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A Tri-Band I Slotted Rectangular patch Microstrip antenna used for Wireless Communications

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Abstract: A Tri-Band I slotted rectangular patch microstrip antenna is presented in this paper .The antenna resonates at1.43 GHz, 5.16 GHz and 7.60 GHz frequencies. The antenna is fed with coaxial feed giving band widths of 10.52%, 7.20% & 30.83% for VSWR values less than 1.14.Theproposed antenna can be used for WLAN (Wireless Local Area Network) applications.

Keywords: Impedance bandwidth, Microstrip patch antenna, Return loss, VSWR

1. INTRODUCTION

Microstrip antennas are the most popular because of their numerous advantages in wireless communication systems. This is due to attractive features such as small size, light weight, low profile, and low cost, and that are easy to fabricate and assemble [1]. However, the major disadvantage of the microstrip patch antenna is its inherently narrow impedance bandwidth. Wireless communication systems are developed widely and rapidly, which leads to a great demand in designing low-profile antennas, especially for WLAN and WiMAX applications [2-3]. They are many techniques that can improve the bandwidth. Such as increase in the substrate thickness, the use of a low dielectric substrate and feeding techniques [4]. By considering all these parameters coaxial feeding is provided as it can be placed at any place in the patch. Hence, the bandwidth is increased [5].The proposed I slotted rectangular patch microstrip antenna provides the improved Bandwidth [6-8].

2. PROPOSED SLOT ANTENNA DESIGN

The proposed antenna has tri bands that are used for wireless communications such as WLAN applications. The geometry of the designed antenna is shown in Figure 1.The material FR4 is used as substrate with dimensions 80x60x3.4 (mm^3) and its dielectric constant value is $€_r$=4.4.The antenna is resonatesat1.43 GHz, 5.16 GHz and 7.60 GHz frequencies. The antenna is provided with coaxial feed with suitable inner and outer conductor diameters. The feed position is at bottomed right side of the patch. The feeding technique used is coaxial feed as it can be placed at any position in the patch. The dimensions of the patch and the slots are shown in the Table 1.

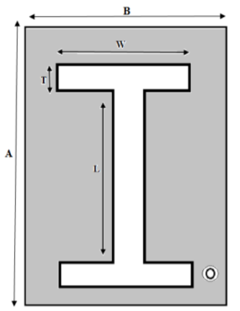

Figure 1. Geometry of the Proposed Antenna

Table1: Dimensions of the 9 slots microstrip patch antenna

Parameters	Dimensions(mm)
Patch length(A)	80
Patch width(B)	60
Slot length(L)	40
Slot width(W)	30
Slot thickness(T)	10
Feed Inner conductor radius(r)	1
Feed Outer conductor radius(R)	2

3. RESULTS AND DISCUSSIONS

The important results obtained using the proposed antennas are discussed in this section.

Return loss

Return loss is the ratio of power reflected to the power delivered expressed in negative logarithmic db. The return loss should be as low as possible for maximum power delivery in microstrip antennas .The return loss plot of the designed antenna is shown in Figure 2.

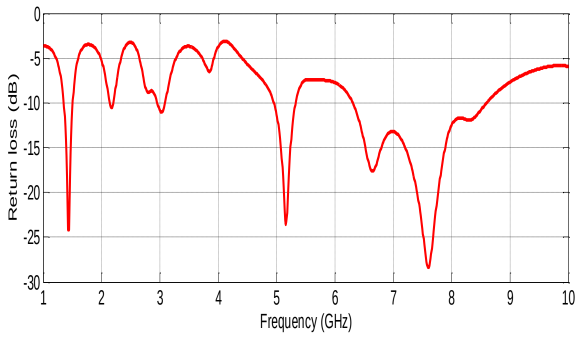

Figure 2. Return Loss Plot of the Proposed Antenna

For this proposed antenna tri bands are achieved. For the first band the bandwidth is measured between the frequencies from 1.35 GHz to 1.50 GHz which is 10.52 %, similarly the bandwidth of the second band is measured between the frequencies from 4.95 GHz to 5.32 GHz which is 7.20 % and the bandwidth of the third band is

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measured between the frequencies from 6.31 GHz to 8.61 GHz which is 30.83 % as observed from Figure 2.

VSWR

The VSWR is a measure of the impedance mismatch between the antenna and the transmission line connected to it. Higher the VSWR, greater is the mismatch between antenna and feed line. The plot between VSWR and frequency of the proposed antenna is shown in Figure 3.The voltage standing wave ratio for proposed antenna is observed to be $\leq$1.14 which is close to unity.

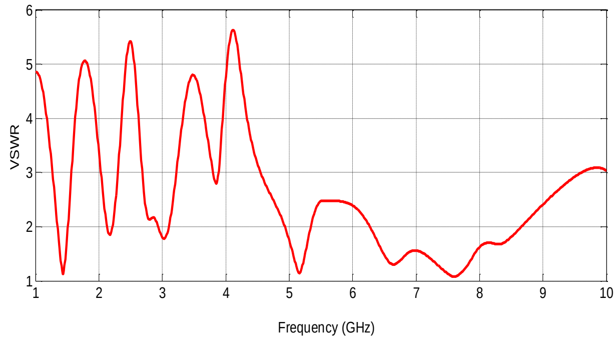

Figure 3. VSWR Plot of the Proposed Antenna

Radiation Pattern

Radiation pattern is the graphical representation and it shows the variation of power radiated by the antenna as a function of the direction away from the antenna. The radiation characteristics of the designed antenna is represented by the 2D radiation pattern at $\emptyset=0^0$,$\emptyset=90^0$.

