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Design of Compact Dual Band Notched Antenna for UWB Applications

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Abstract :*Inthispaper design of aDual-Band Notched UltraWidebandantennaconsisting of variouswireless applications ispresented. The proposed antenna overall size is 30mm x 40mm x 1.6mm. The antenna consists of a rectangular patch on the top of FR4substrate with 50ohm feed line with defected ground structure.Notch bands include WLAN system at 5 GHz (5.1 - 5.8 GHz) and WiMAXSystemat (3.3 to 3.7 GHz). The UWB range of 3.1 - 10.6 GHz approved by FCC, has a chance of producinginterferences in the variouswirelesssystems applications. In order to reducethecenter rferenceswe go for band notching.The simulated band width with return loss (RL) >=10db is 3.1 to 11.2 GHz with VSWR<2. It works for the applications of WiMAX system at 3.5GHz (3.3 – 3.7 GHz), C-band satellite communication (3.7 - 4.2 GHz), wireless local area network (WLAN) system at 5GHz (5.15 – 5.825 GHz), X-band satellite communication system (7.25 - 7.75).*

Keywords - *Band notched, Compact, UWB Antenna, Rectangular patch.*

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I. Introduction

In awireless communication system antennas of various types are used. The antennasthatwe use for a particular system depends on the type of application, frequency, gain and suchparameters. In most of the applications antennassuch as planarantennas, micro-stripantennas, monopole antennas, dielectricresonatorantennas etc., which have low profile are used. Theseantennas have an extensive applications in mobile systems, WLAN with 5 GHz band, WiMAXwith3.5 GHz band, Ultra Wide Band (UWB) with 3.1-10.6 GHz band.

Due to the rapid growth in the wireless communication systems the ultra wide band (UWB) antennas received extensive attention because they have huge advantages like high speed, simple to fabricate, small in size, low power consumption, less complexity, secure, less interference, low cost and low profile. It is utilized as a part of various applications for example, radar, imaging in drug and military correspondence. UWB receiving wires ought to be non-dispersive or dispersive in a controlled manner that is agreeable to remuneration. Ultra wideband (UWB) innovation is at present spreading in various zones, for example, beat radars, radiometers, radio stargazing, recurrence jumping, spread range and OFDM remote correspondence frameworks, checking frameworks and direct vitality.UWB fix receiving wires could be planned with various geometries; i.e. triangular, round circle, strip circle and square. In wireless communication systems, antennas of various types are used. The desired antenna for a particular system depends upon the type of application, frequency, gain and so on. In most of the applications, antennas such as planar antennas, micro-strip antennas, monopole antennas, dielectric resonators etc[3]., are used because of their low profile. These antennas have an extensive application in mobile systems, WLAN with 5GHz band, WiMAX with 3.5 GHz band, ultra wide band (UWB) with 3.1 - 10.6GHz band.

