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Modified Rectangular Two Element Antenna with Isolation Enhancement using Polarization Diversity

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Abstract: ***In the antenna technology field various types of patch antennas are there, out of them the rectangular shape is most popular antenna. In this work rectangular shape is modified and two element antennas is proposed. The microstrip patch antenna (MPA) is always suitable for low profile application. The MPA can very easily designed, low-cost, and easily mounted or integrated within the printed circuit boards of notebook, mobiles, computers, and other wireless networking devices. In this research a two element, multiple slots modified rectangular MIMO antenna has been designed for 5.3 GHz Wi-Fi applications. The antenna are placed is orthogonal manner using polarization diversity for isolation enhancement. The MIMO antenna parameter like gain, bandwidth, S-Parameter, surface current, far field, and directivity has been evaluated. The proposed antenna resonates 5.3 GHz. The isolation at 5.3 GHz is found -26 dB while the bandwidth obtained as 208 MHz. The gain of MIMO antenna has 0.7 dBi . The envelop correlation coefficient (ECC) found less than 0.008.***

I. METHOD AND PATCH ANTENNA - DESIGN SPECIFICATION

The proposed designed antenna works at 5.3 GHz. The antenna design for wireless application using two element MPA. The repored result also discussed for various MIMO antenna parametrs.

A. Design Parameters

Here calculated the design parameter for single patch. The proposed designed patch antenna that operates at 5.3 GHz. The FR-4 substrate has a dielectric constant of 4.3 and a height of 1.524mm. The table 1 given the basic dimension of patch, ground and substrate. Figure 1 and 2 shows the proposed design front view and back view.

The feeding techniques used here as modified feed to reduce the size of antenna. The designed antenna is a dual band patch antenna. FR-4 Lossy material considered here for substrate with height og 1.524 mm and perfect electric conductor is used for patch design and feed design and for ground with height of 0.07 mm. The length and width of antenna is optimized using CST simulation tool for compact antenna design.

Table 5.1 : Dimension of Patch antenna:

Layer	Size	Dimension in mm
Ground	Gl X Gw X Gh	38.2 X 84.1 X 0.07 mm^3
Substrate	Sl X Sw X Sh	43.1 X 84.1 X 1.524 mm^3
Patch	Pl X Pw X Ph	29.2 X 39.2 X 0.07 mm^3

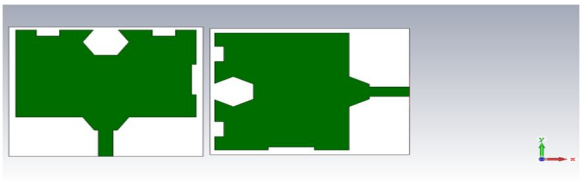

Figure 1: Front View of Patch antenna

Figure 2: Back View of Antenna

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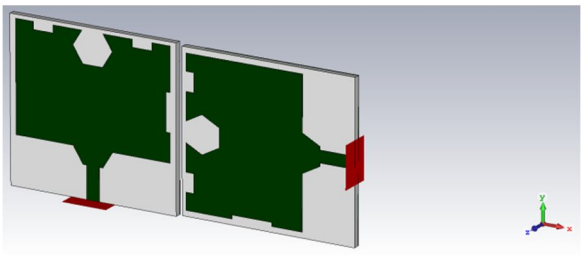


Figure 3: Prospective View of antenna

II. RESULTS AND DISCUSSION

The simulation results of above micro strip patch MIMO antenna at a frequency 5.3 GHz shown in below graphs. The result showed that MIMO antenna resonates at frequency 5.3 GHz. The below graph represented the S-Parameter value S_{11}, S_{12}, S_{21} and S_{22}. In figure 4, S-parameter results shows for 5.3 GHz frequency and return loss found -20.5 dB while the isolation coefficient is -26.6 dB.

