Dual Feed Short Circuited Rectangular Microstrip Antenna for GSM,WLAN & C BAND Applications

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ABSTRACT
Three short circuited microstrip patch antenna structure with dual feed has been proposed with conical via. The design is based on rectangular hole structure with conical via loading and slit loading technique. The simulation is based on method of moment method, using IE3D software. It is also observed that by cutting slits of different areas, the resonating frequencies are getting changed along with bandwidth and return loss. This antenna can operate at GSM frequency, WLAN and also this antenna can be applied for C Band applications.
A dual feed wideband microstrip antenna has been proposed. The design is based on dual feed technique. In this paper, the two patches at the either side acts as resistive elements to the main patch in the middle. We have observed that least the area of flowing of the current through the patch, better the wideband.

Keywords:– Dual Feed, Three short circuited Patch, Wideband Microstrip Antenna, GSM Microstrip Antenna, WLAN & C BAND Applications

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1. INTRODUCTION

With the increase of the wireless communication systems we can notice the urge of future technologies are in need of low-profile antennas for wireless communications [1-2]. Because of many attractive features, microstrip antennas have received considerable attraction for mobile communication handset terminals.

There are several techniques to reduce the size of microstrip antennas at resonant frequencies. Using microwave substrate of high dielectric constant, patch dimension can be reduced, but the antenna shows poor efficiency due to surface wave generation. Edge-shorted patches using shorting wall or shorting plate can lower the physical dimensions of a microstrip patches. Further lowering of antenna dimension is possible using shorting pin at the proper position and by using shorting-pin loaded technique, antenna size reduction of about 89% can be achieved [3]. Also slot loaded patches are used to design small microstrip antennas.

The disadvantage of microstrip patch antenna is that it gives narrow bandwidth. However, researchers have made outstanding efforts to overcome this problem and configurations have been presented to increase the bandwidth.

In this paper we have designed a dual feed conical via loaded rectangular structure having three patches which gives a wideband at frequencies 710MHz to 1100MHz and 5.9GHz to 7.2GHz and narrowband at frequency 3.8GHz. We have taken the FR4 substrate which has dielectric constant as 4.4 and loss tangent 0.02 having substrate thickness 1.4mm.

2. INDENTATIONS AND EQUATIONS

We have a taken a rectangular microstrip antenna whose length was calculated depending on the dominant mode of operation i.e m=1 and n=0 from the equation given below.

The equations are [4]:

The length L is calculated as:

$$L = \frac{c}{2 f_0 \sqrt{\varepsilon_{eff}}}$$

The width W is calculated as:

$$W = \frac{c}{2 f_0 \sqrt{\frac{\varepsilon_r + 1}{2}}}$$

For our design, Ɛe = 4.4 [FR4 Substrate]

The length and width of patch 1 and patch 2 = 10 mm

The length and width of patch 3 = 15 mm

After constructing the structure, we have cut a slit on Patch 3 of 13 mm in length and width [5], because of which we are able to get better return loss with wider bandwidth. And because of that the current path is getting directed in definite direction, thus showing us characteristics of wideband antenna. As well as the current well formed by the dual side rectangular patches [6].

3. FIGURES AND TABLES

We have proceeded from the basic patch to the slit cut-off final patch. The respective Figures show the path to our designed antenna.

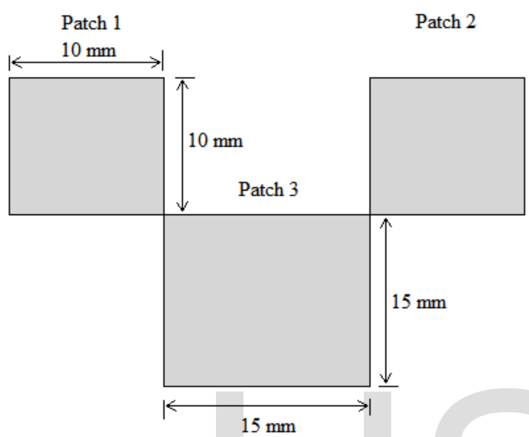


Figure 3.1- Shows the three rectangular patches proposed firstly.

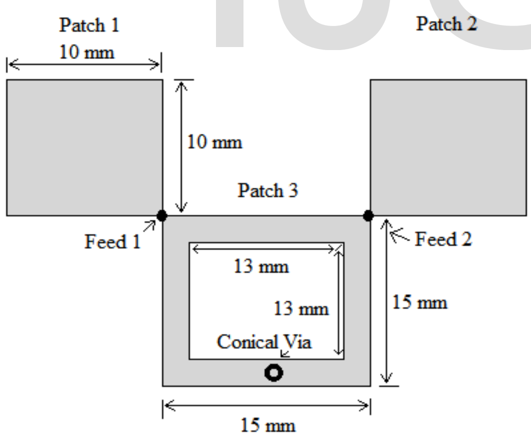


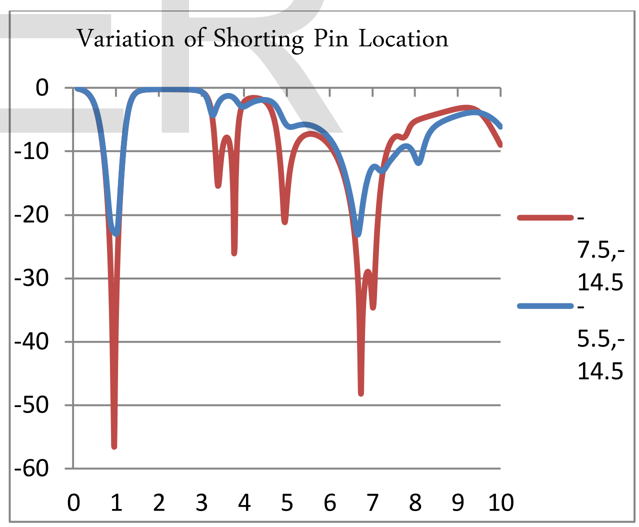
Figure 3.2 - Shows the final structure with dual feed and conical via. (Here Conical via location is -7.5, -14.5 according to the axis taken.) Feed 1 is at location (-15,0) Feed 2 is at (0,0)

