

PERFECT PAIR FOR FILTER TUNING: CST STUDIO SUITE® AND R&S®ZNB

CST® Filter Designer 3D, which is part of the CST Studio Suite® simulation software from Dassault Systèmes, is a complete synthesis tool for filters and diplexers. It provides a range of solutions throughout the design process of coupled resonator filters and even beyond with its VNA based tuning capability. CST Filter Designer 3D assists in tuning filter hardware, significantly reducing the time for optimizing a device to meet the expected specifications. An attractive instrument to obtain fast data reading for realtime filter tuning is the R&S®ZNB vector network analyzer from Rohde & Schwarz.

Your task

4G/5G base station filters/diplexers are typically challenging DUTs. They require high out-of-band rejection. Transmission notches, also called nulls, can be as deep as 80 dB and more. The dynamic range and speed of the R&S®ZNB vector network analyzer together with CST Studio Suite® from Dassault Systèmes is a perfect match for this scenario.

Rohde & Schwarz solution

For real-world tuning, CST Studio Suite® supports USB, socket and Ethernet connections for a wide range of Rohde & Schwarz vector network analyzers. The R&S®ZNB is the leading vector network analyzer for production environments with a focus on speed, dynamic range and ease of operation. It combines high measurement accuracy with exceptional speed – better than 5 μ s per point. This enables short sweep times, e.g. 4 ms for 401 points. Furthermore, the R&S®ZNB vector network analyzer combines high power handling capacity with high sensitivity and low trace noise. The R&S®ZNB base unit provides typically 140 dB dynamic range (at 10 Hz IF bandwidth), which outperforms other, comparable products on the market. Optional dynamic range enhancements deliver a dynamic range as high as 150 dB (real dynamic range without receivers going into compression at low transmission coefficients).

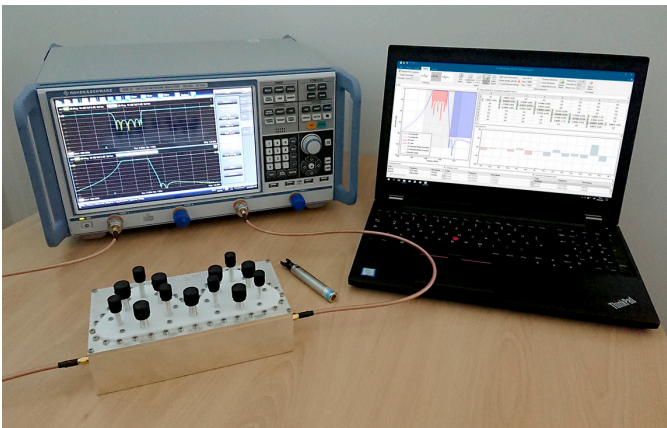


Fig. 1: VNA tuning setup with CST Filter Designer 3D and R&S®ZNB.

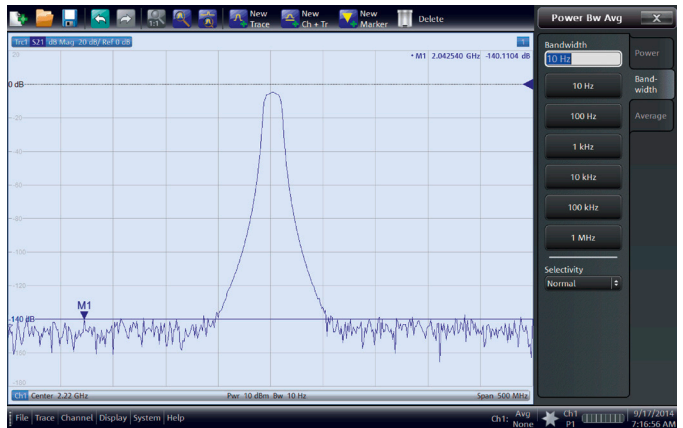


Fig. 2: R&S®ZNB dynamic range (at 10 Hz IF bandwidth).

Application Card | Version 01.00

ROHDE & SCHWARZ

Make ideas real



Fully integrated and easy to use

There are four steps to tune a filter:

1. Calibrate the R&S®ZNB vector network analyzer and perform S-parameter measurements on the DUT
2. Establish a remote connection between CST Filter Designer 3D running on a PC and the R&S®ZNB vector network analyzer. The software automatically reads the measured data in realtime
3. Based on the selected filter topology, the software extracts a coupling matrix from the measured S-parameters
4. Error bars indicate to what extent couplings and self-resonances are detuned. This provides the necessary information to optimize the filter hardware through its tuning mechanisms such as screws, variable capacitors and varactor diodes.