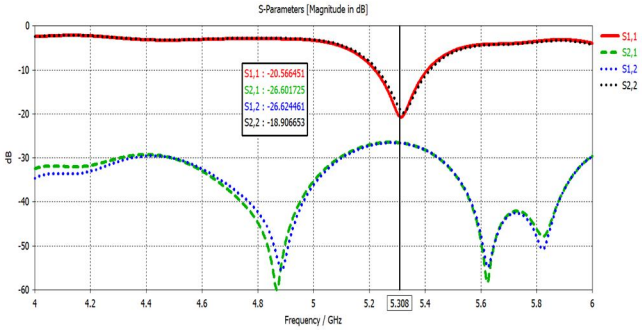


Figure 4: S-parameters of antenna

Figure 5 and figure 6 given E-field pattern of proposed MIMO antenna at 5.3 GHz at port 1 and port 2 respectively. The main lobe magnitude, main lobe direction and angular width are 12.4 dBV/m, 91^0, and 64.7^0 respectively. Figure 5.7 given E-field pattern of proposed MIMO antenna at 5.3 GHz of element 2.

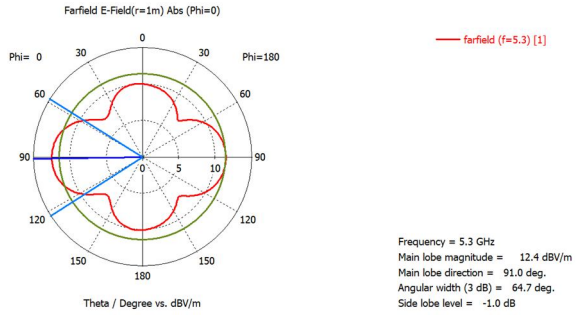


Figure 5: E-field at port 1

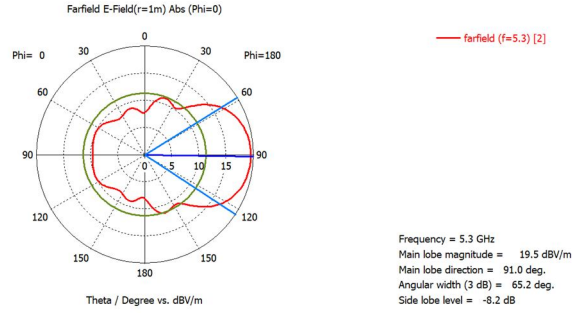


Figure 6: E-Field at port 2

1) *Gain and Directivity:* The plot for Gain and directivity is given in below graphs. Figure 7 given gain 0.728 dBi at resonant frequency 5.3 GHz. The red colour shows the highest value of gain while blue shows the lowest value of directivity. Gain of antenna element 2 is 0.452 dBi.

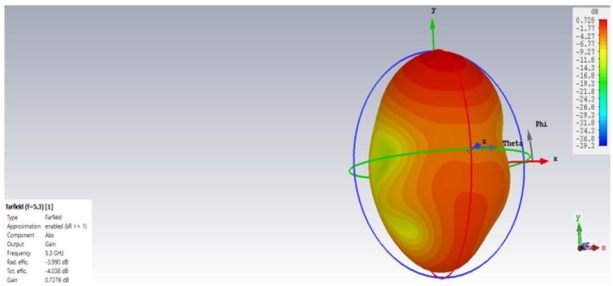


Figure 7:Gain of proposed antenna at port 1

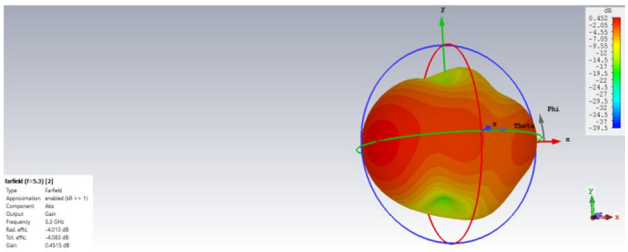


Figure 8:Gain of proposed antenna at port 2

The surface current presents an analytical view of how much and how current flows in the antenna? It is also present direction of flow of current. It is observed from figure 9 that surface current value has maximum at the centre of the patch; the maximum value is 30.9 A/m.

