

Microstrip 3dB Coupler

Vildana Buljubašić

Department of Computer Sciences and Engineering
International University of Sarajevo
Sarajevo, Bosnia and Herzegovina

OUTLINE



WHAT IS A
COUPLER?



INTRODUCTION



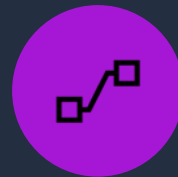
DESIGN



SIMULATION



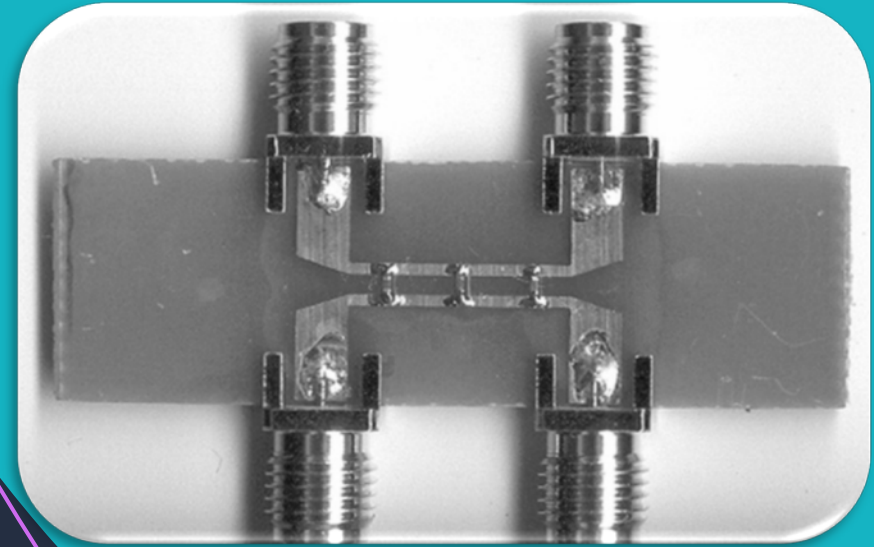
CONFIGURATION
VARIATIONS



CONCLUSION

WHAT IS A COUPLER?

- A coupler is a device that connects two mechanical components.



