International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue III, March 2018- Available at www.ijraset.com

A Multi Band Mimo Antenna With Enhanced Isolation Using Defected Ground Structure

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Abstract : In this paper a multi band MIMO antenna was proposed. The proposed antenna resonates at 17.849GHz, 29.25GHz, 33.3 GHz, 38.9 GHz, 44.15GHz and 49.35GHz. The proposed antenna is used in fixed satellite communication, mobile communication, radio navigation. The performance of the proposed MIMO antenna was evaluated in terms of S-parameters, Radiation pattern, VSWR and ECC.
Keyword: MIMO, DGS, Mutual coupling, Envelope correlation coefficient

I. INTRODUCTION

Now-a-days technology is developing at a fast pace. We need high performance with small size. We need antennas with a different characteristic like minimal cost, less in weight, better performance over a large spectrum of frequencies. We mostly prefer everything portable, so the Portable technology has grown with the mobile and cellular technologies. An antenna with better performance characteristics leads to low power consumption, more durable, improves transmission and reception. This demand for small and compact antennas lead to the development of the microstrip patch antennas. Microstrip patch antennas with small size and simple geometry, exhibit many advantages when compared to conventional antenna.

MIMO antennas are mostly used because of its wide range of advantages. By using MIMO technology one can get significant increase in link range, data throughput without increased transmit power and additional bandwidth. Channel capacity is increased in MIMO systems. The size of the antenna can be reduced by placing antennas near to each other. This leads to a major problem called signal interference caused by strong mutual coupling between the adjacent antennas [3].

Several designs are existing for increasing isolation between antenna elements. A modified serpentine structure is proposed to reduce mutual coupling between antenna elements is proposed in [4]. In this paper a single slot antenna is designed and after optimizing the parameters of single modified antenna, creates a 2x2 MIMO antenna. A technique is used to reduce the mutual coupling between the antennas.

II. ANTENNA DESIGN

Schematic configuration of the proposed antenna is shown in figure 1 .the antenna is designed using copper and FR-4 materials. Copper is used to design the ground plane and the conducting patch on the substrate while FR-4 is used to design the substrate. We consider the 20x20x0.1 mm^3 for ground. For substrate we used 50x20x1.6 mm^3.the relative permittivity of the substrate is 4.4. For patch the thickness is 0.035 mm and the width is 6.5 mm.

Antenna starts with the rhombus slot on the ground plane as shown in figure 2. Then we used a square patch first. Then the same patch is copied rotated with an angle of 45^0. These two square patches are added. To reduce the size of antenna we subtracted a circular ring from the square patch. Later triangle slots are subtracted to form a flower shape. Feed of width 3mm is used.

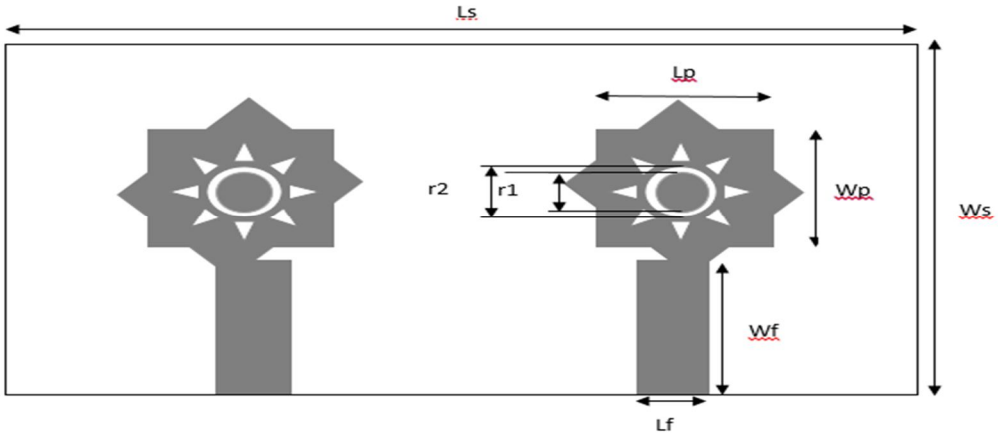


Figure 1. Integration of 1x2 MIMO Antenna

Lp: length of the patch= 6 mm
Wp: width of the patch= 6 mm
Lf: length of the feed= 3 mm
Wf: width of the feed= 6.5 mm
Ls: length of the substrate= 50 mm
Ws: width of the substrate= 20 mm
r1: diameter of the inner circle= 2 mm
r2: diameter of the outer circle= 3m

