Dual Resonance Bandpass Filter

Šejla Džakmić

Electrical and Electronics Engineering
International University of Sarajevo

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Theoretical Background

- A rapid development and progress in modern wireless communication technologies causes higher requirements for new designs of digital microwave components
- Multiband filter design, as one of the most significant component in microwave engineering, imposes to the researchers worldwide
- There are different approaches and solutions for improved filter performance

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Related Work

- To integrate two Defected Microstrip Structures to produce high attenuation
- Using dual mode dual band bandpass filters
- Parallel-coupled and vertical-stacked configurations
- Slow-Wave Resonant Cell with Dual-Resonance (ultrawide stopband response)

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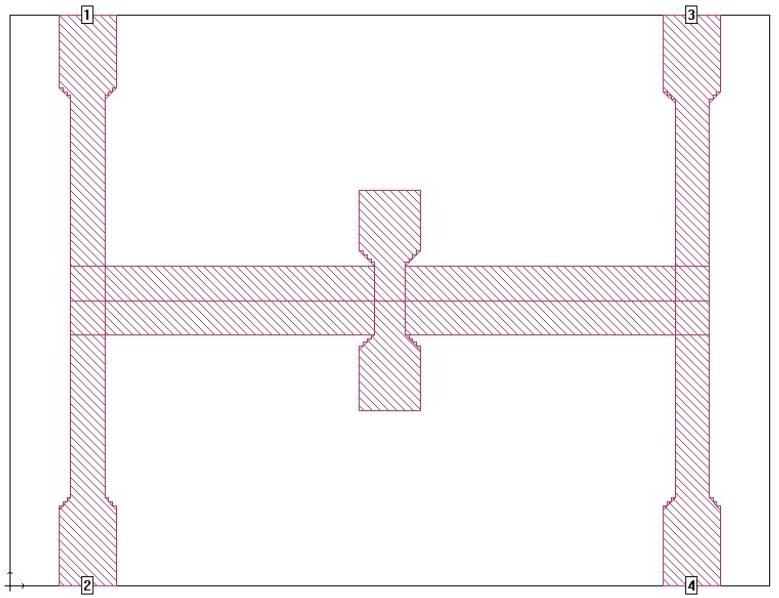
Filter Design

- Four ports placed at the edge of vertical stub long 15 mm
- Short circuit stubs connected by two horizontal stubs 33.6 mm long
- Each has width of 1.8 mm.
- Vertical stubs are wider after 10.6 mm for 45°
- Center stub dimensions:

3.2 mm width and 4.0 mm length



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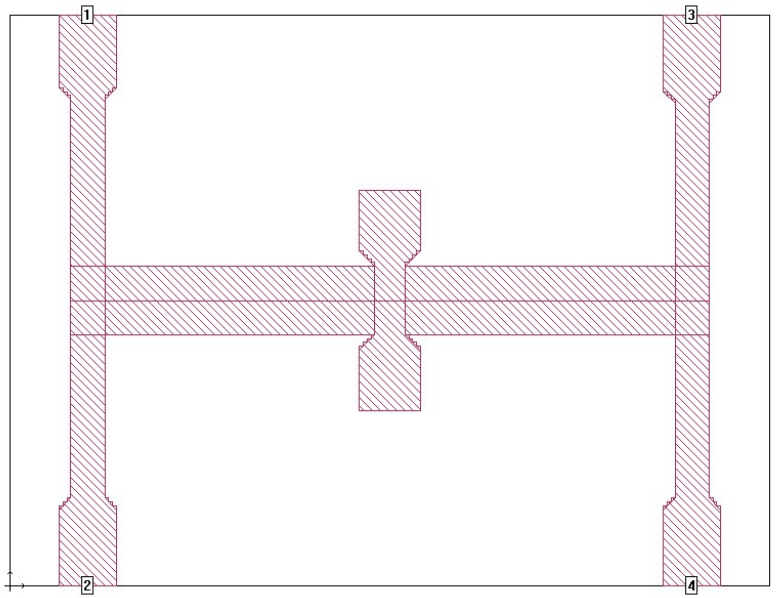

