Split Ring Loaded Slotted Patch Antenna for Wimax and X-Band Applications

CH. Sai Ram, Ramesh N V K, B T P Madhav, B Prudhvi Nadh

Abstract*: A dual band antenna printed antenna asymmetric ground plane is designed for WiMAX and X-band frequencies. The proposed antenna uses FR4 material with thickness of 1.6mm and relative permittivity of 4.4. Antenna consists of asymmetric ground structure to attain the better resonance characteristics. The antenna is loaded with split ring resonator on the left side of the rectangular patch. The antenna operating in the frequency of 5.8 GHz to 6.1 GHz and second band ranges over the frequency of 8.4 GHz to 9.8 GHz. The antenna covering the bandwidth of 0.3 GHz and 1.4 GHz respectively.

Index Terms*: Asymmetric Ground structure, CPW feeding, Slotted patch.

I. INTRODUCTION

The requirement of the rectangular patch antenna is increasing day by day, mainly due to easy fabrication, compact size and cost-efficiency. A coplanar waveguide fed printed antenna with a rectangular shape which exhibits ultra-wideband operation is reported in [1-4].In [5] proposed that coplanar waveguide fed antenna with P-shaped feeding line is used to cover the entire GPS, RFID, WLAN and WIMAX and by varying the dimensions of P-shaped slot lines in a ground plane which is in circular shape gives broadband circular polarization and good impedance matching. A technique of adding elements using coplanar waveguide fed for bandwidth improvement is proposed in [6-7] for this technique the antenna covers the ultra-wide band range frequency(GHz).A coplanar waveguide is explored in [8] to design a multi band coplanar monopole antenna with linear and circular polarizations is achieved by utilizing the trapezoidal structure. In [9-13] a design of dual notched ultra-wide band antenna to produce impedance band width.

The width of the coplanar wave guide is excited by the asymmetrical ground plane in order to perform to achieve the circular polarization operation. A novel broadband circular polarization using CPW structure [14-15] is proposed for Wi-Fi and LTE applications to produce a circularly polarized wave using dual modes through controlling of amplitude and phase differences between odd and even modes in CPW slots. A novel printed monopole antenna with a trapezoidal patch with p shaped antenna with the coplanar waveguide is proposed in [16-19], and two rectangular slots are removed on two sides of the trapezoidal patch to improve the radiation characteristics and return loss.in order to achieve the high impedance bandwidth a horizontal slit is excited by a CPW with a vertical stub. A CPW fed antenna is described in [20] for body implantable applications due to which a wideband feature is achieved with a horizontal slit through multiple modes and miniaturization and impedance matching are obtained with asymmetrical ground plane square ring slots. This paper presents the designing of a CPW fed circular monopole antenna UWB applications. In this design coplanar waveguide structure is used to enhance the bandwidth and the return loss of the antenna at GSM and WLAN bands [21-24].

The asymmetric ground structure slotted rectangular patch antenna is designed for the WiMAX and X-band applications. The slotted structure in the rectangular patch is made to attain the better reflection coefficient values at the resonating frequencies values [25-26].

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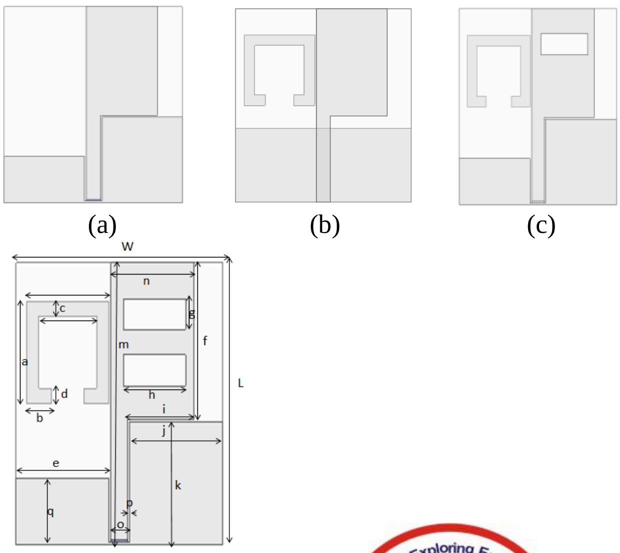
II. ANTENNA DESIGN

Fig. 1(a) The proposed antenna is a CPW-encouraged monopole antenna shown in the fig.1. Antenna is designed over a FR4 substrate with measurement of W L h, dielectric steady of 4.4. The dimensions of the antenna are 55 x 50 x 1.6 mm^3. The antenna is feed by the CPW feeding. The optimised dimensions of proposed antenna are summarized in table1. The basic iterations of the antenna consist of the rectangular patch with asymmetric and in the second iteration split ring on the left side of the patch is added and in the third iteration slotted structure is added on the rectangular patch. Similarly, in the final design the antenna is loaded with another slotted structure on the patch.