Microstrip coupled-line coupler



Cable adapter coupler

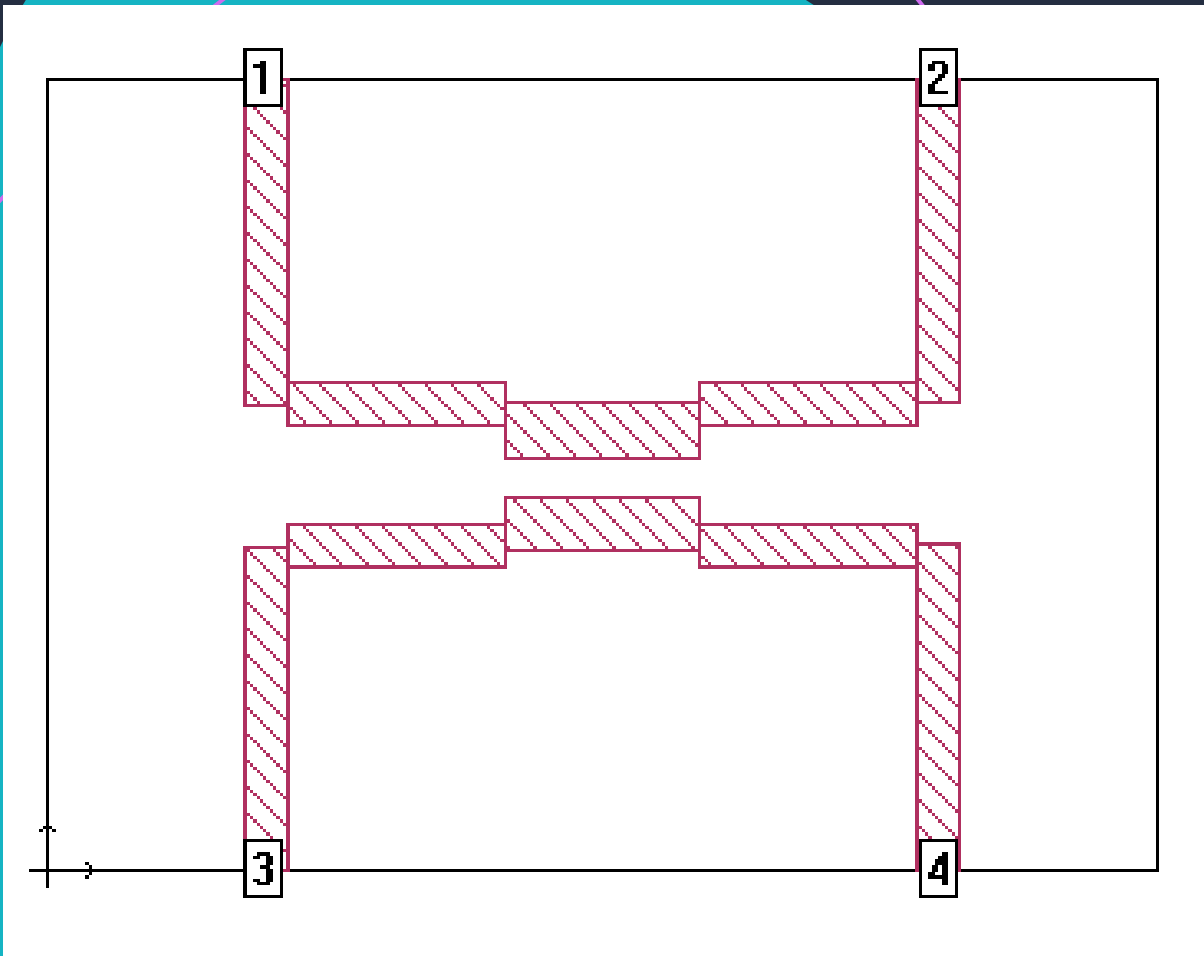
INTRODUCTION

- Coupling is desirable transfer of energy from one medium to another
- Process can be done through metallic wires or an optical fiber
- Directional coupler is a very commonly used basic element for measuring the power level of a signal

INTRODUCTION

- Easier solution is using symmetrical coupler
- Microstrip technology is used for simplicity
- Microstrip coupled line coupler is consisted of two parallel open circuits with a gap between them, and three sections
- Design and simulation are performed using Sonnet Software

DESIGN



- Coupler is made of two parallel open circuits with three sections microstrip coupled line
- Its structure is symmetric so all reflection and transmission coefficients will be identical
- The coupler is a four-port device

