Proximity Fed Antenna with Partial Ground Structure for Wideband Applications

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***Abstract*—This proposed antenna is a double ring structured MSP antenna with partial ground surface to obtain wideband response. This antenna is fed with normal microstrip feedline to obtain better performance of antenna and operate in different frequency band (1.9 - 3.6 Ghz) that covers wireless applications of Wimax, Bluetooth and WLAN. Also used for medical and scientific applications. The proposed antenna size is 55 x 44 x 1.6mm^3 uses FR_4 epoxy as a substrate with thickness of 1.6mm. The antenna gain at different frequency and its radiation pattern are observed for this proposed antenna with and without DGS designed using HFSS version14.**

***Index Terms*—MSP-Microstrip Patch Antenna, DGS-Defective Ground Structure**

I. INTRODUCTION

The rapid growth in communication technology has led to greater demand to have integrated antenna operating in different frequency bands. This interesting method which is extensively used for Tele-medical, radar, military and satellite applications (that is ISM bands) [1]. Therefore, desired antennas to operate in wideband and ISM band have to be designed. Communication system requires Microstrip antenna because of low cost, compact structure and allow flexible feedline configuration [2]. As Microstrip antenna provides narrow bandwidth, surface wave radiation is not desired for some applications [3]. Various design techniques to improve bandwidth are implemented in which one with L and U-shaped coplanar feed-line antenna having slotted patch and can also use L- coaxial feeding [3]. A circular ring MSA designed to provide bandwidth enhancement [6]. For an indoor environment, omnidirectional antenna gives increase in probability of receiving multipath signal which can be used for long distance communication while other is provided with a signal of weaker strength [7]. Many designs have been given to develop isotropic microstrip antenna in which few are compact in size [8] and use slots of multiple shapes; rectangular, circular and T-shaped with feedline techniques [11]. Antenna proposed in [10] enhances gain but provides narrow bandwidth which is not desirable.

In this paper, a MSP antenna having double ring fed by microstrip feedline is designed in order to enhance bandwidth and to obtain desire gain so that can be used for wireless applications. The double rectangular ring structure is used to obtain wideband response. In this paper section I explain the structure of MSP antenna with double ring and DGS. In section II simulated return loss graph with and without DGS, radiation pattern at four different frequency and 3D-polar plot is discussed. Then last section concludes the proposed antenna with require performance and its characteristics.

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II Antenna Design

The rectangular ring MSP antenna is designed using FR4 epoxy as substrate having dielectric constant of 4.4 and height of 1.6mm fed by microstrip line technique.

A. MSP Antenna wit double ring structure

To get wideband response a two ring structure R_1 and R_2 are used as shown in Figure1 which are printed on top of the substrate.

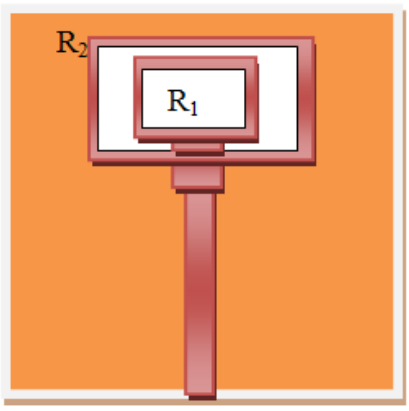

Figure 1: MSP antenna with two slotted ring structure

B. MSP antenna structure

The dimension of feedline and ring structure of MSP antenna is as shown in Figure2 and Figure3. Table I shows the dimensions of proposed antenna. The antenna design made up of two rectangular rings both attached to a common bridge like feedline with partial ground plane structure.

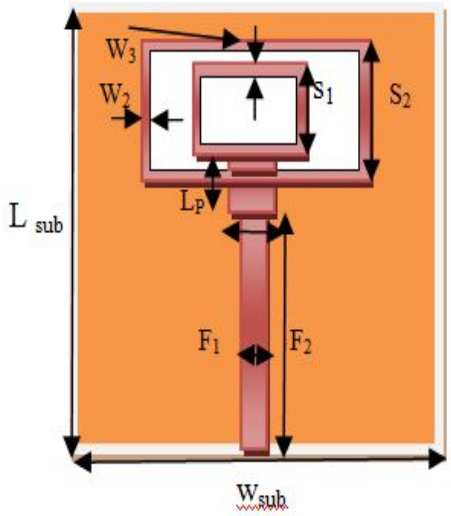

Figure 2: MSP antenna structure (top view)

