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# Textile MIMO Antenna for Ultra Wide-band Applications

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**ABSTRACT**: Antennas are a crucial component of wireless communication systems. There is a great requirement for fast data rates and minimal power in ultra-wide band communication. UWB transmits more data in low energy states, although multipath fading is caused by diffraction and reflection between two interacting antennas. Multiple-Input Multiple-Output (MIMO) technology is utilised to get around this flaw in Ultra-wideband (UWB) technology. Layouting a textile MIMO antenna that functions at UWB frequency is the challenge at hand. So, we create a structure using jeans material with a loss tangent of 0.02 and a fr of 1.6. To enhance port isolation, the ground plane is used to create the 'T' shaped stub. The antenna is 36*55x1.5 mm3 in size and has a superior frequency range of 2.27 to 12.33GHz. The suggested antenna was designed using HFSS software.

**KEYWORDS:** MIMO, UWB, wearable, mutual coupling, patch, stub

## I.INTRODUCTION

Antennas are a crucial component of wireless communication systems. There is a great requirement for fast data rates and minimal power in ultra-wide band communication. UWB transmits more data in low energy states, although multipath fading is caused by diffraction and reflection between two interacting antennas. Multiple-Input Multiple-Output (MIMO) technology is utilised to get around this flaw in Ultra-wideband (UWB) technology. Layouting a textile MIMO antenna that functions at UWB frequency is the challenge at hand. So, we create a structure using jeans material with a loss tangent of 0.02 and a fr of 1.6. To enhance port isolation, the ground plane is used to create the 'T' shaped stub. The antenna is 36*55x1.5 mm3 in size and has a superior frequency range of 2.27 to 12.33GHz. The suggested Numerous techniques, including nails, apertures, and limited ground structures, are coordinated with the designs of the reception equipment. The most important perspective on MIMO reception comes from shared coupling lowering.

## II.LITERATURE SURVEY

Various research and development organizations have been conducting specific trials throughout the last few years. The following are a few of the groups:

[1] Jump up to:a b "ANSYS HFSS: Everything to Know - Explore the Future of Engineering: 3D Modeling, CAD and More". 2020-01-04. Retrieved 2022-03-04.

[2] K.Sumathi, M.Abirami,"Hexagonal shaped fractal MIMO antenna for multi band wireless applications" Analog Integrated Circuits and Signal Processing, 104, pp 277-287, 2020.

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[4] Ashim Kumar Biswas, Ujjal Chakraborty, "Compact wearable MIMO antenna with improved port isolation for ultra-wideband applications", IET Microwaves Antenna Propagation, Vol 13, pp 498-504, 2018.

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## III. PROPOSED SYSTEM

| |
|---|
| **1. The antenna has dimensions of(36*55x1.5) mm3 and covers better frequency range of 2.27-12.33GHz** |
| **2.The arising UWB innovation guarantees minimal effort, short-range with rapid correspondence frameworks.** |
| **3.Joining of the MIMO strategy with super ultra-wide band may offer an achievable arrangement by alleviating numerous disadvantages of ultrawideband correspondences.** |

