 Vector Network Analyzer User Manual (omicron-lab.com)

Note: All measurements in this application note have been performed using the Bode Analyzer Suite V3.51 Use this version or a newer version to perform the measurements shown in this document. You can download the latest version at
Bode Analyzer Suite - Download Area - OMICRON Lab (omicron-lab.com)

1 Introduction

The Circuit Fit feature in the Bode Analyzer Suite (BAS) is a tool that produces data-driven models of impedance measurement that can be used for circuit simulation and component characterization. The Circuit fitting feature is a handy tool for engineers to extract information from measurements, such as the parasitic of passive components, and output a SPICE netlist for ease of simulation integration.

This document provides a quick guide for the feature using the simple pre-defined models commonly employed for single passive components, such as resistors, capacitors, inductors or quartz oscillators.

2 Measurement

The **Circuit Fit** feature requires an impedance measurement to generate a model. **Circuit Fit** is compatible with all impedance measurements performed with Bode 100 and Bode 500. In this document, a 1.8 µF capacitor was measured using the Bode 500. For more information on impedance measurements using the Bode 100 or Bode 500, please refer to the application note about Impedance Measurements.

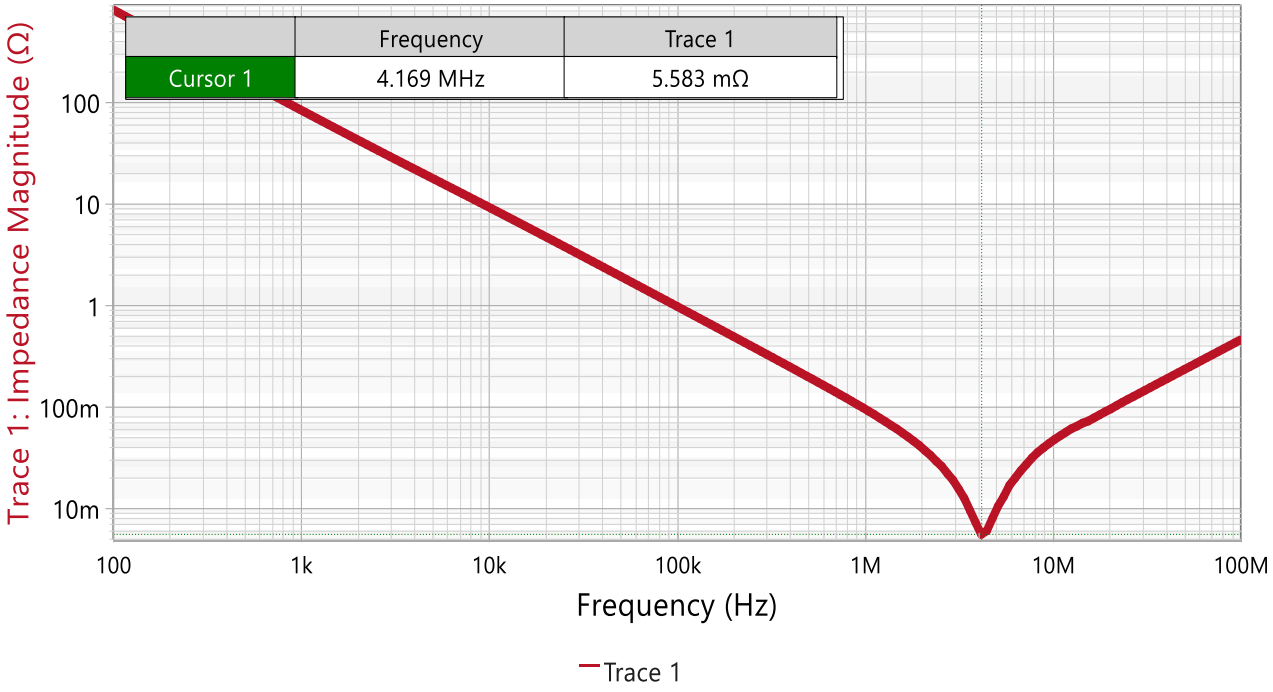

Figure 1: DUT capacitor measurement with Bode 500.

