MatchedRF Product Description

MatchedRF is a network synthesis design tool for broadband RF applications. It supports impedance matching for a restricted class of terminations - namely the capacitive sources and loads that are so commonly encountered during the design phase of RF power amplifiers.

Filter-Based Impedance Matching

Since filter structures are the most efficient broadband impedance-matching structures [1], MatchedRF outputs filter-based lumped LC ladder structures that are matched to user-specified terminations. As in [2] and [3], parasitic capacitance of an active device can be absorbed by the matching components at either end of the network or even both ends simultaneously. MatchedRF is directly applicable to input matching, output matching and interstage matching in the design of broadband RFIC and millimeter wave power amplifier systems.

Bandpass Chebyshev Frequency Response Order 2-6

Wherever possible, MatchedRF generates the Fano-Optimum [2], lumped-element Chebyshev filter structure representation.

Bandpass topologies of network order 2 through 6 are supported.

In addition, the tool supports the recommendation, insertion and manipulation of lumped-element impedance transformers [4]. MatchedRF provides the transformer solutions (if they exist) and allows users to further add or remove transformers and make refinements such that component values closely match those supported by their manufacturing process.

Interstage Design Example

Suppose a 2-stage FET power amplifier is required to cover NR Bands N77 + N78 + N79 (3.3 GHz to 5.0 GHz). Given output power requirements and the device technology, the following transistor properties were determined:

	Cgs (pF)	Rgs (Ω)	Ropt (Ω)	Cds (pF)
PA Stage 1	1.0	12.5	200	0.125
PA Stage 2	10.0	1.25	20	1.250

Solution To design an interstage to match the output of Stage 1 to the input of Stage 2, a parallel RC network of 200 Ω + 0.125 pF (output Ropt + Cds of PA Stage 1) must be matched to the series RC network 1.25 Ω + 10.0 pF (input Rgs + Cgs of PA Stage 2).

The appropriate MatchedRF settings to solve for the interstage match are shown in the left column of Figure 1. The solution is also shown in the figure along with the frequency response of the matching network. Transforms N1, N2 and N3 are used to adjust the component values without affecting the frequency response. The schematic output can be archived to .pdf and also exported to any 3rd party CAD tool that supports text .csv format.

