International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 03 | Mar 2020 www.irjet.net p-ISSN: 2395-0072

COMPACT MICROSTRIP ANTENNA FOR WLAN APPLICATIONS

A. Ramesh[1], Keerthi Sai. B[2], K. Sri Poojitha[3], D. Pallavi[4], K. Monika[5]

[1]Asst. Professor , Department of Electronics & Communication Engineering, Potti Sriramulu Chalavadi Mallikarjuna Rao College of Engineering & Technology, Vijayawada, India.
[2,3,4,5]student, Department of Electronics & Communication Engineering, Potti Sriramulu Chalavadi Mallikarjuna Rao College of Engineering & Technology, Vijayawada, India.

Abstract-*A Compact Microstrip Antenna is a patch of circle shape placed on the semi-circle for wireless communication applications is designed using DGS technique for which the proposed antenna is operating in WLAN frequencies. The antenna is designed over FR-4 substrate with Ɛr=4.4 and simulated using HFSS software. The dimensions of the substrate is 50mmx50mm and 1.6mm thickness is used where return loss of -37.3653dB, bandwidth of 3.61GHz, VSWR of 1.0275 and impedance matching of 49.7713ohm are obtained.*

Keywords: HFSS, WLAN, return loss, impedance matching, Rectangular Patch Antenna with Full Ground(RPAFG), Rectangular Patch Antenna with Half Ground(RPAHG), Circular Patch Antenna with Full Ground(CPAFG), Circular Patch Antenna with Half Ground(CPAHG), Semi-Circular Patch Antenna with Full Ground(SCPAFG), Semi-Circular Patch Antenna with Half Ground(SCPAHG).

1. INTRODUCTION

Microstrip antennas are eminent for their advantages like inexpensive, ease of fabrication, light weight, simplicity in design [1]. A rectangular Microstrip patch antenna is designed. This produces omnidirectional radiation pattern. It is mostly applicable in WLAN [2].

DGS can be implemented by introducing a defect in the shape of an actual ground plane. A circular Microstrip antenna with rectangular DGS is designed provides ultra wide band. Microstrip feed line technique is used in the antenna [3]. In Microstrip antennas, this technique has been used to improve the antenna performance in terms of increasing the bandwidth [4], [5]. DGS patch antennas have been quickly developed to achieve reduction of antenna size and wide band operation [6-8].In this paper, a circle is placed on the semicircle is proposed for which a line feeding technique is used. Using DGS technique, return loss, bandwidth, impedance matching, VSWR is attained.

2. DESIGN

Initially, RPAFG is designed as in fig.1 (a). It is fed with a microstrip line of width 3mm,length 26.5mm.RPAFG has a return loss of -23.2507dB and bandwidth of 0.38GHz.Then, RPAHG is designed of which a return loss of -25.8384dB and bandwidth of 5.35GHz is obtained. In this design line feeding technique is used. This antenna is designed by using the formulas which are in [9]

(a) (b)

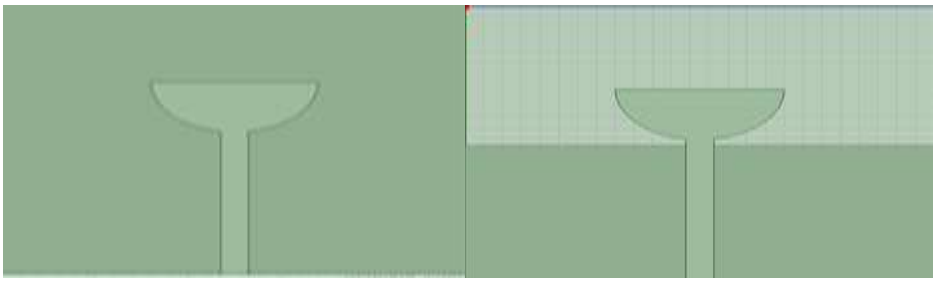
Fig. 1 (a)RPAFG **(b)**RPAHG

Now the above RPA design is modified by a CPAFG is designed of which a return loss of -12.1483dB and bandwidth of 1.35GHz.Next, for good return losses CPAFG is modified by a CPAHG is designed of which a return loss of -20.0055 dB and bandwidth of 2.48GHz is obtained.

