Microstrip Patch Antenna Implementation for WiMAX/GPS/WLAN Applications

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***Abstract* - A rectangular microstrip patch antenna with parasitic elements has been presented in the three proposed designs. They are suitable for applications working at resonating frequencies within 1.07-2.47-2.48-2.54-2.93 GHz frequency band. In this paper the minimum value of return loss up to 56.78 dB. The dielectric constant for the substrate layer is 2.2 and the designs are fed by the coaxial cable. The microstrip patch antenna is simulated by using high frequency simulation software FEKO version 5.5. In addition the results of the voltage standing wave ratio (VSWR) are also shown.**

***Index Terms* - return loss, patch antenna, VSWR, bandwidth, FEKO, Coaxial probe.**

I. INTRODUCTION

The key components of any wireless system are antenna [1][2] An antenna is a device that receives and/or transmit electromagnetic waves. The microstrip antenna has many advantages like small size, light weight, easy to integration with feed networks and low cost fabrication [3][4]. The patch shape can be of circular, rectangular, triangular, elliptical, etc. In this paper we selected rectangular shape for the patch [5][6][7].

The designs have been implemented by FEKO software which is based on Method of Moments [8]. The general geometry of the proposed antenna consist of perfect conductor patch layer with dimensions (Wp X Lp), substrate layer with dielectric constant 2.2 and thickness (h) and an infinite ground plane below them. The coaxial cable is fed the antenna at the point (x0, y0) from the center. The geometry is shown with all dimensions in the Figure 1 and Table 1.

