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DESIGN OF WIDEBAND MICROSTRIP ANTENNA FOR UWB APPLICATIONS

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Abstract - ***in this paper, a rectangular slot in patch scheme is described to enhance the operation bandwidth of microstrip patch antenna for wideband applications. By cutting rectangular slot from the rectangular patch, the bandwidth enhancement of the proposed patch antenna is well realized. From the simulation results, it is shown that this scheme is an excellent approach, which can be used to make the proposed antenna match well over an enhanced impedance bandwidth of 8GHz (2~10GHz), for a - 10dB return loss. The proposed antenna was simulated using Ansoft High frequency structure simulator (HFSS). The proposed antennas with rectangular patch fabricated on the FR4 substrate with relatively permittivity r_ε =4.4 and thickness 1.5mm.microstrip feed line of 1.7mm is used in this proposed antenna. The proposed antenna has compact dimension of 29 mm ×26 mm (W×L). On the front surface of the substrate, a rectangular patch with size of 13.5mm ×9.8mm is printed. A rectangular slot in patch and two slots in ground are cut to enhance the operation bandwidth of microstrip patch antenna for wideband applications. The simulated impedance bandwidth of the antenna, defined by 10dB return loss, can reach an operating bandwidth of 8GHz (2-10GHz), from proposed microstrip fed patch antenna with rectangular slot in patch and multiple slotted ground plane. The antenna gain varies from 2 dB to 3.5 dB over the operating UWB frequency range. So this scheme is an excellent scheme for enhancing bandwidth of microstrip antenna which can be used for various wideband and UWB applications.***

Key Words: Wideband antenna, slot antenna, UWB applications.

I. INTRODUCTION

In now day's the wireless system has become a part of human life. Most of the electrical and electronics equipment around are using the wireless system. An antenna is an important element of the wireless system. In modern wireless communication systems, the design of antennas capable of operating at a broad frequency range has received an increasing interest for use in a high data rate system to continuously expand range of wireless communication services. Because of their low profile, wide bandwidth, compact size, low cost, and ease of fabrication slot antennas are attractive candidates for broadband and ultra wideband (UWB) applications.

In the past, a large number of wideband antennas have been studied and reported in the literatures [1-10]. Wide slot antennas fed by microstrip-line [4, 5, 6, 7, 8] were investigated for wideband and ultra-wideband applications. And, many attempts have been made to increase the operation bandwidth, such as employing a variety of wide slots [4, 5, 6, 7, 8] with truncated corners [4] or using hexagonal [5] and parasitic central patch [7]. These slot antennas can achieve a good broadband characteristic. However, the sizes in [6, 7, 9] are too large and the bandwidths in [3, 7, 6] are not enough for ultra-wideband requirement. Due to their appealing features of wide bandwidth, omnidirectional radiation pattern, several wideband configurations, such as L-shaped DRA [3] and antenna with four capacitively coupled feeds have been proposed for UWB applications. However, they are not suitable for integration with printed circuit boards since they do not have planar structures. Thus, a microstrip-fed antenna is suitable candidate for integration with hand-held terminal owing to its attractive features such as low profile, low cost, and light weight.

In this paper, a rectangular slot in patch scheme is described to enhance the operation bandwidth of microstrip patch antenna for wideband applications. By cutting rectangular slot from the rectangular patch, the bandwidth enhancement of the proposed patch antenna is well realized. From the simulation results, it is shown that this scheme is an excellent approach, which can be used to make the proposed antenna match well over an enhanced impedance bandwidth of 8GHz (2~10GHz), for a - 10dB return loss.

II. ANTENNA DESIGN

Figure 1 shows the geometries of the proposed antennas with rectangular patch fabricated on the FR4 substrate with relatively permittivity r_ε =4.4 and thickness 1.5mm. A non-symmetric open inverted L-slot on the ground was used for producing a wide Operating bandwidth. To obtain a bandwidth for UWB applications, a rectangular slot scheme is used to enhance the bandwidth in this work. As shown in Figure 1, the Rectangular patch fed by microstrip-line has been cut with rectangular slot

The proposed antenna, which has compact dimension of 29mm × 26 mm (W×L). The width of the microstrip feed line is fixed at 1.7 mm. On the front surface of the substrate, a rectangular patch with size of 13.5mm ×9.8mm is printed.