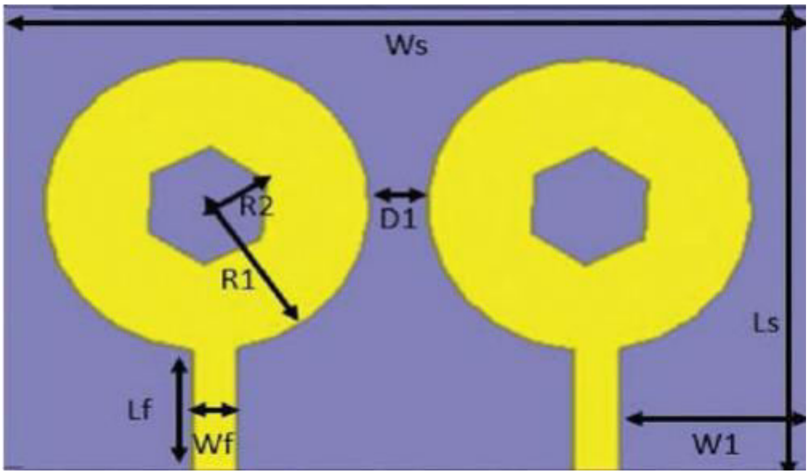


**Figure3.1:Front view of the proposed antenna**

## IV. HFSS SOFTWARE

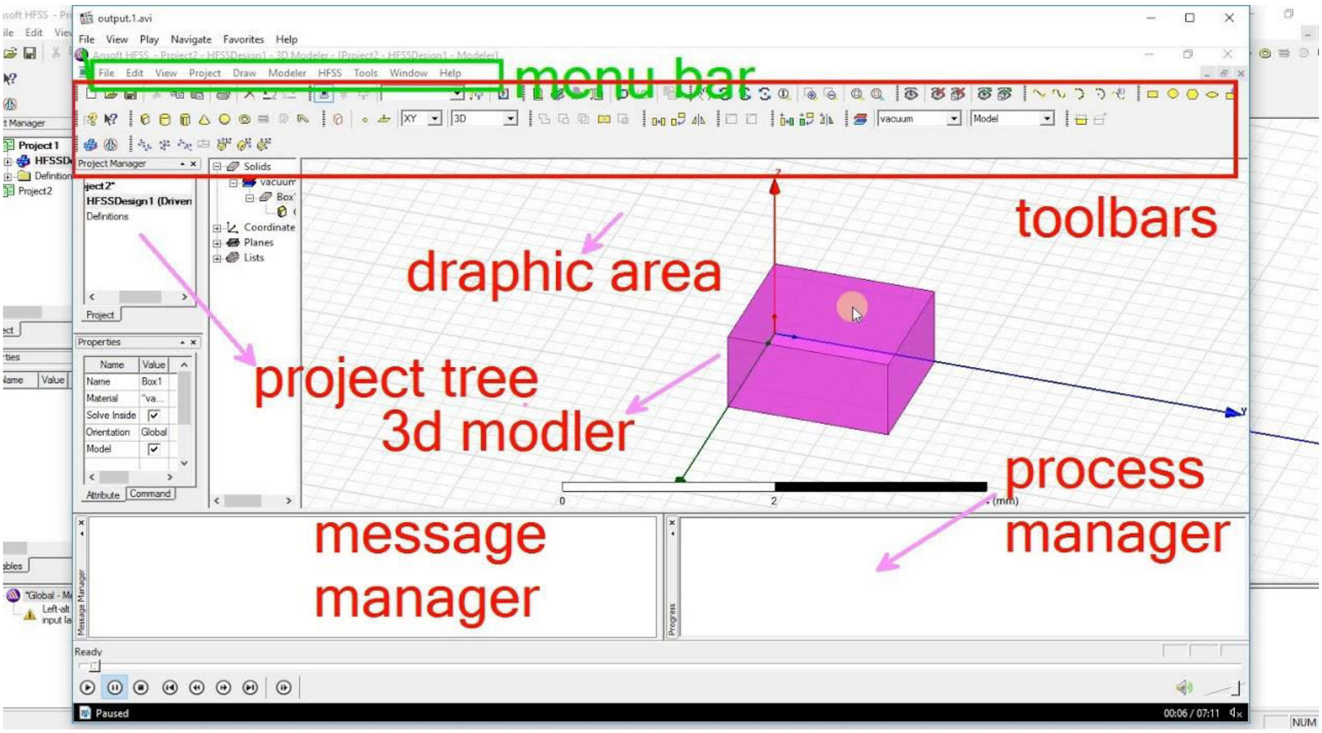


**Figure4.1: Hfss software window look**

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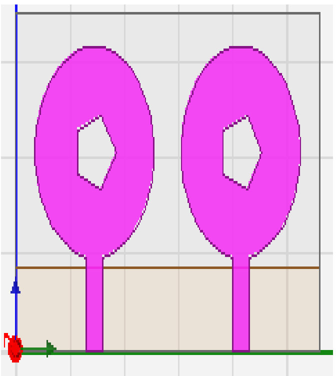
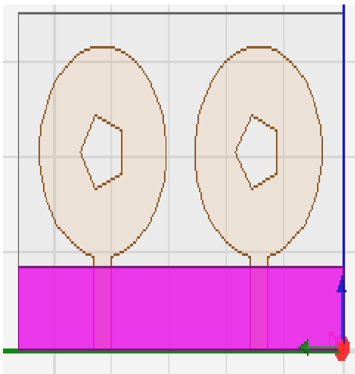
## V. RESULT



