A Novel UWB Antenna with Multiple Notched Bands for WiMAX and WLAN Applications

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***Abstract*—A novel planar ultrawideband (UWB) antenna with dual notched bands is proposed and investigated. The antenna consists of a square patch and a modified grounded plane. To realize dual notched bands characteristics, a T-shaped stub embedded in the square slot of the radiation patch and a pair of U-shaped parasitic strips beside the feed line is used. The advantage of this antenna is the high rejection level in the stopband. The measured results show that the proposed multiple-notched-bands planar antenna shows a very wide bandwidth from 2.8 to 11.0 GHz defined by voltage standing wave ratio VSWR < 2 with multiple notched bands of 3.3-4.0 GHz (WiMAX band) and 5.05–5.90 GHz (WLAN band), respectively. Both the experimental and simulated results of the proposed antenna are presented, indicating that the antenna is a good candidate for various UWB applications.**

***Keywords*—Multiple notched bands, planar antenna, ultrawideband (UWB) antenna.**

I. INTRODUCTION

In recent years, the increasing demands for antenna with multiband operation in modern wireless communication systems have attracted much attention. In particular, as one of the key components of the ultrawideband (UWB) system, extremely broadband antennas have been launched in the frequency range from 3.1–10.6 GHz, which has drawn the attention of a large number of researchers because of its advantages of low cost, resistant to severe multipath and jamming, etc. [1]. Lately, a number of antennas with notched band property have been proposed, and various techniques have been used to achieve the function. The widely used methods are etching slots on the patch or on the ground plane, i.e., such as H-shaped slot [2], U-shaped slot [3], C-shaped slot [4], etc. Introducing parasitic strips [5] near the radiation elements or the ground plane is another way to create notched bands. However, most of the previous works have been focused on the single-notched-band design and few works have been concentrated on dual-notched-bands design. Multiple notched band are designing in thesis.In these designs, by inserting the proper slits in the interior of the radiation element and the ground plane, two rejected bands have been obtained.

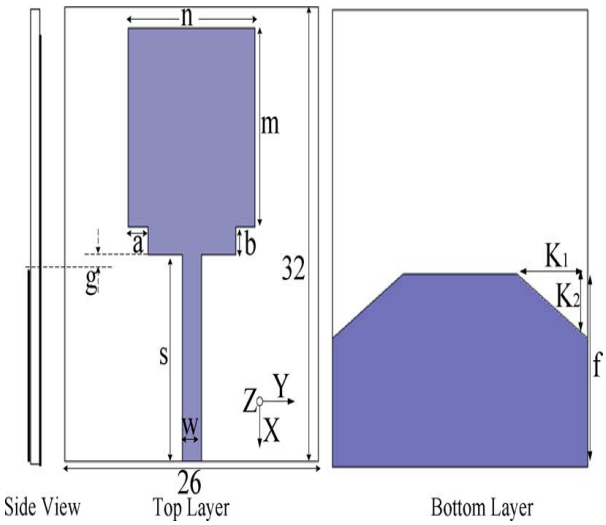

Fig:1 configuration of UWB antenna

Most of these designs have the common deficiency of poor voltage standing wave ratio (VSWR) of the dual notched bands. In this letter, a novel UWB planar antenna with multiple notched bands is proposed. A T-shaped stub in the radiation patch and two U-shaped stubs beside the feeding line are used to realize multiple-band-notch characteristic. In other design, two T-shaped stubs are used to achieve a notched band [9], and in our design two U-shaped stubs beside the feeding line are first used in the UWB antenna to achieve a notched band. The parametrical analyses of these filtering structures are carried out. An antenna prototype is designed and fabricated to demonstrate the proposed strategy. The proposed antenna structure is simulated using the Ansoft High Frequency Structure Simulator (HFSS), one commercial 3-D full-wave electromagnetic simulation software. The simulation and measurement both indicate multiple band rejection with central frequencies of 3.49Ghz, 5Ghz and 5.2Ghz respectively, and excellent notched bands characteristics.

II.UWB ANTENNA WITH MULTIPLE NOTCHED

A.UWB monopole antenna :

In the previous papers we study about UWB antenna for the WiMAX and WLAN application and the microsrip rectangular patch antenna for the good radiation control and low cost fabrication. So for improving the high rejection level in stopbands, and for ignore the interference between the UWB and WLAN. We are uses the notches in the UWB antenna with rectangular microstrip patch antenna.

An antenna is a rectangular patch antenna design on Rogers4003 substrate having dielecrric constant 3.38 substrate height 32mm , length of rectangular patch 16mm and width of the patch 13mm.

