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Compact Wideband MIMO Antenna with Modified Ground Structure

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Abstract- In this article, a novel and compact MIMO antenna for wideband application is presented. Proposed antenna is designed with two symmetric elementwhich is present on the top surface and isolation is significantly reduce by T-shaped structure used in modified ground structure. Overall dimension of the designed antenna is 18mm x 34 mm x 1.6mm. As a consequences of that it provides wider bandwidth of 4.2-11.73 GHz along with lower mutual coupling (< -15dB)has lower and quasi-omnidirectional radiation patterns.

Keyword- MIMO antenna, modified ground structure,Isolation

I. Introduction

Today high data rate,compact size and efficient spectrum utilization are demand of various wireless devices.This requirements can be achieved by multiple-input-multiple–output (MIMO) system. In MIMO technology, multiple antenna are placed at transmitter and receiver side which offers enhanced channel capacity and diversity gain due to which fading has reduced significantly. But one major problem mutual coupling occurs by placing of multiple antenna in small space. So,today number of research is going to improve mutual coupling or enhance the isolation between various antenna. Etching of rectangular or T-shaped slot in [1-2] on the ground plane to enhanced the isolation by suppressing surface current between ports. Furthermore protruding grounds, tree-like structures, defected ground structures (DGS), electro-magnetic band gap (EBG) and neutralization line [3-7] are also the efficient method to improve isolation. Antenna elements placed perpendicular, T-shaped stub is extruded in the ground and F-shaped stubs are introduced in the shared ground plane [8-10] are used to improve the isolation.

In this paper, two radiating elements of similar types are presented to operates in the frequency band of 4.2- 11.73 GHz which suitable for various wireless device applications. To obtained wideband by modifying ground-plane and improve the isolation by using T-shaped structure in modified ground.Each element consist of triangular patch along with half circle. The proposed antenna is design on HFSS simulation software and simulated result has wider impedance bandwidth (7.5 GHz), stable gain, good return loss,quasi-omnidirectional radiation patterns and high isolation.

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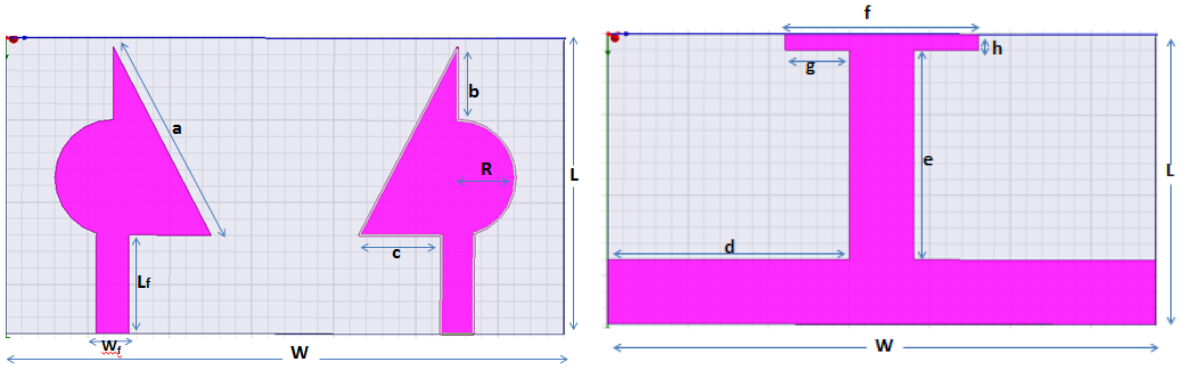
II. Antenna Design

Fig.1 depicts the design of proposed antenna structure fed by microstrip-line. The antenna is design on low cost FR4 substrate whose dielectric constant is 4.4 and loss tangent 0.025with compact size of 18mm x 34mm x 1.6 mm. The simulation is performed by using HFSS simulation software. All the parameter of proposed antenna are optimized and are presented in Table I.



