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The Modular Design of M-SIW Wideband Band-stop Filter

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Abstract - The wideband band-stop filter M-SIW (Microstrip-Substrate Integrated Waveguide) is designed to achieve tradeoff between low loss and low cost with simplicity. In this section the high-pass filter of the Substrate Integrated Waveguide (SIW) in a modular system and parts of a Microstrip low-pass filter are combined. The M-SIW band-stop filter was created using a concept design which is simple and straightforward, making it simple to build a band-stop filter at the output frequency with required specification. The experimental determination of the M-SIW wideband band-stop filter that was manufactured was discovered to BW = 5.15 GHz and f_C = 4.74 GHz based on a simulation performed by Computer simulation Technology (CST).

Keywords: substrate integrated waveguide, microstrip, band stop filter, insertion loss method, modular design concept.

I.INTRODUCTION

Microwave filters are widely utilised in a variety of industries, including telecommunications . DWDM systems, which transfer data at 100 Gbit/s, are a suitable example.A fibre optic cable with only one channel (single fibre pair). The C-Band is commonly employed in DWDM systems due to its low cost and Losses are minimal. The band-pass and band-stop filters are separated. Signals that are desired or unwanted. It's possible to utilize band-stop filters. Side band interference signals are suppressed. Microwave filters can come in a variety of shapes and sizes, satellite, telecommunications, and wireless application, weather radar and networking technology. SIW filters have several advantages over rectangular filters. Waveguides are low-cost, easy-to-integrate, low-loss, and high-performance Q-factor, etc. The M-SIW wideband band-stop filter could be useful in DWDM can be utilized in satellite communication**.**

II. DESIGN OF M-SIW WIDEBAND BAND-STOP FILTER

A band-stop filter for the C-Band and S-Band is predicted in this study. Between 2.5 and 8 GHz, a band-stop filter design is investigated. Using this, we can create a band-stop filter. The SIW and the structure of a microstrip low-pass filter in a single model, there is a high-pass filter structure. The planned band-stop filter's measured results are as follows: when compared to simulation findings.

Stage I: Combination of SIW High-pass Filter and SIW Low-pass Filter. A planar rectangular waveguide is a SIW construction. SIW filters are hence high-pass filters.

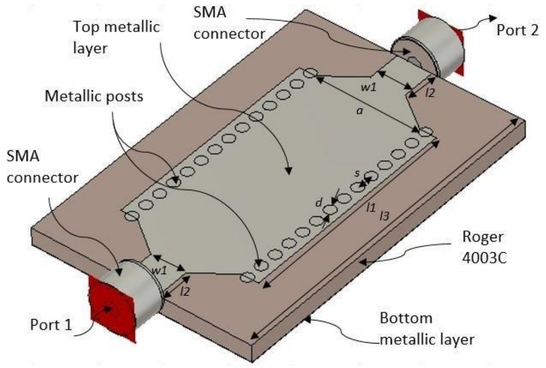

Fig.1 Structure of SIW high-pass filter

In this filter design, Roger 4003C substrate material is employed. R0=50 Ω, ε_r= 3.38, h = 1.52 mm, and $tan\delta$ =0.0027.

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The cut-off frequency of SIW high-pass filter is

$$f_{cmn} = \frac{1}{2\pi\sqrt{\mu\varepsilon}}\sqrt{(\frac{m\pi}{a})^2 + (\frac{n\pi}{b})^2}$$

The guided wavelength is declared as

$$\lambda_g = \frac{2\pi}{\frac{\sqrt{(2\pi f)^2\varepsilon_r}}{C^2} - (\frac{\pi^2}{a^2})}$$

If it is assumed as a > b, TE_{10} (Dominant TE mode of planar rectangular waveguide) cut-off frequency (f_{c10}) is

$$f_{c10} = \frac{1}{2a\sqrt{\mu\varepsilon}}$$

The diameter of the metallic posts is d, the distance between two metallic post centers is s, and the dielectric substrate material's height is h. SIW has a width of a. In order to construct a SIW filter, several conditions must be met.