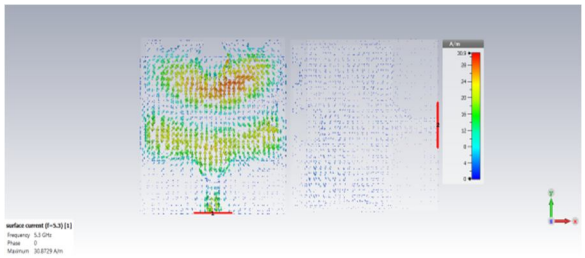


Figure 9: Surface current distribution

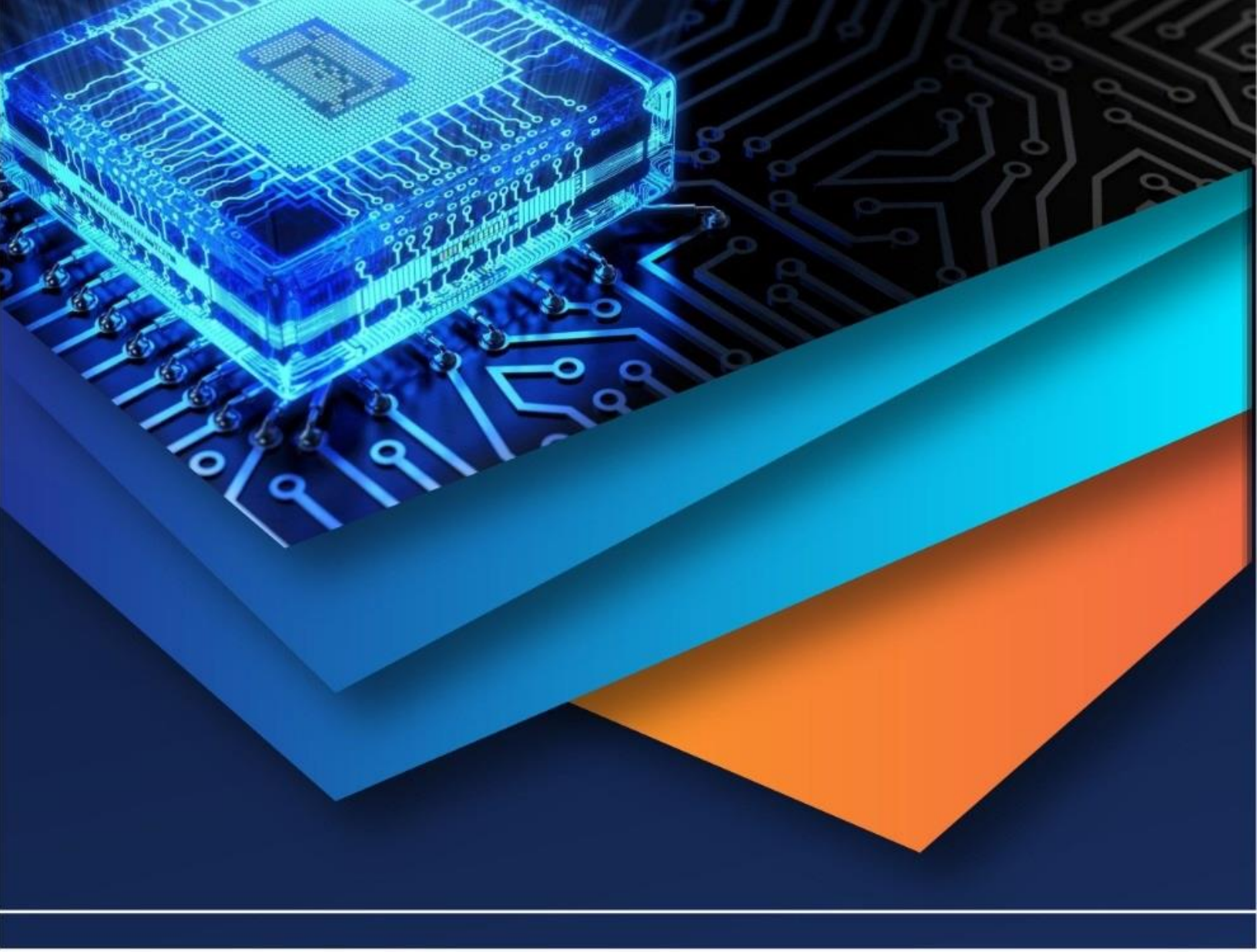
III. CONCLUSION

A modified rectangular micro strip patch antenna is designed for 5.3 GHz wireless applications using the CST Studio Suite software. The antenna is designed at frequency 5.3 GHz with FR-4 substrate (ε_r=4.3), h=1.524mm. The MIMO antenna has return value of -20 dB. The isolation of below -26 dB was found. The 208 MHz bandwidth was obtained. The antenna has good value of other MIMO antenna parameters. The isolation is improved by orthogonal arrangement of antenna element.