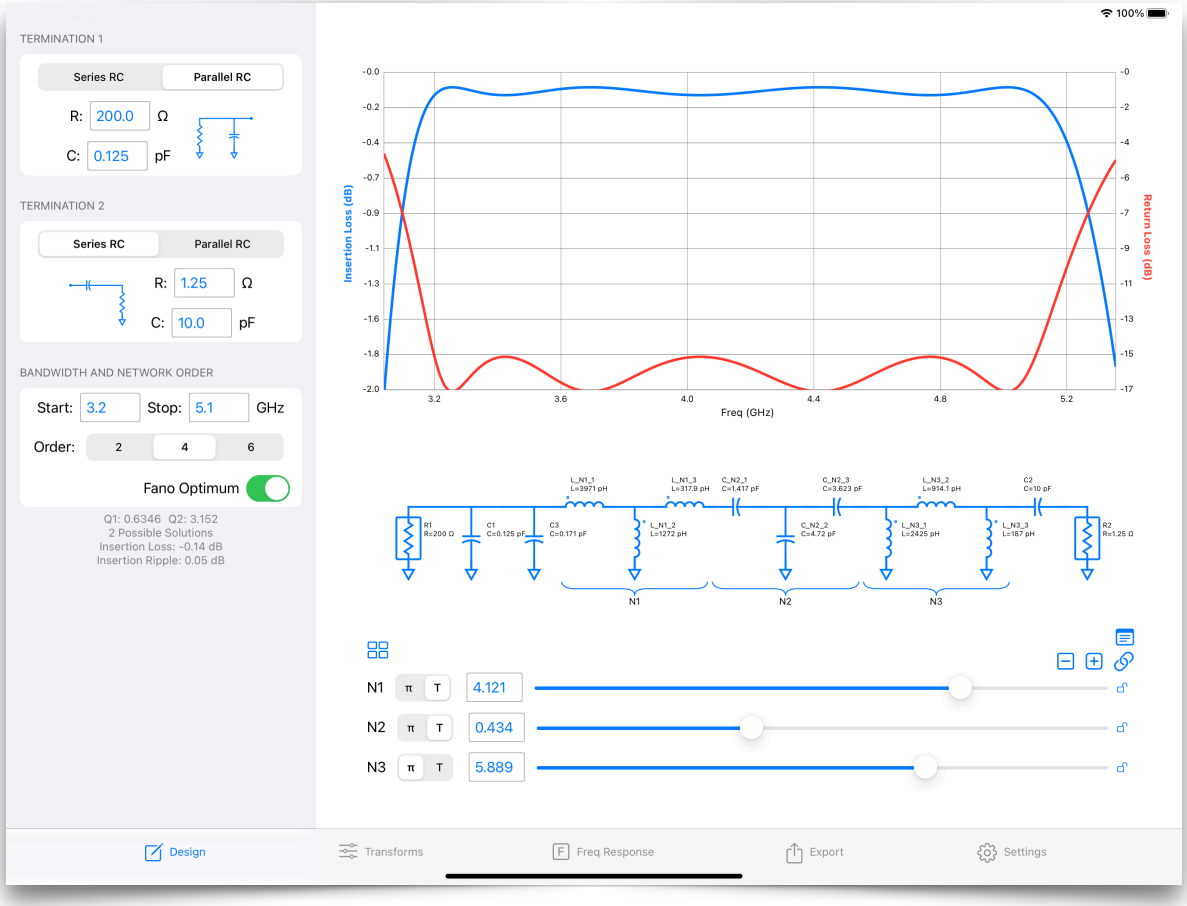
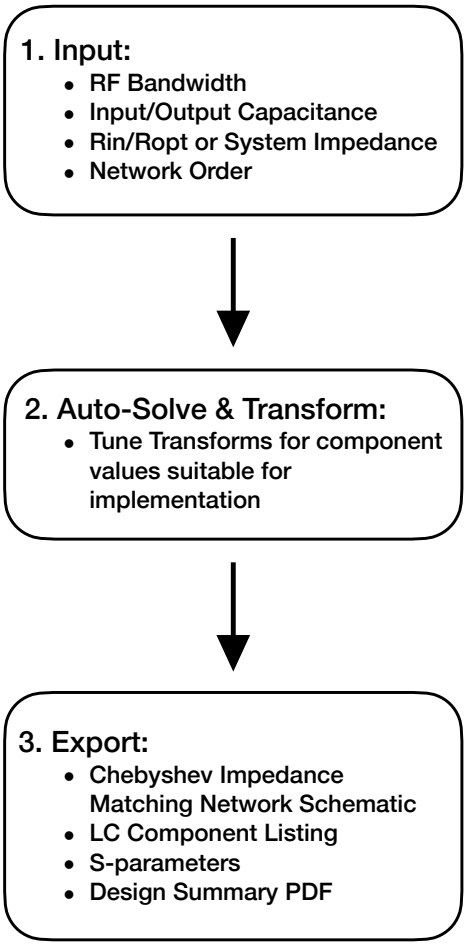


Figure 1. Input parameters and solution to an interstage matching problem.