(a)

**Figure 5.1 : Front view of the patch antenna**



(b)

**Figure 5.2: Front view of the ground plane**

**S11 an S21**

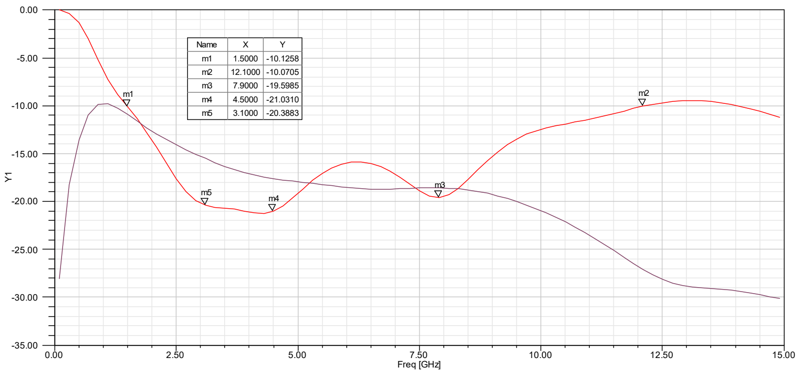



**Figure 5.3:Return loss and Isolation of Antenna before inserting the stub**

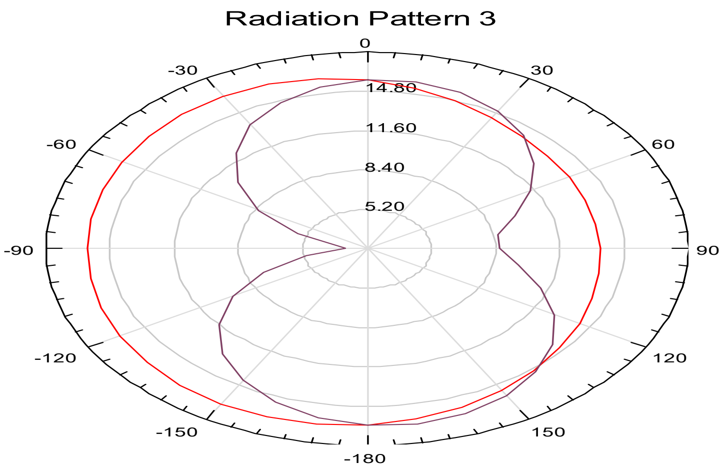



**Figure 5.4: Radiation Pattern before Insertion of stub**

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**Sub struture:**

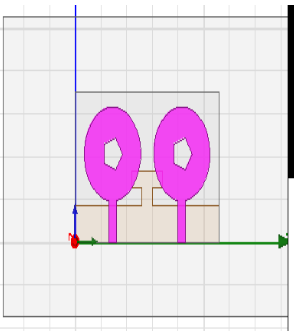