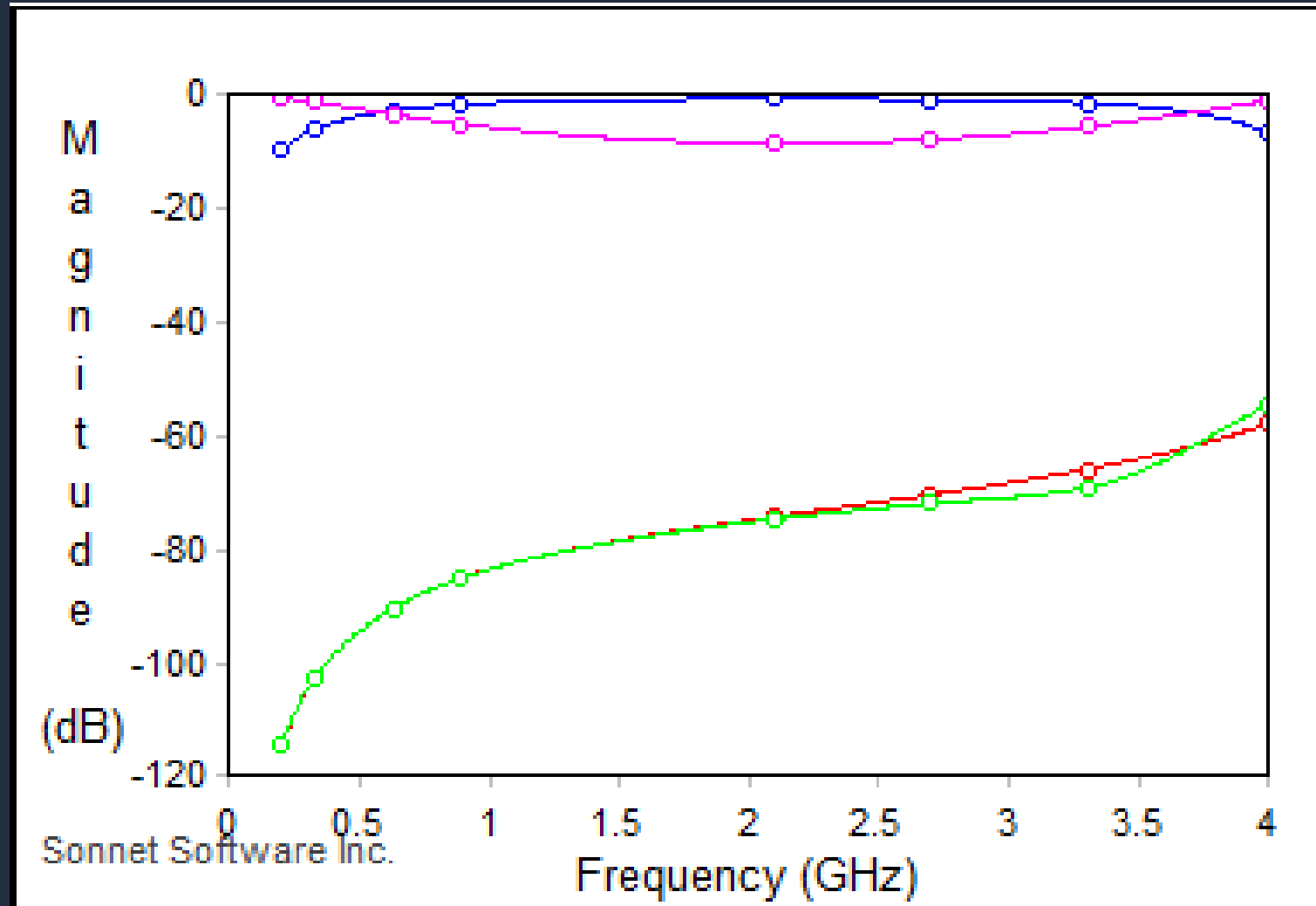
DESIGN

- Filter box is 600 x 430 mils
- Four open stubs are 23 mils wide, and 177.6 mils long
- Separation is 342 mils between them
- Two circuits are 20.95 mils separated

SIMULATION

- Coupler was simulated under the current frequency from 0.2 GHz to 4.0 GHz
- Dielectric thickness is 1.7 mils and ϵ_r is 4.7
- Magnitudes (blue and purple curve) are intersecting in two spots
- Simulations were recorded in those two spots

