Improvement of Bandwidth of Microstrip Patch Antenna by Multiple Notches

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Abstract

In this paper we present a proposed design for rectangular micro strip patch antenna by cutting multiple notches. Using proposed antenna design and coaxial probe feeding at proper position, we will compare the resultant bandwidth with the previous results of normal rectangular, single notch and double notch patch antenna. We are using IE3D simulation software for designing and analysis. We have observed that using multiple notches patch antenna and using coaxial probe feeding at proper location we can get better bandwidth.

Keywords: Rectangular Microstrip patch antenna with notch; bandwidth; VSWR; return loss; comparison of normal Rectangular shaped and cutting multiple notches shaped.

1. INTRODUCTION

In wireless communication Microstrip patch antenna plays a major role. It has many advantages such as low profile, compactness, easy to fabricate, easy installation, low cost etc but it has a major disadvantage of narrow bandwidth which proved to be a challenge for engineers to meet high data rate for various broadband application. Bandwidth of antenna can be increased by various methods such as by increasing the thickness of substrate with low dielectric constant, by probe feeding, by cutting slot, by cutting notches and by different shapes of antenna. By probe feeding and moving the location of probe feeding and using notches we get optimized bandwidth. The Increased bandwidth is compare with bandwidth of normal patch antenna and bandwidth of microstrip patch antenna with multiple notches. We will analyse that there is increase in bandwidth using proposed antenna and using coaxial probe feed at position where maximum matching is obtain. Simulation of normal shape patch antenna has been carried out using IE3D software. In my proposed work by using IE3D simulator we increase bandwidth up to 26.80% at probe location (44.725mm×5mm), which gives somewhat better result, and for normal patch improve bandwidth is 13.74% at probe location (7mm×5mm), for single notch patch antenna improved bandwidth is 16.47% at probe location (45.75mm ×5mm), for double notches bandwidth is 22.14% at probe location (5mm ×6mm).

2. ANTENNA DESIGN

The proposed antenna is design by cutting three notches in square patch as shown in fig 4. Cutting of this notch in antenna increases the current path which increases current intensity as a result efficiency is increased. The dimension of the ground plane is taken as 60×60 mm. Notches are cut at edges. The substrate dielectric constant is 4.2 and substrate thickness is 1.6mm and loss tangent is 0.0013.The probe feeding is implemented on (44.725mm×5mm) for optimum result. Figure 1 shows the shape of normal patch antenna; figure 2 shows single notch antenna, figure 3 shows double notch antenna. My proposed antenna has improved bandwidth 26.80%.

