DESIGN OF UWB ANTENNA WITH BAND-ELIMINATION PROVISION

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Abstract — This paper presents a microstrip-fed ultra-wide band (UWB) planar monopole micro script antenna with variable frequency band notch characteristic is presented. Two inserted slots are tried in the ground plane to achieve the desired impedance bandwidth (3.1 to 10.6GHz). By adding the H-shaped conductor backed plane the desired band elimination provision can be made. The designed antenna has a small size of 22×22 mm^2 and operates over the frequency band of 4.3 to 10.3GHz for a VSWR of less than 2. The achieved band elimination was around 5.82 to 7.85. There are infinite number of antenna designs available there are only a few of them which are small in size and suitable for UWB applications. This antenna is designed using microstrip fed monopole antenna requirement to achieve good impedance bandwidth.

Keyword- *Ultrawideband(UWB), frequency band elimination function, Microstrip fed monopole antenna*

1. INTRODUCTION

The central idea of this research paper is to present the design philosophy to develop a UWB antenna with band-elimination provision using micro-strip techniques. By inserting two slots in the both sides of microstrip feedline on the ground plane, much wider impedance bandwidth can be produced. A modified UWB antenna with band elimination provision are presented

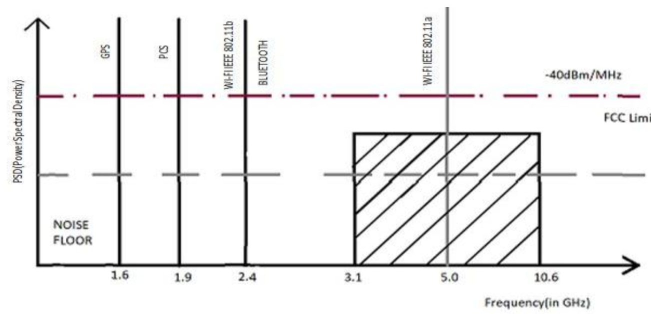


Fig. 1. Frequency and Power spectral density

The configuration of the proposed wideband monopole antenna which consists of a simple rectangular patch, a truncated ground plane with two slots and H-shaped conductor-backed plane. The proposed antenna is constructed on FR4 substrate with thickness of 1.0 mm and relative dielectric constant of 4.4mm.The width of the microstrip feedline is fixed at 1.86 mm to achieve 50-characteristic impedance. On the front surface of the substrate, a rectangular patch with size of is printed. The rectangular patch has a distance of 2 mm to the ground plane with a length of 6 mm printed on the back surface of the substrate. Regarding to defected ground structures, the creating slots in the ground plane provide an additional current path. More over this structure changes the inductance and capacitance of the input impedance which in turn leads to change the bandwidth.

2. ANTENNA DESIGN CONCEPT

The microstrip line causes a resonant character of the structure transmission with a resonant frequency controllable by changing the shape and size of the slot. Therefore by inserting two slots at the ground plane and carefully adjusting its parameters, much enhanced impedance bandwidth may be achieved. These slots placed at a distance of 1 mm from the ground center line. The H-shaped conductor backed plane is placed under the radiating patch and is also symmetrical with respect to the longitudinal direction. As a result, the desired high attenuation near the notch frequency can be produced. For impedance bandwidth enhancement, techniques such as using a pair of elimination at the lower corner of patch, inserting a slot using the elimination of structure in the ground. To generate the frequency band elimination function, modified planar monopoles with inverted U-slot and small strip bar are used as shown in the fig.6. Conventional narrow slot antennas has limited bandwidth, whereas wide slot antennas exhibit wider bandwidth. Different printed wide slot antennas fed by a microstrip line or Coplanar Waveguide have been studied but most of them are not compact, and we micro strip feeding technique as shown in fig4. It operates over a narrow bandwidth. The proposed antenna is compact based on the parametric analysis of the proposed antenna, are optimized to achieve the maximum impedance bandwidth and good impedance matching. The simulated VSWR curves with different values are plotted, it is observed that the impedance bandwidth increases as the length increases.

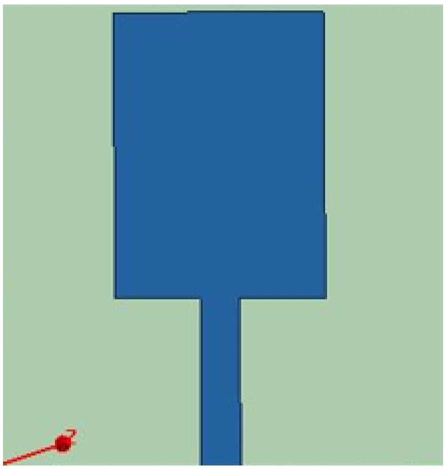


Fig.4. Top view of Antenna

The elimination band, covering the 5GHz WLAN band, is provided by using a modified H-shaped conductor-backed plane instead of changing the patch or feedline shapes of the antenna. Also by inserting two slots in the both sides of microstrip feedline on the ground plane, much wider impedance bandwidth can be produced, especially at the higher band. Experimental and simulated results of the constructed prototype are presented