Typical Design Flow with MatchedRF



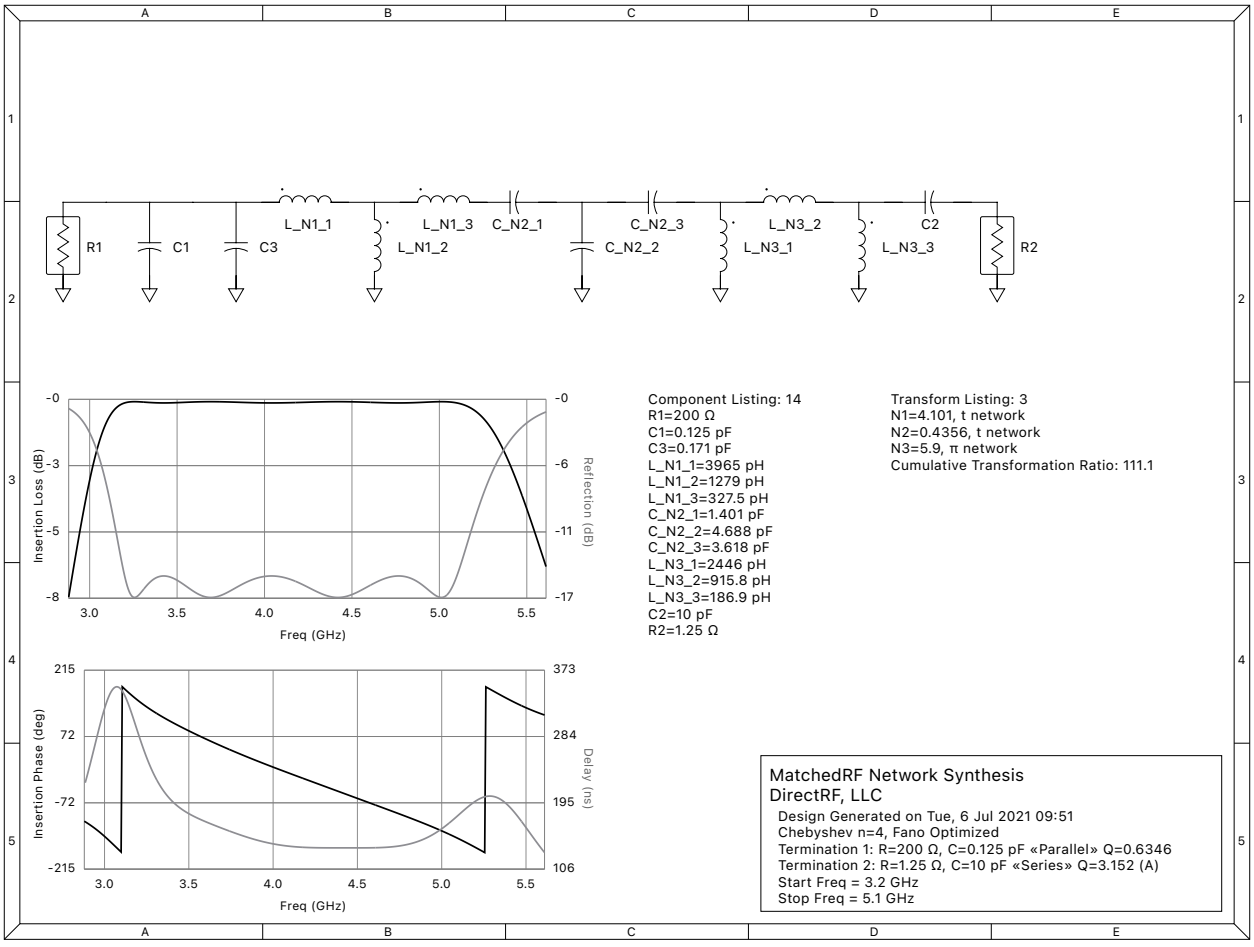
Plotting Capabilities

Description	Units
Insertion Loss (S21)	(dB)
Return Loss (S11)	(dB)
Transmission Phase (<S21)	(deg)
Group Delay	(ns)

Export Capabilities

Description	File Extension
Schematic & Design Summary Documentation	.pdf
Component Listing	.csv
S-parameters	.s2p
MatchedRF custom format	.pamatch

Example Schematic & Design Summary Documentation



References

[1] G. Matthaei, L. Young, and E. M. T. Jones, Microwave Filters, Impedance Matching Networks, and Coupling Structures. New York: McGraw-Hill, 1964, Norwood, MA: Artech House, 1980.

[2] D. E. Dawson, “Closed-form solutions for the design of optimum matching networks,” IEEE Trans. Microw. Theory Tech., vol. 57, no.1, pp. 121–129, Jan. 2009.

[3] R. Levy, “Explicit formulas for Chebyshev impedance-matching networks, filters, and interstages,” Proc. Inst. Elect. Eng., vol. 111, no. 6, pp. 1099–1106, Jun. 1964.

[4] T.E. Shea, “Transmission networks and wave filters”, New York: Van Nostrand, 1929, p. 325