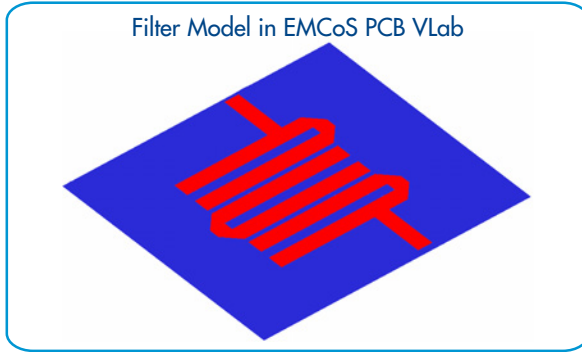# THREE-POLE HAIRPIN-LINE MICROSTRIP BANDPASS FILTER MODELING

Introduction

This document demonstrates modeling of Printed Circuit Boards (PCB) with Green Function approach using new powerful tools of EMCoS PCB VLab and EMC Studio. In conjunction, these two products make it easy to build a full simulation chain for various types of PCB models. In this application note Three-pole Hairpin-line Microstrip Bandpass Filter modeling is considered. Simulated characteristics of structure are compared with reference measurement data.

Simulation Workflow

Filter Model in EMCoS PCB VLab

Filter Model in EMC Studio

Complete Simulation Model in EMC Studio

Network 1
V = 1 V
R = 50 Ohm

Network 2
R = 50 Ohm

Simulation workflow consists of the following steps:

- Importing of filter model from ODB++ file format in PCB VLab
- Assignment of physical parameters using EMCoS PCB VLab tools
- Converting of PCB to EMC model compatible with EMC Studio
- Importing of PCB model to EMC Studio project
- Construction of complete simulation task for analysis in EMC Studio environment
- Comparison of numerical results with measurements
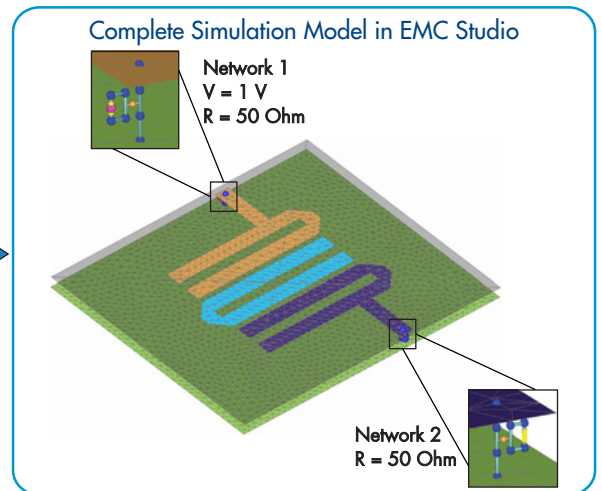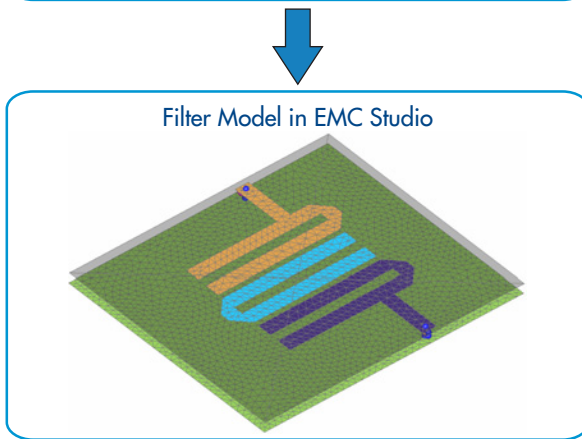
Measurement Setup

Measurement setup is represented by a three-pole hairpin-line microstrip bandpass filter on a 2 mm-thick substrate with relative dielectric constant 4.4. Parameters components of setup are listed in table below.

| Wire Parameters	
Radius of wire	0.1 mm
Filter Parameters	
Thickness of substrate	2.0 mm
Dielectric losses	0.02
Permittivity of substrate	4.4
Model Dimensions	
Substrate length	46.5 mm
Substrate width	55.0 mm
Track width	2.85 mm
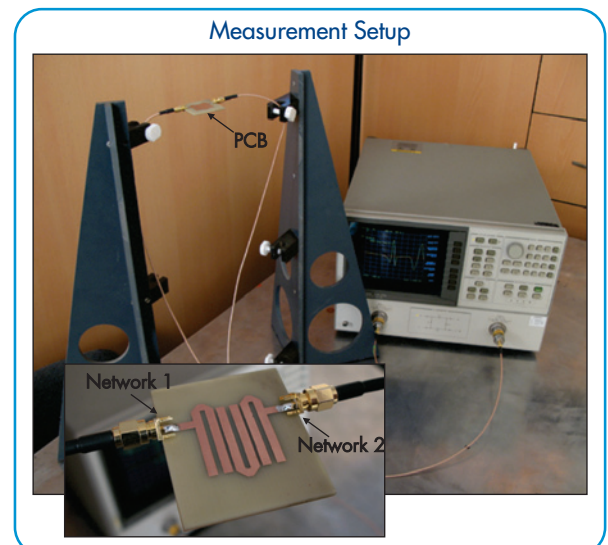
Measurement Setup

Measurements were performed in EMCoS laboratory.

EMC Studio - EMCoS PCB VLab Application Note: #02

EMCoS
Consulting and Software

Results

The comparison of simulation and measurement results is shown below. There is good agreement between measurement and simulation results in considered frequency range.