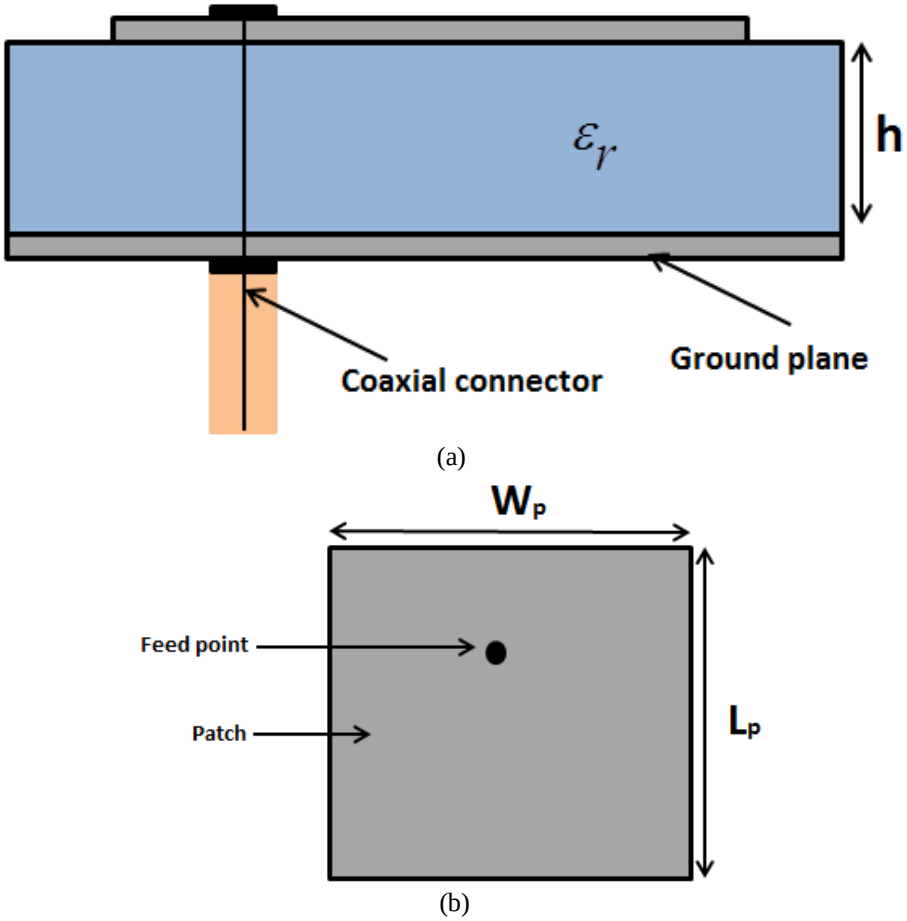

Figure 1: Geometry of microstrip patch antenna (a) Side view (b) Top view

Table 1 Design parameters

Parameter	Value (mm)
Patch width (Wp)	76.69
Patch length (Lp)	61.61
Feed point (x0,y0)	(-16, -2)
Substrate thickness (h)	5.5
Dielectric constant (ε_r)	2.2

In this paper, three proposed antennas are simulated by using FEKO software. Figure 2 show that the structure of the antennas.

