# Tapered Fed UWB MIMO Antenna with Dual Band Notch Characteristcs

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**Abstract -** *In this paper a design of multiple input multiple output (MIMO) Antenna which rejects two notch bands for wireless ultrawideband (UWB) applications is presented. The UWB MIMO Antenna has a compact size of 18 mm x 34 mm. The tapered feed microstrip antenna behaves as a radiating element with inverted L-shaped slits to notch WLAN and IEEE INSAT/Super-Extended C-bands. Mutual coupling is less than -22dB is achieved over the band of (2.93-20GHz).*

***Key Words***: multiple input multiple output(MIMO), tepered feed, ultra wide band(UWB).

## 1. INTRODUCTION

As their is rapid growth in wireless communication forces the regularity authorizes to allow the transmission of signals in higher and wider frequency spectrum in order to achieve high wireless channel capacity. It can be achieved by using diversity/MIMO technology in rich scattering environment without any additional power or spectrum. MIMO technology uses multiple antennas at transmitter and receiver terminals of the transmission system. The UWB system was also susceptible to multipath fading problems similar to that of MIMO. Therefore UEB MIMO technology requires high isolation among antenna paramaters to compact multipath fading. In addition to the above the UWB system faces severe interference challenges with existing narrow band such as WLAN from 5.15-5.825 GHz which lies in the UWB spectrum. Hence the design of a compact UWB MIMO antenna with band notch characteristics was a very challenging task. The another problem of MIMO devices which are operated under UWB band is of Electro magnetic interference between the signals. The reduce the interference among the signals we will design a antenna with band notched characteristics (i.e., Bands which stops the unnecessary or unwanted frequencies which are interprets the other frequency). UWB is a radio technology which operates under the frequency range of 3.1GHz to 10.6GHz at very low level for short range communications without interferences to the other licensed users. In compact UWB band antenna design is also called diversity antenna system(of two elements). The wideband isolation was achieved through a tree-like structure on the ground plane. The S-Parameters is measured which shows isolation is better than (-16dB) across the UWB 3.1GHz to 10.6GHz. MIMO is an antenna technology that is used in both transmission and reception equipment for wireless radio communication. There can be various MIMO configurations. In this project we use 1x1 antennas. MIMO has the advantage of multipath technique. This antennas have the following advantages in our project. 1) Increases throughput. 2) Increases channel capacity. 3) Increases range. MIMO has become an important element of wireless communication standards including Wi-Fi(802.11), Wi-Max(4G), 4G LTE(Long term evolution). As the size of the MIMO antennas are compactable when we compared to that of other antennas So, they can be easily portable devices in which the antennas are closely packed. The major drawback of using these antennas we should maintain sufficient (or) high mutual coupling between antenna parameters while adjusting the size of the designing antenna. The UWB system signal fading is the major issue of these system. So, these can be brought in to practice by increasing channel capacity and improvement over MIMO antennas.

## 2. ANTENNA DESIGN APPROACH

In this, the proposed antenna is designed over substrate. The antenna is 18mm x 34mm. This is composed of two radiating elements with tapered feed elements. The radiating element is designed with combination of rectangular(L1 x W1) and triangular elements (base 5.15mm and height 4mm) to form a novel polygon shape. Ground plane for the antenna is composed of rectangular-shaped and T-shaped stubs and L-shaped stubs is maintained to enhance isolation between two antennas. The proposed antenna is printed on circuit board on FR4 Epoxy substrate (thickness 1.6mm, relative permittivity = 4.4 an dielectric loss tangent of 0.02). A L-shaped slit is in the upper portion of the radiator to suppress the WLAN band (5.09–5.8 GHz) in the UWB band. Finally, to suppress the interference at higher frequencies of the IEEE INSAT/Super- Extended C-band (6.3–7.27 GHz), an L-shaped slit is in fig etched in the lower portion of the radiator. Furthermore, the design of the single element, where $l1 = Lg1 + Lg2$, $l2 = L\ p1$, $g = L\ f - Lg$, $A1 = 2[(Lg2+Lg1-Lg)Wg2+Wg1Lg3]+Wg\ Lg\ -Wg3(Lg\ -Lg1)$, and $A2 = L\ p1Wp1\ +$

$1/2[W_{p2}(L_{p1} - L_{p2})] + L_f W_f$ The ground plane plays major role in performance of antenna. It helps in better impedence matching and good isolation between two antennas.