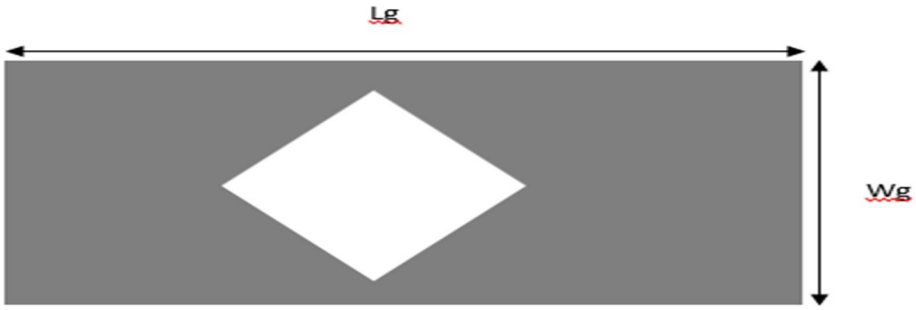


Figure 2: Ground with rhombus slot

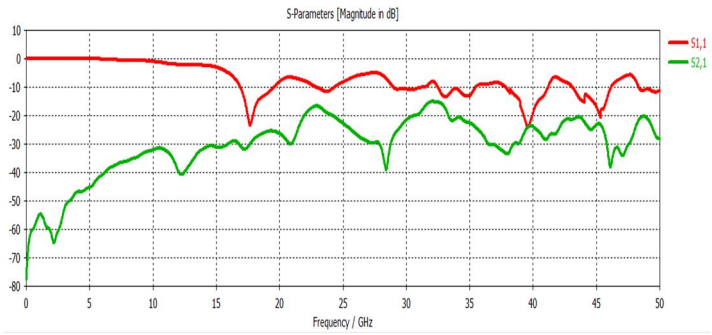
Lg: length of the ground= 50 mm Wg: width of the ground= 20 mm

Two identical antennas are placed side by side. Then ports are given to two antennas. Then mutual coupling is observed between the two antennas.

III. RESULTS AND DISCUSSION

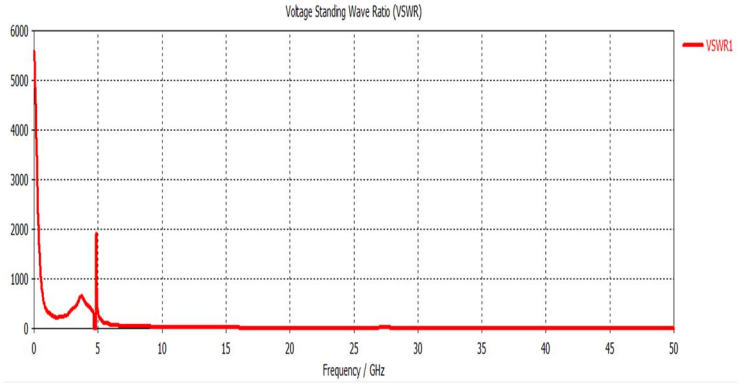
Examining the simulation results, the return loss plots S_{11}, S_{22} satisfies the -10db criteria. The antenna is resonating at seven frequencies. Those are 17.849GHz, 29.25GHz, 33.3 GHz ,38.9GHz ,44.15GHz ,49.35GHz.