The filter model was designed with CST Filter Designer 3D and simulated with CST Studio Suite®. Given an accurate manufacturing process, the same result will be obtained from real measurements with the R&S®ZNB when the hardware is tuned to match the simulated coupling matrix.

The CST Filter Designer 3D environment is shown in the screenshot below, with the measured S-parameters read from the R&S®ZNB. The error bars indicate to what extent each matrix element deviates from the optimal tuning.

Application

Combine coaxial resonator filter

The filter has a 6th order response with two transmission zeros just above the passband. The filter topology consists of two cascaded triplet sections. Figure 3 shows the device with the resonator tuning screws marked with red numbers.



Fig. 3: Filter with numbered resonators.

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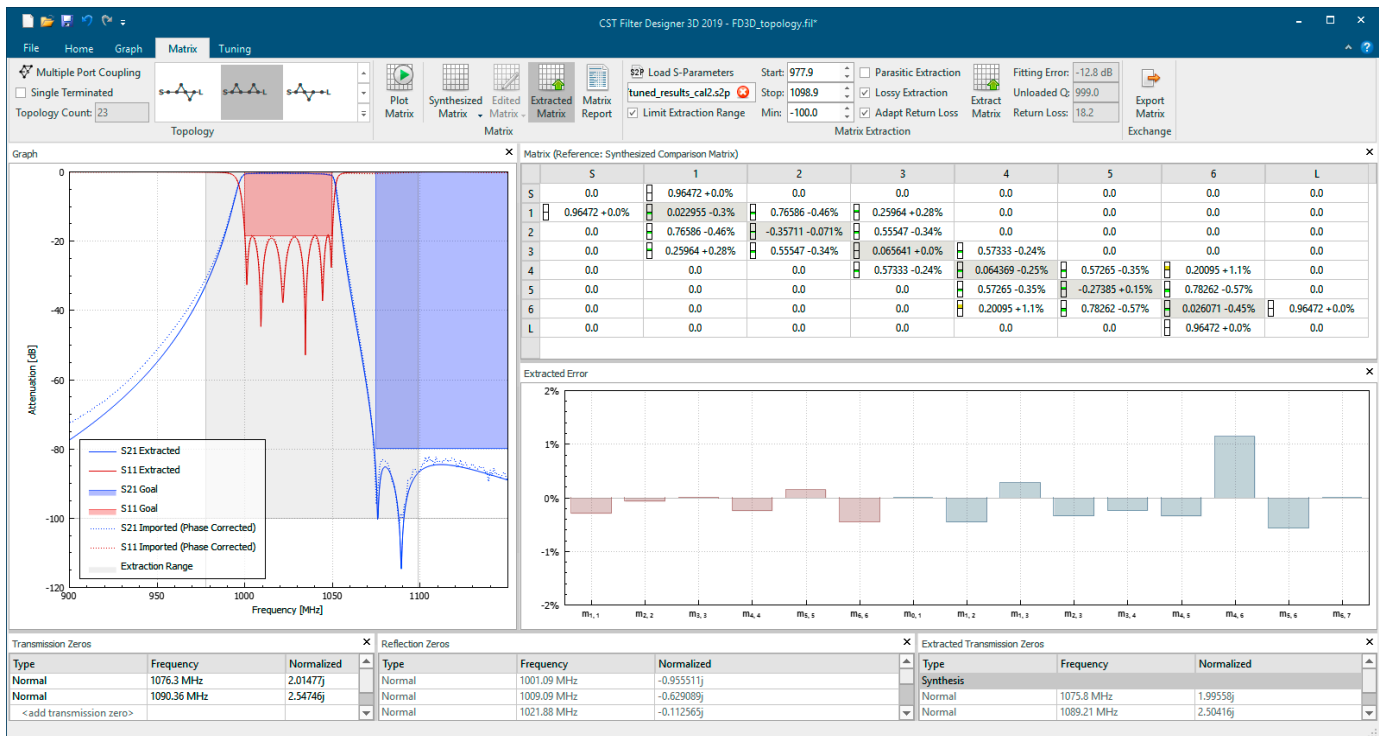


Fig. 4: CST Filter Designer 3D user interface showing the coupling matrix.

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