$$S/d \leq 2\,, d < \frac{\lambda_g}{5}$$

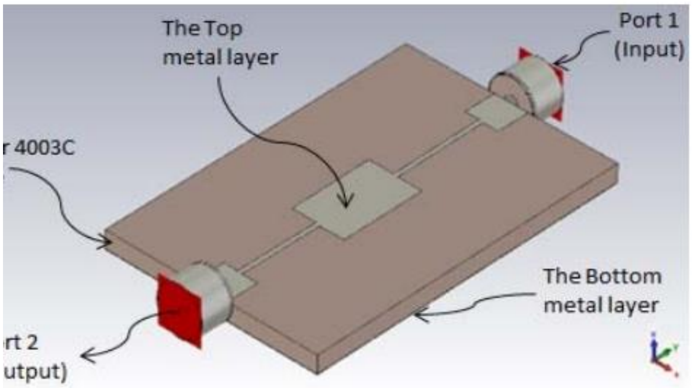

Fig.2 Structure of microstrip Low pass filter

Stage II: MSIW Notch Filter Design the shape and parameters of the 2 port MSIW notch filter are shown in Figure 2. The center frequency (ω0) of the notch filter is $\omega_0 = \sqrt{\omega_1\omega_2}$

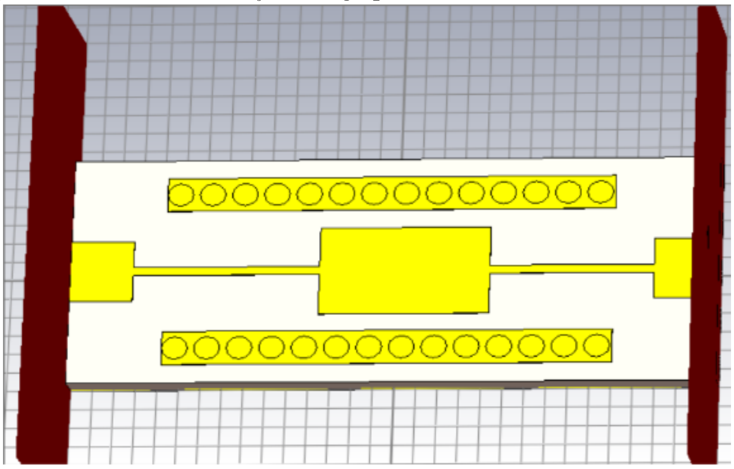

Fig.3 Design of M-SIW Band-stop filter

The guided wavelength (λg) of M-SIW band-forestall clear out is 32.35 mm in keeping with simulation. The forestall-band is 4.81 GHz. Simulation and measured outcomes are visible in Fig. 5. The parameters of M-SIW band-forestall clear out is proven in Table I.

TABLE .I
The Parameters of MSIW Band stop filter

parameters	length	Parameters	length
a	6.5	W4	2.28
d	1	W5	1.78
h	1.52	L1	19.5

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s	1.5	L2	2.94
W1	3.22	L3	30
W2	0.43	L4	7.58
W3	2.36	L5	8.65
		L6	7.72

Based on the measurement results, the sensitivity of CST Studio Suite was found to be good.
Based M-SIW band-forestall clear out out has port (Port1, Port2). The ports are visible on proper and left facets of clear out model.

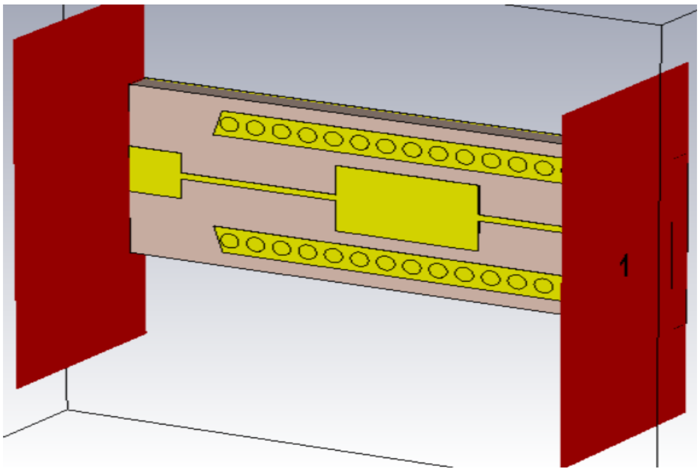

Fig.4 Lateral view of M-SIW Band-stop filter

III. IMPLEMENTATION AND MEASURED RESULTS

The M-SIW band-forestall clear out that designed through CST software using a material means of Roger 4003C substrate cloth is shown in Fig 4. The M-SIW band-forestall clear out turned into measured with the Anritsu community analyzer with inside the RF Laboratory of Yaşar University (The M-SIW band-forestall clear out turned into measured for 2202 frequency fors among 1–12 GHz frequency range. Sampling frequency is 5 kHz). The M-SIW band-forestall clear out is proven.
According to the measured outcomes shown in Fig. 5, the bandwidth of clear out is 5.15 GHz. The low cut-off frequency are f_L= 2.82 GHz, the excessive cut-off frequency f_H= 7.97 GHz and the middle frequency is f_C = 4.74 GHz. Insertion Loss (IL) in dimension is decrease than 0.9 dB.

