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Band Stop Operation of Ultra Wide-Band Frequency by Using Sloted Antenna

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Abstract: *In this article, a novel ultra-wideband (UWB slot antenna with frequency band-stop performance is designed and manufactured. The fabricated antenna has the frequency band of 3.01 to more than 11.07 GHz with a rejection band around 5-6 GHz. Good VSWR and radiation pattern characteristics are obtained in the frequency band of interest.*

1. Introduction

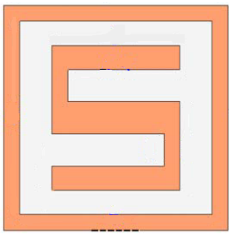
Communication systems usually require smaller antenna size in order to meet the miniaturization requirements of radio-frequency units [I]. It is a well-known fact that planar slot antennas present really's appealing physical features, such as simple structure, small size, and low cost. Due to all these interesting characteristics, planar antennas are extremely attractive to be used in emerging ultra-wideband (UWB) applications, and growing research activity is being focused on them. Consequently, a number of planar slot antennas with different geometries have been experimentally characterized [2-5].

The frequency range for UWB systems between 3.1 and 10.6 GHz will cause interference to the existing wireless communication systems, for example, the wireless local area network for IEEE 802.lla operating in 5.15-5.35 GHz and 5.725-5.825 GHz bands, so the UWB antenna with a band-notch function is required [6-9].

In this article, we present a new design of compact wideband slot antenna with band rejection characteristics for UWB applications. In this antenna, rectangular slot with H-shaped parasitic structure inside it cut in the ground plane was used for enhance of bandwidth and an S-shaped parasitic structure inside the square ring radiating stub was applied to generate a band notch performance. The fabricated antenna has the frequency band of 3.01 to more than 11.07 GHz with a rejection band around 5-6 GHz. The size of the designed antenna is smaller than the slot antennas reported recently [2-5]. Good return loss and radiation pattern characteristics are obtained in the frequency band of interest.

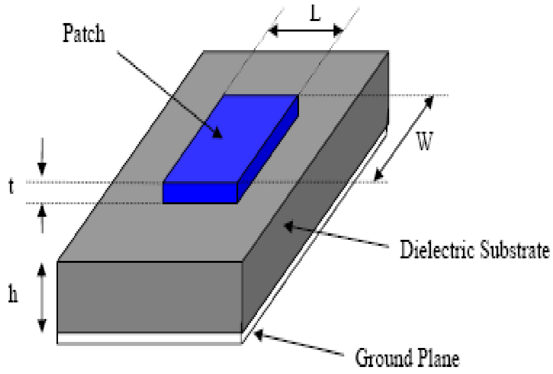
Slot Antenna:

Slot antennas exhibit wider bandwidth, lower dispersion and lower radiation less than microstrip antennas, and when fed by a coplanar wave guide they also provide an easy means of parallel and series connection of active and passive elements that are required for improving the impedance matching and gain [7].



Microstrip Antenna:

Basics of micro strip antenna: In its most fundamental form, a micro strip Patch antenna consists of a radiating patch on one side of a dielectric substrate which has a patch is generally made of conducting material such as copper or gold and can take any possible shape. The radiating patch and the feed lines are usually photo etched on the dielectric substrate. Number of methods is available in micro strip antenna feeding techniques. Main classifications are contacting and non contacting method. In contacting method, RF power is fed directly to the radiating patch using a connecting element such as a micro strip line [2].



2. Antenna Design

The proposed slot antenna fed by a 50-Ω microstrip line is shown in Figure I. which is printed on a FR4 substrate of thickness 0.8 mm and permittivity 4.4. The width of the microstrip feedline is fixed at 1.5 mm.

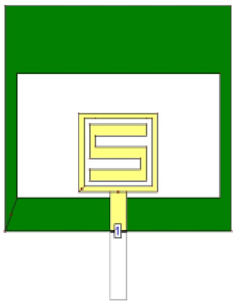


Figure 1. *Geometry of proposed microstrip-fed slot antenna.*

The basic antenna structure consists of a square radiating stub, a feedline, and a ground plane with a rectangular slot. The proposed antenna is connected to a 50-Ω SMA connector for signal transmission.

Regarding defected ground structures (DOS). Creating slots in the ground plane provides 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 DOS 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 [2].

