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Retraction

Retracted: Design of UWB Filter with WLAN Notch

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This article has been retracted as it is essentially identical in content with the published article "Design of Compact UWB Band Pass Filter with WLAN Notch," by Satish Chand Gupta and Mithilesh Kumar, published in the Proceedings of the National Conference on Trends in Signal Processing & Communication (TSPC'11) 10–12 March, 2011 at Bhagwant Institute of Technology, Muzaffarnagar, India [1].

References

[1] H. Kumar and M. Upadhayay, "Design of UWB filter with WLAN notch," *International Journal of Antennas and Propagation*, vol. 2012, Article ID 971097, 4 pages, 2012.

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Research Article

Design of UWB Filter with WLAN Notch

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UWB technology- (operating in broad frequency range of 3.1–10.6 GHz) based filter with WLAN notch has shown great achievement for high-speed wireless communications. To satisfy the UWB system requirements, a band pass filter with a broad pass band width, low insertion loss, and high stop-band suppression are needed. UWB filter with wireless local area network (WLAN) notch at 5.6 GHz and 3 dB fractional bandwidth of 109.5% using a microstrip structure is presented. Initially a two-transmission-pole UWB band pass filter in the frequency range 3.1–10.6 GHz is achieved by designing a parallel-coupled microstrip line with defective ground plane structure using GML 1000 substrate with specifications: dielectric constant 3.2 and thickness 0.762 mm at centre frequency 6.85 GHz. In this structure a $\lambda/4$ open-circuited stub is introduced to achieve the notch at 5.6 GHz to avoid the interference with WLAN frequency which lies in the desired UWB band. The design structure was simulated on electromagnetic circuit simulation software and fabricated by microwave integrated circuit technique. The measured VNA results show the close agreement with simulated results.

1. Introduction

The ultrawide band (UWB) frequency spectrum (3.1 to 10.6 GHz) was released in 2002 [1] by FCC of the United State for unlicensed indoor and hand-held commercial applications shown in Figure 1. Because of the attractive merits such as high mobility, flexibility, and extremely high data rate, the UWB radio systems have been raising more and more attention from scientists and engineers. For some practical applications, there is a need to introduce notch band (s) within the UWB pass band to avoid the interference from existing wireless communication systems such as band 3.5 GHz WiMax and 5.6 GHz band wireless local area network (WLAN). In recent years many techniques such as embedded open-circuited stubs, Multilayer LCP, and so forth have been proposed for design the UWB band pass filter [2–6].

In this paper, a novel UWB BPF with single notch band using aperture backed parallel-coupled microstrip line by embedding an open-circuited stub in the 50 Ω feed line is proposed. The features of the scheme in comparison with proposed in literature [2–6] are in simple design, compact size, low loss and good linearity in the UWB, and easy integration with other circuits and antennas. In Section 2 the design of the proposed filter is presented. In Section 3 characterization of notch filter is discussed. In Section 4, the fabrication and experimental results are expressed. Finally the paper is concluded in Section 5.

2. UWB BPF Design with Notch

The layout of the proposed UWB filter is mentioned in Figure 1. It comprises an aperture backed parallel-coupled microstrip line. It is connected by a 50 Ω microstrip line at the two sides. The length, width, and coupling gap of coupled line is denoted by l_l, W_l and S_l respectively. The rectangular shaped aperture of length l_g, and width W_g in the ground plane is placed below PCML to tighten the coupling between the lines.

An approximately $\lambda_g/4$ open-circuited stub of length l_s and width W_s is embedded on the appropriate place of the 50 Ω feed line. The structure shown in Figure 1 is optimized by simulating it on EM simulator. The simulated frequency response of the UWB band pass filter with notch is shown in Figure 2.