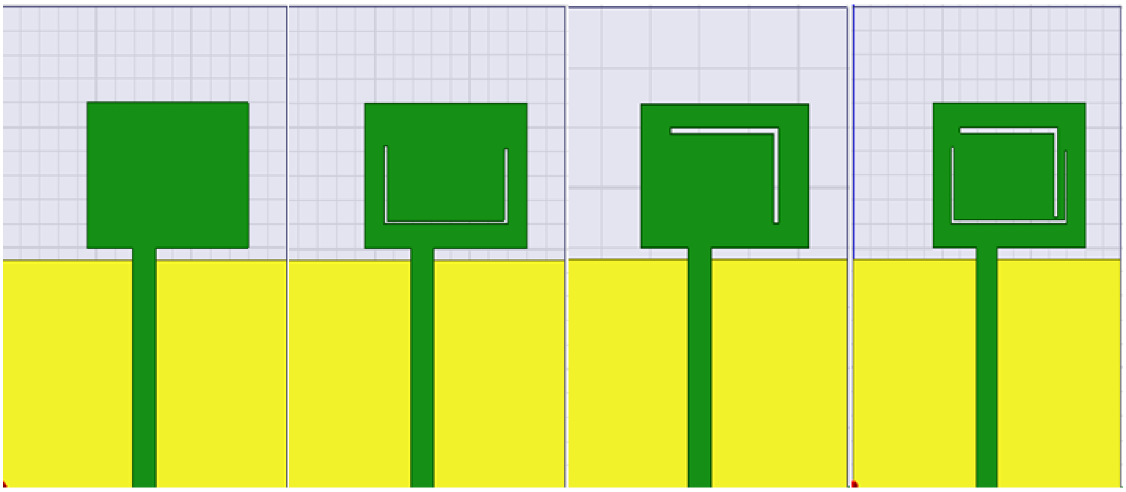


Fig-1.UWB antenna,UWB Antenna with WiMAX notch, UWB Antenna with WLAN notch, Proposed UWB Antenna with two slots

II. Design Equations for Patch Antennas

The proposed UWB antenna is in the Fig. 1, this design is based on the substrate FR4 and εr = 4.4 and tan δ = 0.02. This model contains all measurements in mm.The substrate has width W sub =30, length Lsub=40 and height h=1.6, the rectangular patch has width W=17 and length L=12 the feed line has width Wfeed=2.4 and length Lfeed=20 and the ground plane has width Wg=30 and length Lg =19. In this antenna design approach the UWB antenna with 7-shaped slot and U-shaped slot are placed in such a way that to get the band rejections at WLAN range and WiMAXrange.

The above dimensions are all according to the antenna design parameters formulae such as:

For Width (W) of the patch $W = \frac{c}{2f_0\sqrt{\frac{(\varepsilon_r+1)}{2}}}$ ----- 1(a)

For calculatingthe Effective Dielectric Constant. This depends on the tallness of the substrate and width of the conducting patch.

$$\varepsilon_{eff} = \frac{\varepsilon_r+1}{2} + \frac{\varepsilon_r-1}{2}\left[1+12\frac{h}{W}\right]^{-\frac{1}{2}} \text{ ----- 2(a)}$$

For evaluating the Effective length, & the length extension ΔL

$$L_{eff} = \frac{c}{2f_0\sqrt{\varepsilon_{eff}}} \text{----- 3(a)}$$

$$\Delta L = 0.412h\,\frac{(\varepsilon_{eff}+0.3)\left(\frac{W}{h}+0.264\right)}{(\varepsilon_{eff}-0.258)\left(\frac{W}{h}+0.8\right)} \text{ ----- 3(b)}$$

For length of the conducting patch

$$L = L_{eff} - 2\Delta L \text{ ----- 4(a)}$$

The Bandwidth equation roughly defines in what way it scales with the parameters:

$$B \propto \frac{\varepsilon_r-1}{\varepsilon_r{}^2}\,\frac{W}{L}\,h \text{ ----- 5(a)}$$

The ground length (Lg) and the ground width (Wg) are supposed to be as:

L_g= 6h+L ----- 6(a)

W_g= 6h+L ----- 6(b)

The area of the sustain point where the impedance is very nearly 50 ohms is

Along the width of the patch (x-direction) $X_f = \frac{W}{2}$ ----- 7(a)

Along the length of the patch (y-direction)$Y_f = Y_0 - dL$----- 7(b)

Where, $Y_0 = \frac{L}{\Pi}\cos^{-1}\sqrt{\frac{50}{z_0}}$

$$z_0 = \sqrt{50 * Z_{IN}}$$

$$Z_{IN} = 90 * \frac{{\varepsilon_r}^2}{\varepsilon_r - 1}\left(\frac{L}{W}\right)^2$$

$$f_c \approx \frac{c}{2L\sqrt{\varepsilon_r}} = \frac{1}{2L\sqrt{\varepsilon_0 \varepsilon_r \mu_0}}$$

S.No.	Parameter	Value in mm
1	S1 of U-Shaped slot	(0.3,13)
2	S2 of U-Shaped slot	(0.4,6.2)
3	S3 of U-Shaped slot	(0.3,6.2)

Table 1: Dimensions of U-shaped slot

S.No.	Parameter	Value in mm
1	S4 of 7-Shaped slot	(0.5,8)
2	S5 of 7-Shaped slot	(0.5,11)

Table 1: Dimensions of 7-shaped slot

III. Simulation Results

Return Loss Plot

The S_{11} parameters are considered as antenna return loss parameters. Considering -10 dB to be the base value, the return loss obtained from 3.25 to 12.7 GHZ respectively. Fig shows the plot of return loss.