**Figure 5.5:Front view of the patch antenna after inserting the stub**

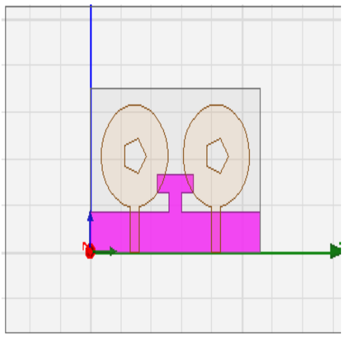

**Figure 5.6:Front view of ground after inserting the stub**

**S11**

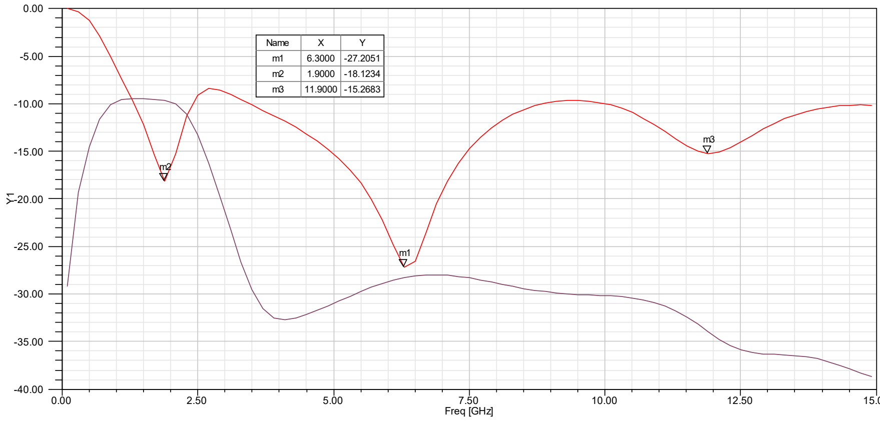


**Figure 5.7: Return loss and Isolation of Antenna after inserting the stub**

**Surface Current:**

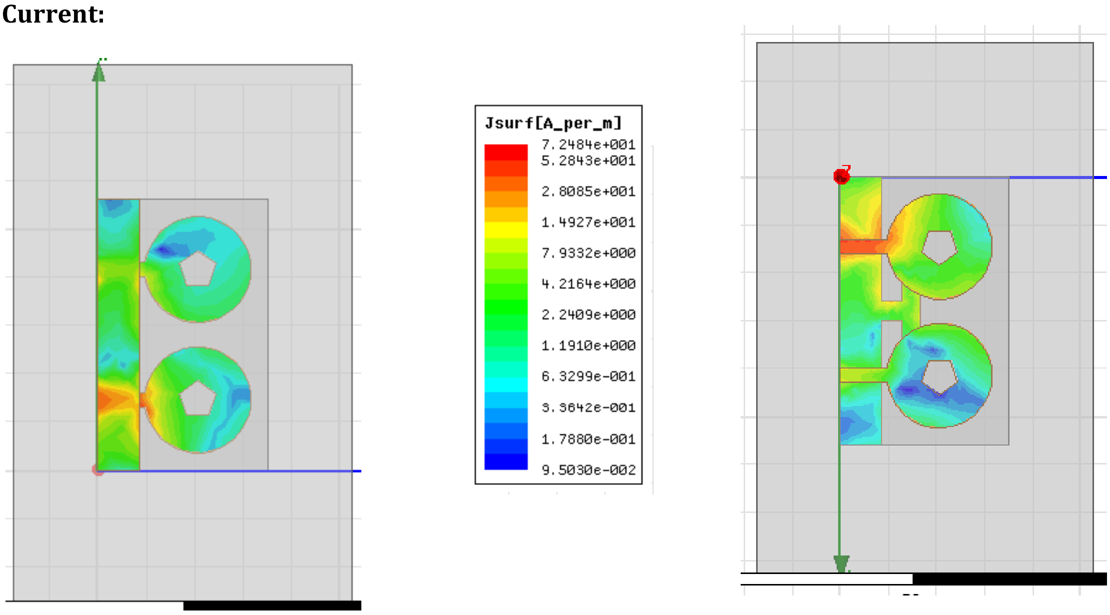


**Figure 5.8: Illustrating the Surface curent of the antenna with and without stub at frequency 3.1G**

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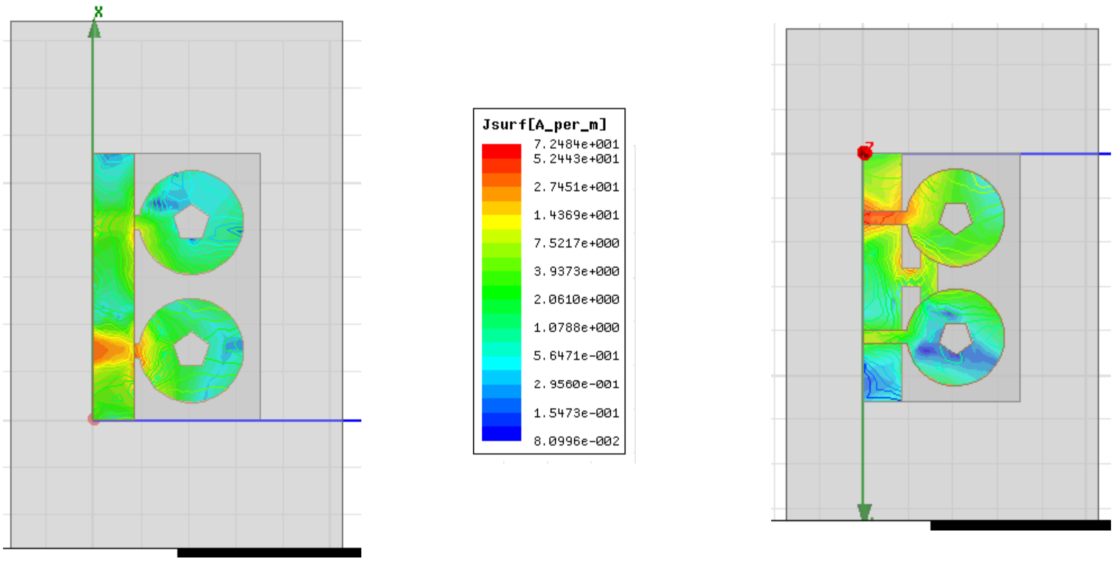


