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TWO ELEMENT MULTI-SLOTTED TRIANGULAR ANTENNA FOR WLAN APPLICATIONS

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ABSTRACT

In the recent years the development in communication systems requires the development of low cost, minimal weight, low profile antennas that are capable of maintaining high performance over a wide spectrum of frequencies. A compact 2×1 Single-band MIMO antenna proposed in this paper. The proposed patch antenna is designed and simulated in CST microwave studio software and it is designed to operate in a WLAN band (5.4 GHz) with the optimum value of the Envelop correlation coefficient and Voltage Standing wave ration. The isolation is more than 26 dB between ports. The diversity performances in terms of E and H component of Far-field, ECC and diversity gain have been reported. ECC is found to be less than 0.01.

KEYWORDS: Isolation, ECC, VSWR, AR,CST, WLAN, PFA etc

1. INTRODUCTION

The more than 1 antenna on board creates problem of mutual coupling which is resolved by few isolation techniques in the literature. The various types of configurations [1-4] previously used for isolation improvement. Few research papers discussed the polarization diversity effect for MIMO antenna [5-8]. The Paper [9] showed an asymmetric coplanar strip fed MIMO antenna working in a UWB frequency band, in this design radiator is shared by two elements to minimize the size. I shaped slot is etched and a rectangular patch is attached on the back to achieve isolation. A working frequency band of proposed antenna covers 3.1- 10.6 GHz frequency band and provided isolation is > 15 dB. To enhance the isolation at 4.7–7.1, 8.1–9.1 and 10.3–10.6 GHz a U-shaped slot is etched in the ground. A compact octagonal shaped [10] antenna Koch fractal geometry is proposed to achieve the wide band phenomenon and to minimize the size. Antenna elements are placed orthogonal to each other to reduce coupling and C-shape slot achieve band rejection phenomenon. Proposed design shows impedance bandwidth from 2 – 10.6GHz excluding 5.5 GHz notch band. Isolation is better than 17dB over UWB range and capacity loss is< 0.1b/s/Hz and ECC is 0.003. Author found [11] a 4×4 MIMO antenna system for mobile tablets in which each antenna can cover 890-960MHz (GSM 900), 1710-1880 MHz(GSM 1800), 1850-1990 MHz (GSM 1900), UMTS(1920-2170 MHz), 2400-2480 MHz(WLAN), WiMAX(3400- 3600 MHz) and several LTE frequency bands. Ground slots are proposed as a decoupling structure that improves isolation better than 15dB. Proposed system provides Envelope Correlation Coefficient less than 0.09. Author [12] discussed a dielectric resonator antenna for LTE Band 38. Proposed Antenna system consists of a single Rectangular DRA (RDRA) element fed by two microstrip lines. Two symmetrical slits in the ground plane are proposed as a decoupling structure which gives isolation better than 20 dB and ECC is 0.054. Proposed system covers a measured bandwidth of 80 MHz (2.56–2.64 GHz) and the ratios of the MEG close to unity and the DG is almost 9.68 dB in the desired band [12]. Some other papers [13-21] has discussed about multi-element antenna system with isolation enhancement techniques are also discussed.

2. ANTENNA DESIGN

The geometry of proposed antenna is given in figure 1. The full ground has been considered during design of proposed two element multi-slotted MIMO antenna. The two element antenna is designed and optimized in CST microwave studio suit. Initially three back to back triangular structures have been designed then the triangular cut has implemented for isolation enhancement. The two element antenna design considered FR4 as a substrate which has a loss tangent of 0.025, height of substrate is 1.6 mm, and height of ground is 0.07 mm.

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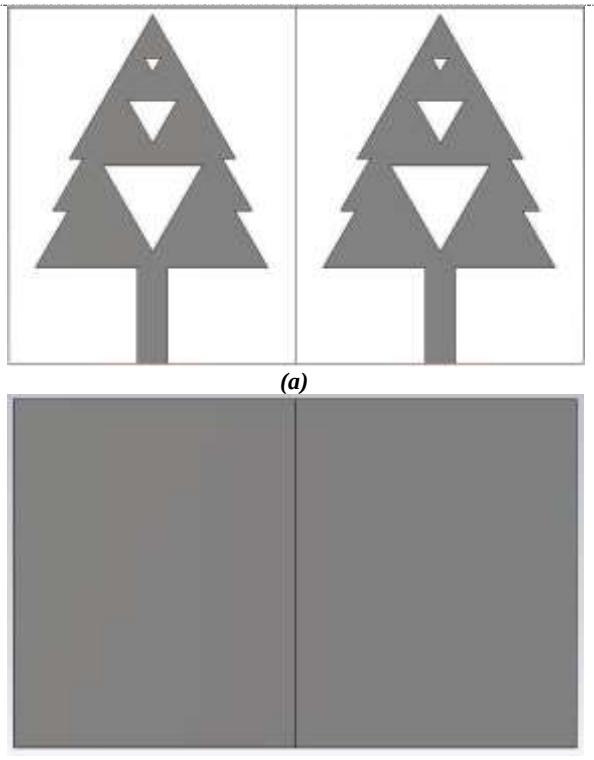

(a)

(b)

Figure 1. Proposed MIMO antenna (a) Front (b) Back.