3 Configure Circuit Fit

Select the **Measurement** tab on the top left corner of the BAS ribbon menu and click on **Add Circuit Fit.**

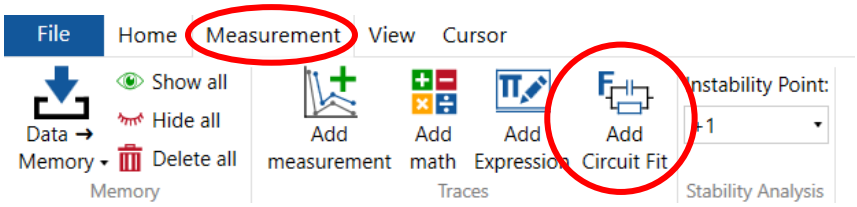

Figure 2: Measurement tab of Bode Analyzer Suite

Once the **Circuit Fit** window opens (Figure 3), make sure the **Fit Model** setting is configured as default **Simple** setting. In the **Data Source** line, select the trace from which you want to create a model. The feature can fit both Memory traces and active Measurement traces.

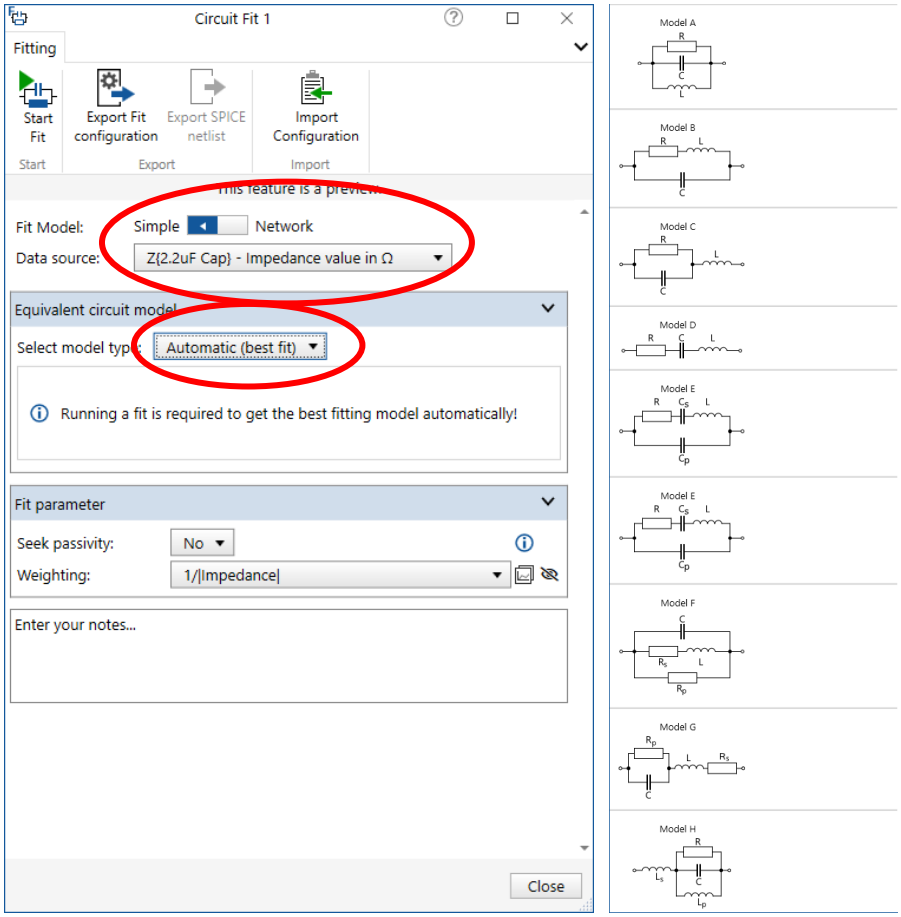

Figure 3: Circuit Fit window.

The simple configuration offers predefined circuit models for passive components. The circuit model can be selected manually in the dropdown menu besides **Select Model Type**; however, for this example, **Automatic (best fit)** will be used. Automatic is the default setting which will automatically check for the best suitable model type. If you already know which model fits best, select the model type from the list shown in Figure 3.

The **Fit Parameter** setting can be adjusted to optimize the fit; however, for an initial fit, the default option is sufficient. Click **Start Fit,** located in the top ribbon of the window, as seen in Figure 4.

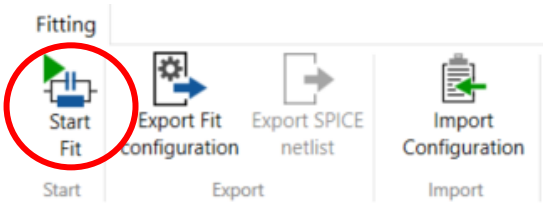

Figure 4: Circuit Fit option tab.

