

MULTIMATCH ADW / IMW V9.10

AMPLIFIER AND IMPEDANCE MATCHING DESIGN TECHNOLOGY

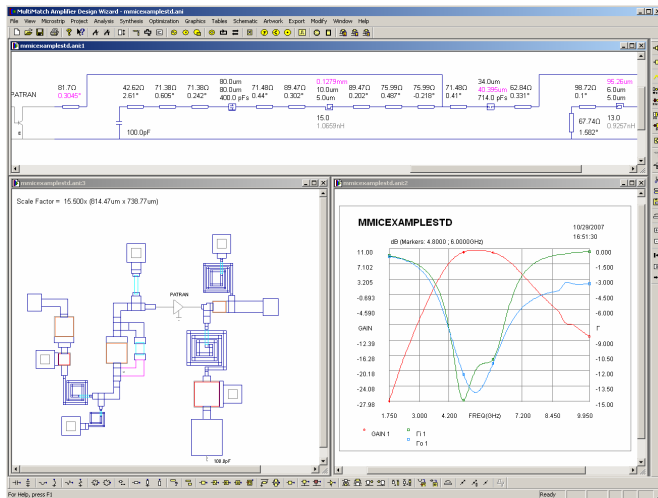



Figure 1. An example of a MMIC amplifier designed with the MultiMatch Amplifier Design Wizard (MultiMatch ADW).


Features

Ampsa provides you with the technology to design high quality RF and microwave amplifiers (class A, B), at an affordable price, in its MultiMatch software. MultiMatch also has powerful oscillator synthesis capabilities. Because of its specialized structure and its powerful real-world synthesis, analysis, optimization and artwork tools, design cycles are reduced to a fraction of the time previously required. Circuits designed with MultiMatch are usually more robust (less sensitive) than those designed with other tools. This derives in part from the synthesis-based systematic searches implemented to ensure that the solution to each matching and modification problem is close to optimum (Forced solutions tend to be sensitive).

MultiMatch is typically used as a front-end to one of the popular RF and microwave circuit simulators. The circuits synthesized/ designed can be exported as Microwave Office™ schematic scripts, or in Super Compact™ or Touchstone™ nodal analysis format. The artwork and the schematics generated can also be exported in DXF or HPGL format.

Products

 **The Multimatch Impedance-Matching Wizard** (Windows 2000/XP/Vista™ UnicodeVisual C++ 2005 MFC program): Solves user-defined (equivalent) passive impedance-matching problems up to artwork level. The source and/or the load impedance may be complex, and the gain slope, as well as the gain outside the passband, can be controlled.

 **The Multimatch Amplifier Design Wizard** (Windows 2000/XP/Vista™ UnicodeVisual C++ 2005 MFC program): Amplifier synthesis and impedance-matching software. Small-signal, low-noise, power and high dynamic range amplifiers can be synthesized. The circuits synthesized can be analyzed and optimized too. Analysis includes loop gain and reflection gain analysis. Optimization includes direct optimization and optimization by re-synthesis. Load-pull contours and constant gain |

noise figure circles can also be generated for transistors biased in class A or B mode.

Data Required

Matching problems must be specified in “real-frequency” format (impedance-matching data can also be imported from Touchstone™ .s1p or .s2p files). The gain target can also be set to be equal to, or less or greater than the gain value specified. The less than option is useful when filtering is combined with matching. The equivalent passive matching problem associated with controlling the active performance of a transistor can be set up automatically in the Amplifier Design Wizard.

When an amplifier or an oscillator is synthesized, S-parameters must be specified for the transistor(s) of interest in Touchstone™ .s2p format. A small-signal model, the IV-curve boundaries (four boundary lines) and the dc operating point must be specified in order to control the 1 dB compression point (output power) of the transistor (class A, B mode). The required small-signal models can be specified and can also be fitted in the Amplifier Design Wizard. The model is used to map the external voltage and current to the intrinsic quantities. Clipping of the intrinsic current and/or voltage is used to predict the maximum linear output power of a transistor. Fitting factors are also provided to allow modeling of the noise parameters with the small-signal model (Fukui, Pucel and Pospieszalski noise models).

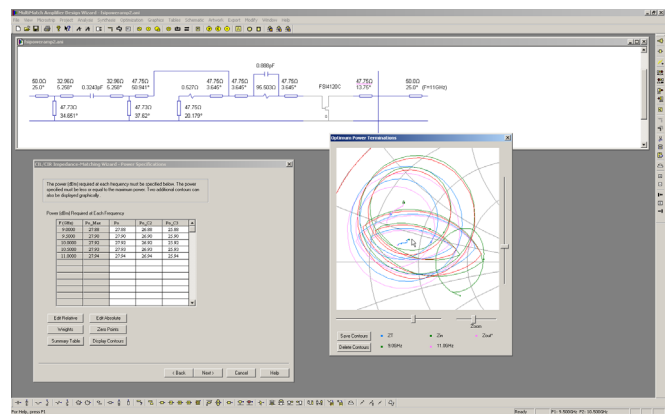


Figure 2. The gain circles and power contours generated for a transistor with the MultiMatch Amplifier Design Wizard.