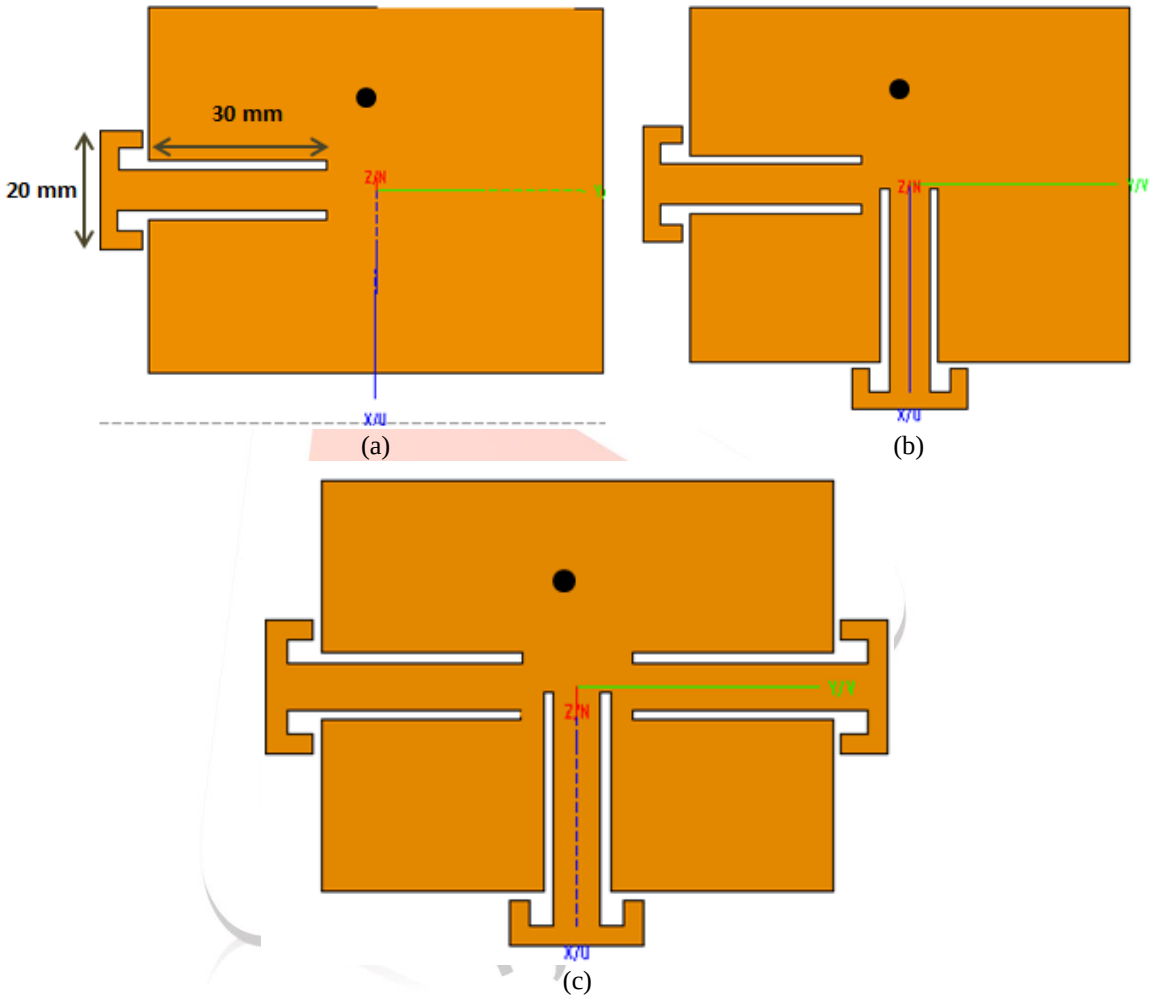

Figure 2**:** Proposed antennas (a) Antenna1 (b) Antenna 2 (c) Antenna 3

II. RESULTS

Return loss is the way to characterize the input and output signal sources. It can be defined in dB. It's observed that the antenna 1 work at two resonant frequency 2.48 and 2.93 GHz (above 10 dB return loss). The minimum value of return loss is achieved at resonant frequency 2.47 GHz which was 56.78 dB for antenna 3.

Bandwidth is another fundamental parameter which is describes the range of frequencies [9] [10]. Figure 3 and Table 2 shows that the output results for the proposed antennas.

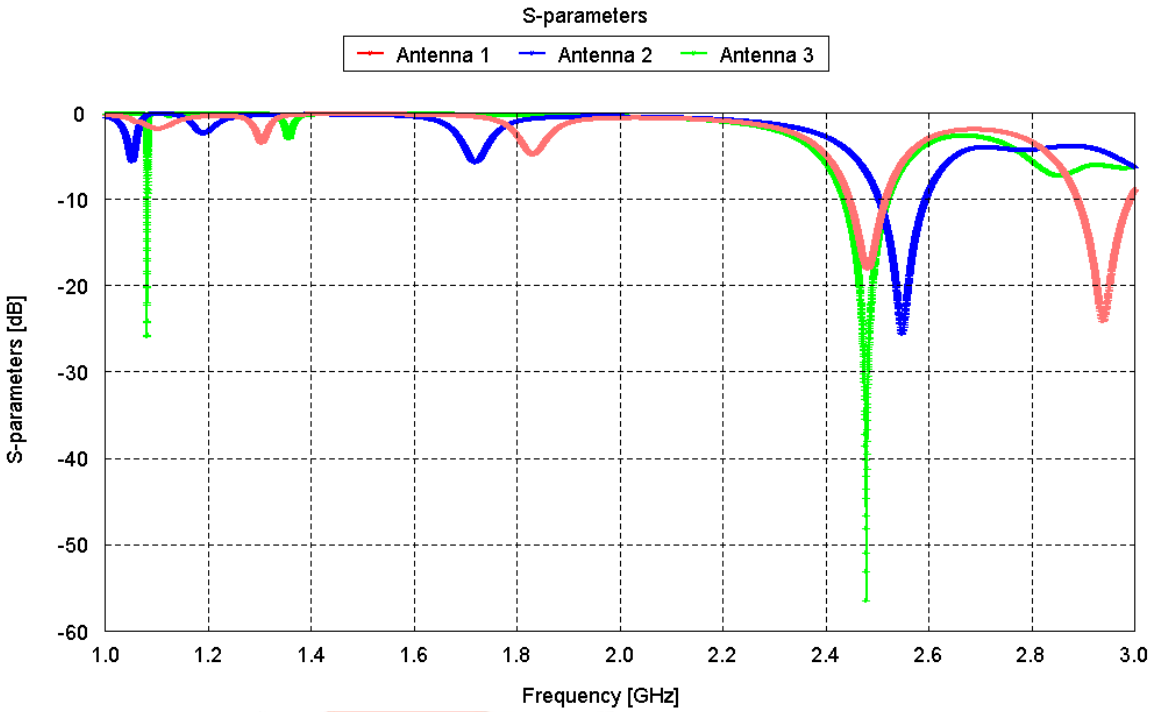

Figure 3: Return losses results for the microstrip patch antennas

Table 2 Design parameters

Antenna	Resonant frequency (GHz)	Return loss (dB)	Bandwidth (MHz)
Antenna 1	2.48	18.21	70
	2.93	24.29	100
Antenna 2	2.54	25.74	90
Antenna 3	2.47	56.78	90