**TABLE I**

DESIGN PARAMETERS OF THE PROPOSED UWB MIMO ANTENNA SHOWN IN FIG 1

| Parameters | Wg | Wg1 | Wg2 | Wg3 | Lg1 | Lg2 | Lg |
|---|---|---|---|---|---|---|---|
| Unit(mm) | 34 | 6 | 1.35 | 3.8 | 1.25 | 16.75 | 5 |
| Parameters | Lg3 | Wp1 | Wp2 | Wp3 | Wp4 | Wp5 | Wf |
| Unit(mm) | 1 | 3.75 | 4 | 6.1 | 4.2 | 0.2 | 1.6 |
| Parameters | Lp1 | Lp2 | Lp3 | Lp4 | Lp5 | Wf1 | Lf |
| Units(mm) | 5.5 | 0.35 | 2.75 | 3.25 | 0.25 | 1 | 6.5 |

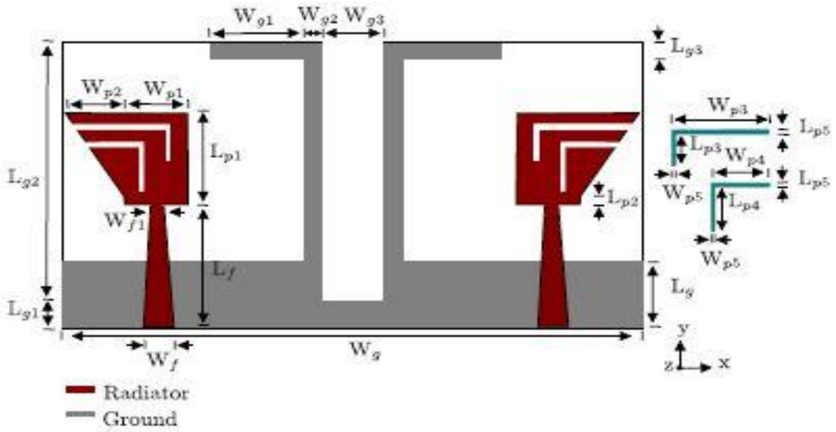


Fig 1 Geometry of the MIMO Antenna

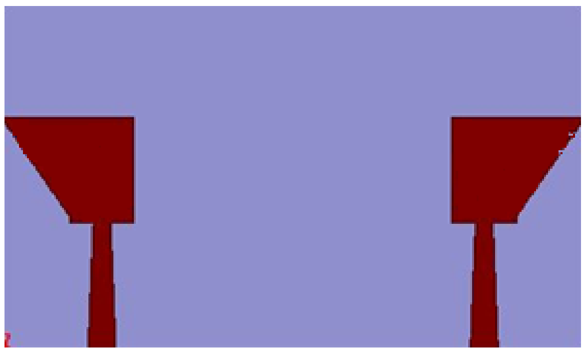

Fig 1 (a) antenna with no L-shaped slits on radiating elements and only rectangular shape on ground plane.

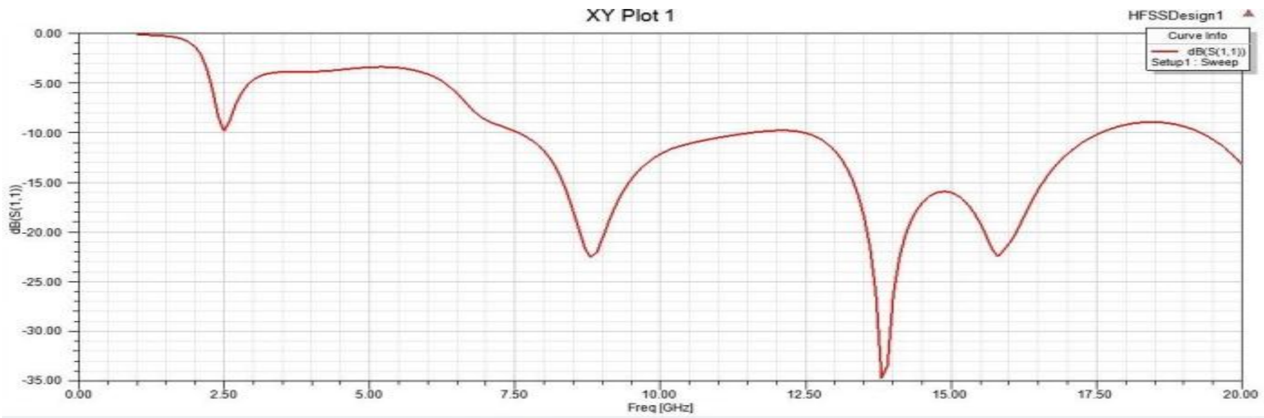


Fig 1 (b) Simulated S11 with respect to Frequency for no slots in radiator.