A. Iterations



(d)

Fig.1 Iterations of the antenna(a)Antenna 1(b)

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Antenna 2(c) Antenna 3(d)Antenna 4

Table.1 Dimensions of Antenna

Variable	Value (mm)	Variable	Value(mm)
a	20	e	22.5
b	6	f	30.5
c	3	g	6
d	14	h	15
i	15	j	22.5
k	24	L	55
m	54	w	50

III. RESULTS AND DISCUSSIONS

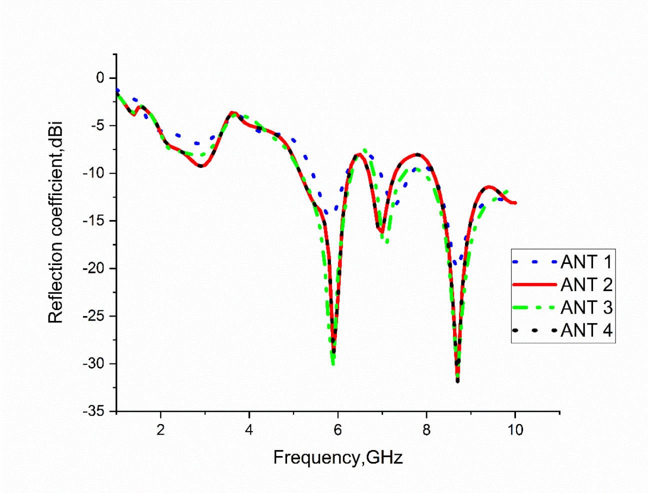


Fig.2 Reflection coefficinet of the iterations

The basic antenna shows the resonating frequency at the 5.9 GHz and 8.8 GHz with S_{11} of -12dB and -16dB by placing the split ring in the structure the antenna S_{11} values changed to -28dB at 5.9 GHz and -32dB at 8.8 GHz respectively and a small resonating frequency is observed at 6.9 GHz to 7.1 GHz. The antenna 4 presents the similar reflection coefficient values at the resonating frequencies shown in fig.2.

A. Parametric Study

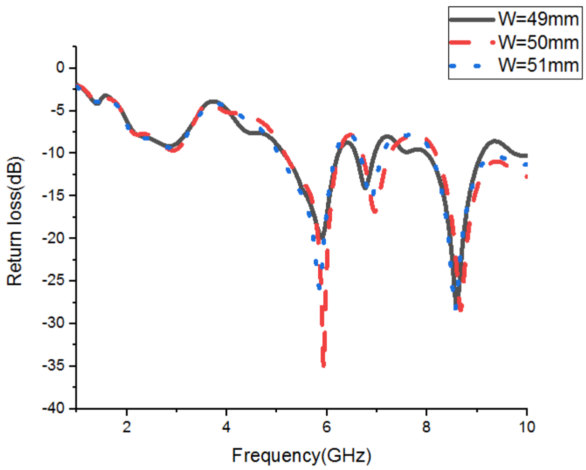


Fig.3 Parametric analysis by varing the W.

To get the upgraded components of the monopole radio wire, distinctive parameters think about is investigated. The tallness of the asymmetric structure ground is studied. The variations of asymmetric ground plane's with height are varied has a great impact on the antenna's good impedances matching and wide CP bandwidth. For the purpose of parametric analysis of the antenna is done for obtaining the optimised value of the parameter. To get the optimised substrate width and length the values are varied. The width of the substrate is varied from the 49-51mm. When the width of the substrate is 50mm the reflection coefficient shows the better values. Similarly, when the length of the patch is varied from 54-56mm for the value 54mm doesn't show any reflection coefficient. When the value is 55mm the best results are observed.