(a)Top View (b)Back view

Fig.-1 Structure of designed antenna structure with parameters

TABLE I. optimized parameters dimensions

Parameters	L	W	L_f	W_f	a	b
Dimensions(mm)	34	18	6	2	12.97	4.46
Parameters	c	d	e	f	g	h
Dimensions(mm)	5	15	13	12	4	1

III. RESULTS AND DISSCUSIONS

Fig.3and fig.4 shows the simulated S-parameters for the proposed wideband MIMO antenna.The proposed antenna covers 4.2 GHz to 11.73 GHz bandwidthwith S11/S22 <- 10 dB and S21/S12 <-15 dB.

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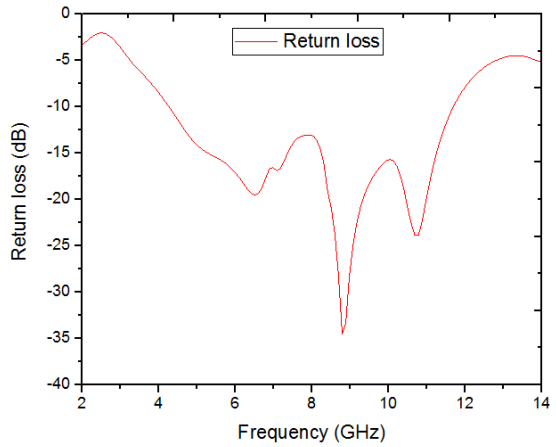


Fig.-3 Frequency Response plot (S_{11})

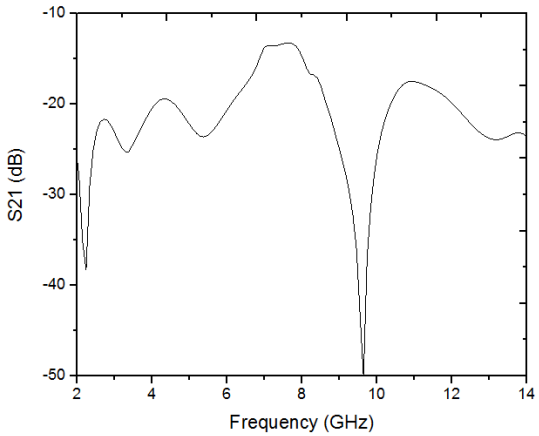
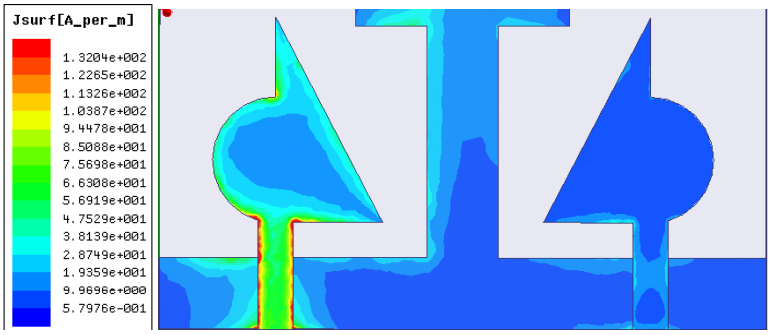
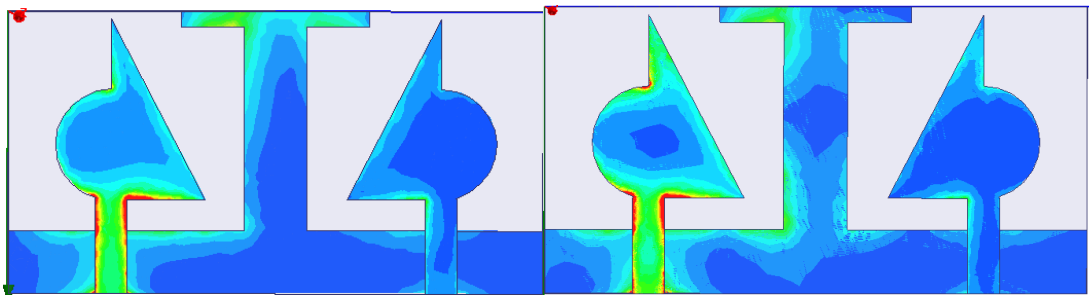