4 Fit Results

After the **Circuit Fit** is finished, the result will appear as shown in Figure 6. On the left-hand side, the chosen model type is shown. In this case, Model G, a series equivalent circuit with a parallel loss resistor has been selected as the best fitting model type. The right-hand side of the window shows detailed fit results.

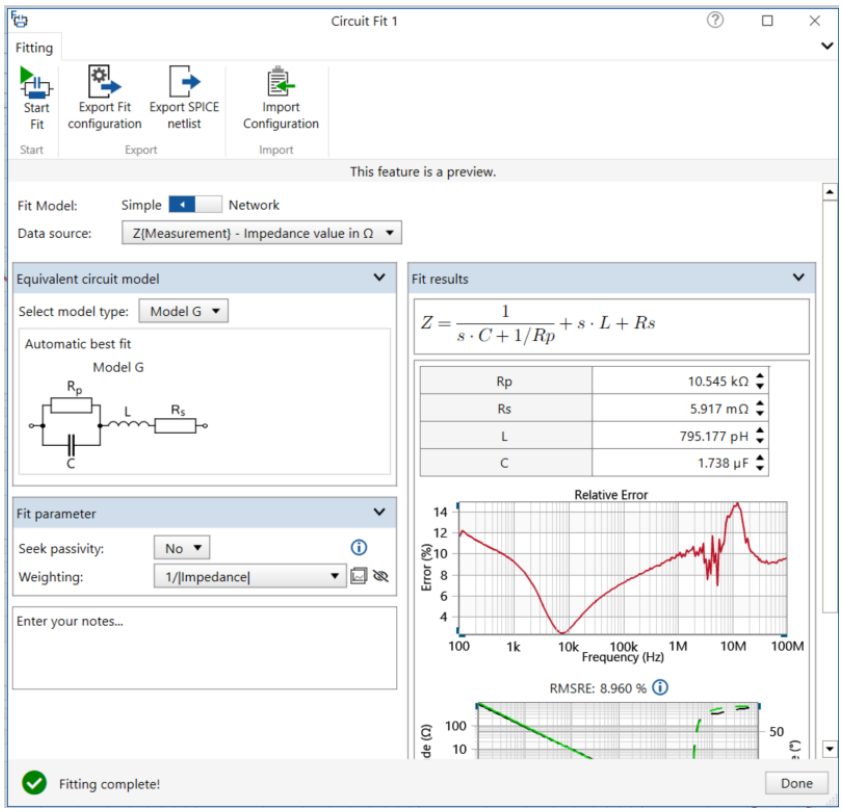

Figure 5: Circuit Fit result window.

The relative error graph and the quality of the fit can be seen on the right side of the window under the circuit element values (Figure 6). The relative error graph displays the difference between the data source and the model result over frequency. The **Root Mean Square Relative Error (RMSRE)** result is displayed above the fit result graph and gives an indication of the overall fit quality. For more information on the RMSRE, please refer to the Bode 100, Bode 500 user manual.

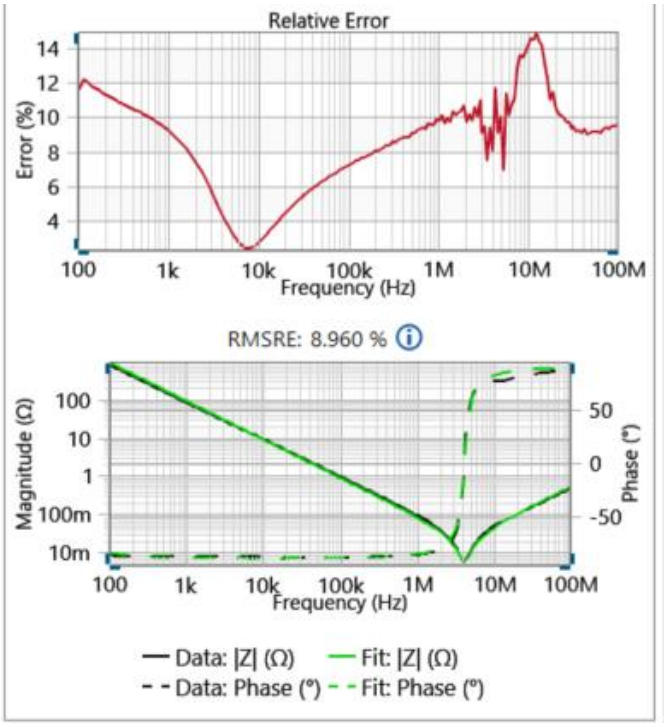

Figure 6: Relative error and model fit graphs.