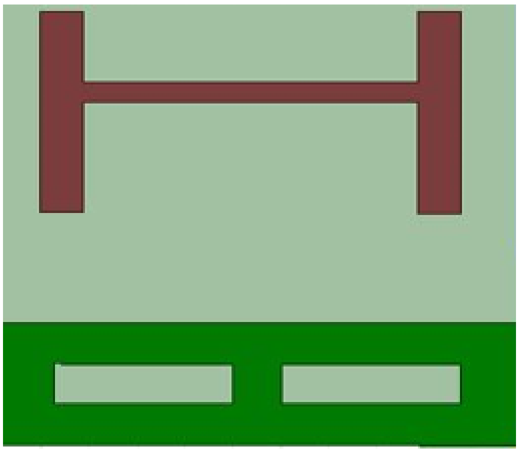


Fig.5. Bottom view of Antenna

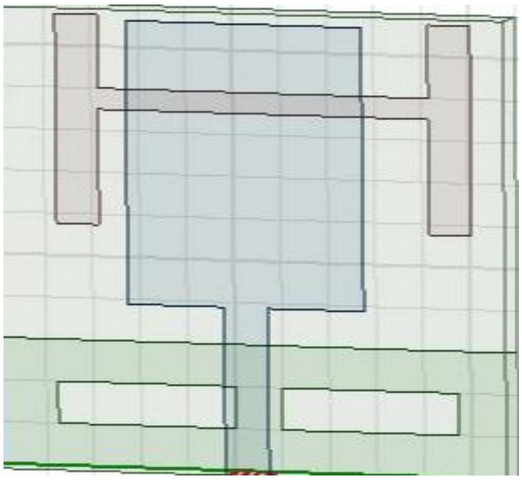
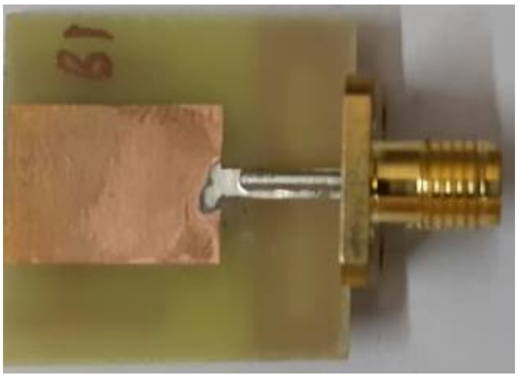


Fig.6. Designed Antenna in Simulation Tool

Regarding to defected ground structures (DGS), the creating slots in the ground plane provide an additional current path. Moreover this structure changes the inductance and capacitance of the input impedance which in turn leads to change the bandwidth. The DGS applied to a microstrip line causes a resonant character of the structure transmission with a resonant frequency controllable by changing the shape and size of the slot



optimized H shaped microstrip antenna with microstrip feeding technique using HFSS and it gives my desired simulation result,

Now I am looking forward to fabricate my design. Now here is the problem the patch antenna can be fabricated using CNC(computer numerical control) machine, but the machine inly accepts Garber file, now Garber file can be generated using PCB design software like OrCAD, NI Utility board.

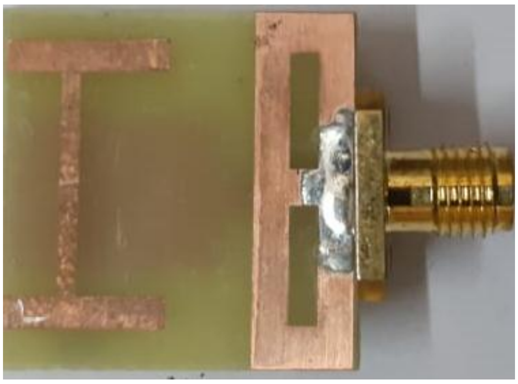


Fig.7. Fabricated Antenna

Table:1 facts and its ranges

Usable frequency range	3.1 to 10.6GHz
Propagation speed	linear speed of light (0.3m/ns)
Max. range	200m (656.2ft)
Max. transmission power	<1mw
Range	10-200m (32.8-656.2ft) (depending on the application
Localization accuracy	0.1-0.5m(0.33-1.64feet)
Low susceptibility to interference	no interference with WLAN and ISM channels

3. SIMULATION RESULTS AND DISCUSSIONS

The antenna performance was measured in HFSS electrmanetic simulator software and fabricated results are measured in Fig.8 shows the simulated VSWR against frequency which is less than 2 from 5.28 dB at 9.8 GHz GHz and Fig.9 shows the antenna gain of the proposed antenna in HFSS. It is seen that the proposed antenna exhibits a wideband performance from 4.3 to 10.8GHz covering of UWB range. Gain plots are shown in Fig.10,11.

