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Band Notched Planar UWB Antenna to Avoid Interference in WiLAN and WiMAX Ranges

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ABSTRACT: A compact planar UWB antenna with notching at three various frequencies are designed and analysed. The antenna consists of radiating patch, dielectric substrate and partial ground. The triple band notching characteristics of antenna are obtained by including T-stub in square patch and two pair of C-shaped parasitic strips along the feedline. This design works well in 3.1-10.6GHz with VSWR<2 and band notched is obtained at 3.26-3.9GHz (WiMAX), 5.16-5.4GHz (LOWER WLAN) and 5.78-5.95GHz (UPPER WLAN). Therefore this antenna is suitable for various UWB applications. Index terms-Planar antenna, Ultra wide band(UWB) antenna, triple notching,Worldwide interoperability for microwave access(WiMAX), LOWER and UPPER WLAN.

KEYWORDS: Antenna, Wilan, Notched filter

I.INTRODUCTION

In recent past, US-FCC(Federal communications commission) had authorised the unlicensed use of UWB frequency range from 3.1-10.6GHz with a emission limit of -41.3dBm/MHz for commercial applications [2].After tremendous efforts on researchesof UWB systems the range of operation was found to have significant advantages such as low cost, less complexity, low power emission level, high precision ranging, resistant to jamming and multipath for short range high speed wireless communications.

The solution to suppress the interference levels by nearby systems is to design UWB antennas with band notched characteristics. Different methods had been proposed such as H-shaped slot [1],U-shaped slot, C-shaped slot [3], resonators etc. By using parasitic strips near radiation elements or ground plane notching can be obtained. Recently, some antennas address the dual or multi-rejected frequency band design. For example, a band notch antenna with dual notched bands has been proposed for UWB applications. By placing two U-parasitic strips on the radiator, the proposed antenna successfully create a nothing in lower WLAN and by placing a T-stub it provides nocthing in WiMAX[1]. Therefore, a combination of both on the patch successfully brings out a dual notching in WiMAX and lower WLAN bands [1].

In this letter, a UWB antenna with triple notched band has been proposed. By using a stubs and parasitic strips, the proposed antenna achieved UWB characteristics with triple notched band for WiMAX, lower and upper WLAN. Some of the proposed band notch design for WLAN completely rejected the entire 5-6GHz frequency band, though the desired notch-bands are 0.2GHz(5.15-5.35GHz) for lower WLAN band and 0.1GHz(5.725-5.825GHz) for upper WLAN band. Hence, any useful information contained in the frequency band of 5.35-5.725GHz will also be lost resulting in thedegradation of received information and thus shorter range of coverage and lower signal quality.In the designing of triple or multiband notch antenna, it is difficult to control bandwidth of the notch bands in a limited space. Moreover, strong couplings between the band-notch characteristics designs for adjacent frequencies are the complication in achieving efficient triple band- notch UWB antenna. Therefore, an efficient frequency band notch technique for lower and upper WLAN band along with WiMAX band is still difficult to implement for allowing maximumavailable frequencies of the UWB applications.

To realize the triple band notch characteristics for a compact monopole antenna, a T-shaped stub in radiation patch and four C- shaped strips beside the feeding line are used. With a compact dimension of 32X26 mm^2, the proposed antenna achievesa bandwidth ranging from 2.9 to more than 11GHz with triple notched bands centered at 3.45GHz, 5.25GHz and 5.85GHz. By adjusting the sizes and locations of strips, notched frequency bands can easily be achieved and controlled according to practicalrequirements. The parametrical analysis of these filtering structures is

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carried out. An antenna prototype is designed and fabricated to demonstrate the proposed strategy.The proposed antenna structure is designed using the CST Microwave Studio and simulation results are obtained.

II.ANTENNA DESIGN AND RESULTS

A.UWB monopole antenna

Fig .1 shows the geometry of a planar UWB monopole antenna. The antenna is fabricated in FR-4 substrate with the dielectric constant of 4.3 and its thickness is 1.6mm. The overalldimension of the microstrip antenna is32mm x 26mm x 0.8mm. The radiating patch and the feeding line are printed on the top side of the substrate and the ground plane on the bottom side. The ground plane is the partial plane.