A. S Parameters



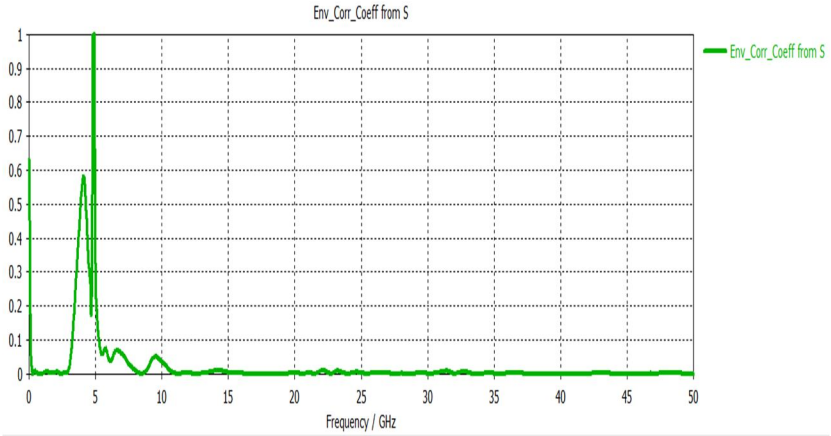
From the above plot we can observe that the mutual coupling in MIMO system is very low. Hence the isolation is obtained between the two antennas.

B. VSWR

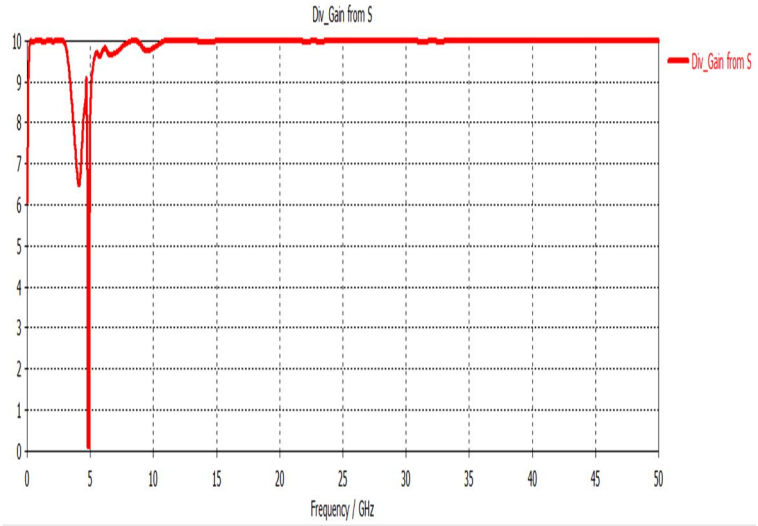


For a good antenna the value of VSWR must be less than 2. The proposed antenna has a VSWR less than 1.69.