(a) (b)

Fig. 2 (a)CPAFG **(b)**CPAHG

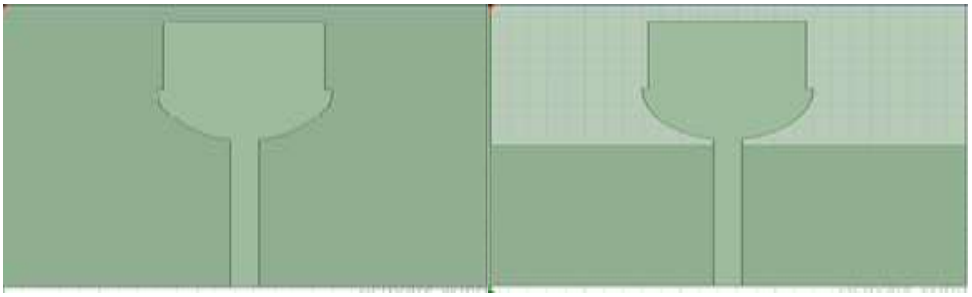
CPA is modified by a SCPAFG is designed of which a return loss of -13.3076 dB and bandwidth of 0.3GHz. Next, SCPAFG is again modified by a SCPAHG and it is designed of which a return loss of -27.9079 dB and bandwidth of 5.91GHz for better return losses.



(a) (b)

Fig. 3 (a)SCPAFG **(b)**SCPAHG

For the above SCPA design, a rectangle is placed on the SCPAFG and it is designed of which a return loss of -14.4905 dB and bandwidth of 0.24GHz.For the enhancement of bandwidth, a rectangle is placed on the SCPAHG is designed of which a return loss of -22.0319 dB and bandwidth of 6.5GHz.



(a) (b)

Fig. 4: Rectangle placed on the semicircle patch Antenna with full ground and full ground

The geometry of a Compact Microstrip antenna is shown in fig.5.A circular patch of radius R1=9mm and a semicircular patch of radius R2=7.21mm is designed over the substrate material FR-4 with dielectric constant of 4.4 and height of 1.6mm is chosen.A circle is placed on the semicircle with DGS is obtained by removing rectangular shaped metal strip from the ground plane of 50mmx50mm.Dimensions of the Compact Microstrip antenna are tabulated in table1.

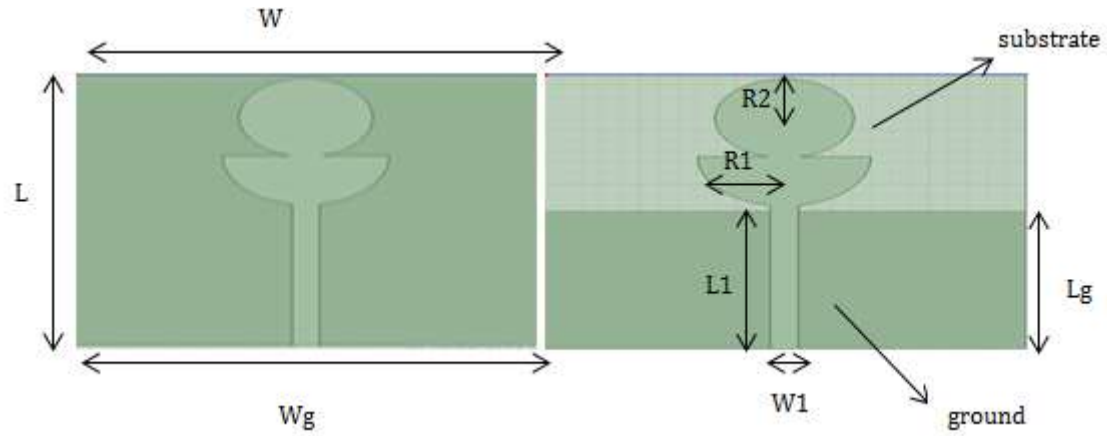


Fig.5: Compact Microstrip antenna with full ground and half ground

Table-1: Dimensions of the Compact Microstrip antenna

Parameters	L	W	Lg	Wg	L1	W1	R1	R2
Dimensions	50	50	25	50	26.5	3	9	7.21

3. SIMULATED RESULTS

Initially, when full ground is implemented in the compact microstrip antenna exhibits a return loss of -16.4641 dB but a narrow bandwidth of 0.25GHz. When a half ground is introduced by removing 25mm x50mm in the ground plane, the simulated return loss plot is shown in fig.6. This graph exhibits an improved return loss of -37.3653dB operating at a frequency of 5.6GHz and it is observed that the antenna shows a -10dB impedance bandwidth of 3.61GHz. .Fig.8 shows the impedance matching at 49.7713ohms at a resonant frequency of 5.6GHz. Fig.9 shows the simulated VSWR of the designed compact microstrip antenna of 1.0275 at 5.6GHz.

