International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 06 | June 2021 www.irjet.net p-ISSN: 2395-0072

DESIGN AND ANALYSIS OF MIMO ANTENNA WITH DUAL NOTCH

Kartavya Yadav[1], Karanveer Singh[1], Mayank Chauhan[1], Nishant Malik[1]

[1]Department of Electronics & Communication Engineering of Galgotia College Affiliated to AKTU Lucknow

---***---

Abstract- A dual-notched multi input multi output (MIMO) for ultra wide band (UWB) is designed. A dielectric substrate FR-4 of $30\times22\times1.6$ mm^3 is used. Result shows that the antenna has an impedance bandwidth (S11≤−10 dB) from 3 to 11 GHz and mutual coupling (S12 ≤ -12 dB) . The measured envelope correlation coefficient (ECC) of 0.009 in frequency band 3 to 11 GHz demonstrates that the antenna can be used for portable UWB antenna systems.

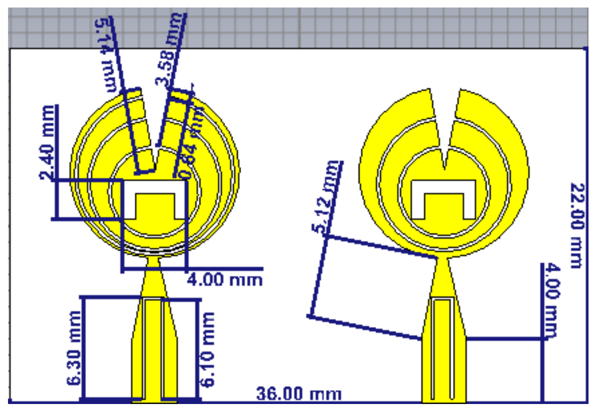
Keywords - Multiple input multiple output (MIMO), Envelope Correlation Coefficient (ECC), Ultra wide band (UWB), and Diversity gain (DG), Wireless local area network (WLAN).

1. INTRODUCTION

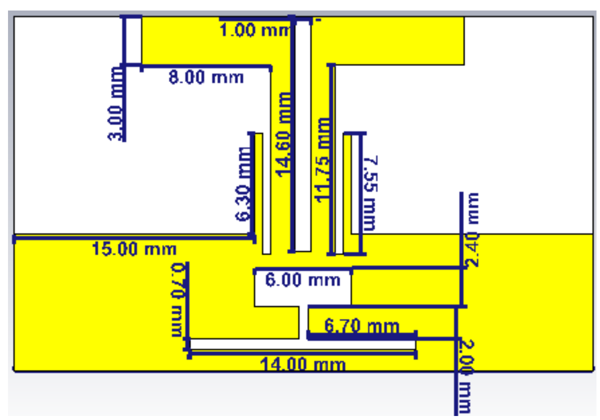
In recent times, ultra-wideband systems received a huge amount of attention in different networking applications. The UWB technology has some built-in advantages (low power, improved quality of service, low cost and higher data rates). To avoid interference accompanied with narrow band systems such as Wireless local area network (WLAN), Wi-Fi, Satellite communication etc. UWB is an encouraging technology for short distance high speed communication with low power requirements. UWB antenna with integrated frequency notching function at interfering frequency band is a practical quick fix to alleviate the frequency interference. UWB system execution is constricted by multipath fading owing to rich scattering environments which leads to inter symbol clashing. Recently, multiple inputs multiple output (MIMO) technology has appeared as a discovery in wireless communication systems. The MIMO system Uses multiple antennas at transmitter and receiver [1] which helps in utilization of a rich multipath vicinity to alleviate multipath fading effect, also betters the scope of communication and system extent (data rate)by not having the requirement for additional bandwidth[1-3]. A protruded T-shaped decoupling structure should be launched in UWB–MIMO antenna for achieving a good diversity performance [4]. In addition, inverted L-shaped slits are utilized to generate good diversity performance [5].