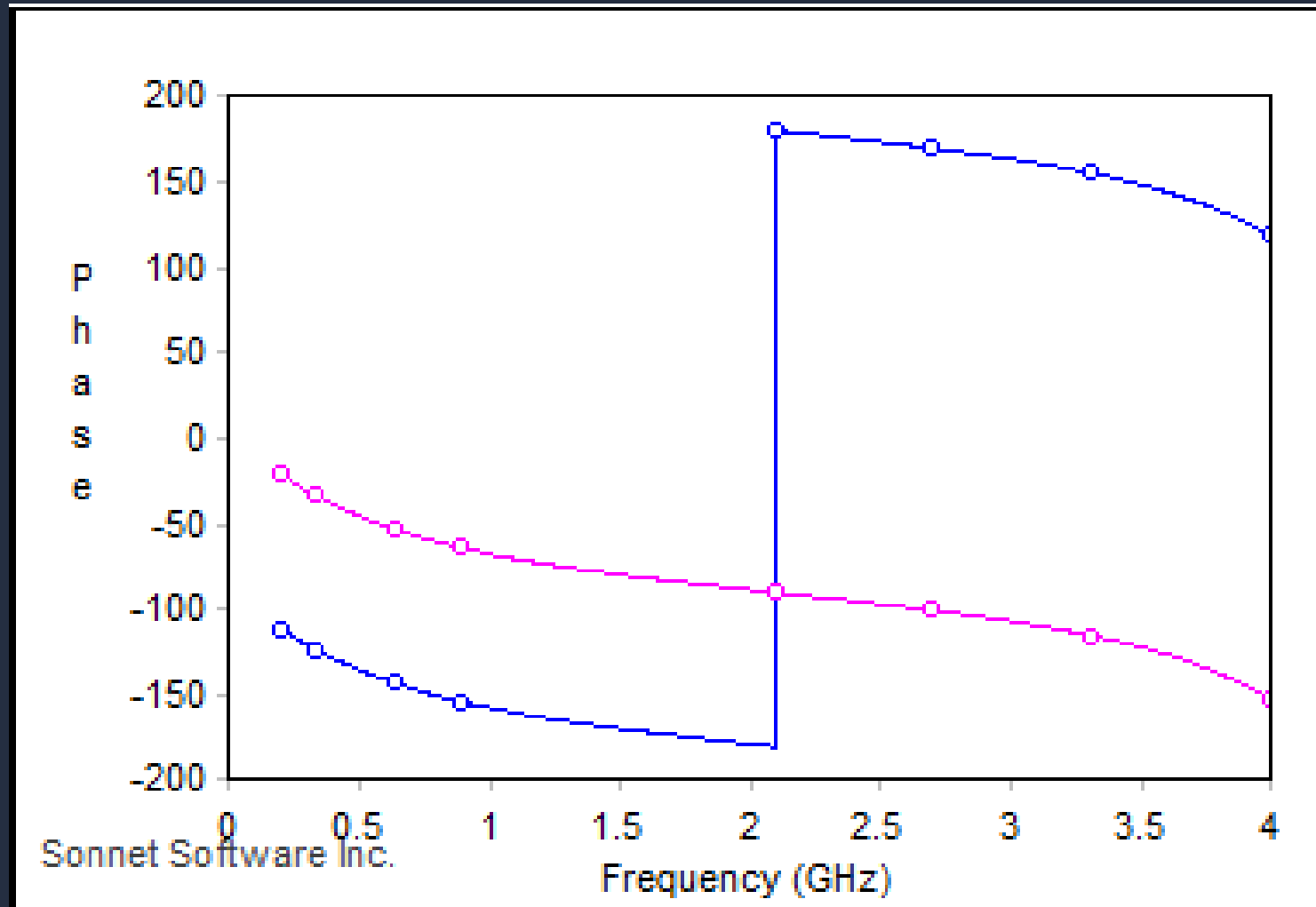
SIMULATION



SIMULATION

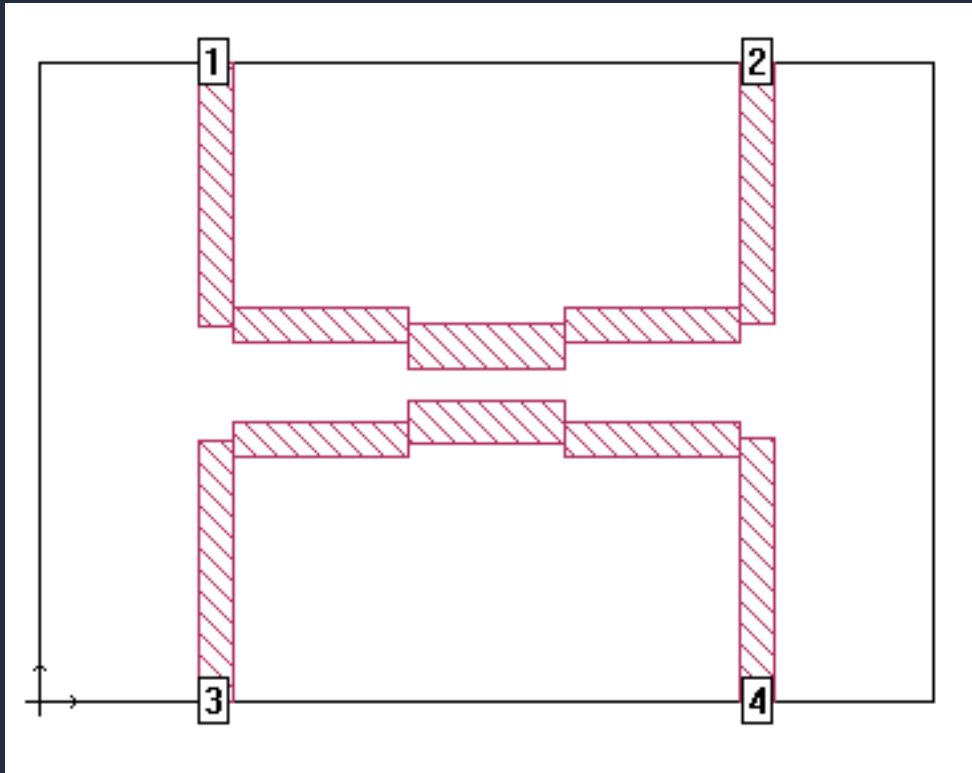
- Generally, branch-line couplers are 3dB, and four port directional couplers are having a 90° phase difference between its two output ports
- Starting from 0.2 GHz, there is 90-degrees phase shift throughout the band

SIMULATION



SIMULATION

- Going back to the proposed design



- For each new analysis, separation between circuits was most important.
- Stubs were in fixed positions during simulations, except for two parallel in the middle
- Theirs width was the same, only height was changed

CONFIGURATION VARIATIONS

- When manipulating with the data we can change, results are supposed to be similar (without big deviations)
- Average values were recorded:

Mils	Thickness	ϵ -r	Ratio1 (dB)	Frequency 1 (GHz)	Ratio2 (dB)	Frequency 2 (GHz)
204.0	1.6	4.7	3.008	0.562	3.006	3.51
204.0	1.7	4.7	3.016	0.596	3.002	3.494
204.2	1.7	4.7	2.98	0.576	2.978	3.68

CONFIGURATION VARIATIONS

- Set configuration is good and current is flowing regularly (no big deviations)
- If original structure is changed results will vary
- Modifications that are related to the width and height of the stubs, number of stubs, distance between them, etc. are also affecting results

CONCLUSION

- This coupler meets the requirements of good performance
- By changing some geometry different results can be achieved without big deviations in final output which proves the correctness of the proposed design
- If fabricating, due to its suitable size and simplicity, fabrication will not be a problem

ACKNOWLEDGEMENT

I would like to thank my mentor, professor Doctor Şehabeddin Taha İmeci for his valuable guidance and selfless support while doing this project.





Thanks for your attention!