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A Compact Disc Shaped Microstrip Patch Antenna Using Inset Fed at 5GHz for Satellite Communications

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Abstract. This examination work is focused around planning and simulating another kind of inset feed Disc Shaped Microstrip Patch Antenna (DSMPA) with Inset feed and Defected ground plane (DGP). By presenting a round space at the focal point of the ground plane, improved attributes of Microstrip patch antenna can be accomplished. The proposed Disc Shaped Microstrip patch antenna is reverberating at 5 GHz. Simulation has been finished by utilizing reenactment programming HFSS version15. From recreation results, it discovers that our examined Disc Shaped Microstrip patch antenna yields better return loss of - 25.1 dB & VSWR estimation of 0.96 dB. The examined DSMPA is yielding a higher radiation efficiency of 77.20 %. The minimized size and higher radiation efficiency contrasted with rectangular Microstrip patch antenna makes it all the more generally helpful for satellite communications.

Keywords. Disc Shaped Microstrip patch antenna (DSMPA), Defected Ground Plane (DGP), Satellite applications, 5 GHz, Radiation efficiency, Return Loss.

1. Introduction

Microstrip patch antenna apparatus has significant applications particularly in the field of versatile deices, military, medical, business applications and remote interchanges. Their usage has become different in view of their minimal size and light weight. An Antenna is normally a metallic segment utilized for transmission or accepting electromagnetic waves. As remote applications require increasingly more transmission capacity, the interest for wideband antennas working at higher frequencies gets inescapable. Quick and practical manufacture is particularly significant with regard to the prototyping of radio wires for their exhibition assessment. Naturally Microstrip patch antennas have slender transmission capacity and low productivity and their presentation significantly relies upon the substrate boundaries. The main aim of the proposal is designing a Disc Shaped Microstrip Patch antenna because we need to find only one parameter (radius) for designing the Disc Shaped Microstrip Patch antenna.

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[3] For high velocity remote neighborhood and other remote correspondence frameworks covering 5.15–5.825 GHz recurrence band, wideband E-molded microstrip patch antenna has been planned. To irritate the surface current way two equal openings are joined, neighborhood inductive impact presented is answerable for excitation of another frequency. To tune about recurrence of second resounding mode without influencing the crucial full rage, length of middle arm is managed. Reflection Coefficient estimated underneath −10 dB about 5.05 GHz to 5.88 GHz. Presentation excess than satisfying interest transfer speed determination to cover the high recurrence. [4] In which reception antenna utilizes corporate feed strategy using inset feed input reverberating at 5.216 GHZ. FR−4 material is utilized as a dielectric substrate for the proposed cluster structure. The proposed reception antenna has been intended for the reach 5.15 − 5.35 GHz. According to IEEE 802.11 standard 5.15GHz-5.35 GHz reach can be considered as one of the reaches for 5 GHz band remote neighborhood (WLAN). The most extreme output yield and direction of radiation about the proposed exhibit are 9.019 dB & 12.81 dB separately and the cross polarization is low. The introduced cluster array is appropriate for 5 GHz. [5] An inset microstrip patch antenna is planned, recreated and fabricated at recurrence 5 GHz. To plan the proposed microstrip patch antenna, substrate GML 1000 (lossy) is taken with dielectric constant value of 3.2 and tangent loss 0.002. The components of the patch antenna are 20.07 mm (width) and 16.56 mm (length). In this fabricated on Microstrip patch antenna the impedance is 50 Ω's. Ground plane soldered with external conductor using co-pivotal and afterward the middle conductors are checked not to have cut off the ground plane. [6] Creator proposed triband minimized printed microstrip patch antenna that can be used for WiMAX& Wireless LAN applications. Microstrip patch antenna design comprises of collapsed open stub, asymmetric trapezoid ground structure plane, long and short L-formed strips. The construction planned is operable at 3 different frequency ranges (2.4 GHz, 5 GHz Wireless LAN and 3.5/5.5 GHz Wireless MAX groups). The imploded open stub, long and short L-shaped strips recognize impedance organizing at 2.4, 3.5 and 5.2/5.8 GHz independently, and the lopsided trapezoid ground plane changes impedance planning at 5.2, 5.5 and 5.8 GHz. [7] Plan of Microstrip patch antenna as model of variety cluster as 4X4 is intended for 5 GHz band Industrial, Scientific & Medical (ISM Bands) and Wireless LAN application. Single component strip is intended for desired particular & later 16 component strip is intended for frame exhibit and a force divider to fabricate the reception apparatus antenna with the referenced determinations. In this paper, various procedures used to upgrade acquire have been audited. Investigation of size decrease strategies is all around considered. By utilizing a 16-component patch cluster exhibit at 5GHz band, addition is expanded trade off in beam width. The acreage of reception antenna considerably diminished utilizing TLC 30 overlays with compact substrate misfortunes at 5GHz. [8] A couple of rearranged T-formed cuts and an inset feed care of circular Shaped molded microstrip patch antenna for remote correspondences is introduced. The proposed reception antenna is reverberating at four unique frequencies (2.33 GHz, 4.18 GHz, 5.04 GHz and 6.49 GHz) accompanied by impedance data transfer capacities of 2.7%, 2%, 2.1% and 2.6%. This reception microstrip patch antenna enfolds Wireless LAN (2.4 - 2.48/4.97 - 5.12 GHz), X-band lower satellite correspondence (6.42 - 6.59 GHz) usage and shows a main side radiation trademark at wanted recurrence bands. [11] Applications of DGS structure and its effects in ground plane.

