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Printed Band-Rejection UWB Antenna with H-shaped Slot

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I. INTRODUCTION

The development of the high data rate wireless communication systems, has placed significant demands on antenna designers, in particular, the requirement for smaller elements with broader bandwidths. In recent years, ultrawide band (UWB) antennas have received increased attention. Planar UWB monopole antennas with rectangular, circular, elliptical and triangular shapes patch have been reported [1-3]. It is also necessary for UWB systems to minimize in-band interference effects, within the UWB band (3.1GHz-10.6GHz). In particular, the growth of IEEE 802.11a wireless LAN in the frequency-band 5.15GHz-5.825GHz, has increased.. Therefore, antennas providing reject notch function are becoming necessary. Recently, some antennas with notch-band function have been discussed [4-5]. In this paper, a novel UWB antenna with notch-band frequency is studied. Effects of the various parameters for antenna performances are also discussed. An optimized compact UWB antenna with notch-frequency function is fabricated and experimentally examined. The measured results show the proposed UWB antenna can achieve a return loss greater than 10db over an ultrawide bandwidth, of 9.8GHz, from 2.97GHz to 12.77GHz with a tunable notch-frequency band of 5.15GHz to 5.825GHz.

II. SIMULATED RESULTS FOR THE PRINTED MONOPOLE ANTENNA WITH SLOT PATCH

In order to design the proposed UWB antenna with the narrow band-rejected frequency, the rectangular patch with a H-shape slot is employed, as shown in Figure 1. Using the optimized parameters for the antenna, the proposed antenna dimensions are selected as $L=28\text{mm}$, $W_g=30\text{mm}$, $W_1=12\text{mm}$, $L_1=16.5\text{mm}$, $G_w=1.5\text{mm}$, $L_2=4\text{mm}$ and $W_2=3\text{mm}$. The substrate is a Taconic RF-35 of relative permittivity 3.5 and the thickness is 1.52mm. The effects of the width and length of H slot for narrow rejected-band function are analyzed below..

Figure 1 The geometry of the proposed UWB antenna with notch-frequency function

Figure 2 Comparison of the return loss for the proposed antennas with different L_{sc}

2 Effect of slot width W_s

Figure 3 shows return loss with difference W_s dimensions for $L_{s1}=4\text{mm}$, $W_{s1}=2.2\text{mm}$, $L_{sc}=2.25\text{mm}$, $W_s=0.3\text{mm}$ and $L_s=4\text{mm}$. It is noted that the centre frequency of the rejected-band will increase as the slot width W_s increases, and the return loss at the centre frequency decreases slightly with increasing slot W_s .

Figure 3 Comparison of the return loss for the proposed antennas with different W_s

3 Effects of the slot W_{s1} and L_{s1}

Figure 4 and Figure 5 illustrate the return loss for different values of W_{s1} when $L_{s1}=4\text{mm}$, $L_{sc}=2.25\text{mm}$, $W_s=0.3\text{mm}$ and $L_s=4\text{mm}$ and also for different values of L_{s1} when $W_{s1}=2.5\text{mm}$, $L_{sc}=2.25\text{mm}$ and $W_s=0.3\text{mm}$. It is found that the centre frequency of rejected-band increases with increase of slot width W_{s1} and also with increase of slot length L_{s1} . The optimum length and width are $W_{s1}=2.5\text{mm}$ and $L_{s1}=4\text{mm}$.

Figure 4 Comparison of the return loss for the proposed antennas with different W_{s1}

Figure 5 Comparison of the return loss for the proposed antennas with different L_{s1}

III. MEASUREMENT OF RETURN LOSS FOR THE PROPOSED ANTENNAS

A compact and ultrawideband printed antenna with a narrow notch-frequency function is designed and fabricated based on the simulated results in previous sections. It is printed on the Taconic substrate of relative permittivity 3.5, thickness of 1.52mm and loss tangent of 0.0018. Its optimized dimensions are as follows: $L=28\text{mm}$, $W_g=30\text{mm}$, $L1=16.5\text{mm}$, $W1=12\text{mm}$, $L2=4\text{mm}$, $W2=3\text{mm}$, $G_w=1.5\text{mm}$, $L_g=10\text{mm}$, and the 50 ohm microstrip line width w is 3.5mm. The parameters of the H-shaped slot are selected to be $L_{sc}=2.25\text{mm}$, $L_{s1}=4\text{mm}$, $W_{s1}=2.5\text{mm}$, $L_s=4\text{mm}$ and $W_s=0.3\text{mm}$. Figure 6 illustrates the simulated and measured results of return loss for the proposed antenna. The 10dB return loss impedance bandwidth is about 9.8 GHz, from 2.97GHz to 12.77GHz with a narrow notch-band of 5.15GHz to 5.825GHz. The measured boresight gains in the H plane are shown in Figure 7, which have a large drop in the notch-frequency band.

IV. CONCLUSIONS

In this paper, a parametric study of the slotted planar monopole is made with regard to the notch frequency and

impedance bandwidth. According to the above analysis, the compact and optimized ultrawideband antenna with a tunable notch-frequency band is designed, fabricated and measured.

Figure 6 Comparison of the measured and simulated results for the proposed antenna

Figure 7 The measured boresight gain against frequency for proposed antenna

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