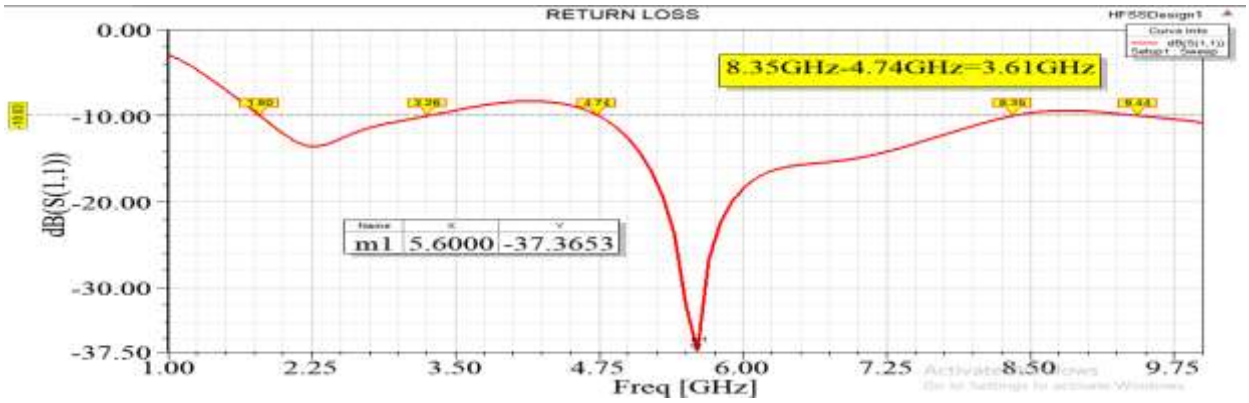


Fig.6: Return loss for the compact microstrip antenna

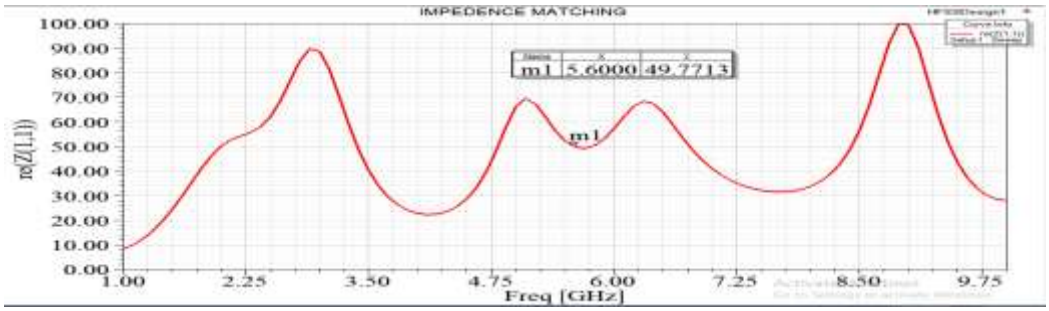


Fig.7: ImpendanceMatching for the compact microstrip antenna

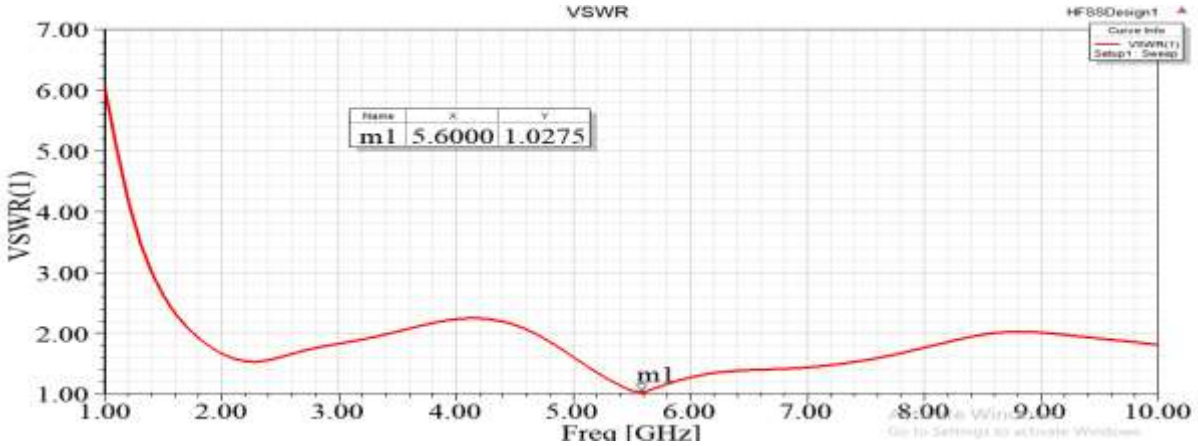


Fig.8:VSWR for the compact microstrip antenna

Table-2: Comparison Table for simulated design results

Title	Return Loss(dB)	Band Width(GHz)	Impedance Matching(ohms)	VSWR
RPAFG	-23.2507	0.38	43.8016	1.1477
RPAHG	-25.8384	1.15	48.8484	0.8878
CPAFG	-12.1483	1.35	47.4013	1.6529
CPAHG	-20.0055	2.48	57.5905	1.221
SCPAFG	-13.3086	0.3	45.1307	1.5513
SCPAHG	-27.9079	2.41	46.5441	0.6993
Rectangle placed on the semi circle patch antenna with full ground	-14.4905	0.24	63.1974	1.4648
Rectangle placed on the semi circle patch antenna with half ground	-22.0319	1.44	51.3371	1.3777
Cirle placed on the semi circle patch antenna with full ground	-16.441	0.25	45.0582	1.3536
Cirle placed on the semi circle patch antenna with half ground(proposed antenna)	-37.3653	3.61	49.7713	1.0275

4. CONCLUSION

A Compact Microstrip antenna is designed and simulated.The measured antenna shows that the antenna is capable of operating in WLAN frequencies.The proposed antenna behaves as an wideband antenna.By comparison of above simulated design results mentioned in above table, the circle placed on the semicircle has better return loss,good impedence matching and improvement in bandwidth.Bandwidth of 3.61GHz and return loss of -37.3653dB has been obtained from the designed antenna.

REFERENCES