For the submission, two elements pointed fed high diversity gain, WLAN and Satellite notched UWB-MIMO antenna was put forward and it has been designed on FR-4 dielectric substrate of size 36x22x1.6 mm^3. Dual band notched characteristic is obtained by cutting two circular strips of 0.25 mm width and inverted U-shaped strip on patch and feed line.

2. ANTENNA GEOMETRY

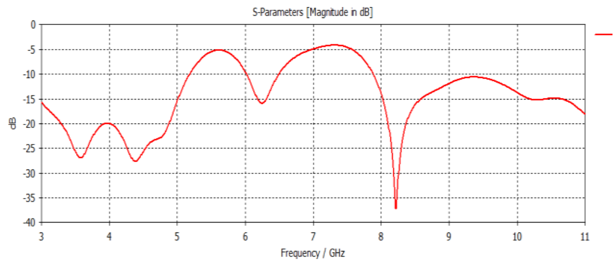


(a) Antenna front view

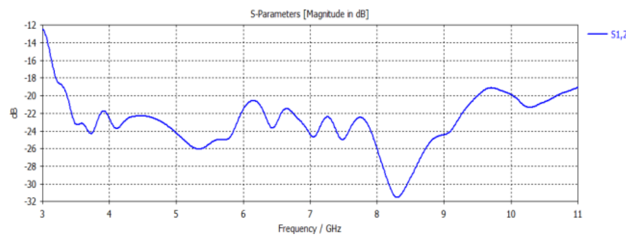


(b) Antenna back view

Fig.1 2D structure of MIMO Antenna with (a)Front view and (b)Back view



(a) S^{11} parameter



(b) S^{22} parameter

Fig.2 The mentioned graphs show (a)S^{11} parameter and (b)S^{12} parameter

3. RESULT AND ANALYSIS

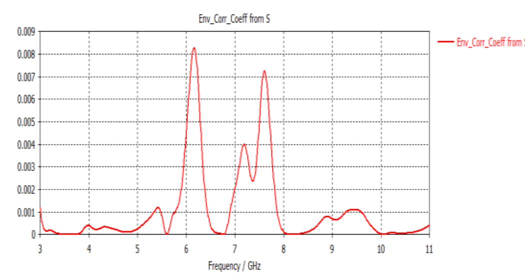
The fabricated antenna with the optimized dimensions mentioned in Section 2 is depicted in Fig. 1(b).

S11 and S12 parameters of the proposed design are measured using CST Studio 2019.

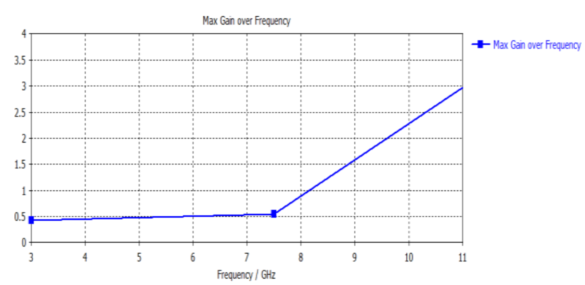
Analyzer. Comparisons between the assumed and confined S11 and S12 parameters are illustrated

In Figs. 1(a) and 1(b). The advised antenna shows better impedance bandwidth (|S11| <

−10 dB) starting with 3 till 11 GHz with band notch having 5.28-6 GHz and 6.5-7.8 GHz as marched in Fig. 1(a). Therefore, the specified UWB-MIMO antenna can productively abolish the frequency interference coming from WLAN band. The assumed and calculated mutual coupling Values in the operating band are from −20 dB excluding some frequencies about 6.5 and 7.8 GHz (−16 dB) exhibiting spirited isolation within the ports. At 6.5 and 7.8 GHz, S12 with −16 dB. The assumed and confined S-parameters are identified, excluding a few differences because of Creation and repairing imperfections, casualties in dielectrics as well as conductors, outcomes of SMA connector, as well as estimation forbearances.