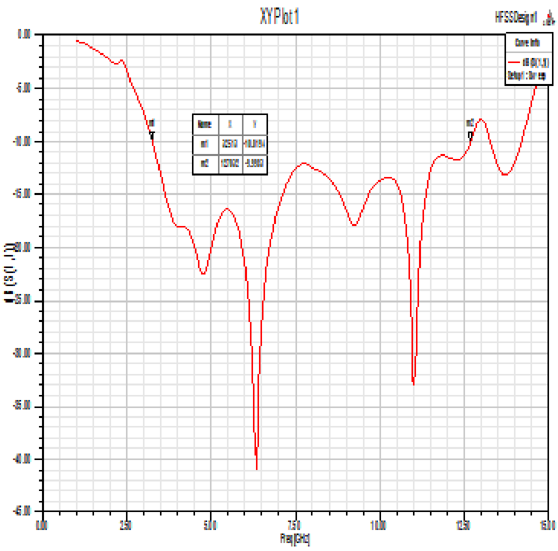


Fig-2.RL of UWB Antenna

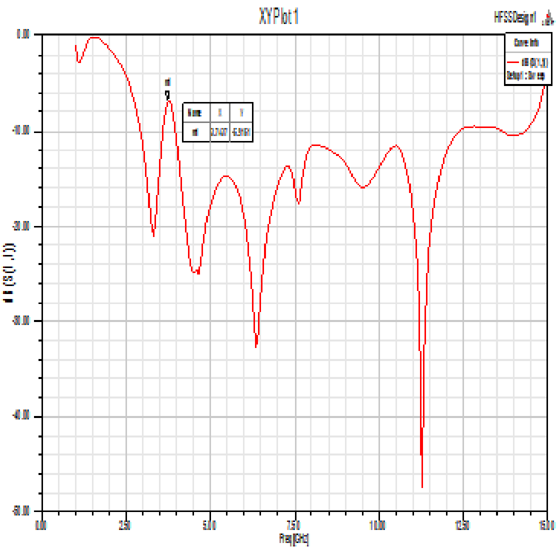


Fig-3.RL of UWB for WiMAX notch

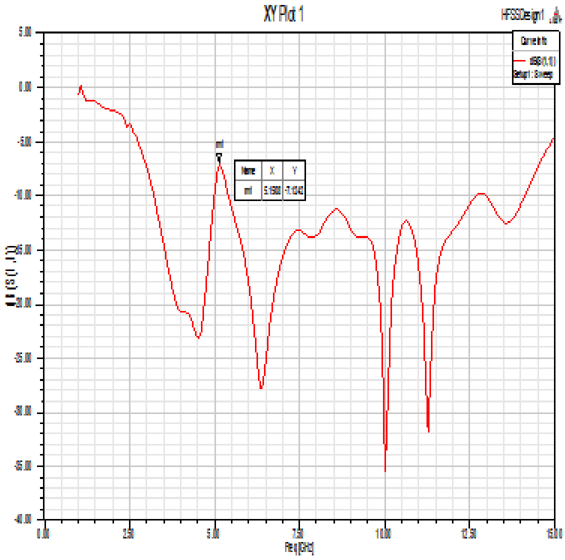


Fig-3.RL of UWB for WLAN notch