Fig.-4 Frequency Response plot (S_{21})



(a)



(b) (c)

Fig.-5 Surface current distribution at(a)6.51 GHz (b)8.03 GHz (c) 11GHz

Fig. 5 depicts the current distribution at 6.51 GHz, 8.03 GHz and 11GHz.and fig.6 show the gain of proposed antenna.The peak gain of antenna changes from 2 dBi to 7dBi at frequency band from 4.2-11.73GHz.

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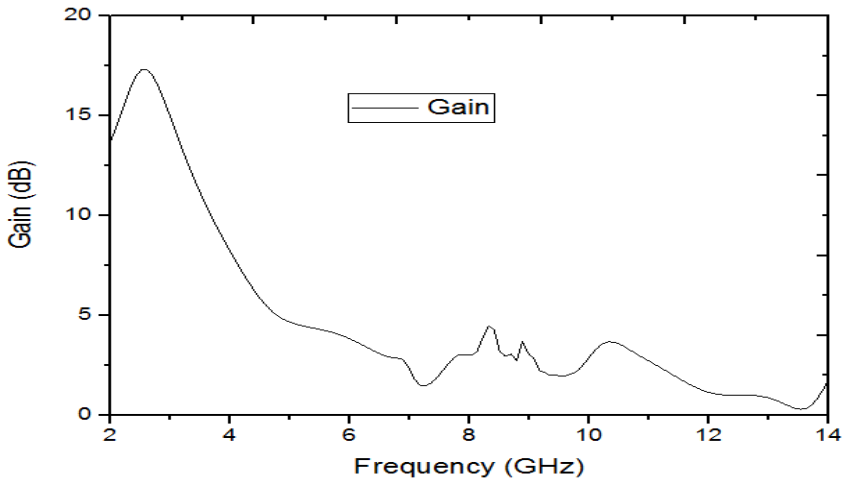
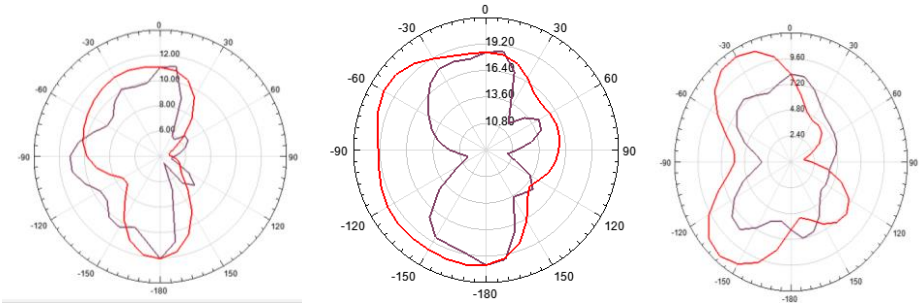


Fig.6 Gain of proposed antenna



(a) 6.51GHz (b)8.03 GHz (c)11 GHZ

Fig.7 Radiation pattern of proposed antenna at (a)6.51GHz (b)8.03GHz (c)11GHz

Fig.7 shows the radiation pattern of proposed antenna at 6.51GHz ,8.03GHz and 11GHz for E-plane and H-plane which quasi omni-directional for H-plane.

IV Conclusion

Miniaturized two element wideband MIMO antenna is proposed in this article. The high performance as well as compact size are obtained by modifying ground structure and introducing T-shaped in ground plane. More over the major parameter like S-parameter,radiation pattern,isolation and gain are investigated by simulation which is carried on HFSS simulation software.Above result shows the good return loss, wider bandwidth, high isolation, quasi omni–directional radiation pattern. Therefore, the proposed antenna is good for various wireless portable devices.

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