(a) Envelope correlation cofficient



(b) Maximum gain over frequency

Fig.3 Confined and Measured outcomes (a) Envelope correlation coefficient and (b) Maximum gain

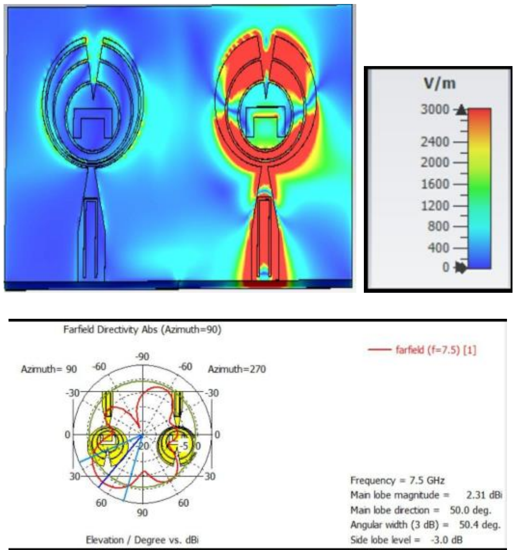


Fig.4(a)

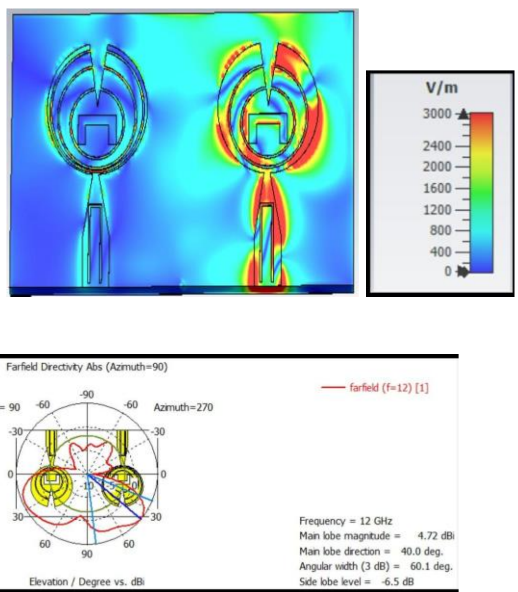


Fig.4(b)

Fig.4 Electric field and Farfield distributions (a) at 7.5 GHz and (b) at 12 GHz respectively

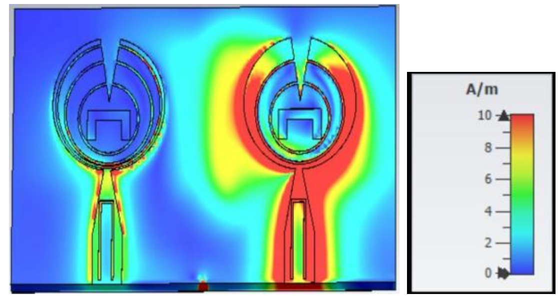


Fig.5(a)

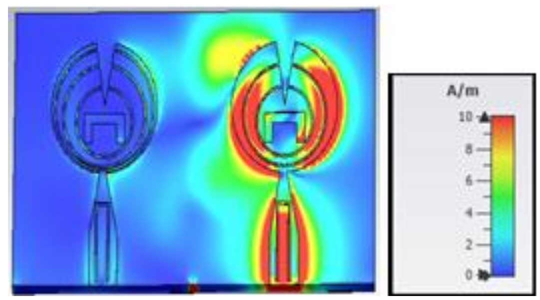


Fig.5(b)

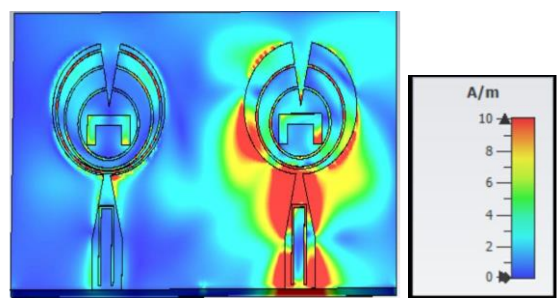


Fig.5(c)