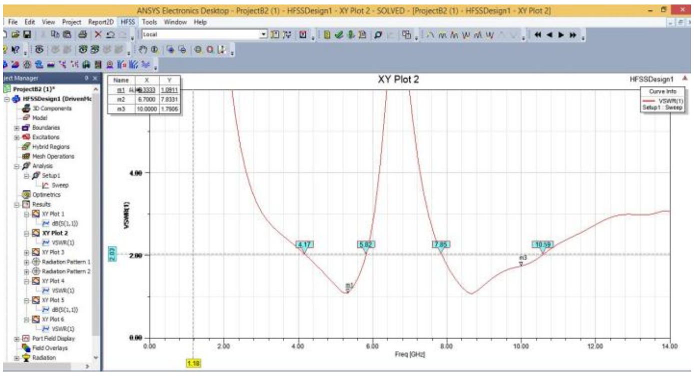


Fig.8.Measured VSWR characteristic

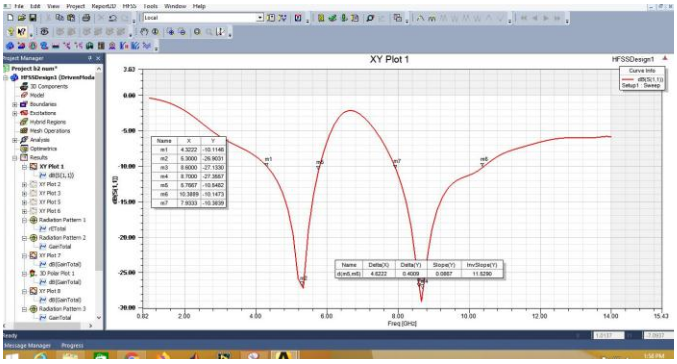


Fig.9. Measured antenna Gain

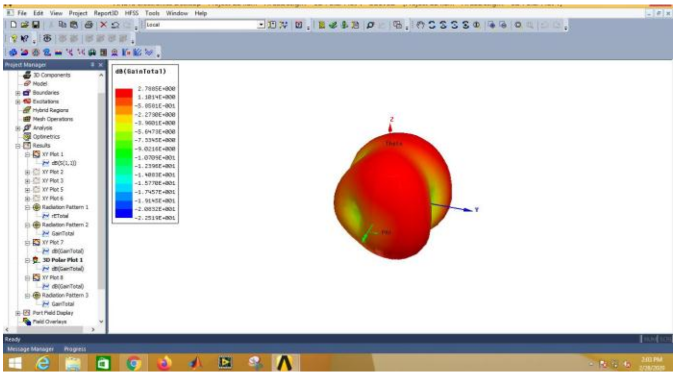


Fig.10. Gain Plot at 8.7GHz

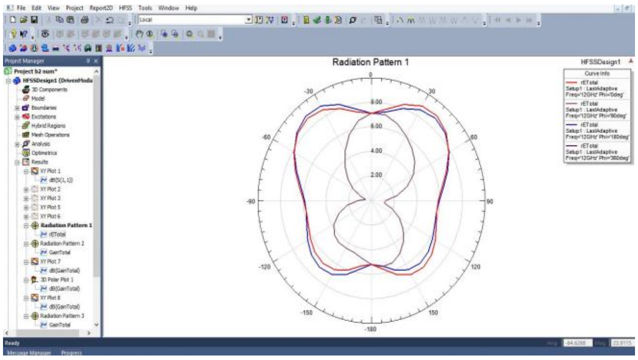


Fig.11.Measured plane radiation pattern at 8.6GHz

I observed that the sharp frequency band-notch characteristic is obtained very close to the desired frequency at 8.6GHz when a modified conductor-backed plane is added to the antenna The measured radiation patterns in the and plane are plotted. From an overall view of these radiation patterns, the antenna behaves quite similarly to the typical printed monopoles. The measured maximum gain of the proposed antenna with and without conductor-backed plane. A sharp decrease of maximum gain in the notched frequency band at 8.6GHz

4. CONCLUSIONS

An uwb antenna with band elimination provision characteristics has been proposed and presented. Two inserted slots on the ground plane are used to increase the impedance bandwidth. Band-stop characteristics are achieved by adding the H-shaped conductor-backed plane. The proposed monopole antenna has the frequency band of 4.3 to over 10.3 GHz with a rejection band around 5.82 to 7.85GHz. in UWB communication applications. The antenna is fabricated onto an inexpensive FR4 substrate with an overall dimension of 22x22 mm^2 and simulated using HFSS and fabricated.

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