The *E*-plane radiation patterns of both bands are shown in Figure 4, Figure 5 and Figure 6. i.e. at $\emptyset = 0^0$.

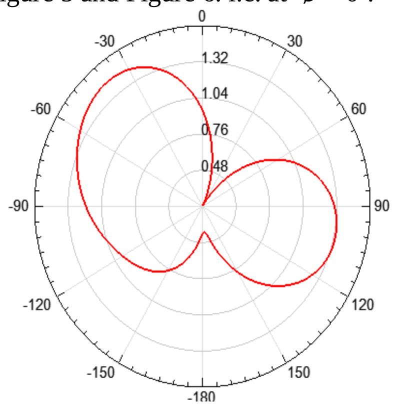

Figure 4. Radiation Pattern at 1.43 GHz for $\emptyset= 0^0$.

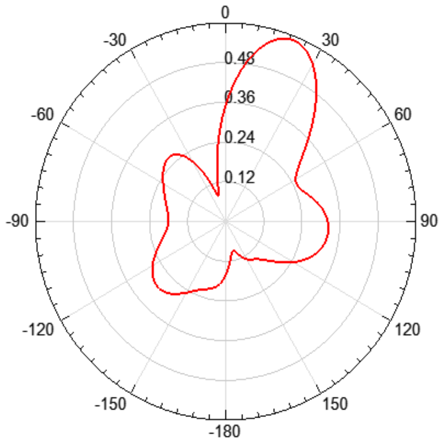

Figure 5. Radiation Pattern at 5.16 GHz for $\emptyset= 0^0$.

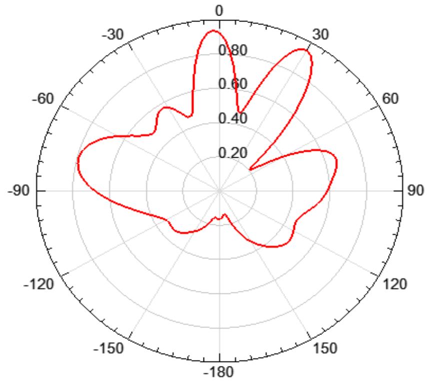

Figure 6. Radiation Pattern at 7.60 GHz for $\emptyset= 0^0$.

The *H*-plane radiation patterns of both bands are shown in Figure 7, Figure 8 and Figure 9.i.e. at $\emptyset = 90^0$.

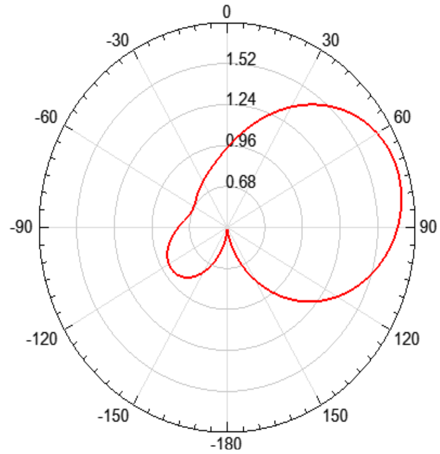

Figure 7. Radiation Pattern at 1.43 GHz for $\emptyset= 90^0$.

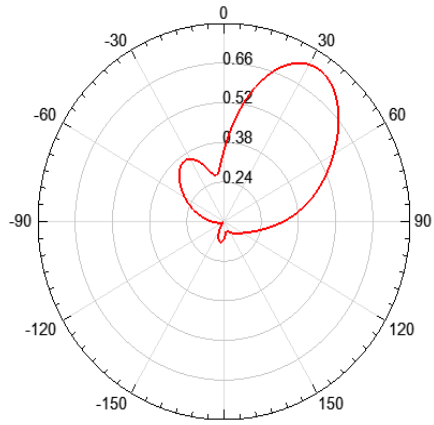

Figure 8. Radiation Pattern at 5.16 GHz for $\emptyset= 90^0$.

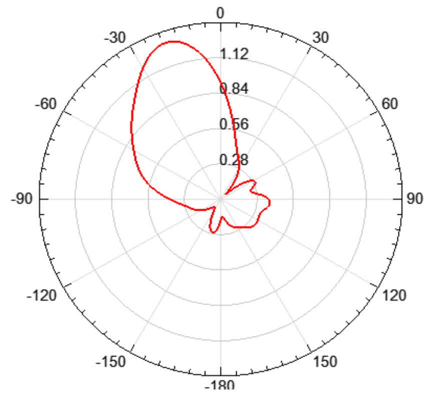

Figure 9. Radiation Pattern at 7.60 GHz for $\emptyset= 90^0$.

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4. CONCLUSION

A Tri-band I slotted rectangular patch microstrip antenna is designed to improve the bandwidth for wireless communications. The antenna resonates in the frequency ranges of 1.43 GHz, 5.16 GHz and 7.60 GHz with bandwidths of 10.52%, 7.20% & 30.83%. The antenna is fed with coaxial feeding and VSWR of the both bands is less than 1.14. It is suitable for WLAN applications.

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