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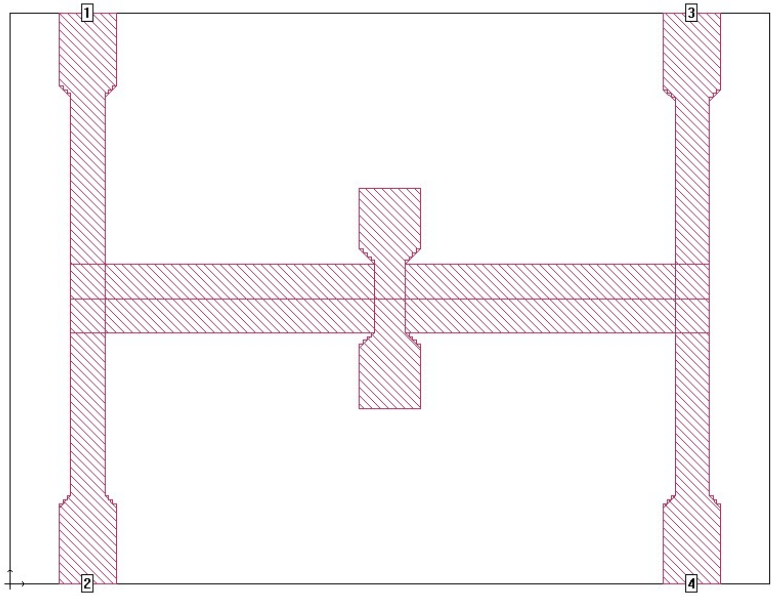

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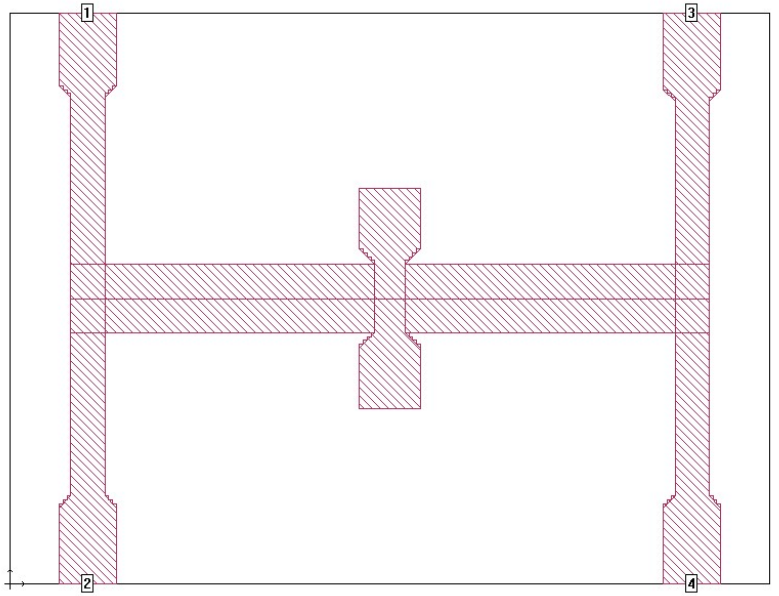

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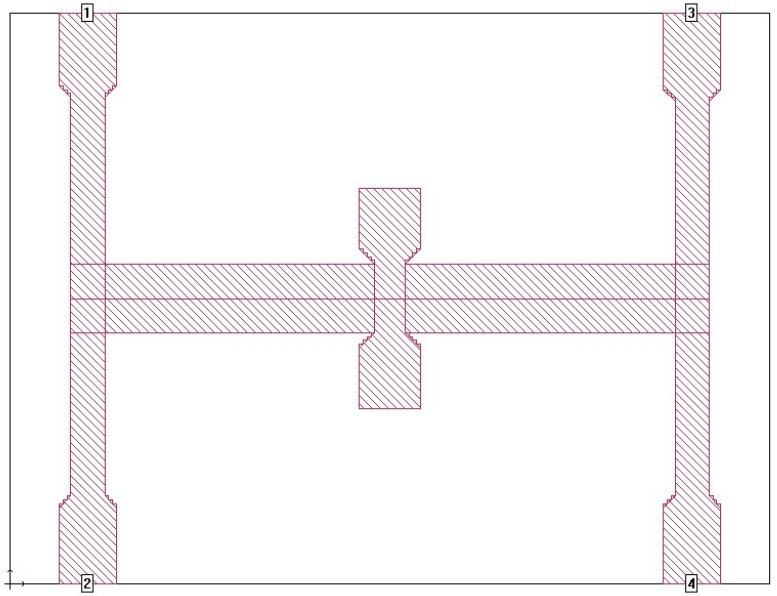