Fig.5 : H Field Distributions (a) at 7.5 GHz and (b) at 12 GHz respectively

The calculated outcomes are clear that the entire UWB band can be operated by the referred antenna having an impedance bandwidth from 3 to 11 GHz. By settling two C-shaped slots on radiating monopoles with

U-shaped strips extended from the ground low mutual coupling of

|S12| < −25 dB is attained. Correlated to the designs quoted in the literature, the antenna has more favorable radiation properties and low ECC (<0.013) crosswise the UWB band. Numerous designs with their performance comparability of the mentioned antenna are specifically shown.

Thus, for portable UWB Applications the specified MIMO antenna can be an appropriate candidate.

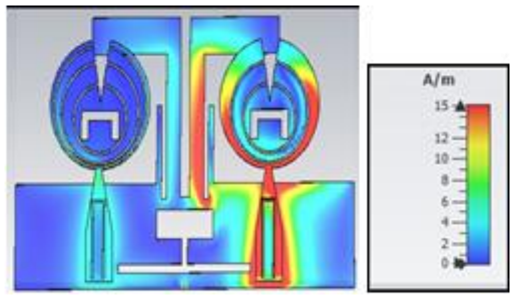


Fig.6(a)

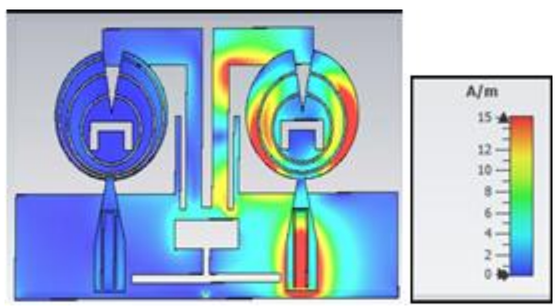


Fig.6(b)

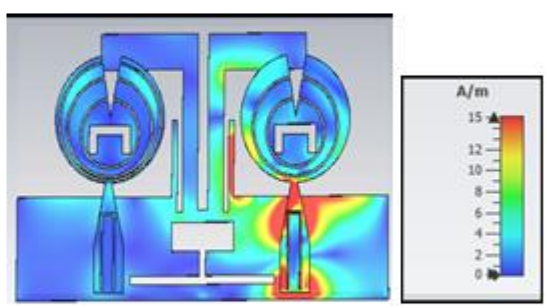
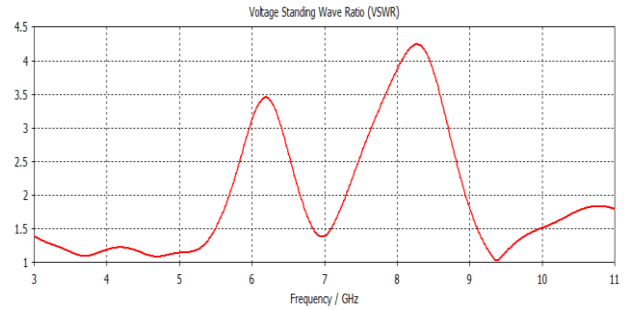
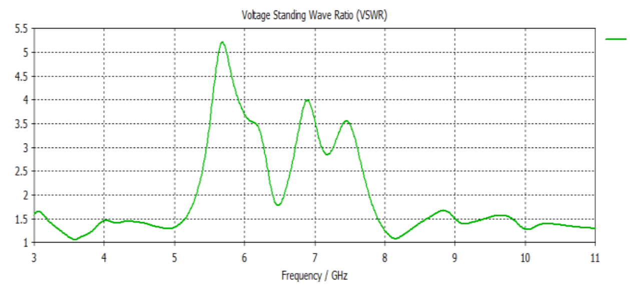