2. Design Methodology of the proposed DSMPA

Figure 1 shows the top perspective on the proposed Disc Shaped Microstrip patch antenna with intercalate feeding technique. Figure 2 shows about base perspective on the examined Disc Shaped Microstrip patch antenna with DGP structure.

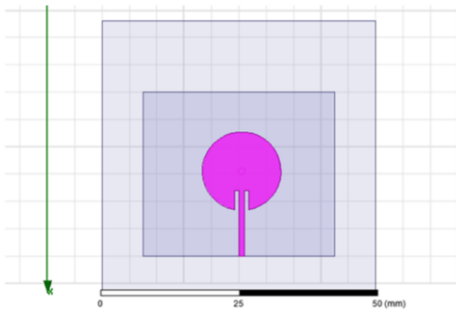

Figure 1. Top view of the proposed DSMPA

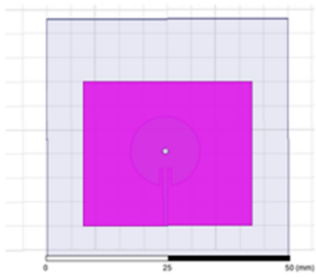

Figure 2. modelBottom view of the presented DSMPA model

Table1. Parameters of the Presented Disc Shaped Microstrip Patch Antenna

Substrate Length	30 millimetre
Substrate Width	35 millimetre
Substrate Height	3.6 millimetre
Patch Radius	7.2 millimetre
Feed Length	12.2 millimetre
Feed Width	1 millimetre
Substrate Dielectric Constant (Ɛr)	4.4

Design Equations with respect to Presented Disc Shaped Microstrip Patch Antenna:

$$p = \frac{F}{\left\{1+\frac{2h}{\pi\varepsilon_r F}\left[ln\left(\frac{\pi F}{2h}\right)+1.7726\right]\right\}^{1/2}} \quad \text{---------- (1)}$$

$$F = \frac{8.791\times10^9}{f_r\sqrt{\varepsilon_r}} \quad \text{---------- (2)}$$

Where, p = Radius of the proposed disc shaped microstrip patch antenna
Ɛr = Substrate Dielectric Constant
h = Height of the substrate material (cm)
f_r = Resonance Frequency
F = Frequency of operation

3. Simulation Results & Discussion

Figure 3 addresses simulated Return Loss of the proposed CMPA model and it is resonating at 5 GHz. Return Loss concerning the proposed Disc Shaped Microstrip Patch Antenna is - 25.1 dB. Figure 4 addresses Voltage Standing Wave Ratio (VSWR) with respect to the presented DSMPA and its worth is 0.96 dB. Figure 5 addresses radiation pattern concerning the presented Disc Shaped Microstrip Patch Antenna has high attainment estimation of 3.76 dB. Figure 6 description about 3D Polar Plot of examined Disc Shaped Microstrip Patch Antenna. Table 1 shows Parameters of the Presented Disc Shaped Microstrip Patch Antenna.