[1] Qassim Nasir," Patch Antenna Performance Improvement Using Circular Slots", IEEE, 2017.

[2] Ogunlade Michael Adegoke, Ismael SaadEltoum, "Analysis And Design Of Rectangular Microstrip Patch Antenna at 2.4 GHz WLAN Applications", International Journal Of Engineering Research And Technology, Vol.3, No.8, pp. 1239-1242, 2014.

[3] B.Ramesh, Dr. V. Rajya Lakshmi,"Design of an UltraWideBand Circular Microstrip Antenna with DGS", IEEE, 2013.

[4] Francisco das Chagas Barbosa de Sena1, José Patrocínio da Silva "Harmonic suppression using optimised hexagonal defected ground structure by genetic algorithm", IET Microwaves, Antennas & Propagation, 2018.

[5] Jingtao Zeng, Kwai-Man Luk, "A Simple Wideband Magneto-Electric Dipole Antenna with A Defected Ground Structure", IEEE, 2018.

[6**]** C. Zebiri, D. Sayad, I.T.E. Elfergani, J. Kosha, W.F.A. Mshwat, C. H. See, M. Lashab, J. Rodriguez, K. H. Sayidmarie, H.A. Obeidat and R.A. Abd-Alhameed2, "Antenna for Ultra-Wideband Applications with Non-Uniform Defected Ground Plane and Offset Aperture-Coupled Cylindrical Dielectric Resonators", VOLUME XX, IEEE,2017.

[7]. Ashiwini, K. Arya, M.V.Kartikeyan, A.Patnaik, "Defected Ground Structure in the perspective of Microstrip antenna"' Frequent, vol.64, issue. 5-6, pp.79-84, oct, 2010.

[8]Abhishek Kandwal and Sunil Kumar Khah "Circular Patch Antenna with Square Shaped Defect for Wireless Communication" IEEE International symposium on Electromagnetic Compatibility (EMC EUROPE), 17-21.Sept.2012.

[9]Constantine.a.Balanis," Antenna theory analysis and design", Second Edition.