Dimension of slot in patch is 2mm ×6mm and dimensions of slots in ground are 9mm ×13mm and 25mm ×9.3mm

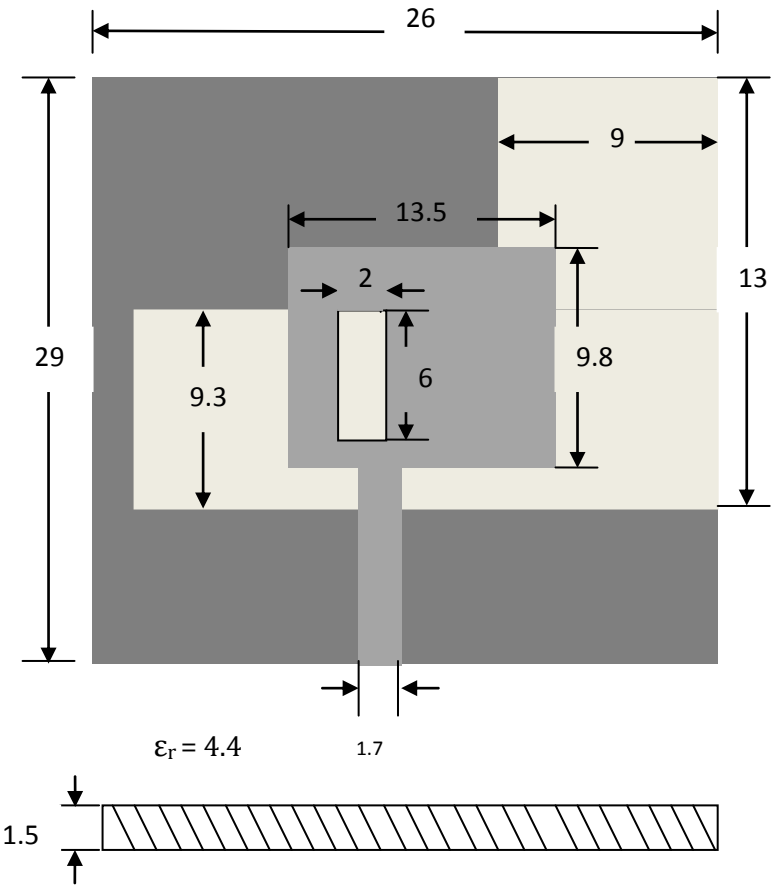


Fig-1: Geometry and dimensions of proposed antenna

III. EXPERIMENTAL RESULTS AND DISCUSSION

The microstip-fed antenna was constructed and studied to demonstrate the proposed bandwidth-enhancement technique. The simulated results are obtained using the Ansoft simulation software high-frequency structure simulator (HFSS). Fig. 2 shows the simulated return loss curves for proposed antenna the simulated impedance bandwidth of the antenna, defined by 10dB return loss, can reach an operating bandwidth of 8GHz (2-10GHz), from proposed microstrip fed patch antenna with rectangular slot in patch and multiple slotted ground plane. Proposed antenna has minimum return loss of -20dB at 8GHz VSWR of proposed antenna design is < 2 for frequency range (2-10 GHz)