Voltage Standing Wave Ratio (VSWR) is describes the maximum to minimum voltage of the antenna [11]. Figure 4 show that the VSWR response for the antennas.

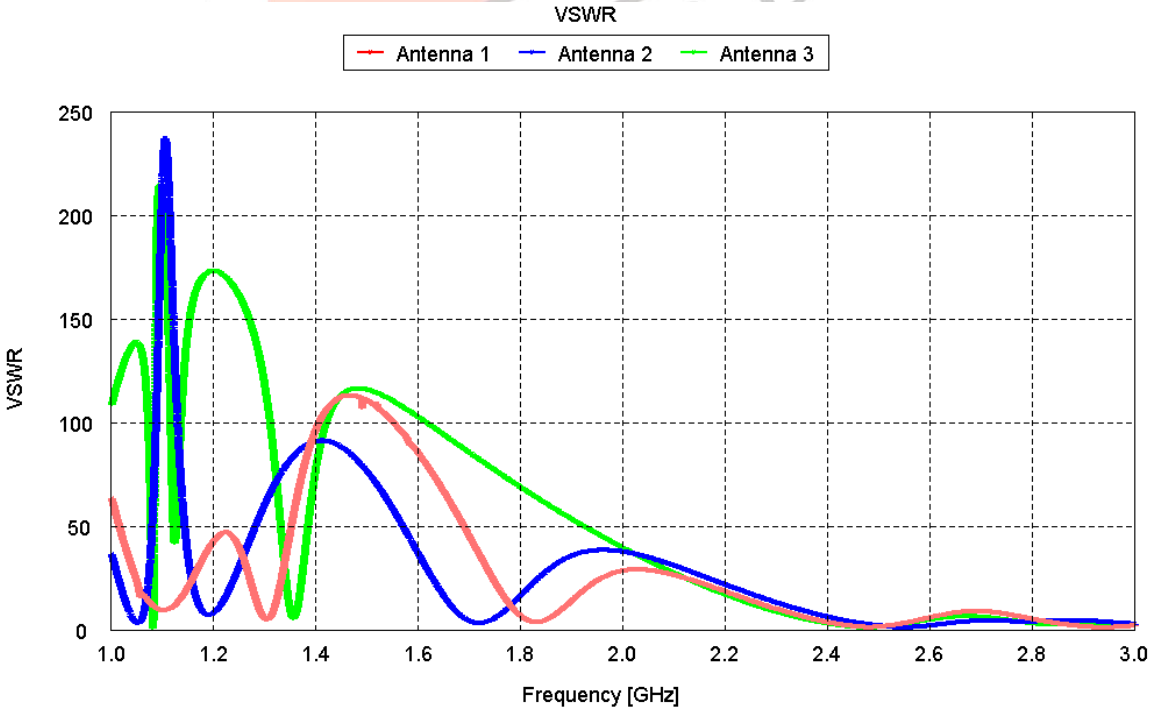

Figure 4: VSWR results for the microstrip patch antennas

III. CONCLUSION

A rectangular patch antenna with parasitic patch has been simulated by using FEKO full wave simulator software in three designs for the frequencies between (1.07-2.93) which are suitable for global positioning system (GPS) and other wireless applications. A minimum return loss among the proposed antennas in this paper has been achieved at resonant frequency 2.47 GHz which is 56.78 dB, in addition, the maximum bandwidth 100 MHz is satisfied at resonant frequency 2.93 GHz. Multi-substrate layers in different thickness instead of single layer are the propose for the future work.

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