The Table 3.1 shows the best results we have found out from the carried out simulations. Simulations are done using IE3D [7].

Index: CVia Location= Conical Via Location
RF1= Resonating Frequency 1 (in MHz)
RF2= Resonating Frequency 2 (in GHz)
RF3= Resonating Frequency 3 (in GHz)
RL1= Return Loss 1 (in dB)
RL2= Return Loss 2 (in dB)
RL3= Return Loss 3 (in dB)

CVia Location	RF1	RF2	RF3	RL1	RL2	RL3
-7.5, -14.5	700 MHz to 1100 MHz	3.8 GHz	6 GHz to 7 GHz	> -50 dB	-28 dB	> -20 dB
-5.5, -14.5	720 MHz to 1050 MHz	---	6.2 GHz to 7 GHz	< -20 dB	---	< -25 dB

Table 3.1



Graph 3.1 – Shows the variation of shorting pin location for the best acquired results.

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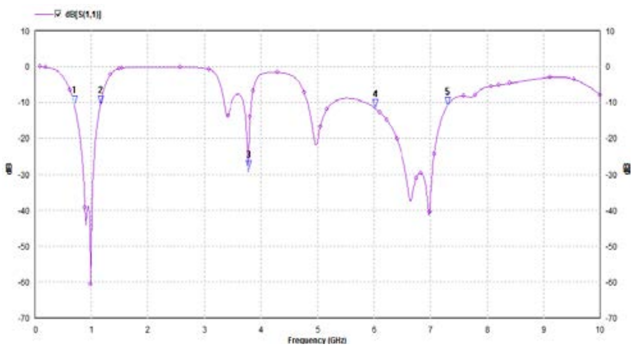

Figure 3.3 – Shows Return Loss graph from IE3D for the final structure

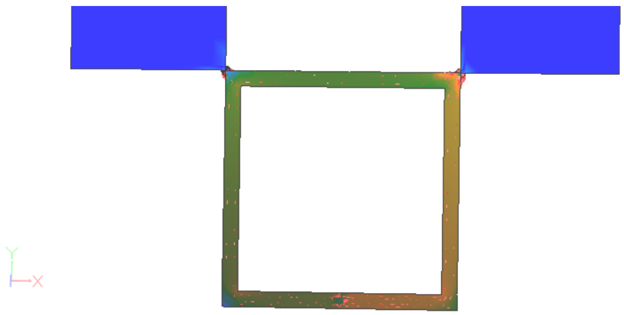

Figure 3.4 – Shows the current distribution of the antenna.

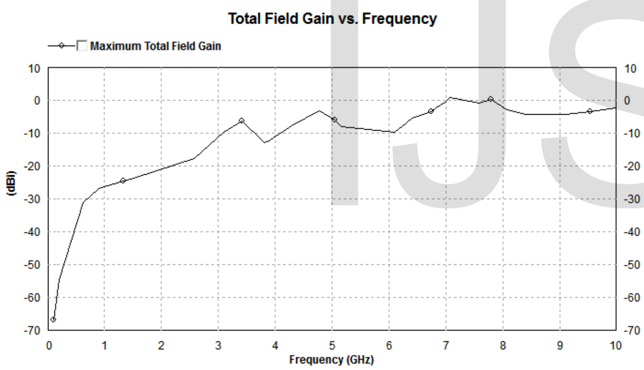

Figure 3.5 – Shows the Graph of Total Field gain vs Frequency from the simulated result

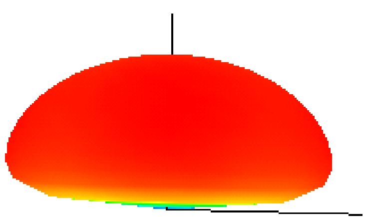

Figure 3.6 – 3D radiation pattern at 3.8GHz with -9dBi gain

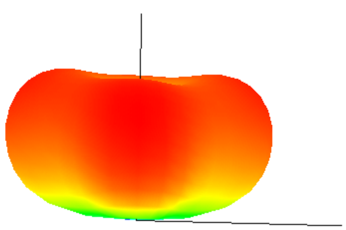

Figure 3.7 – 3D radiation pattern at 7GHz with +0.7dBi gain

4. CONCLUSION

We have seen dual feed triple patch rectangular microstrip antenna resonating at multiple frequencies and also giving wide bandwidth in GSM range, WLAN frequency and C BAND. But it provides with low gain.

Our further study will follow the miniaturization of our antenna and obtaining better gain with almost fixed bandwidth i.e wide. We will study it using ground defected structure.

We are trying to develop a small sized antenna for mobile terminals as well as WLAN applications so that it can be used as both in times using switching functions in communication systems.

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