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ENHANCEMENT IN FREQUENCY BAND OF PRINTED RECTANGULAR MONOPOLE ANTENNA BY PUSHING-UP FEED TECHNIQUE

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ABSTRACT

In this paper, a printed rectangular monopole antenna for UWB applications is proposed whose usable frequency band is increased simply by pushing up microstrip feed location. The proposed antenna consists of a square radiating patch, microstrip feed line and ground plane for ultra wideband application. The total bandwidth of the antenna is greatly improved at the cost of slight increase in of the overall antenna size. The designed antenna has a small radiating patch of $15\times15mm^2$ and ground plane $20\times10mm^2$. The proposed antenna is designed to operate over 4.1 to 10GHz with a return loss less than 10 dB. Good return loss and radiation pattern characteristics are obtained in the frequency band of interest. All the designs are carried out on IE3D software based on method of moments and is quite reliable source of designing printed antennas.

1. INTRODUCTION

IN RECENT DAYS, wireless communication systems are becoming increasingly popular. From mobile telephones to wireless Internet access to networked appliances and peripherals, there is an increasing reliance on wireless communications to provide functionality for products and services. Therefore, the technologies for wireless communication always need further improvement to satisfy higher resolution and data requirements. That is why ultra wideband (UWB) communication systems covering from 3.1 GHz to 10.6 GHz released by the FCC in 2002 [1] are currently under development. For many years, various antennas for wideband operation have been studied for communications and radar systems [2], [3]. The design of wideband antenna is very difficult task especially for hand-held terminal since the compromise between size, cost, and simplicity has to be

achieved. In UWB communication systems, one of key issues is the design of a compact antenna while providing wideband characteristic over the whole operating band. Due to their appealing features of wide bandwidth, simple structure, omnidirectional radiation pattern, and ease of construction several wideband monopole configurations, such as circular, square, elliptical, pentagonal, and hexagonal have been proposed for UWB applications [2]–[5].

As such, here we propose to develop rectangular monopole antenna which can be used for UWB applications. We have also discussed that simply by pushing up the feed location, which slightly increases the overall size of antenna, increases the usable bandwidth to a high extent.

2. ANTENNA DESIGN

The geometry and parameters of the proposed broadband square monopole antenna are depicted in Fig. 1. The proposed antenna has compact dimension of 20 mm×25 mm($L_{s\times}W_s$). The antenna is printed on an FR4 Epoxy substrate[4]-[6] with a relative dielectric constant (ε_r) of 4.4, a tangential loss (tan σ) of 0.00025, a thickness (Hs) of 1.6mm, a length (Ls) of 20mm and a width

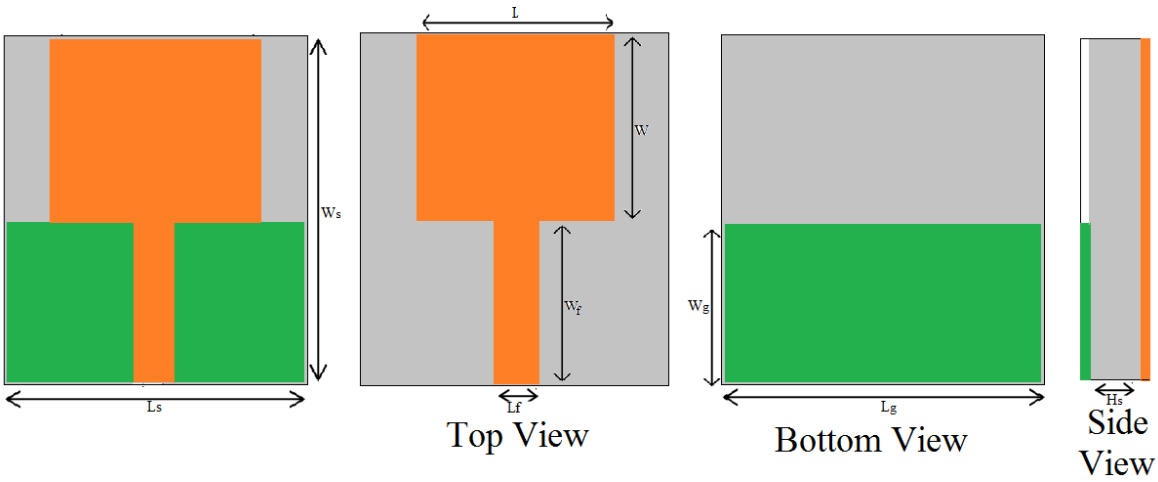

Fig. 1. Configuration of proposed microstrip-feed monopole antenna

(Ws) of 25mm. The basic antenna structure consists of a radiating square patch[6],[9] with a length (L) 15mm, width (W) 15mm and ground plane with a length (Lg) 20mm, width (Wg) 10mm and length of the microstrip feedline is fixed at 4 mm. On the front surface of the substrate, a rectangular patch with size (L×W) 15×15mm^2 is printed.