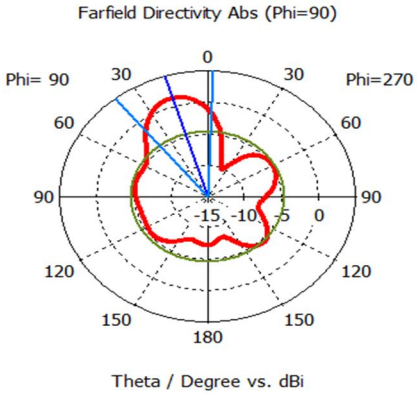
C. Envelope Correlation Coefficient



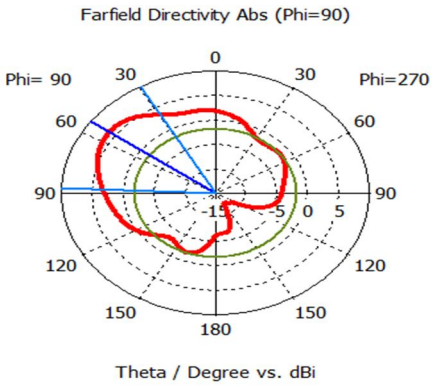
D. Diversity Gain



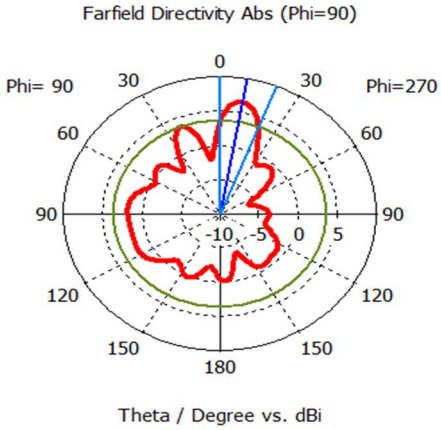
E. Radiation Pattern



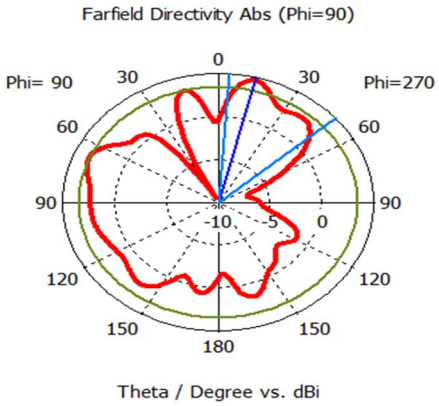
Radiation pattern at frequency 17.688 GHz



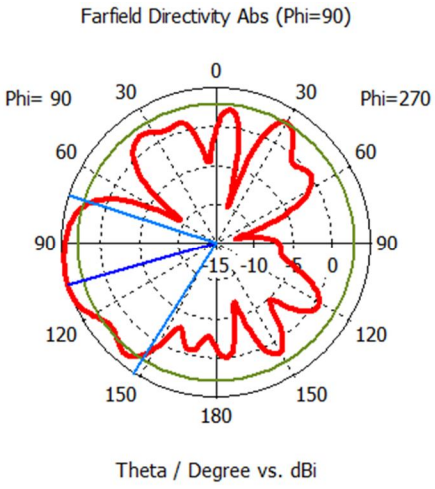
Radiation pattern at frequency 23.73 GHz



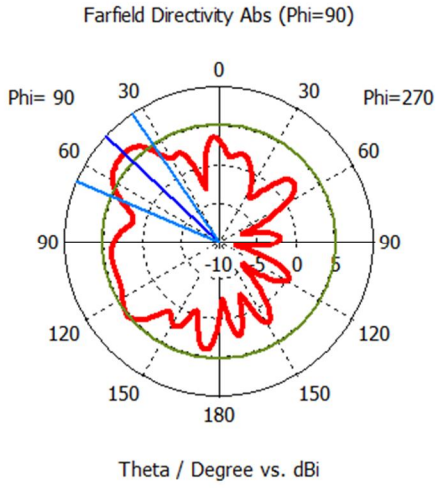
Radiation pattern at frequency 33.11 GHz



Radiation pattern at frequency 34.89 GHz



Radiation pattern at frequency 39.624 GHz



Radiation pattern at frequency 454.33 GHz

IV. CONCLUSION

A small miniaturized antenna with high port isolation and reduced mutual coupling is proposed. The mutual coupling is reduced by using some techniques. The isolation is higher than -20 db at the resonant frequency, indicating a good MIMO performance of the

structure. This antenna has low envelope correlation coefficient. Due to its small size, multi band characteristics, nearly Omni-directional radiation pattern, good gain, less mutual coupling, low envelope correlation coefficient over the operating bands, the antenna is the competitive design for all wireless communication applications. The proposed antenna is used in fixed satellite communication, mobile communication, radio navigation etc.

REFERENCES

[1] Chandra shekharGautam, AvanishBhadauria, "2D Defected Ground Structures in Microstrip Line", IEEE Antennas and wave Propagation
[2] NabilahRipin, Robi'atunAdayiahAwang, Ahmad AsariSulaiman, Noor Hasimah Baba, SuhailaSubahir ," Rectangular Microstrip Patch Antenna with EBG Structure", IEEE Antennas and Wave Propagation, 978-1-4673-5160-7/12/$26.00 ©2012 IEEE
[3] Thasneem.H, Midhun Joy, "Mutual Coupling Reduction on MIMO Antenna", IEEE Antennas and Wave Propagation 978-1-5090-3751-3/16/$31.00 ©2016 IEEE
[4] HenridassArun, Aswathy K. Sarma, MalathiKanagasabai, "Deployment of Modified Serpentine Structure for Mutual Coupling Reduction in MIMO Antennas", IEEE Antennas and Wireless Propag. Lett., vol. 13, pp. 277-280, 2014.