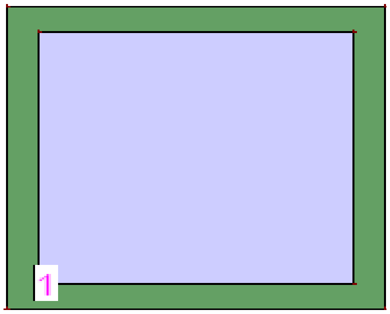

Figure (1): Normal Square Shape Microstrip Antenna

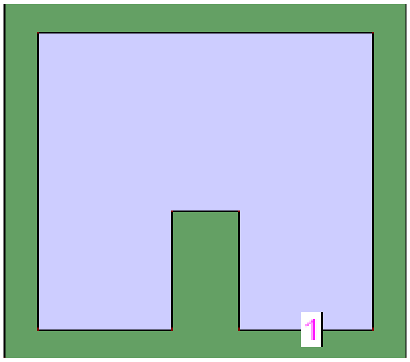

Figure (2): Single notch Microstrip patch Antenna

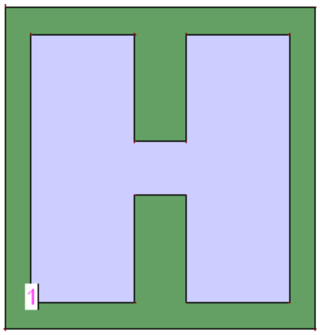

Figure (3): double notch Microstrip patch Antenna

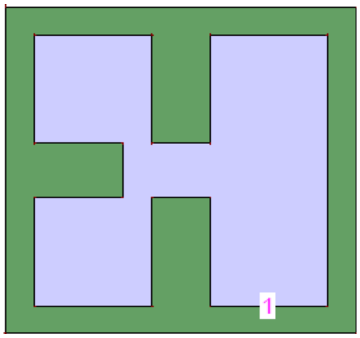

Figure (4): Proposed Microstrip patch antenna

3. ANTENNA RESULT

We are using IE3D simulation software for simulation of microstrip patch antenna [4]. The bandwidth of proposed antenna on simulation comes out to be 26.80% at 2.572GHz resonance frequency and the return loss (S_{11}) of slotted E-shaped patch antenna has -27.1db at the 2.572GHz resonant frequency, and normal square patch antenna is improve bandwidth 13.74%at the 1.4545GHz resonant frequency it has -32.85db at resonant frequency 1.4545GHz. The band width is calculated at the frequency range where the return loss (S_{11}) is approximately -10 or below [1]. The return loss of proposed microstrip patch antenna is shown in figure (8). The return loss of the normal, single notch, double notch is shown in figure (7), (6) and (5). The plot the result of the VSWR at the resonant frequency and VSWR value is observed as ≤ 2 improved matching conditions and VSWR, directivity, gain, efficiency are shown in figure (5-12).