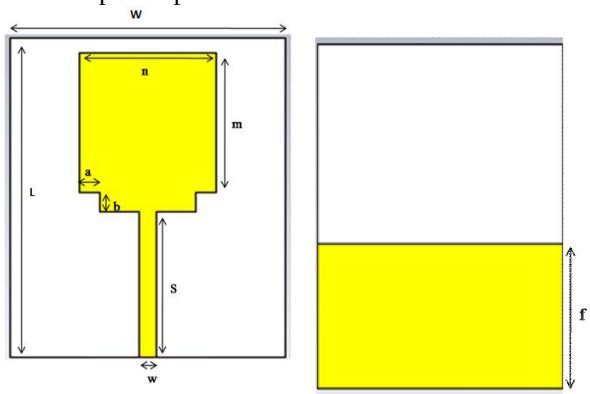

Fig .1 the geometry of a planar UWB monopole antenna

The dimensions of the designed antenna after optimization are listed in Table .1

Table .1 Optimum dimensions

Parameters	a	b	f	h	m	n	W	L	W	S
Value(mm)	2	2	13.5	0.8	14	13	26	32	1.6	14.5

In the proposed design, the monopole antenna and the ground plane form an equivalent dipole antenna. Thus the characteristics impedance of the antenna is affected by the distribution of the current on the patch. The impedance bandwidth can be enhanced to considerable extent by cutting the three notches of required dimensions at the lower corners of the patch. This phenomenon occurs because of the electromagnetic coupling between the radiating patch and the ground plane is affected by the three notches. The gap between the patch and the ground plane is also a significant parameter, to control the impedance bandwidth.

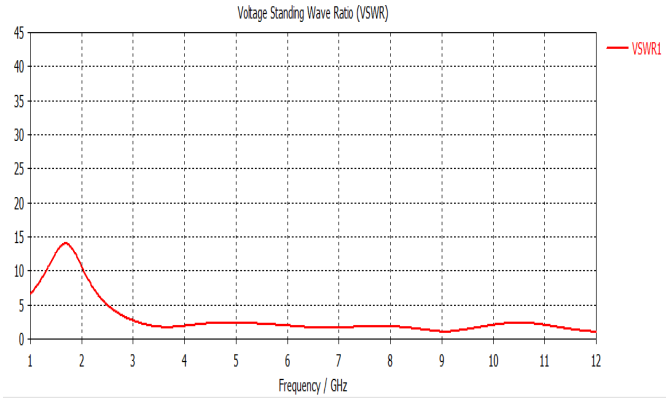

Fig. 2 VSWR plot of the proposed antenna without notched bands

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As the range of the ultra wide band is from 3.1-10.6 GHz, the VSWR in this range of frequency is below 2. For the proper functioning of a monopole antenna the VSWR should be lesser then 2 as the attenuation increases with the increase in the VSWR at a particular frequency. The proposed antenna can obtain high gain at various frequencies.

B.UWB monopole antenna with three notched bands.

To obtain triple notched bands, a T shaped stub on the radiating patch and two pairs of c shaped strips along the sides of the feed line. This design I is implemented to generate notched bands at the desired central frequencies of 3.6Ghz,5.1Ghz and 5.8Ghz respectively.

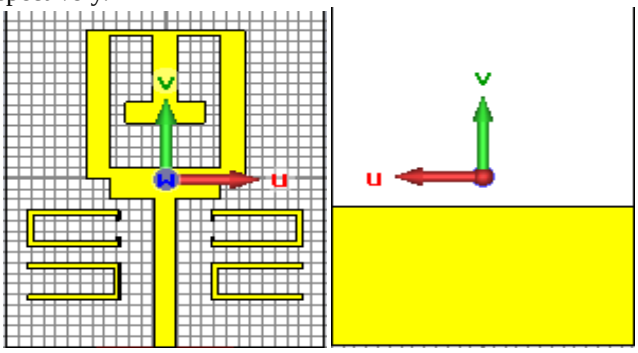

Fig 3 Final design of UWB antenna with triple notched bands

As the range of the ultra wide band is from 3.1-10.6 GHz, the VSWR in this range of frequency is below 2. For the proper functioning of a monopole antenna the VSWR should be lesser then 2 as the attenuation increases with the increase in the VSWR at a particular frequency. The proposed antenna can obtain high gain at various frequencies.

