Rectangular Microstrip Patch Antenna for 4.6Ghz

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Abstract— In this paper, a compact design and construction of microstrip Ultra-Wide Band (UWB) antenna is proposed. The proposed antenna has the capability of operating between 4.1 GHz to 10 GHz. The antenna parameter exists in both frequency domain and time domain analysis radiating element and Gaussian pulse and the antenna parameter in frequency domain analysis have been investigated to show its capability as an elective radiating element As a result, the simulation results demonstrated reasonable agreement with the measurement results and good ultra-wideband linear transmission performance has also been achieved in time domain.

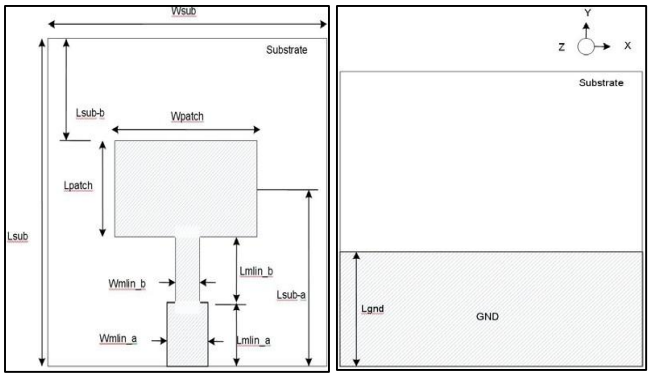
Keywords: Patch Antenna, UWB Application

I. INTRODUCTION

In recent years, with the rapid development of the wireless communication system, ultra-wideband(UWB) antenna has attracted more and more attention [1-2]. Though, the UWB technology has remarkable advantages of low cost, high rate and large communication capacity, it also suffers from reliability has been studied. The technology UWB can not only provide good date rate but also reduce the multipath issues, which will improve the link quality and capacity of communication system. Several UWB antennas recently have been studied. The UWB technology opens new door for wireless communication system, since the current wireless system increasing exponentially. Back from spark-gap impulse to pulse radio, UWB system plays a dominant role in the communication system as the antenna is one of the wireless communications components. Recently, UWB technology with an extremely wide frequency range has been proposed for imaging radar, communications, and localized applications The simulated and measured results shows the bandwidth, high isolation and good radiation characteristics.

II. ANTENNA DESIGN

The dimension of the proposed UWB antenna is shown in Fig. 1. It is fabricated on the FR4 substrate on the PCB simulation technology whose dielectric constant is 4.4 and loss tangent is 0.02 and the substrate thickness (h). The widths of the substrate is 36mm and the length of the substrate is 34mm. the width of the patch is 18mm and length of the patch is 11mm and the input impedance is increased by 300ohms.It working in the entire ultra-wideband frequency range. All the parameters are obtained by the electromagnetic simulation (HFSS).



(a) Front view (b) Ground view

Fig. 1: Dimension of patch UWB antenna

III. RESULTS AND DISCUSSION

To demonstrate the performance of the proposed antenna, the antenna was printed and the results and discussion are divided into three parts which consist of parametric study, time domain analysis and experimental results and discussion. In Section 3.1, parametric study including the simulated results of return loss, group delay, radiation patterns and efficiency of the proposed antenna will be discussed. On the other hand, in Section 3.2, the time domain analysis where electric probe is placed at different positions to investigate the transmitted and received pulse signals. Experimental results are presented in Section 3.3 where the measured results of the fabrication antenna and the simulated results are compared and discussed

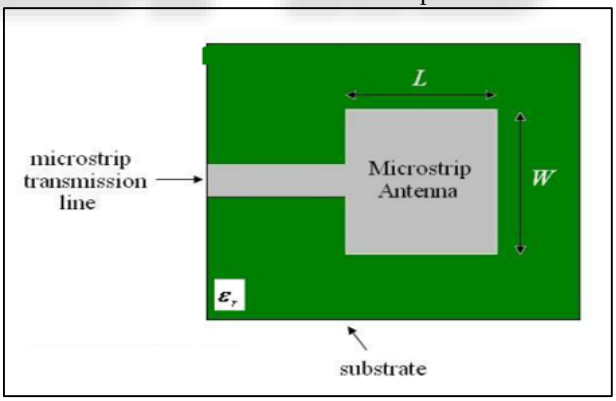


Fig. 2: rectangular patch antenna

The rectangular microstrip patch antenna is also known as the printed antenna, the return loss of the antenna improves dramatically when the length ground patch reduces gradually and the best result is obtained at the height of ground plane, L gnd of 11 mm. The partial ground shows better return loss compared to full ground patch on the bottom because the antenna is transformed from patch

