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Specifying Source-Tuner Terminating Impedance With Maury ATS

Abstract

The source impedance presented at the DUT reference-plane by the source-tuner is a function of the source-tuner and its terminating impedance. The terminating impedance is based on the interaction of several signal conditioning elements, such as a bias tee, a coupler, a low-pass filter, and a reference PA. How the effect of this impedance is compensated for within ATS may have a deleterious effect on the accuracy of the source impedance displayed at the DUT reference-plane. This application note describes the various methods in which Maury ATS will compensate for this impedance.

Why Worry About Source Terminating Impedance?

Figure 1 shows the source-block of a typical load-pull system, with various signal conditioning elements present between the signal source and the source-tuner. The concatenation of these elements results in a terminating impedance, Γ_T, as seen by the source tuner. Using a basic result of microwave network theory, the impedance seen at the DUT reference-plane, looking back toward the source-tuner is

$$\Gamma_S = S_{22} + \frac{S_{12}S_{21}\Gamma_T}{1 - S_{11}\Gamma_T} \quad \textbf{(1)}$$

where the S_{ij} are the source-tuner s-parameters. From this expression, we see that the impedance seen by the DUT looking back toward the source is a function not only of the source tuner but also the impedance terminating the source tuner, Γ_T. How this impedance is treated can have a significant impact on the effective impedance seen at the DUT. Its precise specification is often necessary for accurate device characterization.

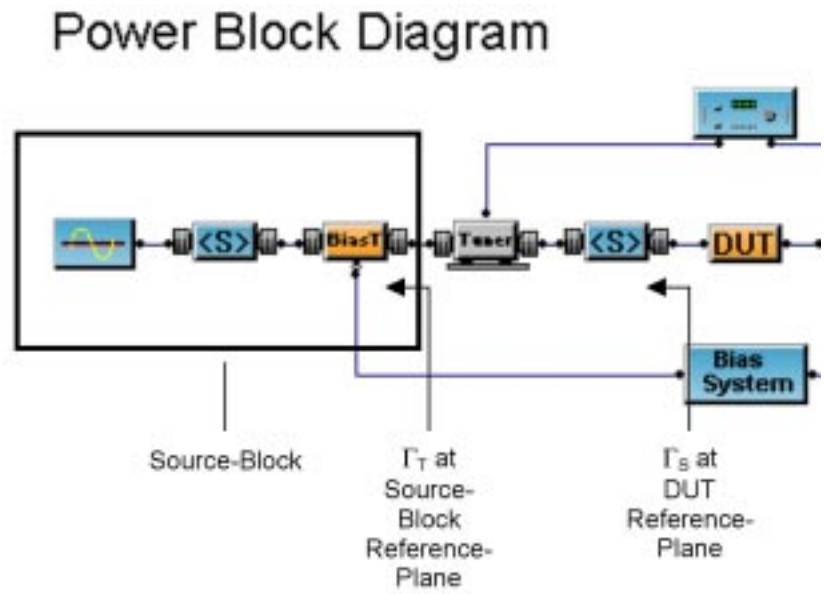

Figure 1. Block Diagram Showing Source-Block and Definitions for Γ_S and Γ_T.

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ATS provides three methods for specifying the source-tuner terminating impedance, Γ_T. Figure 2 shows the <Power Options> dialog. The top row, Source Gamma Calibration, shows three options: Matched, Auto-Cal, and Specify .S1P file. Each of these now discussed.

Matched

This option assumes $|\Gamma_S|=0$. This option is not recommended, since the actual impedance looking into the source-block is seldom close to 0.

Auto-Cal

This option uses a Maury proprietary method to calculate automatically calculate Γ_S using an approximate method based on varying the source-tuner impedance. The method works best when $|\Gamma_S|<<1$ and is useful in many applications since it is an *in situ* calibration method, and requires no additional user measurements. The resultant Γ_S is inserted into the .pcl file.