If you are satisfied with the fitting result, press **Done**. The fitting result will be displayed as a new trace in the trace configuration area on the right-hand side of the BAS main window. If the fit result is not satisfactory, you can change values manually, and the changed result is visible in the fit results. Alternatively, to get a more precise fitting result, you can choose another pre-defined model, start a new fit with different fitting configurations or perform a more advanced network fit.

You can use the **Note** field to document, for example, manual changes.

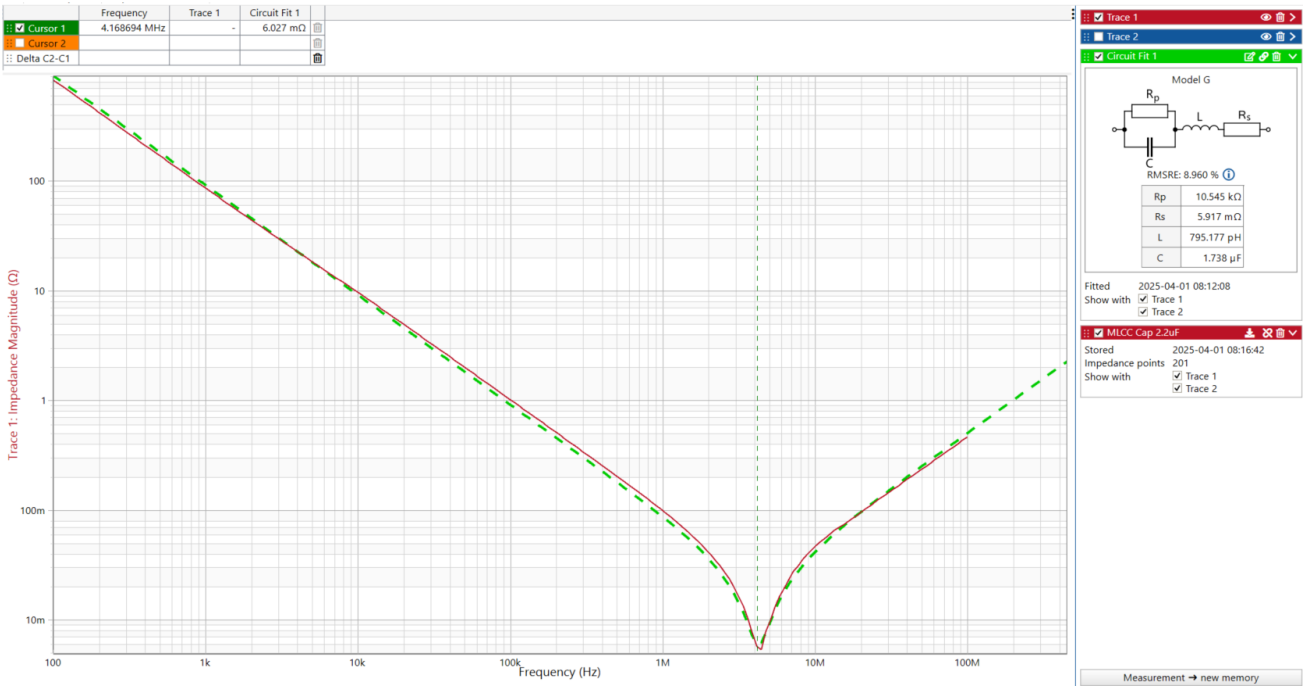

Figure 7: Circuit Fit, and measurement shown in BAS main window.

The circuit fit will be stored in the trace and displayed on the right side of the Bode Analyzer Suite. This fit can be edited, exported, or used to display the behavior of the components at frequencies not measured. It can be easily integrated into the SPICE model with the SPICE netlist export option located at the top ribbon of the Circuit Fit window (Figure 5). The **Circuit Fit** result can also be included in the BAS PDF report of the measurement.

5 Conclusion

The Simple Circuit Fit feature offers a quick and easy way to fit pre-defined equivalent circuit models to impedance measurements. This can be achieved by a couple of simple mouse-clicks. The resulting fit can be displayed in the BAS main window or can be exported as PDF or SPICE netlist which allows the user to import the model in SPICE based simulation tools.

Please refer to the Bode Analyzer Suite User Manual for further details. Additional measurement examples can be found in the Application Note section of the OMICRON Lab webpage www.omicron-lab.com.

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