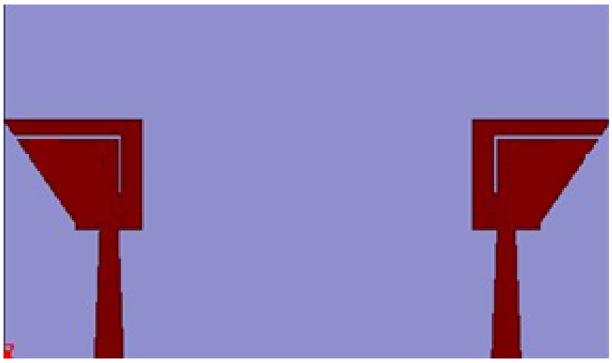

Fig 2 (a) Front view of the antenna with only upper slot and rectangular shape with stubs on ground plane.

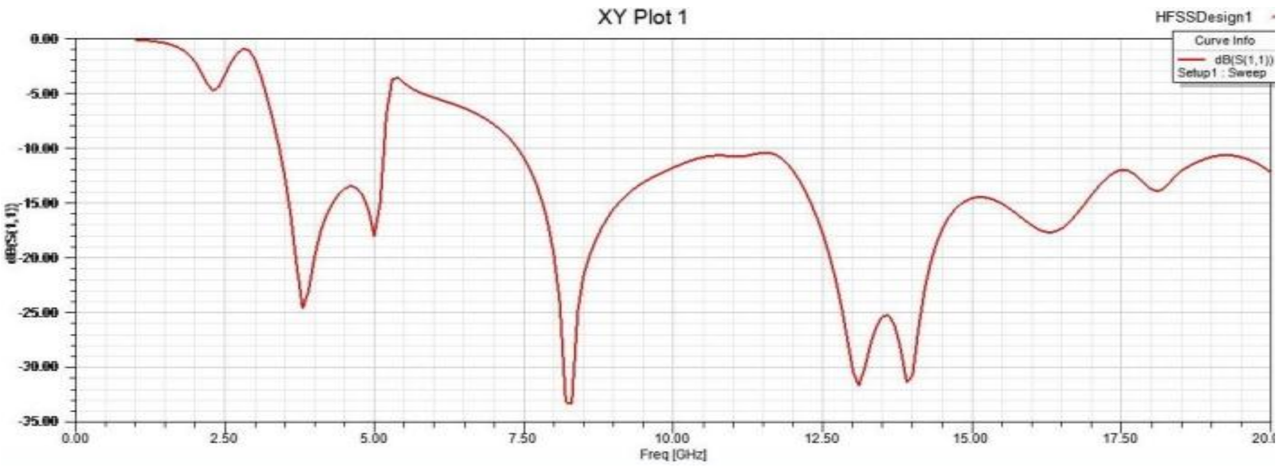


Fig 2 (b) Simulated S11 with respect to frequency for only upper slot on radiator

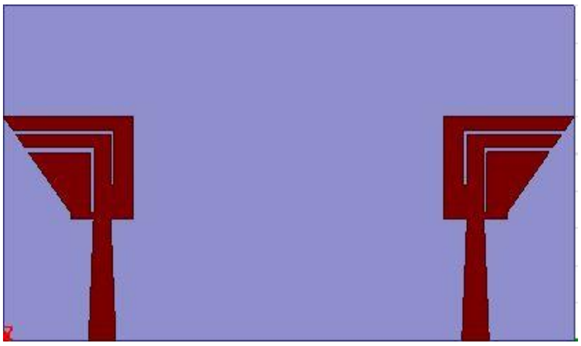

Fig 3 (a) Top layer

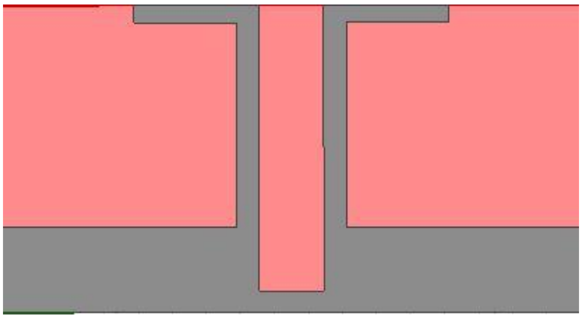

Fig 3 (b) Bottom Layer

Initially antenna with no L-shaped slits on radiating elements and only rectangular shape on ground plan is shown.