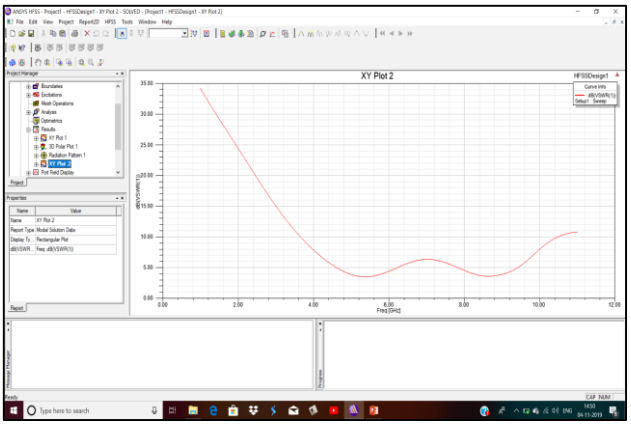


Fig. 3: S-parameter xy plot

The simulated and measured normalized radiation patterns including the xoz plane and yoz plane at 3.5, 7, 11GHz are depicted in Fig. 5. It is clear that the experimental patterns are basically the same as the simulated direction. All experimental results are obtained under the condition that only port I was fed and the port 2 was connected with a 50 Q matching load. At lower frequencies, radiation pattern shows bidirectional characteristics, which is similar to the pattern of monopole antenna. As the frequency increases, due to the higher order mode, the radiation lobe is split. The design of etching slots on the ground plane and the existence of antenna 2 change the current distributions on the radiation patch of antenna, which contributes to the grating lobe. Fig. 6 describes the peak gain variation of the proposed antenna from 3 to 20GHz. Good agreement can be observed compared simulated and measured results. In the whole bandwidth from 3 to 20GHz, the peak gain of antenna varies from 3.7 to 9

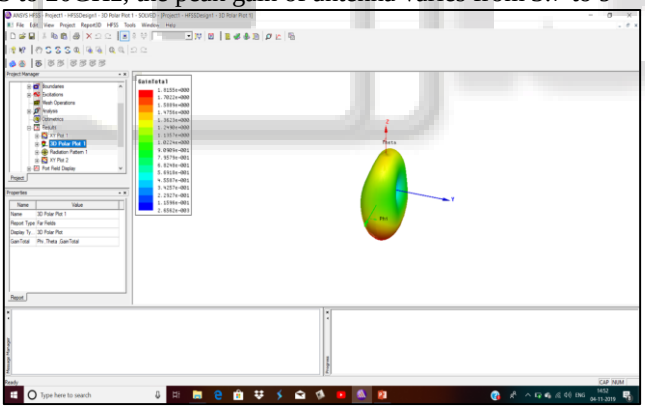


Fig. 4: 3D polar plot

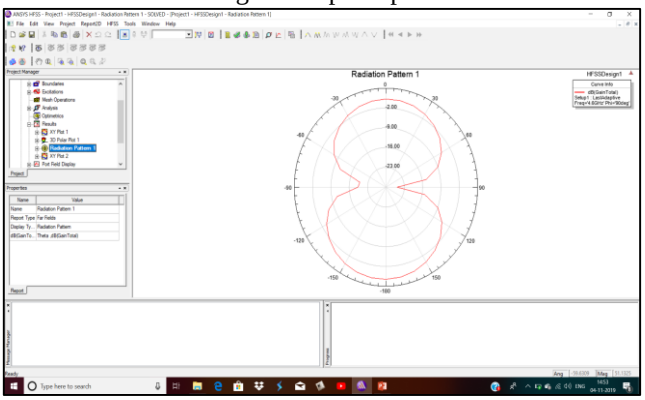


Fig. 5: Radiation pattern

IV. Conclusion

In this paper, we proposed an UWB antenna which can support large bandwidth excited by a time domain pulse base signal to ensure the UWB signal is transmitted and received effectively. By variation on the size of the ground patch at bottom layer, the optimization on return loss has been realized and the potential as the key parameter on return loss improvement has been demonstrated. Furthermore, stepped impedance matching technique applied on the microstrip feed line is proved to provide further enhancement of the antenna performance in term of impedance bandwidth.

References

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