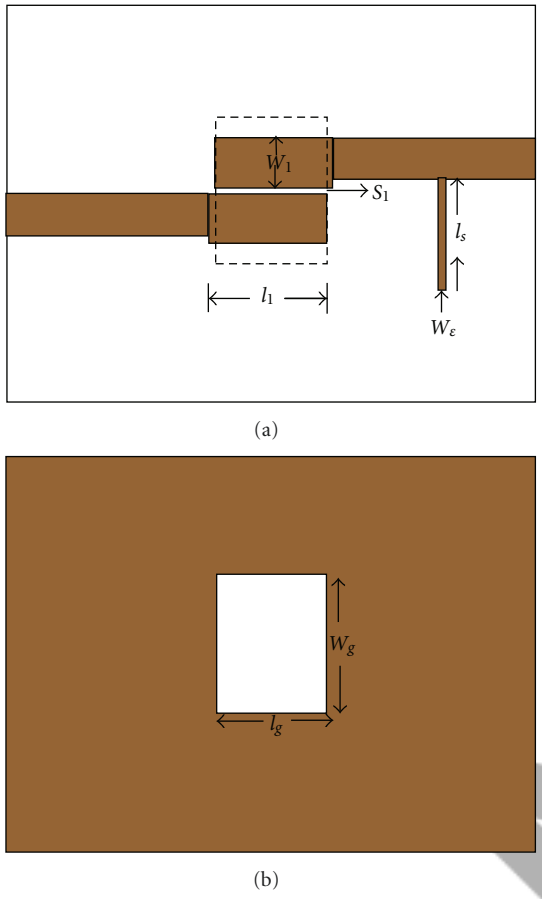

Figure 1: Structure of parallel-coupled line UWB notch filter: (a) front view, (b) back view.

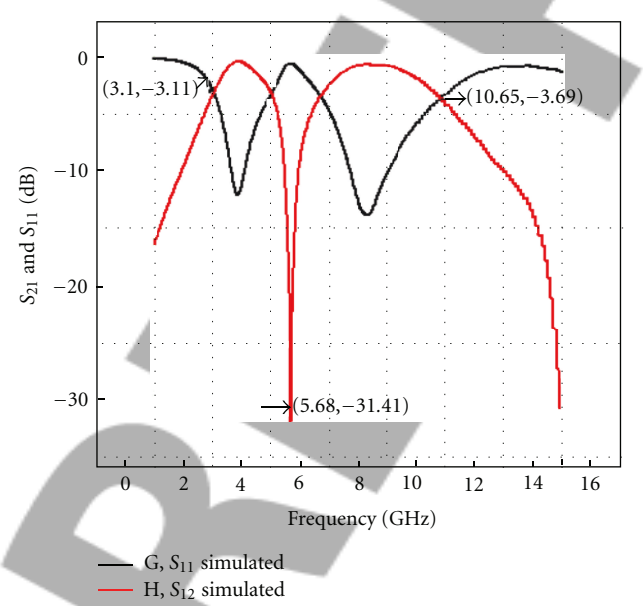

Figure 2: Simulated frequency response of single parallel-coupled line UWB notch filter.

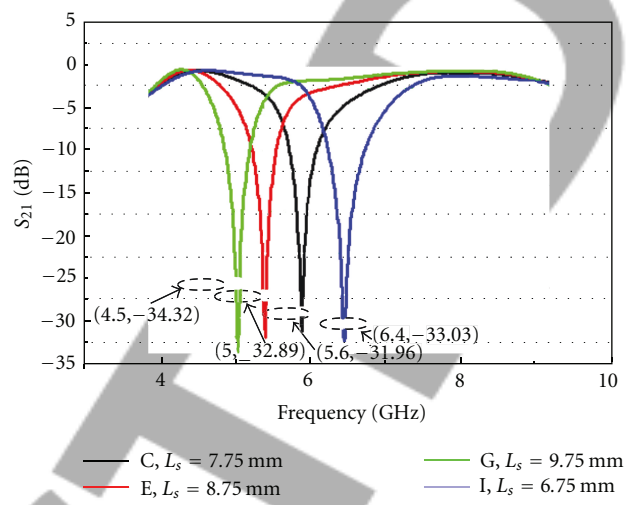

Figure 3: Effect of the variation in the stub length on the notch frequency.