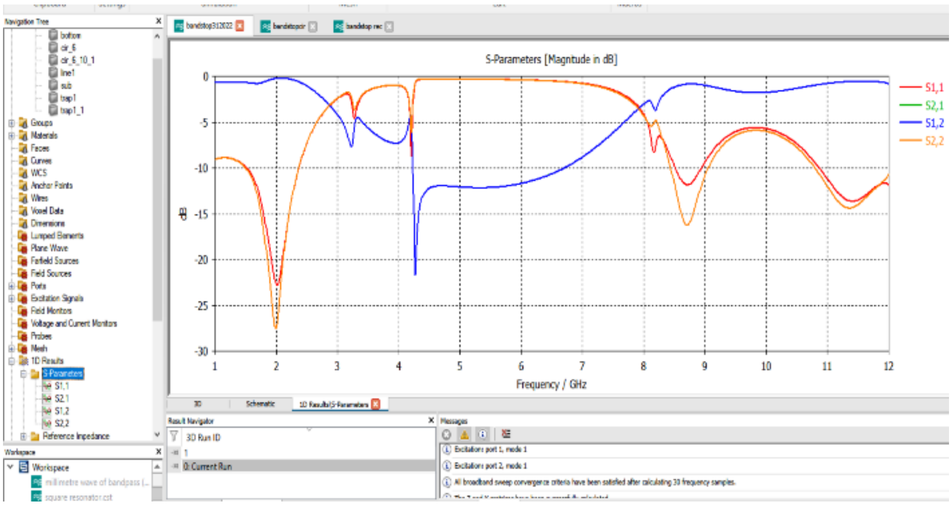

Fig.5 Simulated and measured results.

IV. CONCLUSION

In this design, the band-prevent clear out is taken into consideration a modular idea layout and discussed. Simplicity and intelligibility of the modular idea layout has enabled it to offer a band stop clear out with preferred crucial frequency and bandwidth. The hybrid aggregate of low-by skip and excessive-by skip clear out do now no longer alternate

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the alternate the features of the elements. So, this technique is a bonus in opposition to different band-prevent clear out designs. It is likewise viable to layout band-prevent filters the use of this idea.

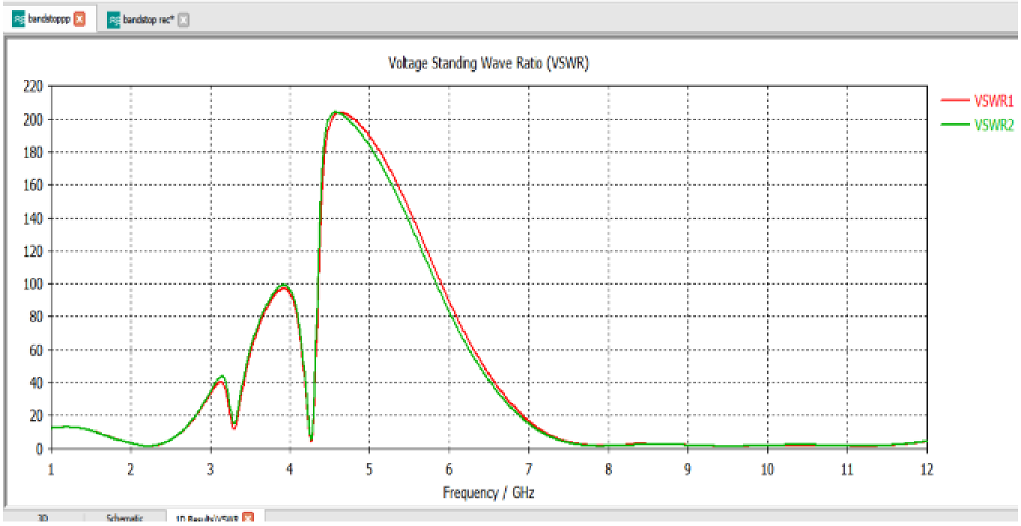

Fig.6 VSWR Results

The distinction among the S_{21} simulated and measured in the 8-14 GHz band is idea to end result from the SMA (Sub miniature of version A) coaxial connectors and soldering. Low-cost dielectric substrate fabric may be used to limit electric strength loss at excessive frequencies. The low-pass filter and the high-pass filter integration are in reality supplied as a band-stop filter. Rogers's 4003C substrate turned into located to be a first-rate fabric for band-prevent filters.

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