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RESEARCH PAPER

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COMPACT HALFMODE SIW BANDPASS FILTER FOR SUPER WIDEBAND APPLICATION

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Abstract: **-** In this Paper, a simple wideband BPF is proposed using a slot resonator which produces passband of 7-16 GHz. The transmission characteristics are improved by etching a square slot resonator in the half mode SIW BPF. The proposed filter uses a microstrip transition which results in better return loss performance and wider bandwidth. A novel compact bandpass filter is designed and simulated using ADS software**.**

Keywords- bandpass filter, wider bandwidth, pass band. transmission line is W1 and the length of the SIW

I. INTRODUCTION

High data rates, low power transmissions, excellent range resolution are main advantages of Ultra Wideband (UWB) technology[1]. UWB filters have lower insertion loss, good return loss performance, good selectivity and better rejection performance. A new design of wideband microwave bandpass filter is constructed by combining S-shaped slot and L-shaped slot loaded quarter-mode substrate integrated waveguide filter [2]. A bandpass filter with a 1.39 GHz bandwidth centered at 4.54 GHz is proposed by using CMRC resonators [4]. Good return loss performance and sharp selectivity are produced using two stubs in a bandpass filter for UWB applications [5]. Microstrip stopband bandpass filters are proposed using two shapes of split ring resonator (SRR) [6].

In this paper, half mode SIW UWB bandpass filter is realized using slot resonator. A microstrip transmission line is attached with the split ring resonator. Here, vertical array of vias are placed in the stubs of the split ring..Further optimization is done by adding L stub in the transmission line.

2. DESIGN OF HMSIW BPF

The half mode substrate integrated waveguide bandpass filter is designed in planar dielectric substrate with linear array of metallic via fences as shown in Fig.1. The SIW transmission line interrupted by two electric walls and it enables the propagation of the mode (TEm0)[7]. The parameters are the diameter of the metallic via d, spacing between the via holes p, the length of the transmission line is L1 and width of the

is L_{SIW} and width of the SIW is W_{SIW}. The Half mode SIW bandpass filter structure is simulated using a substrate that has a relative permittivity of 3.5 and thickness of 0.5mm.The resonant frequency of the pass band is derived using the following formula:

$$f_o = \frac{c_o}{2\varepsilon_r}\sqrt{\left(\frac{1}{W_1}\right)^2 + \left(\frac{1}{L_1}\right)^2} \qquad (1)$$

Where the width and length of the transmission lines are given by the equation,

$$W_1 = W_{SIW} - \frac{d^2}{0.95p}, \quad L_1 = L_{SIW} - \frac{d^2}{0.95p}$$

The proposed half mode SIW bandpass filter consists of linear array of vias in the bottom. The passband bandwidth is determined by the metallic vias coupling structure. The microstrip transmission line source-load coupling structure produce dual mode and better upper stopband performance[8]. Here, coupling depends on the port microstrip transmission line. The super wide bandpass filter of passband frequency at -10dB ranges from (7-20GHz)

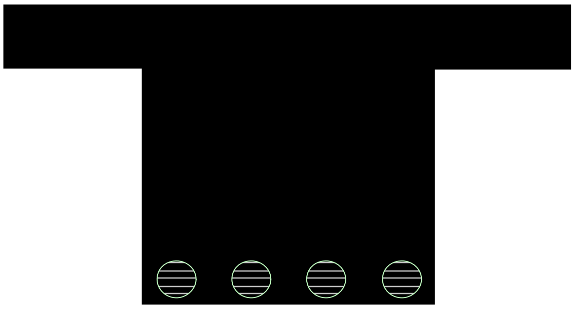

Fig.1 Configuration of Proposed UWB Bandpass filter with vertical array of vias

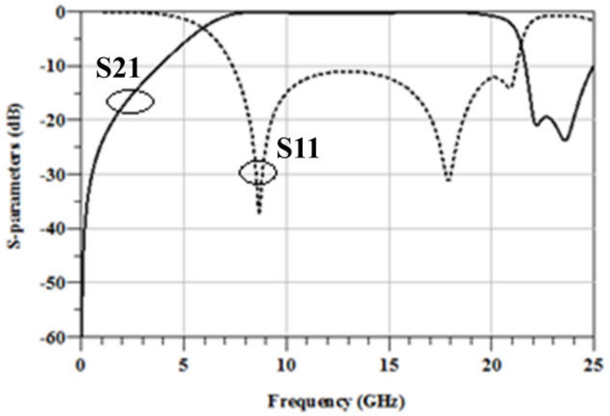

Fig.2. Simulated Result of SIW Bandpass filter using vertical array of vias.