3. Characterization of Notch UWB Filter

In the UWB filter, an open-circuited stub is incorporated for designing a notch at the desired frequency. The variation in length and width of this stub affect the notch frequency and the insertion loss $|S_{21}|$. It is observed that decreasing the stub length, the notch frequency increases with slight variation in the value of insertion loss S_{21}, while notch frequency shifted towards lower side on increasing the stub length, which is shown in Figure 3.

A microstrip DGS has a periodic etched defect on the ground plane and can deliver good stop band character tics in high-frequency microstrip circuits. An DGS is comprised of two semicircular defected area and one narrow conducting slot on the ground plane.

Simultaneously it is also observed that the notch frequency does not change widely with the variation in the width of the stub as comparison to the length of the stub, but it is slightly increases as the width of stub increase with almost constant insertion loss which is shown in Figure 4. It is also observed that this notch behavior of this UWB filter is not achievable at width of stub lesser than 0.3 mm.

4. Fabrication and Experimental Results

Based on the proposed design, the UWB notch filter can be achieved by an aperture backed PCML with open circuited stub in the feed line. The optimized design parameters of the UWB notch filter are as follows:

l_l, W_l, S_l are length, width and spacing between the PCML 6.99 mm, 1.86 mm, 0.11 mm, respectively.

l_g, W_g are the length and width of DGS 6.74 mm, 6 mm, respectively.

l_s, W_s are length and width of the stub 7.75 mm, 0.3 mm, respectively.

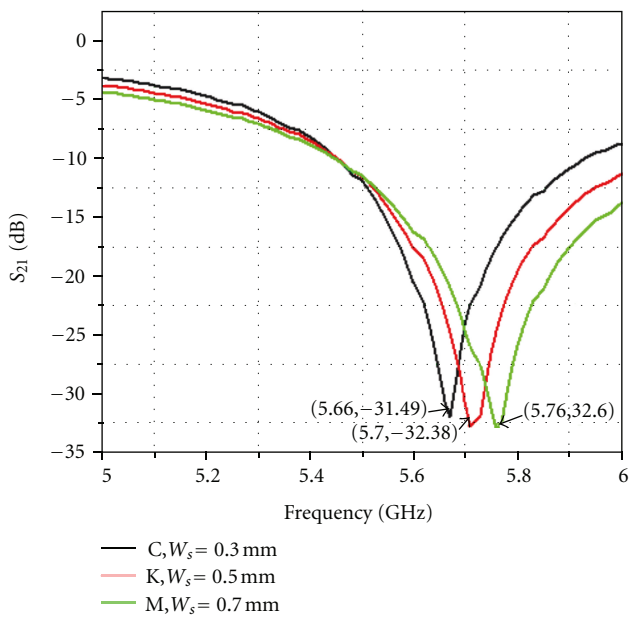

Figure 4: Effect of the variation in the stub width on the notch frequency.

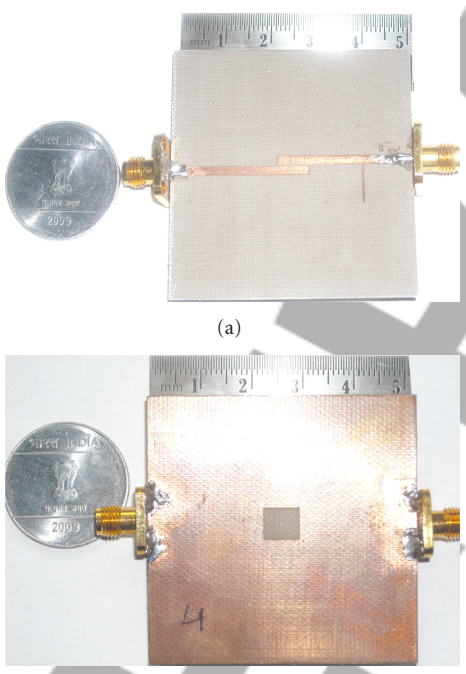

Figure 5: (a) Front view of fabricated structure. (b) Back view of fabricated structure of UWB notch filter.

The designed UWB notch filter is fabricated using conventional microwave-integrated circuits (MICs) technology on substrate having the dielectric constant 3.2 and thickness 0.762 mm. The fabricated structure is shown in Figure 5.