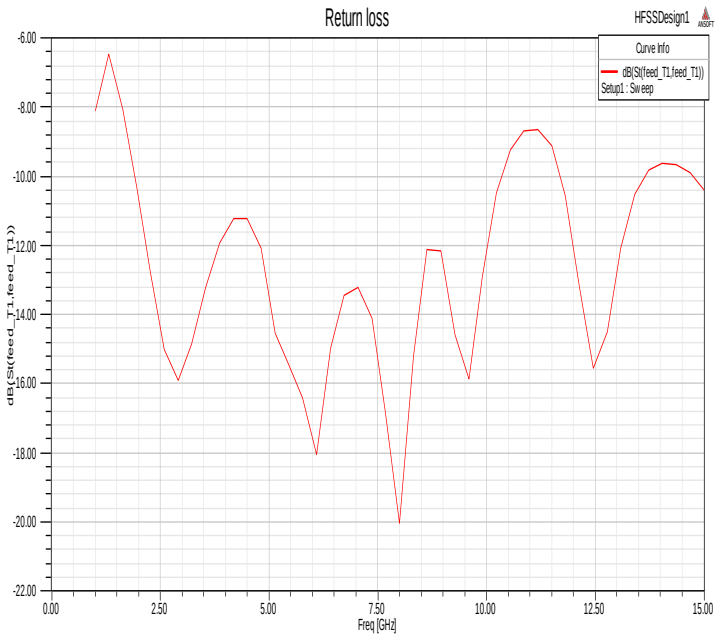
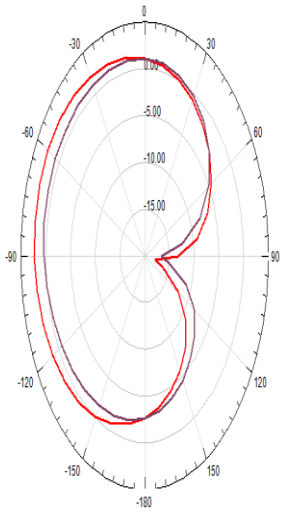
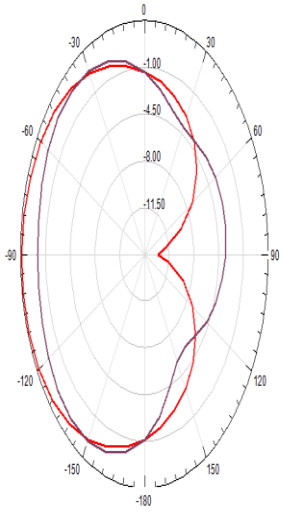


Fig-2: simulated return loss of proposed antenna

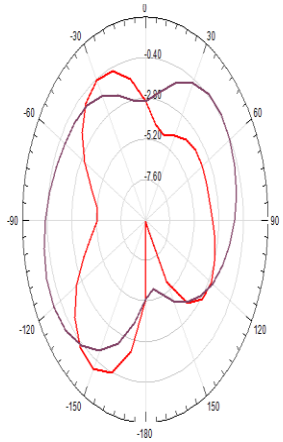
In addition, simulated far-filed radiation patterns of the proposed antenna at three different frequencies 3, 6, and 9GHz are shown in Figure 3.



Radiation patterns at 3GHz



Radiation patterns at 6GHz



Radiation patterns at 9 GHz

Fig-3: Far-field radiation patterns for the proposed antenna

The Simulated maximum gain of the proposed antenna is performed by using HFSS and presented in Figure. The antenna gain varies from 2 dB to 3.5 dB over the operating UWB frequency range. It can be concluded that the gain variation is not less than 2 dB over the entire operating frequency range from 2 to 10 GHz.

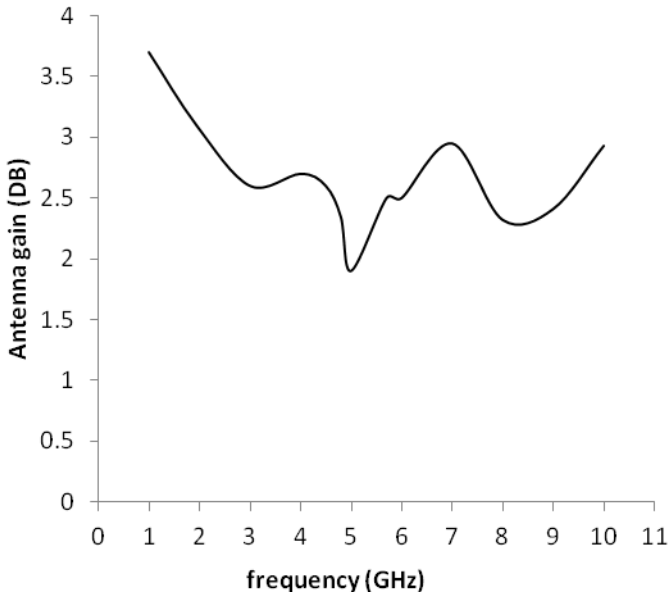


Fig-4: Gain versus frequency plot

IV. CONCLUSION

A printed slot antenna with a rectangular slot in rectangular patch for bandwidth enhancement has been proposed. From the investigation, it is found that proposed patch scheme is an excellent approach, which makes a strong effect on the antenna's impedance bandwidth enhancement for ultra-wideband application. Based on these findings, printed open slot antennas can be further improved and used for many wideband and ultra-wideband wireless communication systems.

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