The Surface current distribution of bandpass filter is shown in Fig3.

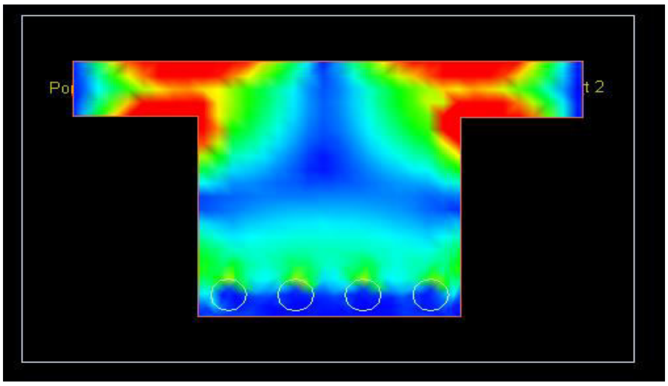

Fig.3. Surface current distributions of bandpass filter using vertical array of vias.

The analysis of compact half mode SIW bandpass filter produces a dual mode with transmission zeros[3] as shown in Fig.2. The dual mode return loss performance is improved by etching the square slot. The strong coupling depends on the size of the square slot. By decreasing the slot size, return loss and stopband performance is improved. The halfmode SIWBPF is proposed using slot resonator to provide transmission zeros in the pass band and lower insertion loss. Here via diameter is d=0.8mm and the gap between vias is p is 1.5mm. The halfmode SIW bandpass filter structure is designed for super wide band bandpass filter frequency at -10dB ranges from (7 -16GHz).

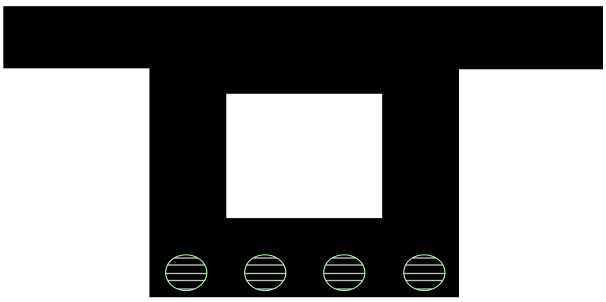

Fig.4 Configuration of Proposed UWB Bandpass filter with vertical array of vias.

The slot resonator of the half mode SIW bandpass filter produces dual mode center frequency of 8GHz and 14GHz and stopband attenuation about -30dB and obtains wide band characteristics. This halfmode SIW bandpass filter produces a super wideband bandpass filter with return loss of dual mode frequency 8GHz is -40dB and 14GHz is -49dB, as shown in Fig.5.

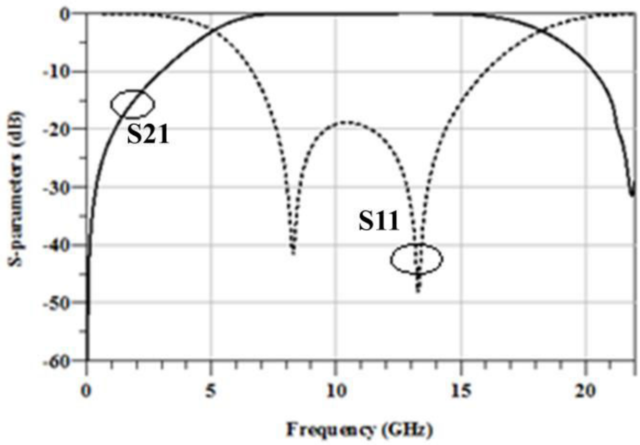

Fig.5. Simulated Result of SIW Bandpass filter using vertical array of vias.

3. CONCLUSION

A super wideband bandpass filter is designed and analyzed. The square slot resonator is etched in the half mode SIW bandpass filter to improve the transmission response characteristics and stopband attenuation. The half mode SIW BPF is designed using square slot resonator in the transmission produces return loss about -40 and -49dB and better stopband attenuation about -30dB operated frequency range of (7-16 GHz).

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