**Figure 5.9: Illustrating the Surface curent of the antenna with and without stub at frequency**

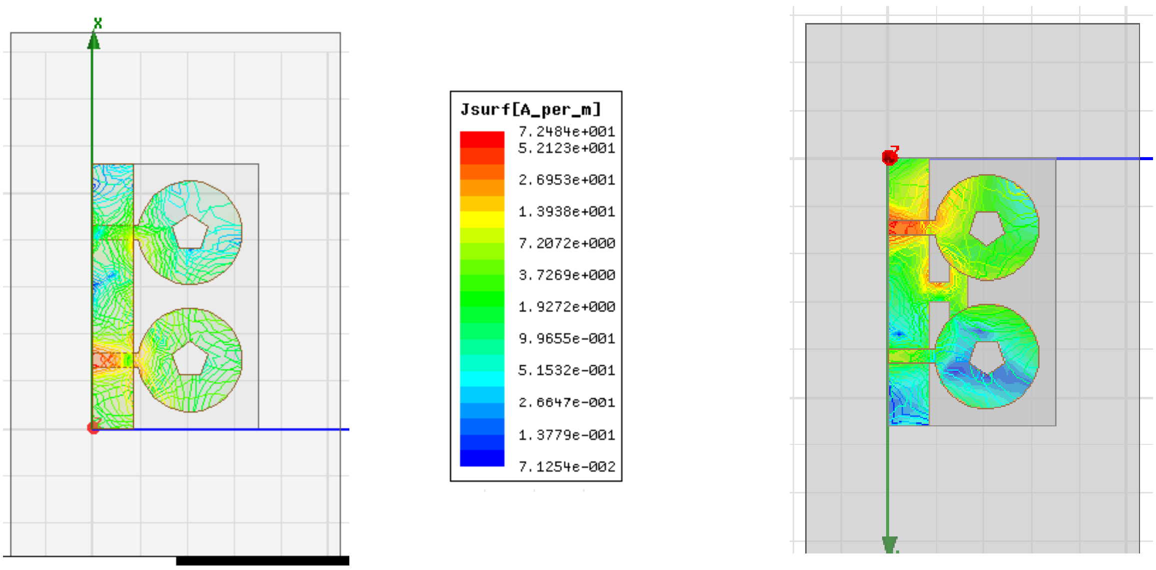


**Figure 5.10: Illustrating the Surface curent of the antenna with and without stub at frequency 7.9 GHZ**

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**Radiation Pattern:**

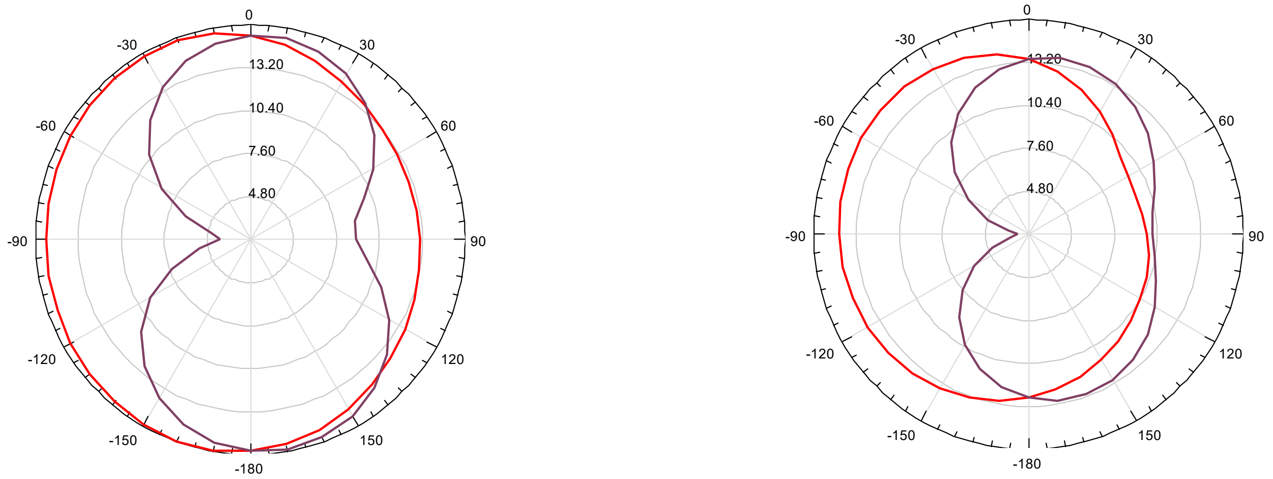


**Figure 5.11:Radiation patterns of antenna with stub and without stub at 3.1GHZ**

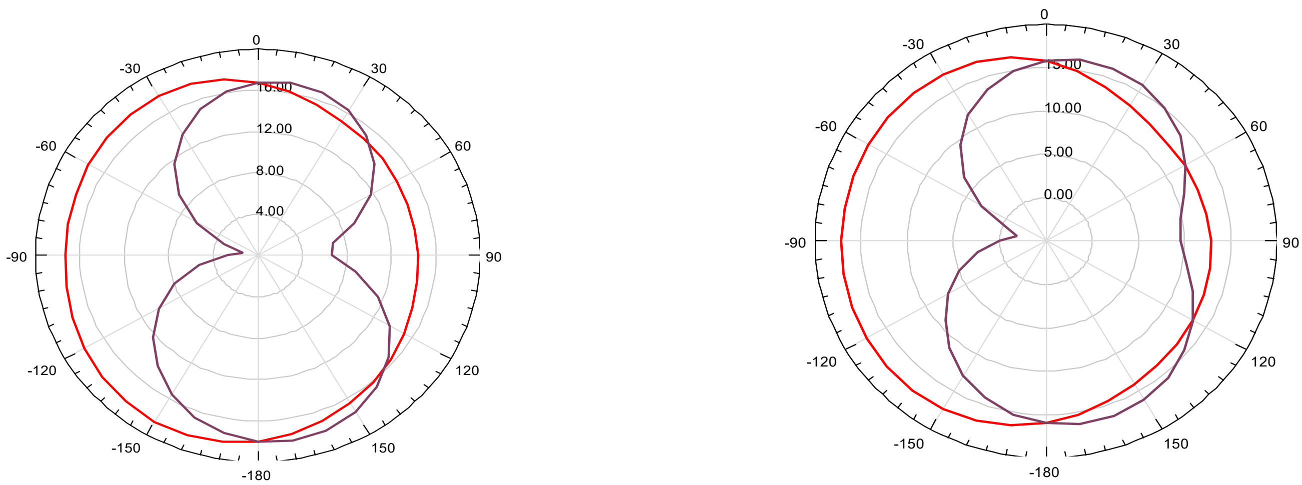


**Figure 5.12:Radiation patterns of antenna with stub and without stub at 4.5GHZ**

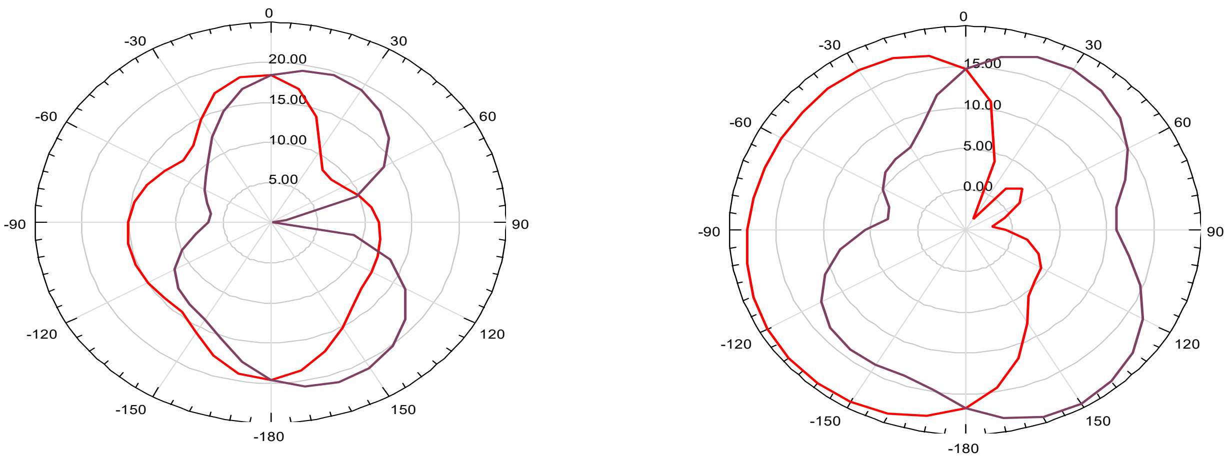


**Figure 5.13:Radiation patterns of antenna with stub and without stub at 7.9GHZ**

To improve the mutual coupling between the ports, a 'T' shaped stub is etched into the bottom surface of the MIMO and coupled with the GP. The stub's longer dimension (G2 + G6) is calculated as /4, where is the guided wavelength at the UWB band's lowest