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Study of Frequency Tuning Characteristic of a Micro-strip Patch Antenna Operating at Dual Resonant Frequency, by Modifying the Slot, Loaded in the Ground Plane

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***Abstract*— In this paper, the tuning characteristic of a rectangular microstrip patch antenna has been studied. It has been shown, how the variation of length of the slot embedded in the ground plane results in shifting of resonant frequency. The antenna mentioned in this paper operates at two resonant frequencies. By modifying the length of the embedded slot, the ratio of the higher resonant frequency to the lower frequency can be varied from 2.03 to 1.In actual case it has been found that one of the resonant frequency remains fixed irrespective of the slot length. If the ratio of this fixed frequency to the tunable resonant frequency is considered, then the ratio can be varied from 2.03 to 0.7 by varying the slot length.**

***Index Terms*—Antenna, frequency tuning, microstrip, multiband, .**

I. INTRODUCTION

With wide spread use of mobile communicating devices, the microstrip antennas have become the most commonly used antenna today. Because of its planer structure and conformal nature, it is the obvious choice for mobile devices. As per current technological trend more than one communication system or services are being incorporated into single device. Incorporating more than one system in a single device results in more convenience to the user, but, increases the complexities in the devices. The antenna section is not exempted from these complexities. Microstrip antenna with dual operating frequency is required where it is required to transmit the signals at two different bands of frequencies [1-6]. The required band separation depends on the system where it is being used. The design and study mentioned in this paper can be used to modify the operating frequency according to the application.

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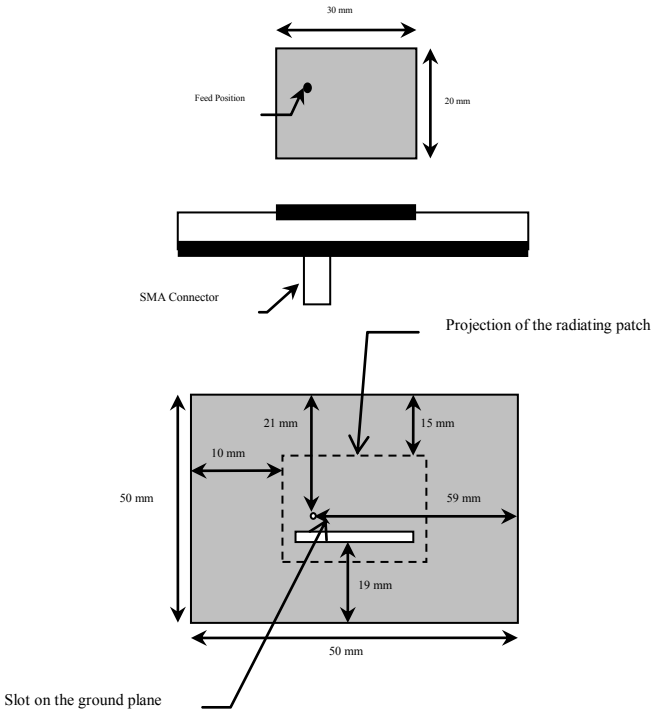

Fig. 1 Layout of Antenna

II. DESIGN OF ANTENNA

The layout of the designed antenna is shown in Fig 1. The layout has been drawn in first angle projection. As shown in the figure, the ground plane is loaded with a slot of width 1 mm and length **L** mm. The slot is positioned at equidistance from the two edges parallel to the horizontal axis in the figure. The patch antenna is fed through a coaxial feed. The feeding point is so positioned to obtain better impedance matching. The radiating patch is positioned at the centre w.r.t ground plane of the antenna.

The above antenna was simulated using FR4 (ε_r= 4.4) and thickness of 1.6 mm using IE3D^{TM} (based on MoM).