3. RESULT AND DISCUSSION

A microstrip-fed rectangular printed antenna is proposed for UWB applications. The microstip-fed monopole antennas with various parameters (L,W, and H) were constructed and studied to demonstrate the proposed bandwidth-enhancement[7],[8] by pushing-up feed location technique.

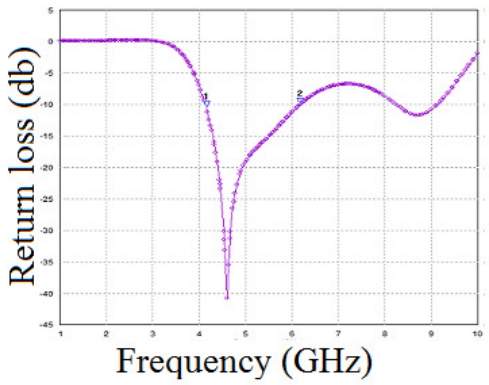

Fig. 2. Simulated Return Loss For Proposed Antenna

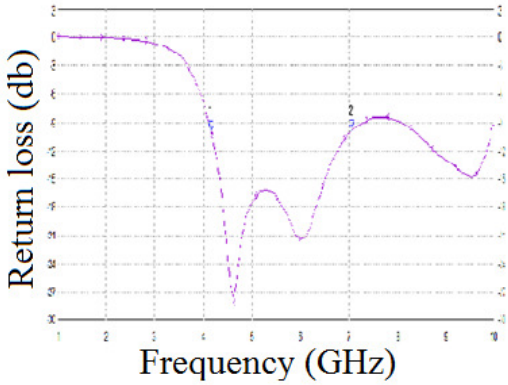

Fig. 3. Simulated Return Loss After Pushing feed 1mm

The overall antenna size is 20 mm×25 mm×1.6 mm. The proposed antenna has a simple configuration and is easy to fabricate. The simulated results are obtained using the IE3D software based on method of moments of Mentor Graphics U.S.A. Fig. 2.shows the simulated return loss curves for basic rectangular monopole antenna having feed at X=0 mm, Y=0 mm,

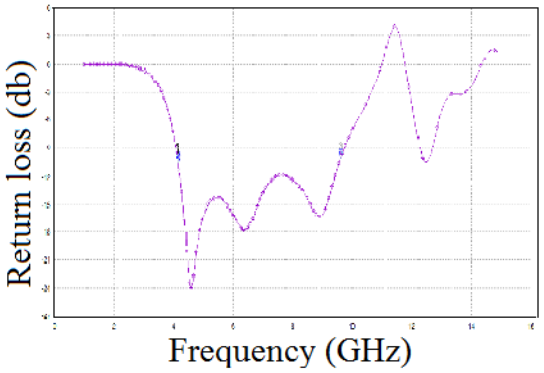

Fig. 4. Simulated Return Loss After Pushing feed 3mm

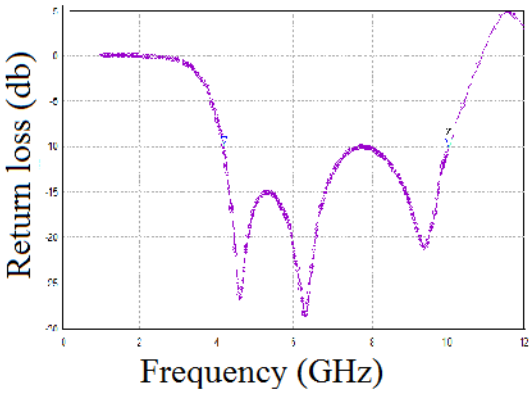

Fig. 5. Simulated Return Loss After Pushing feed 4mm

Z=1.6 mm having usable bandwidth below 10db is 2.2 GHz. Similarly Fig. 3.shows return loss curves having feed at X=0 mm, Y=1 mm, Z=1.6 mm having usable bandwidth below 10db is 2.8 GHz, Fig. 4.shows return loss curves having feed at X=0 mm, Y=3 mm, Z=1.6 mm having usable bandwidth below 10db is 5.5 GHz and Fig. 5.shows return loss curves having feed at X=0 mm, Y=4 mm, Z=1.6 mm having usable bandwidth below 10db is 5.8 GHz.

All the simulated antenna satisfies the 10-dB return loss requirement[1],[5] from 4.1 to 10 GHz. Experimental results show that the proposed antenna could be a good candidate for hand-held UWB application and its usable bandwidth gradually increases from 2.2 GHz to 5.8 GHz simply by pushing up microstrip feed position.

4. CONCLUSIONS

In this proposed work, it has been shown that a very simple technique of pushing –up feed location can increase the usable frequency band to quite a high extent. Due to change in feed location, there is a very slight increase in the size of the antenna. But this increase in size is quite less when the performance of the antenna in terms of bandwidth is compared.

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