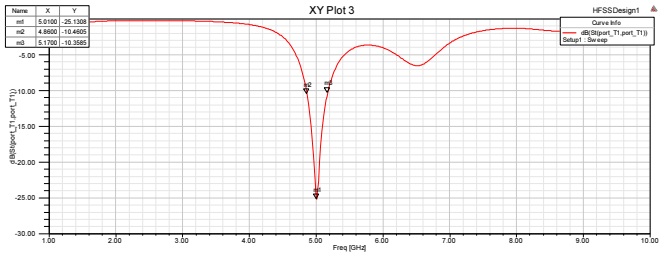

Figure 3. Proposed DSMPA model - Return Loss

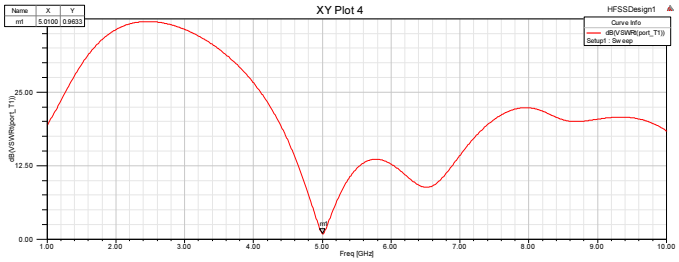

Figure 4. Proposed DSMPA model - VSWR

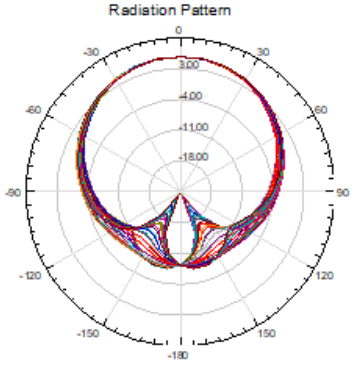

Figure 5. Radiation Pattern of the Proposed CMPA model

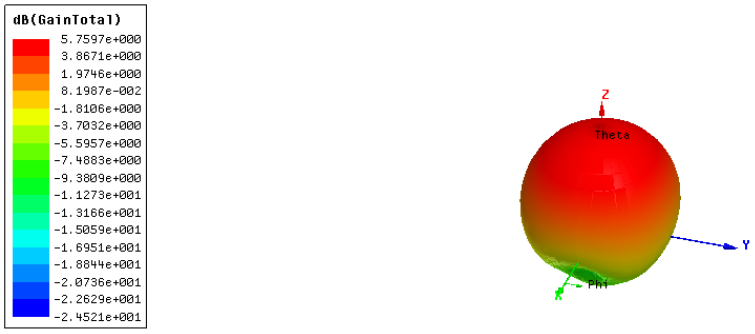

Figure 6. 3D Polar plot of the Proposed CMPA model

The Figure 7 shows the simulated results like Front to Back Ratio, Peak gain, Peak directivity, Radiated power & Radiation efficiency with respect to the proposed Disc Shaped Microstrip Patch Antenna.

Antenna Parameters:

Quantity	Freq	Value
Max U	5GHz	0.0029846 W/sr
Peak Directivity		4.8787
Peak Gain		3.7668
Peak Realized Gain		3.7507
Radiated Power		0.007688 W
Accepted Power		0.0099573 W
Incident Power		0.01 W
Radiation Efficiency		0.77209
Front to Back Ratio		25.332
Decay Factor		0

Figure 7. Proposed DSMPA model - Simulated characteristics

4. Conclusion

A high radiation efficiency Disc Shaped Microstrip Patch Antenna has been planned simulated & yield qualities are estimated. Radiation efficiency about Disc Shaped Microstrip Patch Antenna is improving make usage of DGS hole. Antenna designed is simulated and the outcomes are introduced. The introduced Disc Shaped Microstrip patch antenna radiates at recurrence range around 5 GHz. Greatest increase gain & most extreme directivity of the proposed Disc Shaped Microstrip patch antenna are 3.76 dB and 4.87 dB separately. The proposed Disc Shaped Microstrip Patch Antenna is reasonable around 5 GHz satellite applications.

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