Multimatch IMW Capabilities

The Multimatch Impedance-Matching Wizard synthesizes high quality RF and microwave impedance-matching networks up to artwork (microstrip) level. The components and the microstrip lines used are assumed to be lossless during synthesis. Pads and connecting lines, as well as parasitic inductance for capacitors and parasitic capacitance for inductors, can be specified for the networks to be synthesized. Shunt overlay capacitors and stepped main line sections may also be used. Connections to the ground plane can be made with vias or inductors (bond wires). The impedance-matching problem to be solved can be specified directly (“real-frequency” format) or data can be imported from Touchstone™ .s1p or .s2p files. Different types of networks can be synthesized with the Impedance-Matching Wizard. These include:

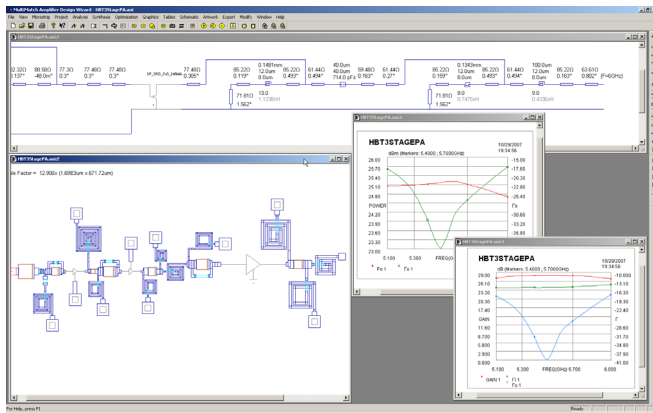


Figure 3. A 3-stage MMIC Power Amplifier Designed with the Multimatch Amplifier Design Wizard.

- Lumped-element networks,
- Commensurate distributed/microstrip networks (line lengths specified, widths used as variables),
- Non-commensurate distributed/microstrip networks (line widths specified, lengths used as variables) and
- Mixed lumped/distributed networks.

Synthesis is generally over topologies (topology independent), but extensive control is provided over the synthesis parameters. Several solutions (usually with different topologies) are provided to each matching problem.

The solutions can be exported as Microwave Office™ schematic scripts, or in Touchstone™ or Super Compact™ nodal analysis format. The artwork can also be exported in DXF or HPGL format. Before exporting it, the artwork can be refined | reduced in size by using the bend, curve and meander commands provided.

The Impedance-Matching Wizard provides a standard and systematic means of solving wideband and narrow-band user-defined impedance-matching problems.

MultiMatch ADW Capabilities

The MultiMatch Amplifier Design Wizard can be used to synthesize high dynamic range RF and microwave amplifiers and impedance-matching networks. Multiple passband amplifiers can also be design with the software.

Many features were added in recent releases to speed up the design of MMIC amplifiers. Mixed lumped/distributed matching networks synthesized with Multimatch can also be transformed easily into distributed form, because MIM capacitors and spiral inductors can be closely modeled as ideal lumped components with pads and some losses.

Load-pull contours (1 dB compression point) can be generated for class A and class B amplifier stages with minimal data. Because of the power parameter approach used, this can also be done for transistors with feedback and/or resistive loading sections added. Cascade and nodal power analysis and optimization capabilities are also provided. Features are also provided to allow

multi-stage amplifiers to be designed to minimize the contribution of the drivers to the third-order distortion.

Apart from an impedance-matching capability, device-modification (application of frequency selective resistive feedback and/or resistive loading to a transistor) techniques are also required in order to design high performance first-time-right amplifiers. Sophisticated device-modification synthesis techniques are implemented in the Amplifier Design Wizard. Device-modification is used to pre-condition a transistor for improved stability, flat gain response, lower VSWRs (before synthesizing the matching networks required), as well as to have low VSWRs at the same time as a low noise figure and/or high output power.

The accuracy of the Multimatch Wizards can be extended up to millimeter-wave frequencies by the user. This is done by modifying the standard discontinuity models, the parallel-plate capacitor models and the square spiral inductor model implemented in Multimatch. The customization option should also be used when matching networks with large steps are designed. Such networks are frequently used in high power matching networks. Note that parallel-plate capacitor models and spiral inductor models are not provided in the Multimatch Impedance-Matching Wizard.

The MultiMatch Wizards extend the power of the expert designer and also provides a learning curve for inexperienced circuit designers.

Many first-time-right MultiMatch amplifiers have already been manufactured.

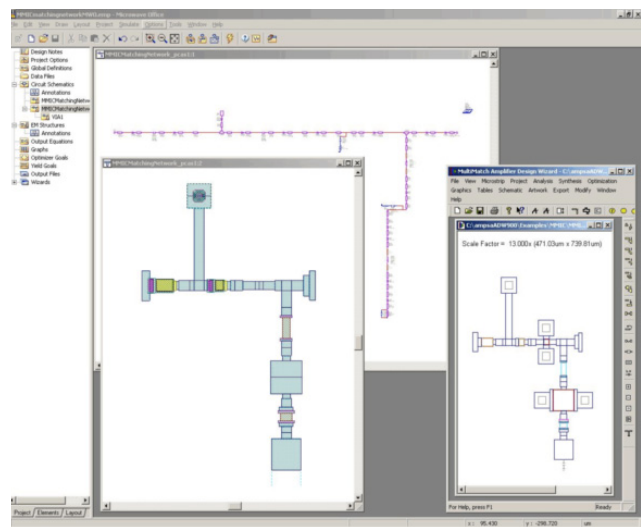


Figure 4. An example of a MultiMatch MMIC matching network exported to Microwave Office™.

Platforms

The MultiMatch ADW and IMW are currently only supported on IBM compatible personal computers with Windows 2000™, Windows XP™ or Vista™ operating systems.



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