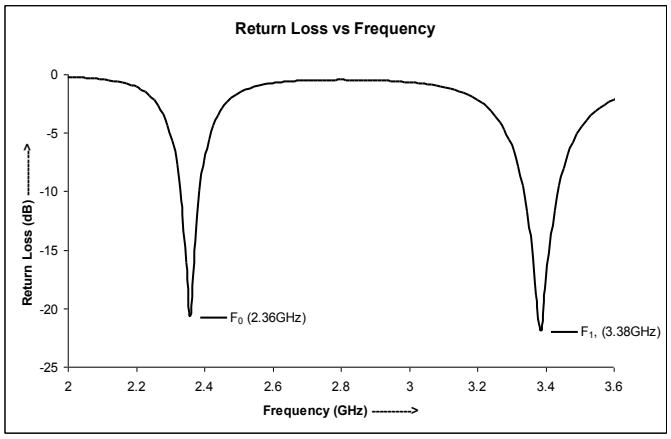

Fig. 2 Return Loss vs Frequency

TABLE 1

Slot Length 'L' (mm)	F_0		F_1	
	Frequency (GHz)	Return Loss (dB)	Frequency (GHz)	Return Loss (dB)
0	2.36	-20.8	3.3867	-21.9
2	2.36	-20.1	3.3866	-21.6
4	2.36	-19.6	3.365	-22.5
6	2.36	-20.6	3.35	-23.8
8	2.36	-20.3	3.305	-25.3
10	2.36	-20.3	3.23	-27.9
12	2.36	-20.5	3.155	-35.7
14	2.36	-20.8	3.065	-31.3
16	2.36	-21.6	2.915	-25.3
18	2.355	-18.4	2.775	-23.1
20	2.37	-20.6	2.64	-20
22	2.385	-18.6	2.445	-17.1
24	2.34	-11.8	2.34	-11.8
26	2.355	-17.9	2.175	-12.8
28	2.355	-19.6	1.995	-11.7
30	2.355	-18.6	1.86	-11.8
32	2.355	-18.0	1.74	-12.7
34	2.355	-17.8	1.65	-14.4
36	2.36	-18.8	1.5	-20.2
38	2.36	-18.4	1.453	-22.0
40	2.36	-18.5	1.3866	-20.2
42	2.36	-18.3	1.3333	-27.3
44	2.36	-18.3	1.28	-20.5
46	2.36	-17.9	1.2133	-19.2
48	2.36	-17.9	1.16	-16.3

III. RESULTS AND DISCUSSION

The return loss for the above antenna without any slot is shown in Fig 2. The fixed resonant frequency is designated as f_0 and the tunable resonant frequency is denoted by f_1. The resultant resonant frequencies for different slot length and their corresponding return loss is given in table 1. The variation of resonant frequencies with that of slot length is shown in Fig 3. It can be observed that the tunable frequency f_1 is inversely proportional to the slot length, whereas the fixed resonant frequency f_0 is independent of the slot length. Therefore, if ratio of the f_0 to f_1 is taken, the ratio can be varied from 2.03 to 0.7.

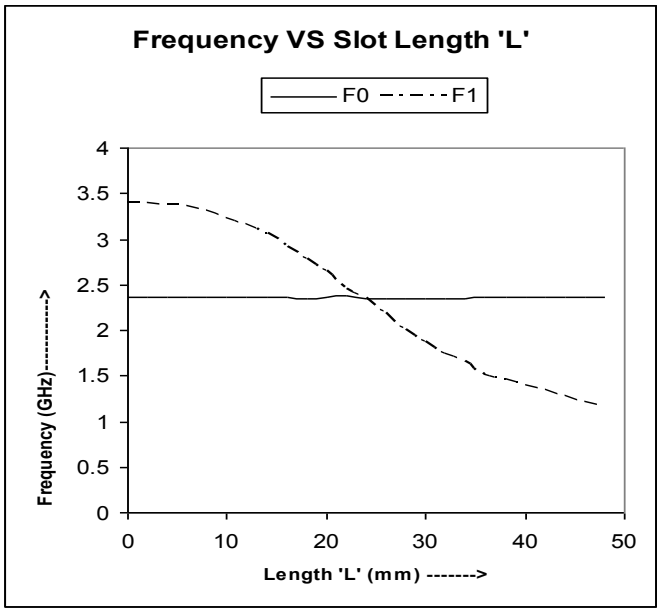

Fig. 3 The variation of resonant frequencies with that of slot length

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