Dimension Calculation:

Substrate height = 32mm, Length of the rectangular patch = 16 mm and Width W of the rectangular patch antenna comes out to be 13mm by using design equations:

1. Calculate patch length:L = $\frac{c}{2f_0\sqrt{\epsilon_{re}}}$

2. Calculate patch width: $W = \frac{C}{2f_0\sqrt{\frac{\epsilon_r+1}{2}}}$

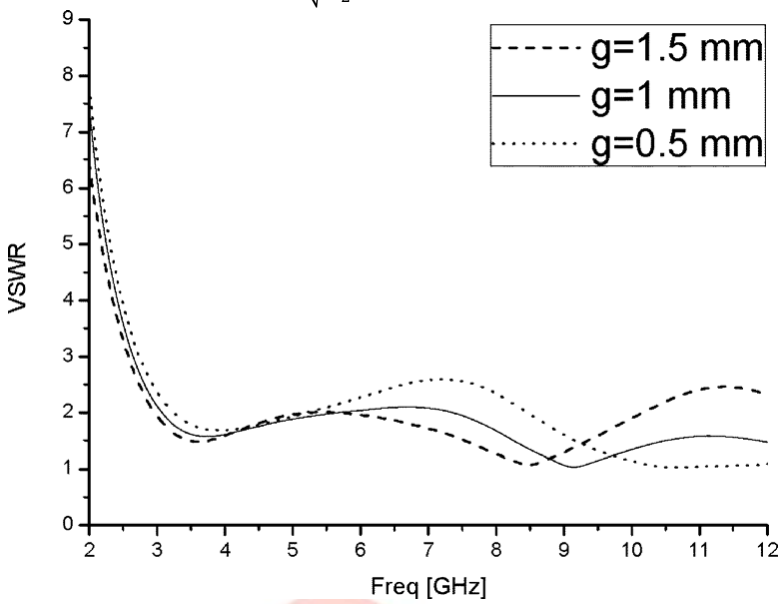

Fig :2 VSWR without notches

In this fig 2 shown the VSWR without the notches and g defined the gap between the radiating patch and ground plane. These gap control the impedance bandwidth of the antenna.

B. UWB antenna with multiple notches:

To achieve the multiple notche bands,a T-shape stub on the radiating patch and a pair of U-shape stub near the feeding line are adopted to generate notched band with central frequencies of 3.49GHz,5GHz and 5.2GHz respectively.

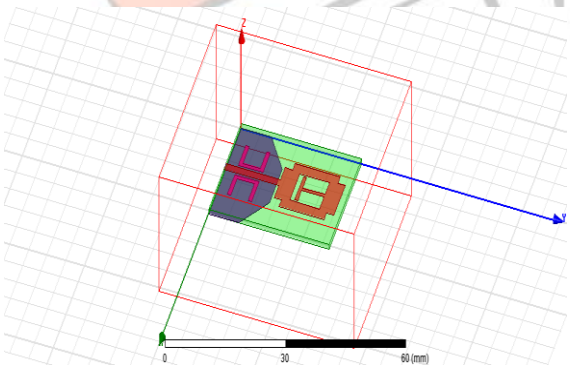

Fig:3 UWB antenna design with multiple notches bands

The T-shape stub in between the radiating patch and the two U-shape stub beside the feed line are adopted the notches in the antenna. With the help of notches signal are attenuated particular frequencies i.e 3.2GHz,4.06GHz,10GHz,10.1GHz,10.8GHz, and 10.9GHz. These notches bands generate with central frequencies 3.49GHz,5GHz and 5.2GHz .

VSWR:

When a transmitter is connected to an antenna by a feed line, the impedance of the antenna and feed line must match exactly for maximum energy transfer from the feed line to the antenna to be possible. When an antenna and feed line do not have matching impedances, some of the electrical energy cannot be transferred from the feed line to the antenna. Energy not transferred to the antenna is reflected back towards the transmitter. It is the interaction of these reflected waves with forward waves which causes standing wave patterns.

The impedance matching is necessary between the antenna and the feed line. and the matching are occurs with the help of antenna tuner. VSWR range lie between the 1-2 below. As shown in fig 4.

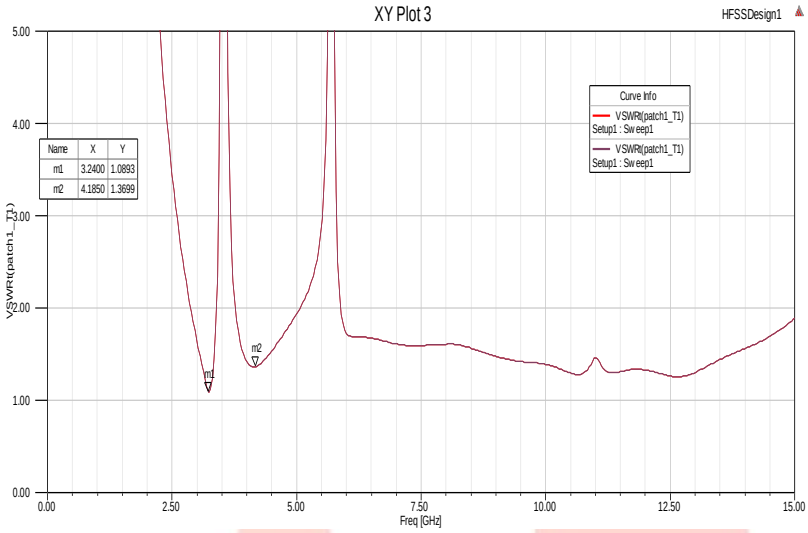

Fig:4 VSWR multiple notches

Radiation pattern:

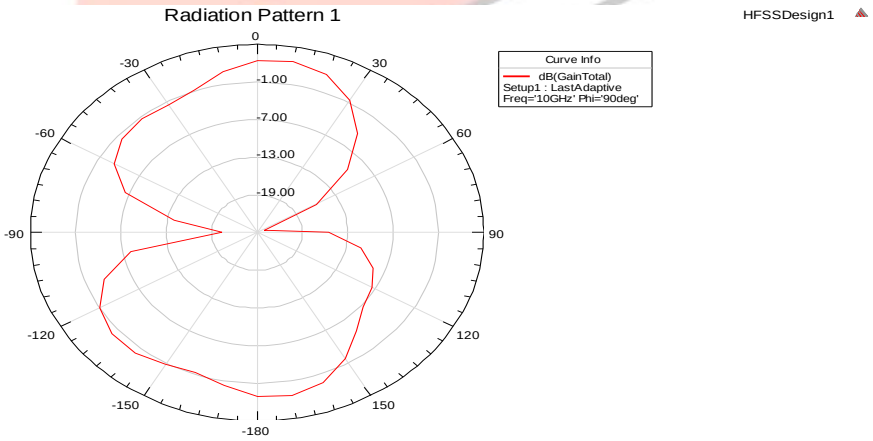

Fig:5 Radiation pattern

Gain:

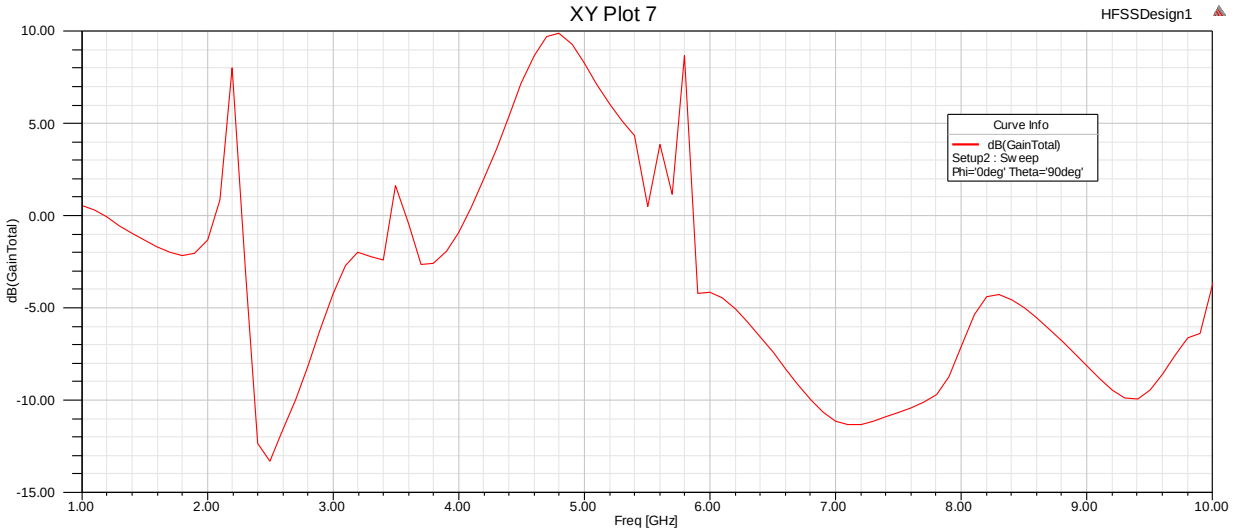

Fig: 6 Gain

III. CONCLUSION :

In this letter, a novel printed antenna with multiple band notches used for UWB application has been presented and investigated. By adjusting the gap between the radiating patch and ground plane , a impedance bandwidth is achived. A T-shape stub at the radiating patch and two U-shape stub besides the feed line multiple stopbands for application of WiMAX and WLAN are created. The radiation pattern of this antenna shows good omnidirectional performance throughout the UWB frequency range and constant gain in theUWB band is realized. Accordingly, the proposed antenna is expected to be a good candidate in various UWB systems.

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