frequency. (3.1 GHz). Figs. 6.4.a and b depict the antenna's top and back views, respectively. We use the vector network analyzer to verify the final, optimised prototype that was built and integrated with the GP.

A very excellent agreement between the simulated and measured S11 (dB) characteristics is demonstrated in Fig. 7.1. The measured and simulated frequency ranges are 1.2 to 12.1 GHz and 1.5 to 12.1 GHz, respectively.and, correspondingly, 1.2 to 14.28 GHz (for S1110 dB). The simulated and measured S12 parameters are less than 28 dB and 28 dB, respectively, for the full UWB (3.1–10.6 GHz) range, as shown in Fig. 7.1. The lowest isolation in the planned MIMO antenna, 33 dB, is found at 3.5 GHz, whereas isolation is higher at all other frequencies throughout the application band.

The addition of the stub increases port isolation by a minimum of 18 dB at 3.5 GHz and a maximum of 28.4 dB at 3.16 GHz. The observed data validate the simulation's findings across the board. (S11 and S12).. The slight variance results from themeasuring tolerances as well as some small fabrication mistakes. We have contrasted our suggested work with several other recent UWB MIMO antenna developments..

## VI. CONCLUSION

The designed MIMO antenna operates at UWB band and resonates at 4 different frequencies providing a good return loss. The port isolation of 26dB is achieved by incorporation of 'T' shaped stub at the bottom side of antenna. This MIMO antenna not only satisfies the wearable properties, also displays the characteristics of UWB and provides high port isolation more than 26dB over the UWB whole band.

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[7] . Ashim Kumar Biswas, Ujjal Chakraborty, “Compact wearable MIMO antenna with improved port isolation for ultra-wideband applications”, IET Microwaves Antenna Propagation, Vol 13, pp 498-504, 2018.

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