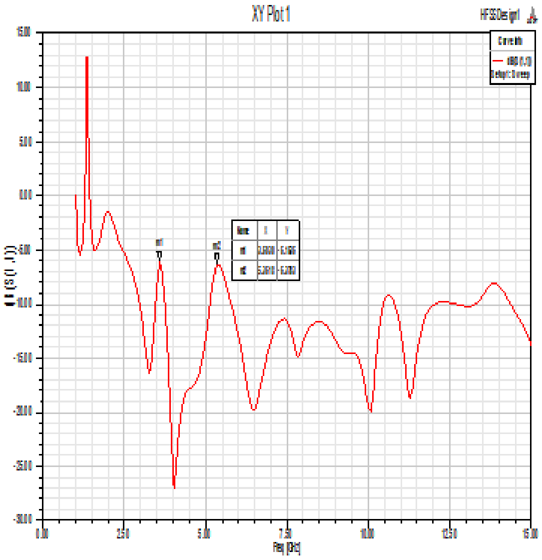


Fig-4.RL of UWB with dual notch

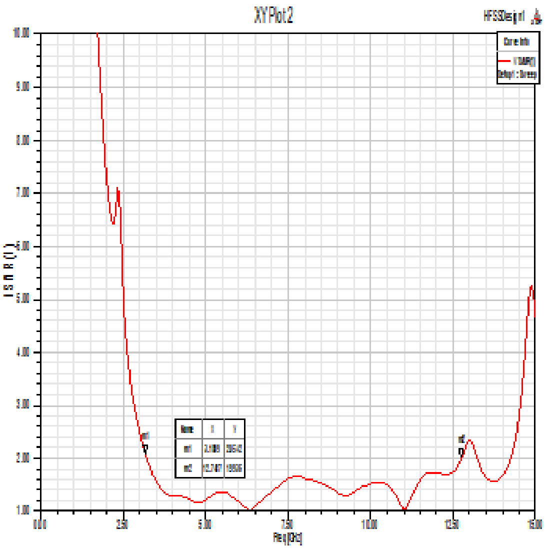


Fig-5 VSWR of UWB Antenna

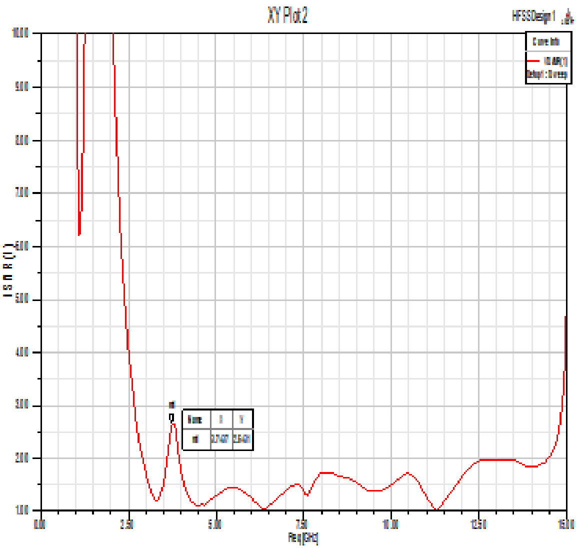
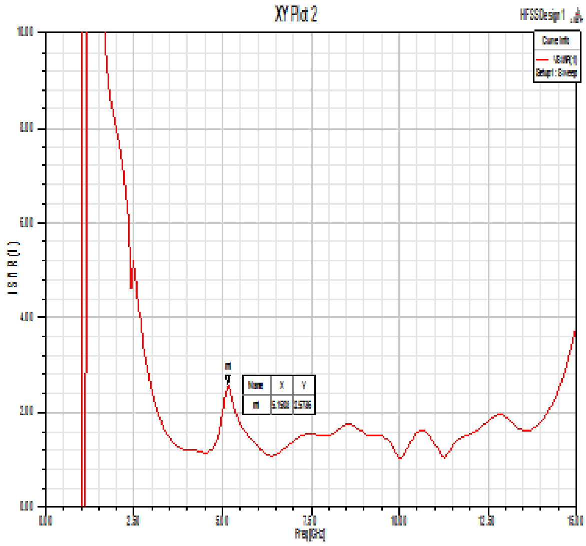


