5G 통신 시스템을 위한 캐비티 필터 설계

판팔리*, 누온스레이맘*, 칫스레이롱*, 장유나*, 안달*

순천향대학교*

phallyphan88@gmail.com

Design of Cavity Filter for 5G Communication Systems

º Phally Phan*, Sreymom Noun*, Sreyrong Chhit*, Youna Jang*, Dal Ahn*

Soonchunhyang University*

ABSTRACT

In this paper, we propose a Cavity Filter 4-order with a center frequency of 27.925GHz. The advantages of this filter are being high Q-factor, low insertion loss, and good frequency stability but manual tuning is required.

I. INTRODUCTION

5G devices need to be able to transmit and receive signals from a wide variety of sources. The Cavity Filter is a type of resonant filter that used to select the desired signals from a specific frequency band and reject the unwanted frequency components, which can interfere with performance. 5G network infrastructure operates in higher frequency bands than ever before, ranging from several GHz to tens of GHz, further exacerbating the need for optimized filter devices. [1]

II. DESIGN PROCESS

The table below are the calculated design parameters. And the value of the coupling coefficient between the resonator is:

$$|K_{ij}| = \frac{f_{peakj}^2 - f_{peaki}^2}{f_{peakj}^2 + f_{peaki}^2}$$. [2]

K_{12}, K_{34}	0.0275
K_{23}	0.0208
t_d	0.679 $[ns]$

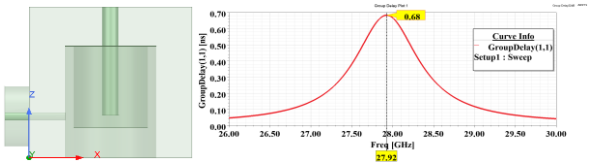

Fig1. The single resonator, S_{11} of the group delay.

The result shows that the $t_d = 0.68ns$ close to the table $t_d = 0.679ns$ at the center frequency 27.925GHz.

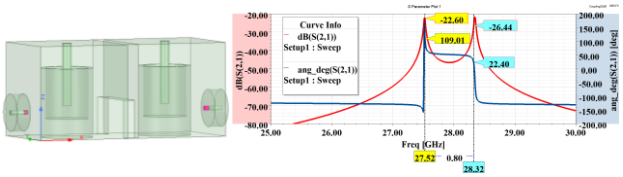

Fig2. The coupling structure and phase of S_{21}.

The result shows the coupling size of each resonator period and the size can be known through the formula above.

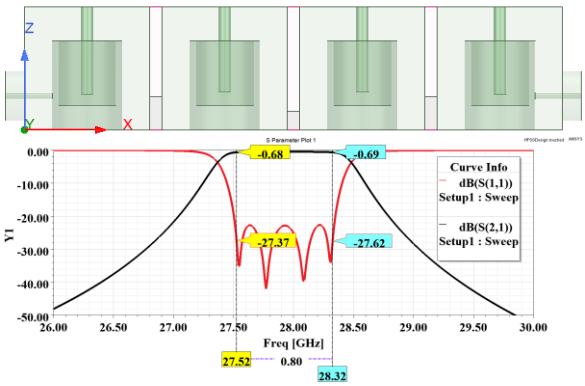

Fig3. S-parameters result of the Cavity Filter.

The results has a good insertion loss of $S_{21} = -0.69\text{dB}$ and a return loss of $S_{11} = -22.2\text{dB}$, reflection coefficient from 27.525GHz to 28.325GHz at the center frequency of 27.925GHz.

III. CONCLUSION

In this paper, we design a Cavity Filter 4-order with a single box of the resonator size $(2\text{mm} \times 2\text{mm} \times 2\text{mm})$ and the tap conductors of port1 and port2 are touched with the resonator. The proposed filter has a return loss at -22dB with the center frequency at 27.925GHz between the frequency range from 27.525GHz to 28.325GHz and designed by using HFSS.

ACKNOWLEDGMENTS

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RESFERENCES

[1] Brianne Christopher, COMSOL Blog, Designing Cavity Filters for 5G Devices with Multi-physics Modeling, April 13, 2021.

[2] Hong, J-S., "Micros-trip filters for RF/microwave applications", Hoboken, John Wiley & Sons, (2011), ch.8, pg.258.