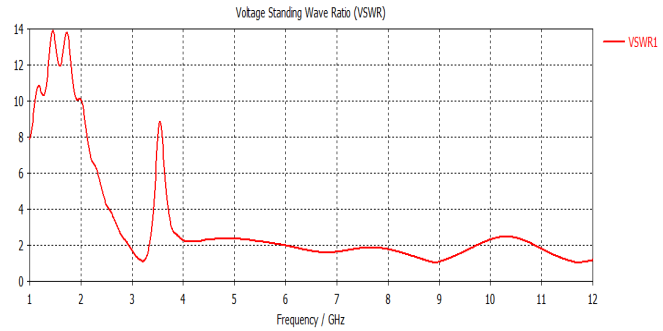

Fig 4 VSWR plot of proposed antenna with T-stub for WiMAX notching

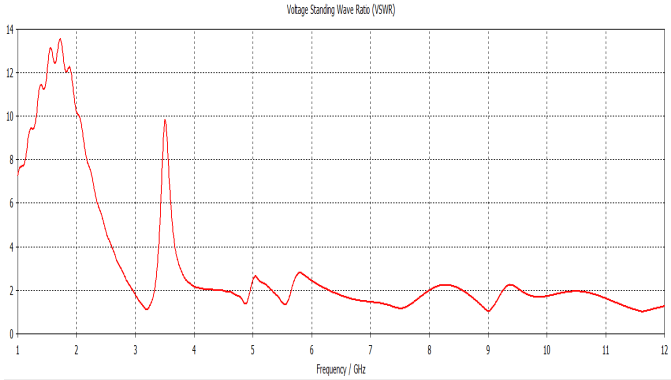

Fig 5 VSWR plot with triple notched bands in case of final integrated design

From the graph the observations which can be made are that there are peaks at the centre frequencies of the WiMAX, upper WLAN and lower WLAN range which gives the notching.The result obtained after simulation showed that the

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characteristics and the functioning of the antenna depends highly on the thickness of the substrate material and the width of the feedline to obtain a desired bandwidth impedance of 50Ω [1].Various other designs were studied for triple notching. But the most appropriate results were obtained with the proposed design. The WiMAX range with the upper and also the lower WLAN is notched which decreases the loss and increases the efficiency of the antenna.

III.CONCLUSION

In this paper, the design of a monopole antenna is obtained for the operation in the Ultra Wide Band range which is from 3.1-10.6 GHz. The antenna is fabricated using FR-4 substrate which makes it cost efficient than the Rogers 4003 substrate material which has a much higher cost than the FR-4 material. The T-stub in the rectangular radiating patch and C-shaped parasitic strips with small extension beside the feedline gives triple notching of the WiMAX band, upper WLAN and lower WLAN. Hence, the interference due to WiMAX, upper and lower WLAN in the operation of the antenna in the Ultra Wide Band range is reduced by the proposed antenna design.

REFERENCES

[1].I.Benjamin and B. Sridhar"A PLANAR UWB ANTENNA WITH NOTCHED BANDS FOR WiMAX AND WLAN APPLICATIONS"*IEEE Antennas and propogation , 2013.*
[2]I. Oppermann,M.Hamalainen,andJ. Iinatti,*UWBTheoryandAppli- cations*. NewYork: Wiley,2004,ch.1,pp.3–4.
[3]S.R.Branch,"Band-notched ellipticalslotUWBmicrostrip antenna withellipticalstubfilledbytheH-shapedslot,"*J.Electromagn. Waves Appl.*,vol.22,pp.1993–2002,2008.
[4]Y.J.Cho,K.H.Kim,D.H.Choi,S.S.Lee,andS.O.Park,"Aminia- tureUWBplanarmonopoleantenna with5-GHzband-rejectionfilter andthetime-domaincharacteristics,"*IEEETrans. AntennasPropag.*, vol.54,no.5,pp.1453–1460,May 2006.
[5]Y. C. Lin andK. J. Hung,"Compactultra-widebandrectangular apertureantennaandband-notched designs,"*IEEETransAntennas Propag.*,vol. 54, no. 11,pp.3075–3081,Nov. 2006.