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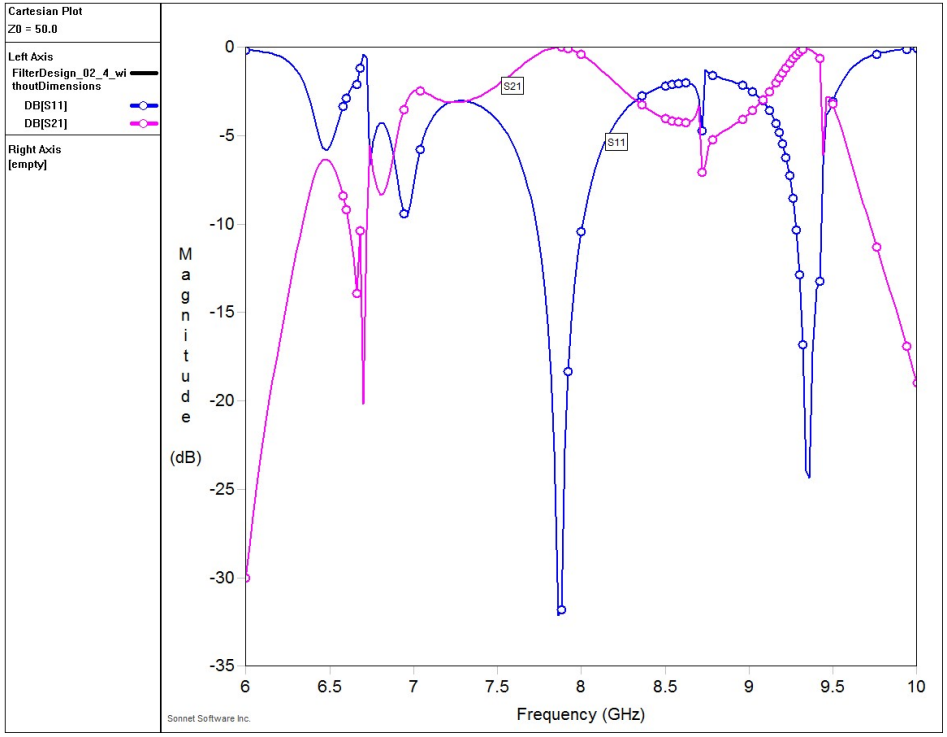
Simulation

- Filter design is simulated with a relative dielectric constant of 1.
- The thickness of the substrate is 0.36 mm
- The whole backside of the substrate is the ground plane.



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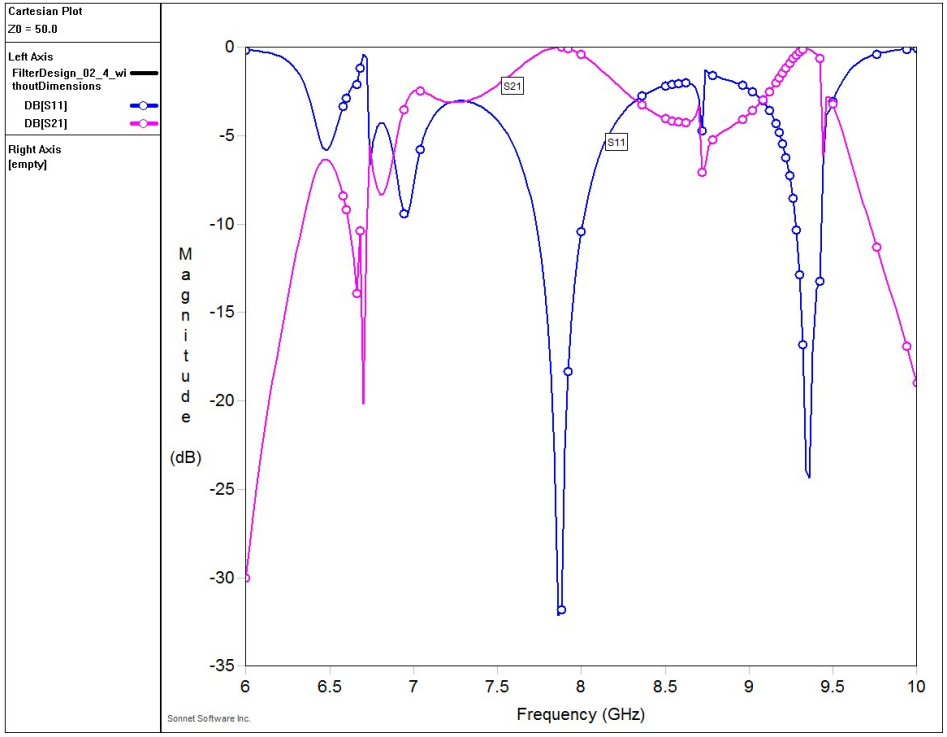