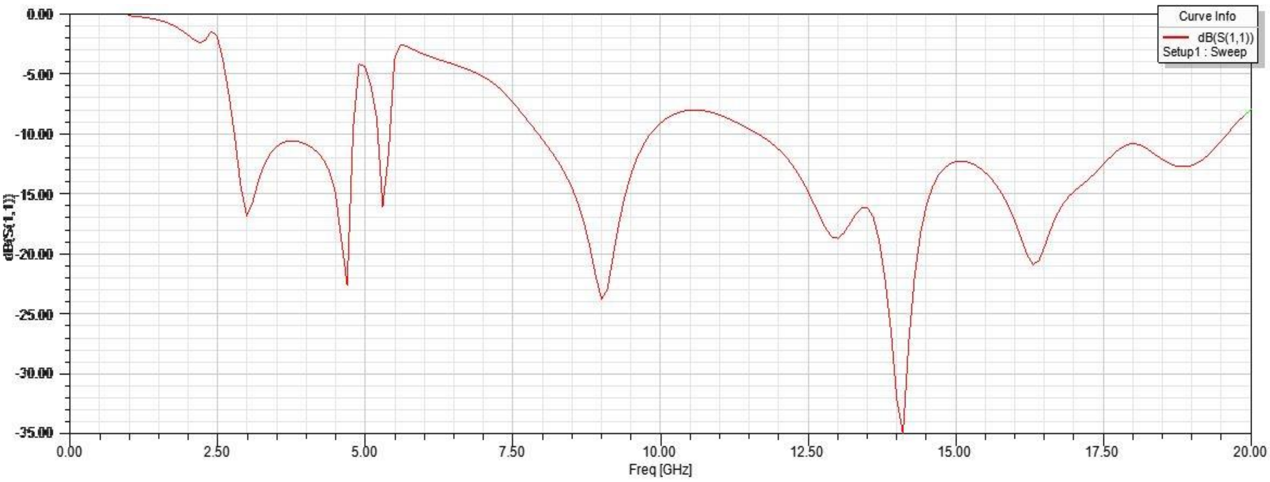


Fig 3 (c) Return loss

## 3. FABRICATION

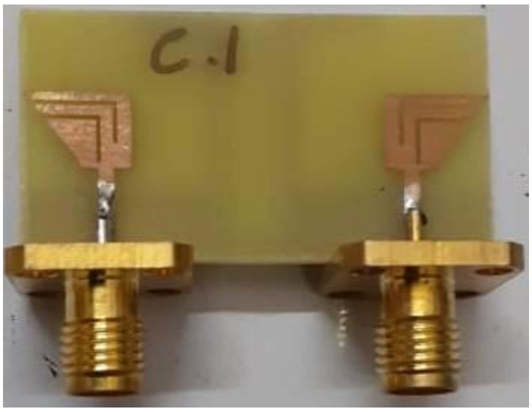


Fig 4 (a) Top view of antenna

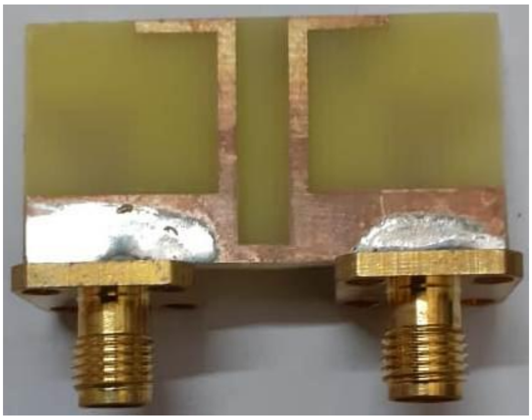

Fig 4 (b) Bottom view of antenna

The above shows the fabricated antenna with fr4 substrate with 1.6mm width with relative permittivity 4.4 . This fabricated antenna was simulated by using antenna simulator.

## 4. CONCLUSION

A tapered fed compact MIMO Antenna with dualband- notched characteristics is proposed. The designed antenna achieves sharp rejection at the WLAN band (5.09–5.8 GHz) and the IEEE INSAT/Super-Extended C-band (6.3–7.27 GHz) with an isolation less than −22 dB, by using a simple inverted L-shaped structure in Ground plane, port isolation, and bandwidth is improved. The diversity performance is also studied and the resuts indicates it is suitable for portable UWB applications.

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