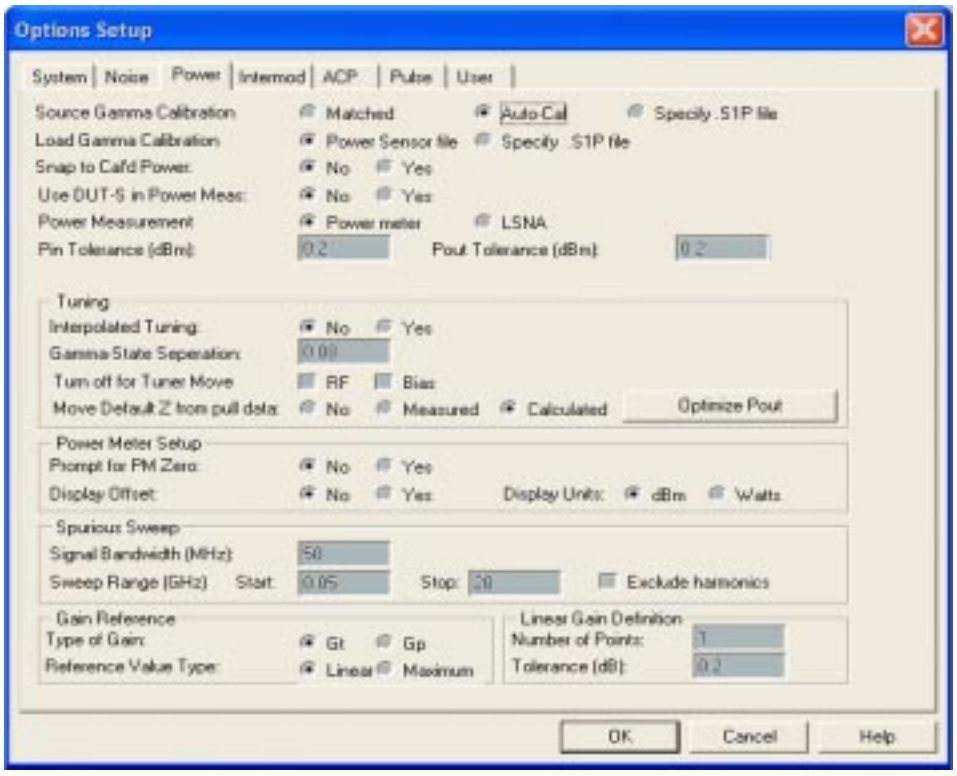

Figure 2. Power Options Dialog Showing Location for Specifying Source-Tuner Terminating Impedance in the Top Row.

2900 Inland Empire Blvd. • Ontario, California 91764-4804
Tel: 909-987-4715 • Fax: 909-987-1112 • http://www.maurymw.com
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Use .s1p File

This option requires the user to measure the impedance looking back into source-block and specify an .s1p file. This method is the most accurate method, in general, and is recommended for those applications requiring the highest accuracy in specifying source-tuner terminating impedance. The file name and path are specified in the <Default Files/Directories> dialog under the Power tab, in the Power Source Gamma field.

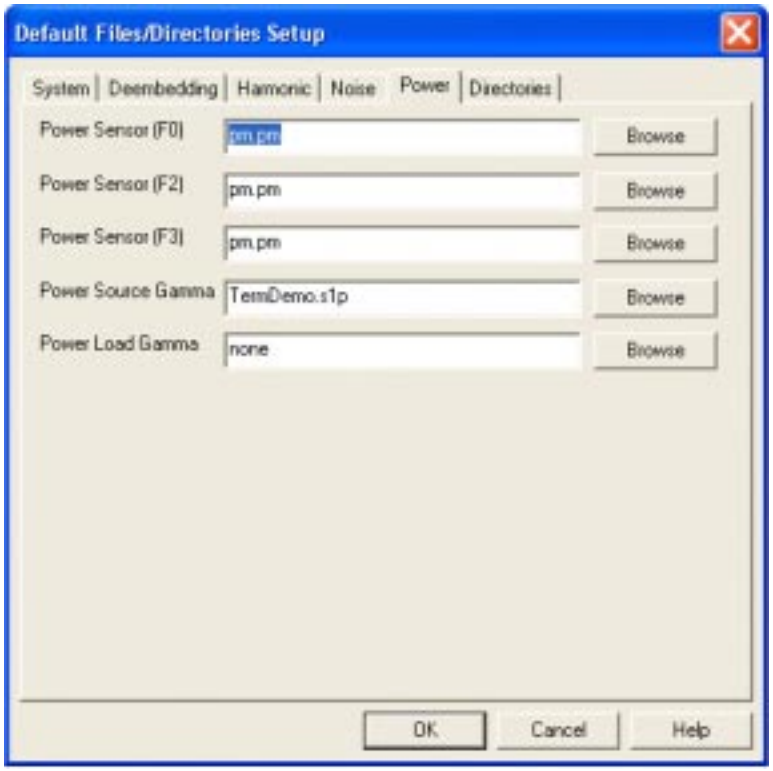

Figure 3. Default Files/Directories Dialog Showing Where to Specify the Source .s1p File.

John F. Sevic, MSEE
Automated Tuner System Technical Manager
Maury Microwave Corporation

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