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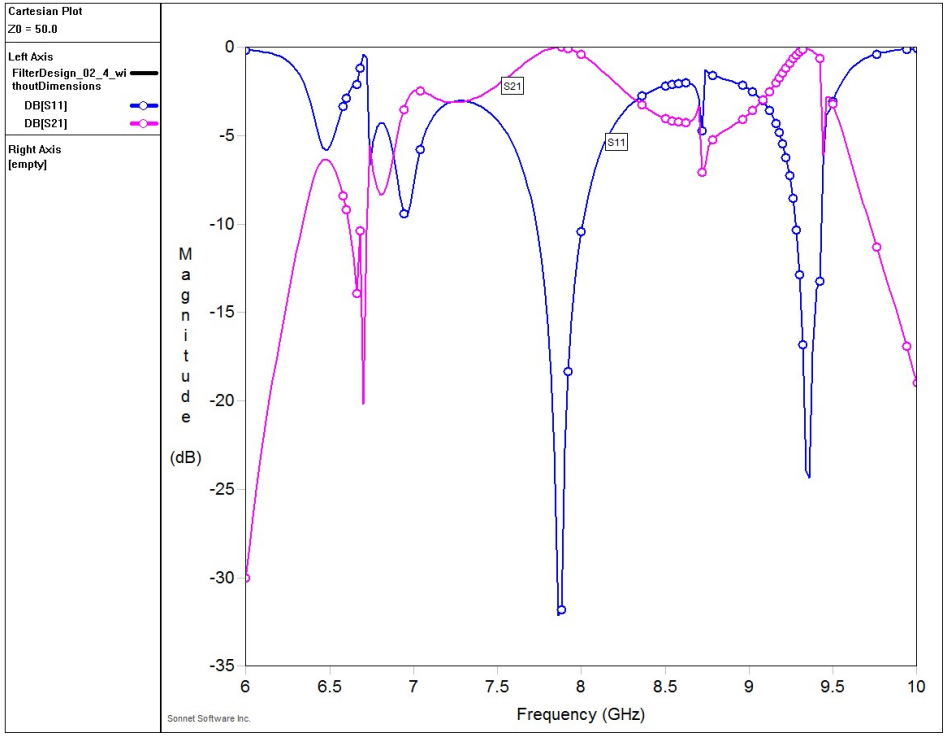