Fig-6. VSWR of UWB with WiMAX notch



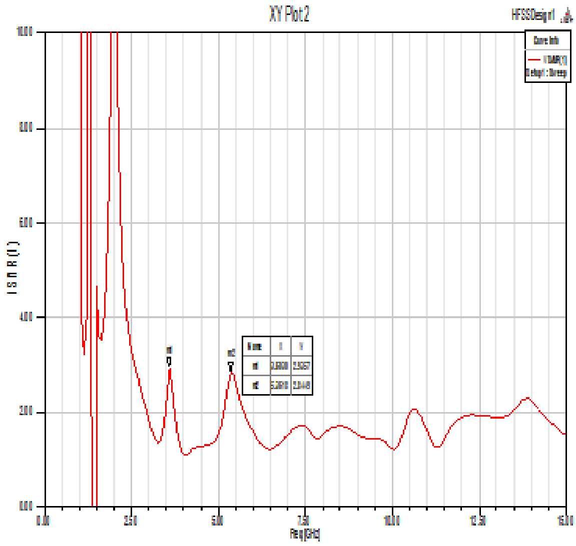
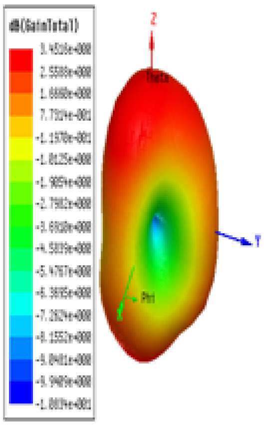


Fig-7. VSWR of UWB with WLAN notc **Fig-8.VSWR of UWB with dual notch**

Gain Plot

The 3D plot shows the gain of antenna. The antenna has a gain of dB. Fig shows the gain of patch.



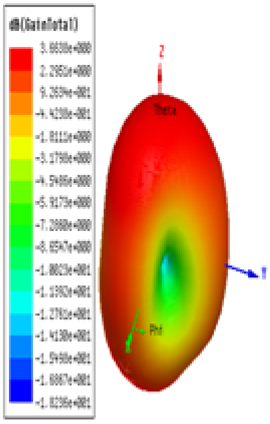
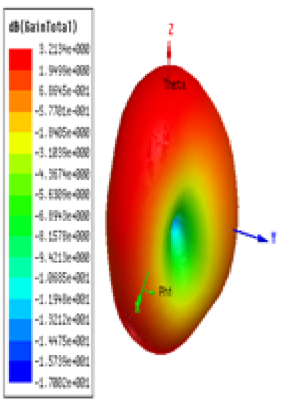


Fig-9.3D Gain of UWB AntennaFig-10. 3D Gain of UWB with WiMAXnotch



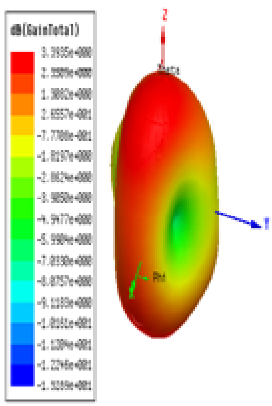


Fig-11. 3D Gain of UWB with WLAN notch **Fig-12. 3D Gain of UWB with dual notch**

IV. Conclusion

Finally, the proposed antenna has got very good characteristics. By inserting the U-shaped slot the rejection has happened perfectly at WiMAX frequency range. And by inserting 7-shaped slot the rejection at WLAN-band has occurred. The VSWR response shows that rejection is done appropriately for the selected bands. Also, the radiation characterists tells us the gain obtained from the proposed antenna is also an acceptable value. The band width obtained is from 3.29 GHz to 11.27GHz.

References

[1]. N. M. A. a. M. K. Abdelazeez, "New UWB Antenna with Inverted F and U Shape," IEEE GCC Conference and exhibition, 2013.
[2]. "USC-electrical-engineering," 2006. [Online]. Available: https://viterbi.usc.edu/new/news/2006/usc-elecctricalengineering.htm.
[3]. H. a. M. A.Medhipour, "A novel UWB antenna for UWB applications," Laughborough Antennas and Propagation Conference, pp. 1-4244-0776-1/07/$20.00, April,2007.
[4]. Hindawi, "Wideband and UWB Antennas for Wireless Applications," International Journal of Antenna and Propagation, pp. 1-45, 2017.
[5]. T. A. D. a. A. R. Sebak, "Broadband L-shaped Dielectric Resonator Antennas," IEEE Antennas and wireless prop,Letters, vol. 4, pp. 1536-1225, 2005.
[6]. m. K. A. Noor M.Awad, "Multishot microstrip attenuator ultrawideband applications," Journal of king sauduniversityEngineering Sciences, pp. 1018-3639, Dec-2015.
[7]. .Z. F. a. L. Z. Yang Gao, "Compact Asymetrical T-shaped Dielectric Resonator," IEEE Transactions and Antenna propagations, vol. 60, no. 3, pp. 0018-926x, Mar,2012.

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