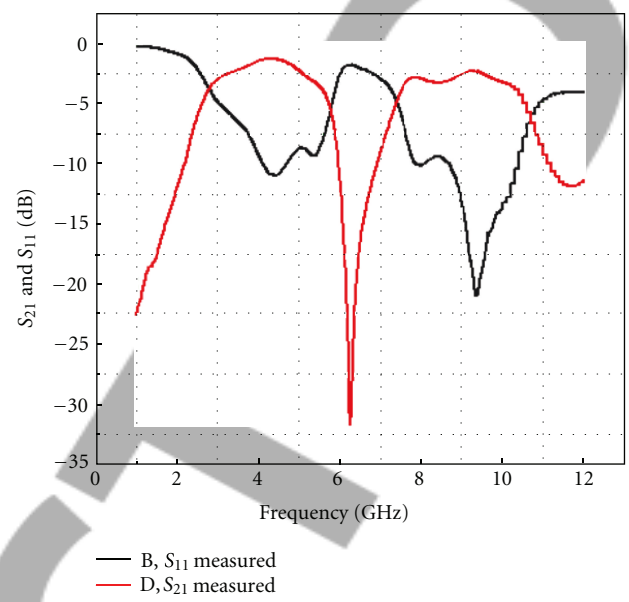

Figure 6: Frequency response of the fabricated UWB notch filter.

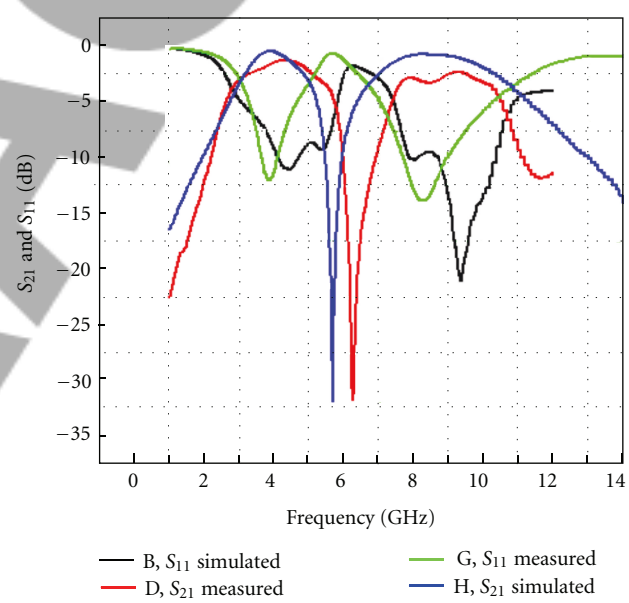

Figure 7: Comparison of responses of UWB notch band pass filter.

The fabricated UWB notch filter is characterized by vector network analyzer (VNA) and measurement characteristic is shown in Figure 6.

The comparison between the simulated frequency response and measured frequency response is depicted in Figure 7.

From the comparison of results we can make some conclusions as follows: (1) the measured frequency responses agree well with the predicted results in the whole pass band, stop band, and notch band which validates the proposed design theory; (2) the return loss $|S_{11}|$ is 1.0 dB at the

frequency 6.85 GHz; (3) the insertion low $|S_{21}|$ of the magnitude –30 dB values is verified with the simulated results but the frequency of the notch is slightly shifted towards high frequency side.

5. Conclusions

A compact UWB BPF with notch filter has been presented. Initially, a UWB band pass filter has been achieved by an aperture backed PCML. The desired notch (rejection) band is introduced by an open-circuited stub in the 50 Ω feed line. The notched band can be controlled by properly selection of the location of the stub, width of the stub, and length of the stub. A filter with a WLAN notch band is designed, simulated and fabricated. The measured results show close agreement with the simulated results which validates the proposed filter design theory. The proposed UWB notch filter is promising for the application in new UWB wireless technologies due to its simple structure, low insertion loss, broad pass band width and high stop band suppression, compact size, and easy integration with antennas and other devices.

Acknowledgments

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