REFERENCES

[1] Atser A. Roy, Joseph M. Môm, Gabriel A. Igwue, " Enhancing the Bandwidth of a Microstrip Patch Antenna using Slots Shaped Patch" American Journal of Engineering Research (AJER) e-ISSN : 2320-0847 p-ISSN : 2320-0936 Volume-02, Issue-09, pp-23-30, 2014.
[2] E.V Byron, "A new Flush Mounted Antenna Element for Phased Array Applications", Proc. Phased Array Antenna Symp., pp.187-192, 1970.
[3] G.J. Foschini, "Layered space-time architecture for wireless communication" International conference pp 12-16, 2015.
[4] R. Leclaratne and R.J. Langley, "Patch antenna for mobile satellite terminal", IEEE Electronics Letters, Vol.36, No.6, pp. 489-490, 2000.
[5] J.Q Howell, "MIcrostrip Antennas", IEEE Trans. Antennas Propagation, vol.AP-23, pp.90-93, 1975.
[6] K.L. Lau, K.M. Luk, and Deyum Lin," A wide-band Dual polarization patch antenna with directional coupler", IEEE Antennas and wireless propagation letters, Vol.1. , pp.186-189, 2002.
[7] Gaoming Chi, Binhong Li, and Dongsheng Qi, "Dual Band Printed Diversity Antenna for 2.4/5.2 GHz WLAN Application," Microwave and Optical Technology Letters.,vol. 45, no. 6, June 20 2005

[8] Jeen-Sheen Row, "A simple impedance matching technique for patch antennas fed by coplanar microstrip line", IEEE Transactions on Antennas and Propagation, Vol.53, No.10, pp.3389-3391, 2005.
[9] A. Uz Zaman, L. Manholm and A. Derneryd, "Dual polarised microstrip patch antenna with high port isolation", ELECTRONICS LETTERS 10th May 2007 Vol. 43 No. 10.
[10] Chi-Lun Mak, K.M Luk and K.F Lee and Y.L Chow, "Experimental Study of a Microstrip Patch Antenna with an L-Shaped Probe", IEEE Trans. Antennas Propagation, vol. 48, pp.777-783, 2000.
[11] Kin-Lu Wong, Hao-Chun Tung, and Tzung Wern Chiou, " Broadband Dual polarized aperture Coupled patch Antennas with modified H-Shaed Coupled Slots", IEEE Trasactions on ANtenans and Propagation, Vol.50, No.2, pp.188-192,2006.
[12] J.D Baena, J. Bonache, F. Martin, R.M. Sillero, F. Falcone, T. Lopetegi, J.G. Garcia, L. Gil, M.F. Portillo, and M. Sorolla, "Equivalent-circuit models for split-ring resonators and complementary split ring resonators coupled to planar transmission lines", IEEE Trans Microwave Theory Tech 53 (2005), 1451–1461.
[13] Anzar Khan, "Analysis of Five Different Dielectric Substrates on Microstrip Patch Antenna", International Journal of Computer Applications (0975 – 8887) Volume 55– No.18, October 2012.
[14] Constantinos Votis, George Tatsis, Panos Kostarakis, "Envelope Correlation Parameter Measurements in a MIMO Antenna Array Configuration", Int. J.Communications, Network and System Sciences, 2010, 3, 350-354 doi:10.4236/ijcns.2010.34044 published Online April 2010.
[15] Constantine A. Balanis, "antenna theory - Analysis and design", Third edition, a john wiley & sons, inc., publication, 2005.
[16] Ramna, Amandeep Singh Sappal, "design of rectangular microstrip patch antenna using particle swarm optimization", international journal of advanced research in computer and communication engineeringvol. 2, issue 7, July 2013.



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