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Tested Design Configuration

- Dual band-pass filter design with bandwidth from 6 GHz to 10 GHz.
- Resonances are centered at 7.8 GHz and 9.3 GHz
- Passband bandwidths $\Delta_1 = 25\%$ and $\Delta_2 = 8\%$
- Return loss is S_{11} at first resonance is $-28.87\,dB$, while insertion loss S_{21} is $-0.05\,dB$ at the same resonance.
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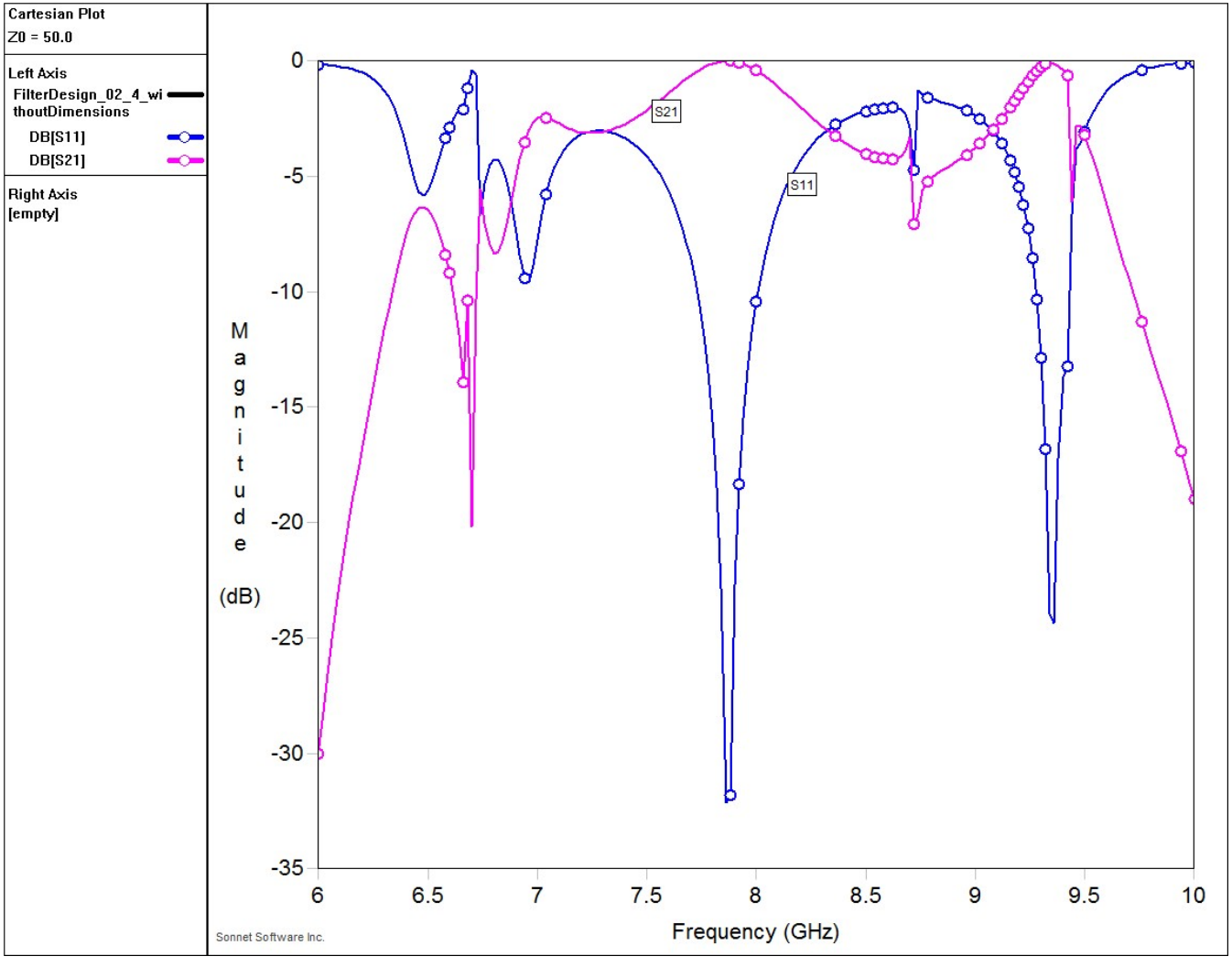

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Results for Different Configurations

Air thick-ness	f_1(GHz)	S_{11}(dB)	S_{21}(dB)	f_2(GHz)	S_{11}(dB)	S_{21}(dB)
1.15	7.84	-31.94	-0.13	9.66	-7.47	-2.83
1.25	7.82	-32.53	-0.05	9.58	-14.42	-2.09
1.0	**7.86**	**-28.87**	**-0.05**	**9.64**	**-8.97**	**-2.74**
1.5	7.8	-36.15	-0.06	9.5	-12.32	-2.35
1.75	7.8	-32.81	-0.06	9.5	-12.19	-2.29
2.0	-7.78	-38.12	-0.061	9.46	-12.12	-2.29

Table: Simulation results with various air thickness

Results for Different Configurations

Center stub length	f_1(GHz)	S_{11}(dB)	S_{21}(dB)	f_2(GHz)	S_{11}(dB)	S_{21}(dB)
4.4	7.88	-36.82	-0.02	9.26	-14.91	-1.41
4.2	7.88	-34.08	-0.03	9.3	-19.89	-0.55
4.0	**7.86**	**-37.84**	**-0.02**	**9.34**	**-24.14**	**-0.23**
3.8	7.86	-34.66	-0.01	9.36	-24.66	-0.09
3.4	7.89	-39.42	-0.02	9.44	-14.8	-2.7
3.2	7.88	-32.23	-0.27	9.4	-11.23	-2.3

Table: Simulation results with various air thickness

Summary

- A novel dual resonance bandpass filter design is proposed
- It is designed and optimized in Sonnet EM Simulator to verify the proposed structure
- Resonances are centered at 7.8 GHz and 9.3 GHz
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