Therefore, by cutting an inverted T-shaped slot in the ground plane and carefully adjusting its parameters, much enhanced impedance bandwidth may be achieved. As illustrated in Figure I, the S-shaped parasitic structure is placed inside the square ring radiating stub. Based on electromagnetic coupling theory. This coupled strip perturbs the resonant rsponseanda1seacls as a T shape if-wave parasitic structure. At the notch frequency, the current flows are more dominant around the S-shaped coupled strip. As a result, the desired high attenuation near [The notch frequency can be produced [4].

3. Results and Discussions

The proposed microstrip-fed slot antenna with various design parameters were constructed, and the numerical and experimental results of the input impedance and radiation characteristics are presented and discussed. The Ansoft simulation software high-frequency structure simulator [10] is used to optimize the design.

Return loss characteristics for ordinary slot antenna, with rectangular slot with an H-shaped parasitic structure in the ground plane as shown in Figure 2, it is observed that the upper frequency bandwidth is affected by using the rectangular slot with an H-shaped parasitic structure inside the slot in the ground plane and the notch frequency bandwidth is sensitive to the S-shaped parasitic structure inserted inside the square ring radiating stub. Also input impedance of the proposed antenna.

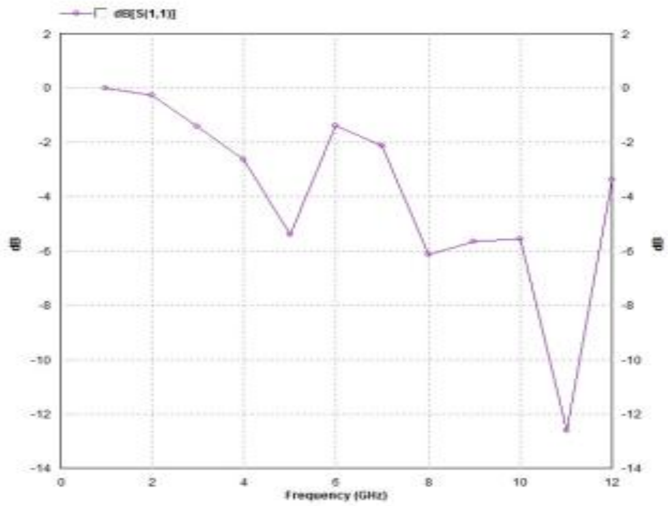


Figure 2. *Simulated return loss characteristics*

To understand the phenomenon behind this additional resonance performance, the simulated current distributions on the ground plane for the proposed antenna at 10.5 GHz are presented in Figure 3(a). It is found that by using rectangular slot with an H-shaped parasitic structure in the ground plane, third resonance at 10.5 GHz can be achieved. Another important design parameter of this structure is the S-shaped parasitic structure. Figure 3(b) presents the simulated current distributions on the radiating stub at the notched frequency (5.5 0Hz). As shown in Figure 3(b). at the notched frequency the current flows are more dominant around of the S-shaped parasitic Structure.

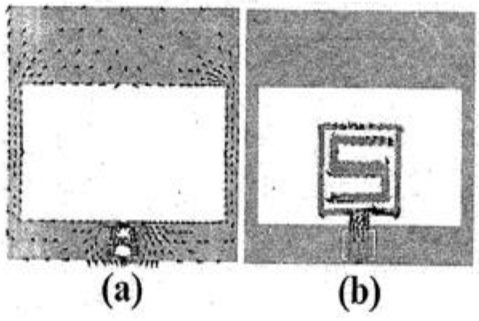


Figure 3. *Simulated surface current distributions for the proposed antenna, (a) on ground plane at 10.5 GHz and (b) on the radiating stub at 5.5 GHz.*

4. CONCLUSION

In this article, a novel design of UWB slot antenna with variable band-notched function is proposed. The presented slot antenna can operate from 3.01 to 11.07 GHz with VSWR<2, and with a rejection band around 5.02-5.98 GHz by cutting a rectangular slot with an H-shaped parasitic structure inside the slot in the ground plane, additional resonance is excited and hence an UWB frequency range can be achieved. In order to generate band-stop function, we use an S-shaped parasitic structure inside the square ring radiating stub. The designed antenna has a small size. The measured results show good agreement with the simulated results. Experimental results show that the presented slot antenna could be a good candidate for UWB applications.

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