Fig.6(c)

Fig.6 Surface Current Distributions (a) at 7.5 GHz and (b) at 12 GHz respectively



(a) VSWR [1]



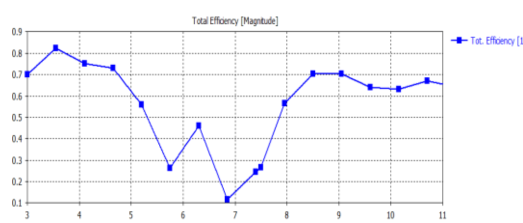
(b) VSWR [2]

Fig.7 VSWR[1] and VSWR[2] of UWB –MIMO antenna

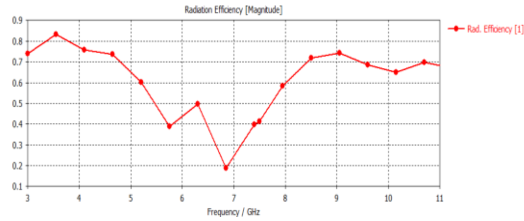
4. MIMO DIVERSITY PERFORMANCE In terms of antenna overall size, impedance bandwidth, mutual coupling, peak gain, and ECC being substantially balanced with the penned designs, the staging analogy of the Referred antenna having the current UWB-MIMO antenna is detected. To achieve dual notched bands at WLAN and Satellite Communications bands ,an inverted- shaped strip was laden on the micro strip line. By cutting two circular strips of 0.25 mm width and inverted U-shaped strip on patch and feed line, triple band - notches at WLAN and Satellite Communication bands were attained.

5. CONCLUSION

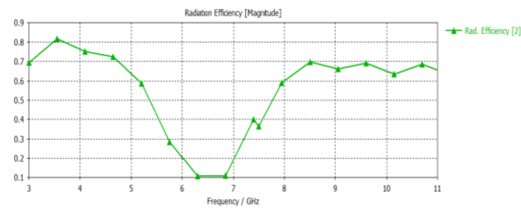
For UWB bandwidth (3-11 GHz) having radiation efficiency (>0.9) and notch band at (5.28-6.1 GHz) a MIMO antenna has been contrived. Both isolation improvement and dual Band rejection operation can be attained just with help of a sole structure.



(a) Total Radiation efficiency



(b) Radiation efficiency[1]



(c) Radiation efficiency[2]

Fig.8 (a) Total radiation efficiency (b) Radiation efficiency [1] and (c) Radiation efficiency[2]

Moreover, the confined MIMO antenna is an appropriate candidate for portable UWB systems, which can be easily demonstrated through the favorable gain and radiation efficiency except the designed notch band, low ECC in the whole operating band, and omnidirectional radiation characteristics.

REFERENCES

1. Compact MIMO Antenna with WLAN Band-Notch Characteristics for Portable UWB Systems Chandrasekhar R. Jetti and Venkateswara R. Nandanavanam

2. Kaiser, T., Z. Feng, and E. Dimitrov, “An overview of ultra-wide-band systems with MIMO,”Proceedings of the IEEE, Vol. 97, 285–312, Feb. 2009.

3. Ben, I. M., L. Talbi, M. Nedil, and K. Hettak, “MIMO-UWB channel characterization within an underground mine gallery,”IEEE Trans. Antennas Propagation, Vol. 60, No. 10, 4866–4874, 2012.

4. High Diversity Gain MIMO-Antenna for UWB Application with WLAN Notch Band Characteristic Including Human Interface Devices BY Gaurav Saxena, Priyanka Jain,Yogesh Kumar Awasthi Accepted on 13 december 2019

5. Sarkar, D., & Srivastava, K. V. (2017). A compact four-element MIMO/diversity antenna with enhanced bandwidth. IEEE Antennas and Wireless Propagation Letters,16, 2469–2472