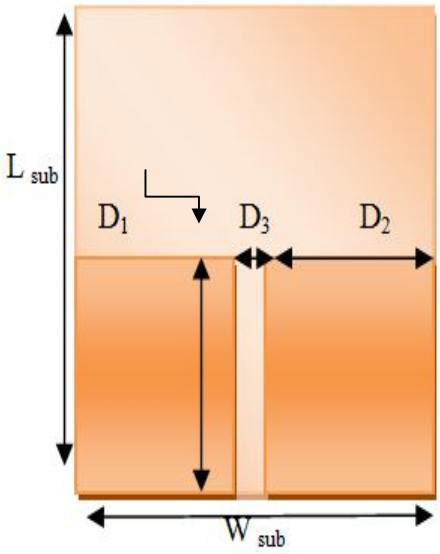

Figure 3: MSP antenna with DGS structure (bottom view)

S_1	15.6	W_2	2.6	D_2	20.3
S_2	22.6	W_3	1.3	D_3	3.4
F_1	4.96	W_1	8.0	L_{sub}	26.5
F_2	27.5	D_1	27.5	W_{sub}	24

All Dimensions in mm

Table 1: Dimensions of Proposed MSP antenna

The dimension for DGS is also show in Table I. The partial ground is used to match its impedance with that of the feedline. Also this structure provides desired radiation intensity and increases the gain.

III Results and Discussions

In this section, the graph of return loss verses frequency for the proposed antenna with and without DGS is discussed. Also shows the radiation pattern at different frequency and 3D polar plot simulated using HFSS.

A. Return Loss

The return loss plot of MSP antenna without DGS is shown in Figure 4. The return loss of MSP antenna with DGS is shown in Figure 5.The comparison of gain of an antenna at different frequency is simulated which are as shown in table II.

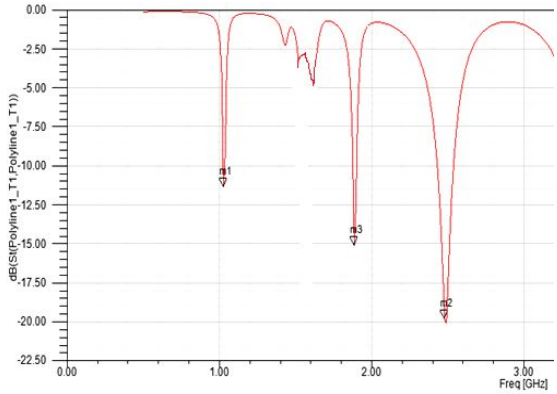

Figure 4: Return loss of proposed MSP antenna without DGS

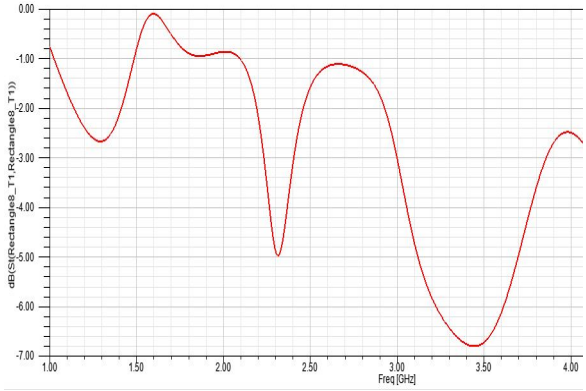

Figure 5: Return loss of proposed MSP antenna with DGS

Frequency(in GHz)	Gain(in dB)
2.4	3.18
2.6	3.48
3.4	4.46

Table II: Comparison of Gain of MSP antenna at different frequency

B. 3D-polar plot

The 3D polar plot of MSP antenna wit peak gain of 4.46Db is shown in Figure 6

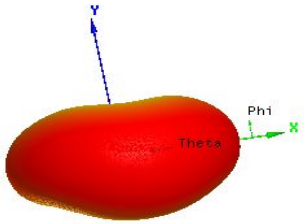

Figure 9: 3D polar plot of MSP antenna with gain 4.46dB at 3.4GHz

IV Conclusion

A compact sized double rectangular ring MSP antenna designed using the FR_4 substrate to be used for wireless communication that operates in different frequency band of ISM bands, Wi-Fi, LTE and WiMAX bands. This antenna provides increase in bandwidth and gain due to DGS with bandwidth of 80% and 4.46dB gain at 3.4GHz simulated using HFSS over that simulated using CST provides approximately 78% bandwidth and 4dB gain.

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