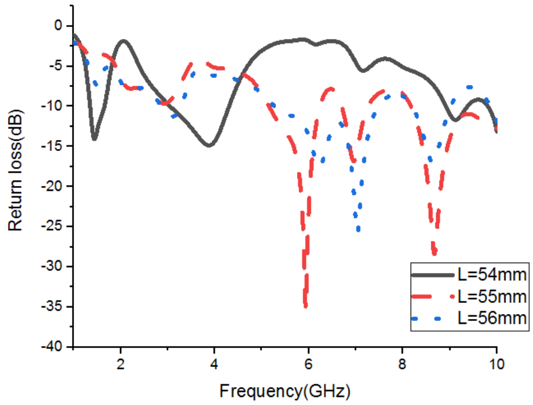


Fig.4 Parametric analysis by varing the L.

B. Radiation Patterns:

The radiation patterns of the proposed antenna are observed in the Fig.5. The radiation patterns are directional and omnidirectional radiation patterns are observed at the different frequencies like 5.9,7, 8.7 GHz.

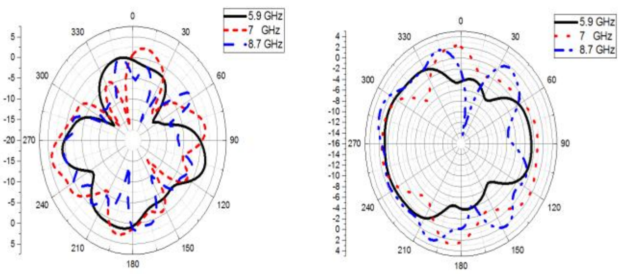
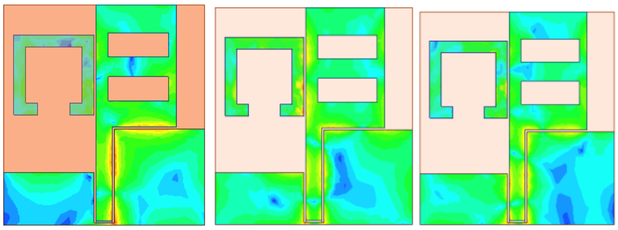


Fig.5 Radiation Patterns if the proposed antenna

C. Surface Currents:

Figure 6 describes the reproduced current values on the transmitting patch of the receiving wire. As appeared in fig 6(a), it is seen that the present streams are more around the feed line when the proposed reception apparatus works at 5.9GHz. Furthermore, the present streams are oppositely coordinated between the left and the correct pieces of the strip. Likewise, it is appeared in fig 6(b) that the present streams are generally focused on the feed line when the proposed reception apparatus works at 7GHz, and they are additionally oppositely coordinated between the inside and outside pieces of the opening. As appeared in fig 6(c), it is seen that the present streams are more around the fix and marginally went into the roundabout strips when the receiving wire works at 8.7GHz.



(a) (b) (c)

Fig.6 Surface current on the antenna(a)5.9 GHz (b)7 GHz (c) 8.7 GHz.

IV. CONCLUSION

The coplanar waveguide monopole antenna is presented in this work for Dual band applications. The shows bidirectional and omnidirectional radiation patterns. In this paper a low-profile broadband monopole antenna presented for wireless applications. The antenna provides the peak gain characteristics and efficiency characteristics. It provides the bidirectional radiation patterns.