S11 (Magnitude)

S11 (Phase)

S21 (Magnitude)

S21 (Phase)
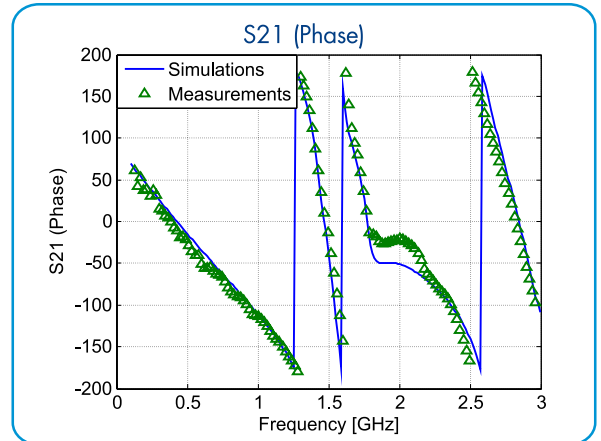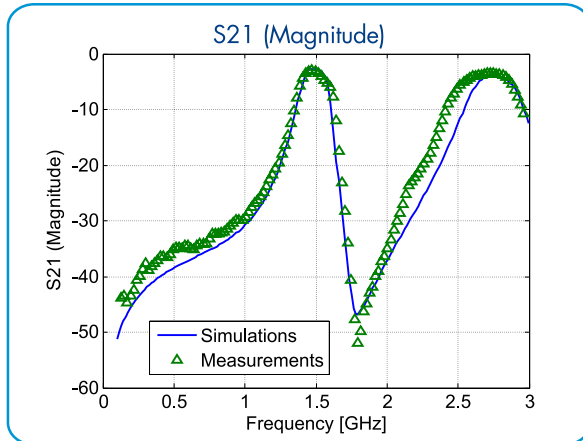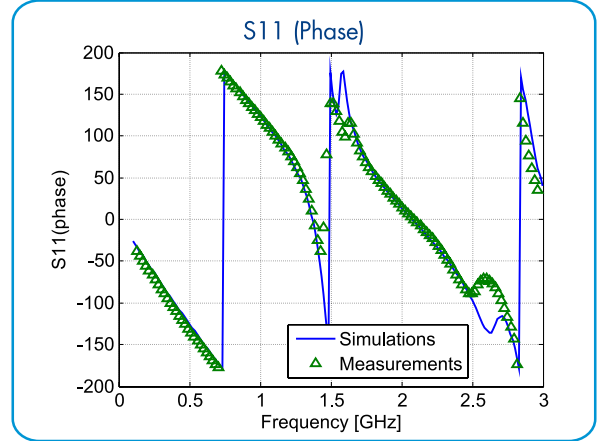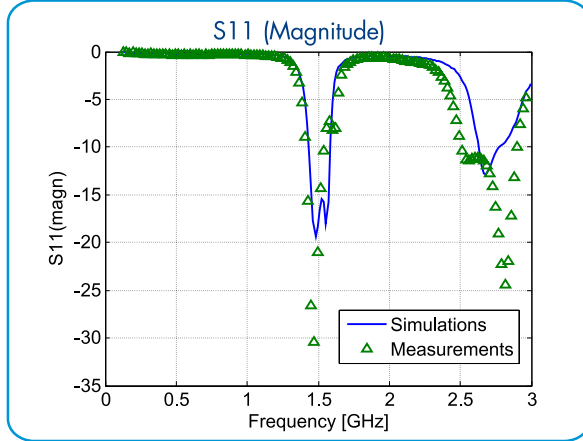
The current distribution on Microstrip Bandpass Filter for resonant frequencies is shown below.

Current Distribution (1.5 GHz)

Current Distribution (2.7 GHz)
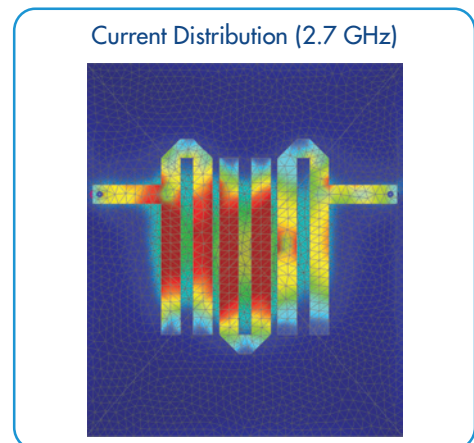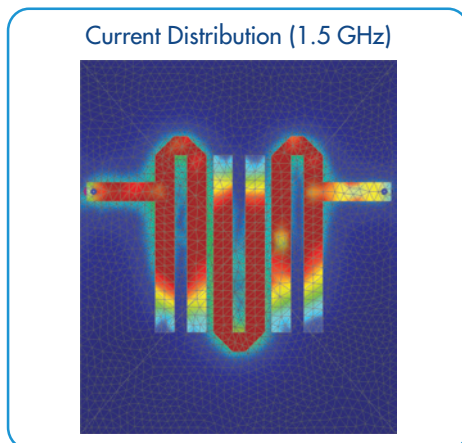
Conclusions

According to performed investigation the main conclusions are:

- Computational model of PCB can be effectively generated using EMCoS PCB VLab and EMC Studio
- Simulation results are in good agreement with measurement results

EMC Studio - EMCoS PCB VLab Application Note: #02