3. RESULT AND DISCUSSION

The S-parameter results of proposed antenna are given in figure 2. The antenna is resonates at 5.4 GHz. The return loss is found -39 dB while the isolation is less than -26 dB in the whole frequency band. The good value of isolation is observed due to multi-slotting of triangular patches.

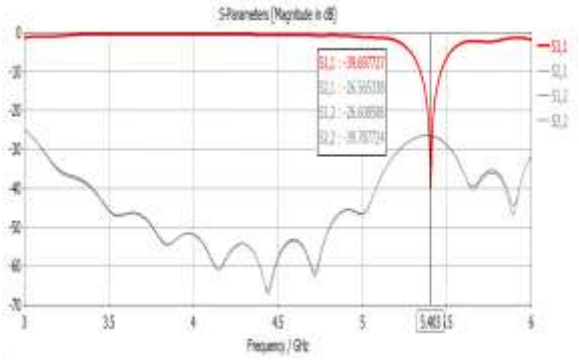

Figure 2. S-parameter of proposed antenna

The surface current distribution on the patch is given in figure 3. The port 1 is excited and second port is terminated by 50 ohm. It is clearly observed from the surface current distribution figure, the small changes can be seen due to nearby antenna element.

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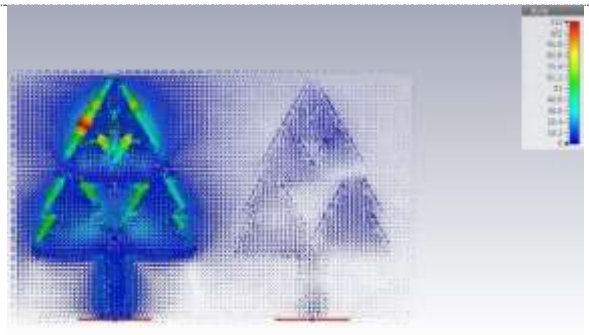
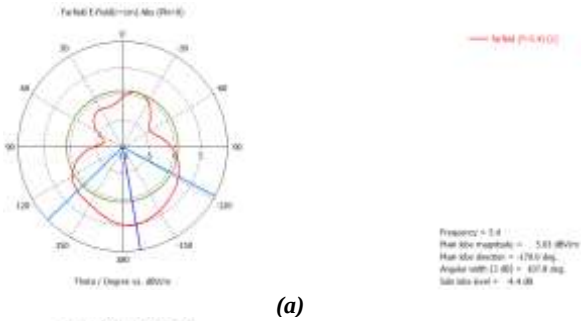
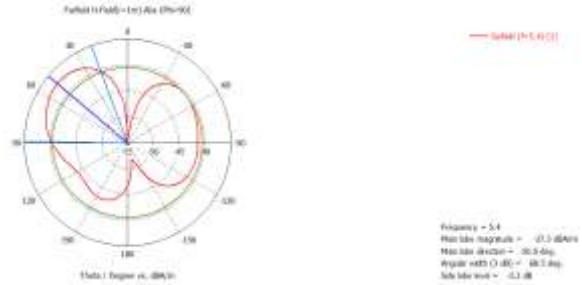


Figure 3. Surface current distribution of MIMO antenna

The far field results of antenna in terms of E-field and H-field is observed in figure 4. The E-field result shows main lobe magnitude of 5 dBV/m with main lobe direction of 170^0. The H-filed result shows the main lobe magnitude of 37.3 dBA/m with main lobe direction of 50^0.



(a)



(b)

Figure 4. Normalized field pattern (a) E-Filed (b) H-Field.

The results of directivity of proposed antenna are presented in figure 5. The maximum directivity was found 6.7 dBi. The scale shows the intensity of directivity in given direction. .

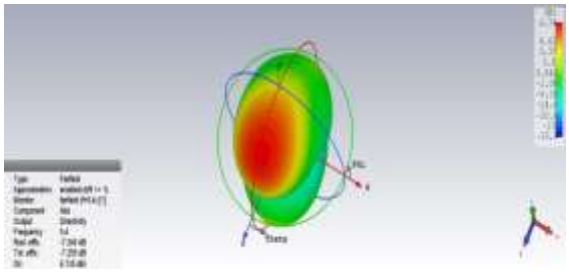


Figure 5. Directivity of proposed MIMO antenna

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The envelop correlation coefficient (ECC) shows the antenna correlation from 1 antenna to other and vice versa. The ECC graph of proposed antenna is given in figure 6. The ECC is found less than 0.01 in the entire frequency band.

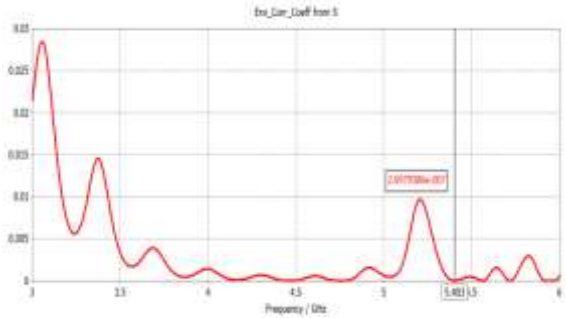

Figure 6. ECC of proposed MIMO antenna

4. CONCLUSION

A two element single-band MIMO antenna is proposed with multi-slotted structures for wireless applications. The effect of mutual coupling between radiating elements is reduced by multi-slotting structures. The antenna is resonates at 5.4 GHz. The obtained isolation is more than 26 dB between radiating elements. The ECC is very low at resonant frequencies.

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