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REFERENCES

1. P., Bharath, N., 2015, "Flared V-shape slotted monopole multiband antenna with metamaterial loading", IRECAP, vol. 5, no. 2, pp. 93-97.
2. Bhavani, K.V.L. 2015, "Multiband slotted aperture antenna with defected ground structure for C and X-band communication applications", JATIT, vol. 82, no. 3, pp. 454-461.
3. Lakshmi, M.L.S.N.S., Khan, H. 2015, "Novel sequential rotated 2×2 array notched circular patch antenna", Journal of Engineering Science and Technology Review, vol. 8, no. 4, pp. 73-77.
4. Lakshmikanth, P "Printed log-periodic dipole antenna with notched filter at 2.45 GHz frequency for wireless communication applications", Journal of Engineering and Applied Sciences, vol. 10, no. 3, pp. 40-44.
5. Dinesh Naga., "Measurement of dimensional characteristics of microstrip antenna based on mathematical formulation", International Journal of Applied Engineering Research, vol. 9, no. 9, pp. 1063-1074.
6. Bhavani, K.V.L. 2015, "Novel printed monopole trapezoidal notch antenna with S-band rejection", Journal of Theoretical and Applied Information Technology, vol. 76, no. 1, pp. 42-49.
7. K., Sriharsha, "Design and analysis of compact coplanar wave guide fed asymmetric monopole antennas", Research Journal of Applied Sciences, Engineering and Technology, vol. 10, no. 3, pp. 247-252.
8. Khan, H. & Kotamraju, S.K. 2016, "Circularly polarized slotted aperture antenna with coplanar waveguide fed for broadband applications", Journal of Engineering Science and Technology, vol. 11, no. 2, pp. 267-277.
9. Nagajyothi, D. 2013, "CPW fed serrated antenna performance based on substrate permittivity", International Journal of Applied Engineering Research, vol. 8, no. 12, pp. 1349-1354.
10. Rakesh D S. “Performance evaluation of microstrip square patch antenna on different substrate materials”. J Theor Appl Inf Technol 2011;26(2):97-106.
11. Harish K. “Flared V-shape slotted monopole multiband antenna with metamaterial loading”. Int J Commu Antenna Propag 2015;5(2):93-7.
12. Ganesh, “Metamaterial Inspired Reconfigurable Fractal Monopole Antenna for Multiband Applications”. International Journal of Intelligent Engineering and Systems, Vol.97 pp. 53-61, (2018).
13. M. Kosuru, K. Umakantham, and K. Satyanarayana, “Reconfigurable Notch Band Monopole Slot Antenna for WLAN/IEEE802.11n Applications”, IJIES, Vol.10, No.6, pp. 166-173, 2017
14. M Vijaya Lakshmi, A Coplanar Waveguide Fed Asymmetric Ground Frequency Reconfigurable Antenna, IJIES, Vol.11, No.4, pp 293-300(2018).
15. Yalavarthi Usha Devi, Mulpuri S. S. Rukmini, A Compact Conformal Printed Dipole Antenna for 5G Based Vehicular Communication Applications, PIER C, Vol. 85, pp 191–208, 2018.
16. V Ramakrishna, Wideband defected Ground Structured Monopole Antenna with Electromagnetic Band Gap Loading, Journal of Engineering and Applied Sciences, Vol 13, No 11, 2018, pp 4099-4103.
17. Shaik Rajiya, Badugu P. Nadh, Munuswami S. Kumar, Frequency reconfigurable monopole antenna with DGS for ISM band applications, Journal of Electrical Engineering, Vol 69, No 4, pp 293–299, 2018.
18. G Sai Dheeraj, Sarvani S Raghavarapu, Multiple Band Mobile Antenna for LTE, GSM, PCS, UMTS & IoT Applications, International Journal of Engineering & Technology, Vol 7, No 3.27, 2018, pp 609-612.
19. Raghavaraju Aradhyula, T V Rama Krishna, Electromagnetic Bandgap Structured CPW Fed Circular Monopole Antenna with Bandwidth Enhancement for Wideband Applications, International Journal of Engineering & Technology, Vol 7, No 3.27, 2018, pp 617-620.
20. K S R Murthy, K Umakantham, K S N MurthyPolarization and Frequency Reconfigurable Antenna for Dual Band ISM Medical and Wi-Fi Applications, International Journal of Engineering & Technology, Vol 7, No 3.27, 2018, pp 651-654.
21., M. Siva Kumar, Circular ring structured ultra-wideband antenna for wearable applications, International Journal of RF and Microwave Computer-Aided Engineering, Vol 28, No 9, 2018, pp 1-15.
22. Prudhvi Nadh B, Metamaterial inspired quad band circularly polarized antenna for WLAN/ISM/Bluetooth/WiMAX and satellite communication applications, AEU - International Journal of Electronics and Communications, Vol 97, 2018, pp 229-241.
23. Y Usha Devi, Defected ground structured compact MIMO antenna with low mutual coupling for automotive communications, Microwave and Optical Technology Letters, 2018, pp 1-7.
24. Tirunagari Anilkumar, Asymmetric Ground Structured Circularly Polarized Antenna for ISM and WLAN Band Applications, Progress in Electromagnetics Research M, Vol. 76, 2018, Pp 167–175
25. M Vijaya Lakshmi, and Circular Monopole Reconfigurable Antenna with Notch Band Filter Characteristics, Journal of Engineering Science and Technology Review, Vol 11, Issue 5, 2018, pp 139-143.