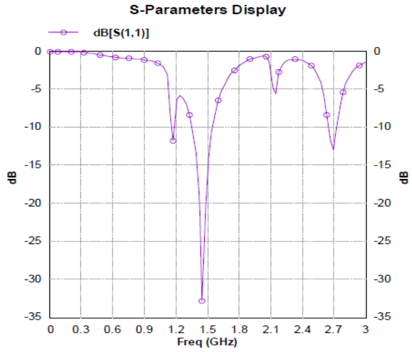

Figure (5): Return loss Vs Frequency for the square patch antenna

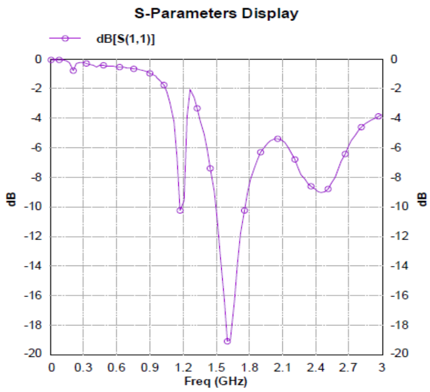

Figure (6): Return loss Vs Frequency for single notch patch antenna

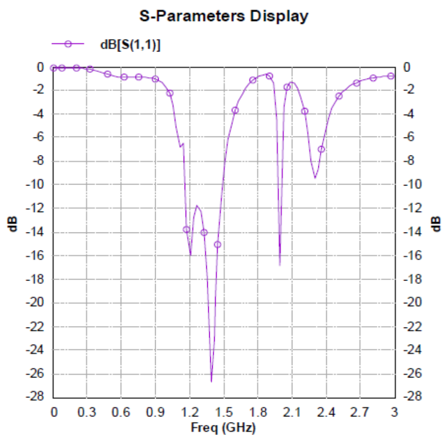

Figure (7): Return loss Vs Frequency for double notch antenna

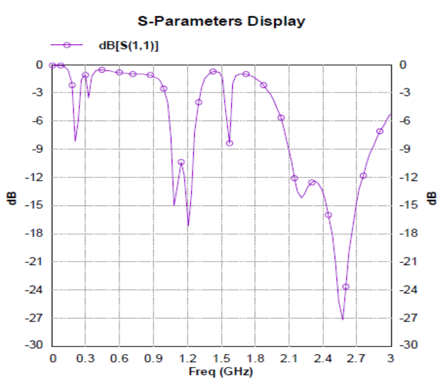

Figure (8): Efficiency Vs Frequency for the proposed antenna

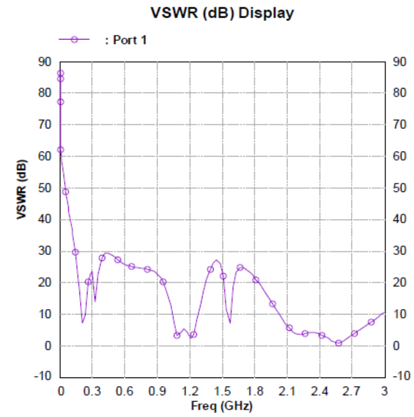

Figure (9): VSWR vs. Frequency for proposed antenna.

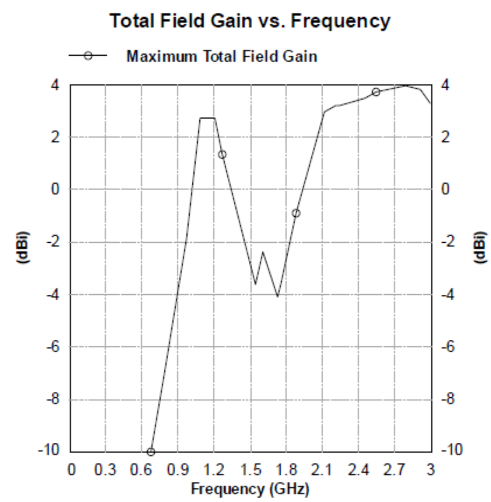

Figure (10): Gain Vs frequency for proposed antenna

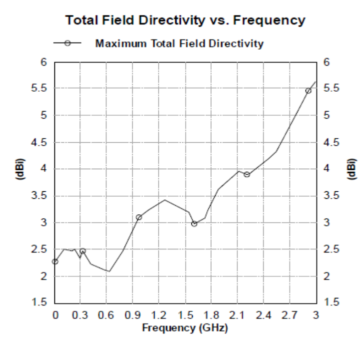

Figure (11): Directivity Vs Frequency for proposed antenna

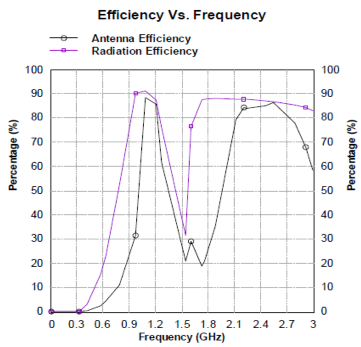

Figure (12): Antenna and Radiation efficiency Vs Frequency

4. COMPARISION

As we see in previous work that are based on DSP algorithm and various work that cutting the shapes of microstrip patch antenna have been done figure (1), in our proposed work we are using IE3D simulator and by cutting multiple notches gives better bandwidth and more efficient results figure (4). In my proposed work by using IE3D simulator we increase bandwidth up to 26.80% at probe location (44.725mm×5mm), which gives somewhat better result, and for normal patch improve bandwidth is 13.74% at probe location (7mm×5mm),for single notch patch antenna improved bandwidth is 16.47% at probe location (45.75mm ×5mm),for double notches bandwidth is 22.14% at probe location (5mm ×6mm).My proposed antenna is improve bandwidth 26.80% at 2.572GHz resonant frequency and cutting three notches square patch antenna.

5. CONCLUSION

We can analyse that by using different shape, feeding techniques we can achieve modified bandwidth. The antenna band width is increased up to 26.80% and it resonates at 2.572GHz resonance frequency. Along with band width antenna directivity, efficiency and radiation pattern also improved. The proposed antenna has high bandwidth which can be used for wireless communication of high data rate. Compared with normal Rectangular patch antenna whose impedance bandwidth 13.74% and for our proposed antenna whose impedance bandwidth is 26.80%.

6. REFERENCES

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