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A Review On Different Band Notching Techniques Used In Design Of Slot Antenna For UWB Applications

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ABSTRACT

As per Federal Communication Commission (FCC) standard 3.1~10.6 GHz is unlicensed frequency band for UWB communication. Notching will be helpful to avoid interference between UWB and some narrow band that are WiMAX (3.3–3.7GHz), C-band satellite downlink (3.7GHz–4.2GHz), WLAN (5.15–5.825 GHz), DSRC (5.50–5.925 GHz) etc. Different notching techniques are discussed in this paper. Some techniques include adding parasitic stubs of different shapes, rectangular slits, and slots. In this paper comparative study will be done for different notching techniques.

Key words: UWB, slot antenna, band notching characteristics.

1. INTRODUCTION

In Feb 2002,the Federal Communication Commission (FCC) declared the 3.1 to 10.6 GHz unlicensed frequency band for UWB communication[1].Due to the huge industrial introduction in UWB applications companies have produced computer, mobile phones, set-up boxes type applications in market[2].Other important application of UWB is ranging and localization due to fine delay resolution[3].Due to the extremely large bandwidth of UWB, the interference between the narrow band and UWB system is a major challenge in UWB. Some narrowband communication standards occupy the UWB spectrum due to the power level limitation. Hence it causes interference between UWB and narrowband. Therefore band notching characteristics is one of the important techniques to avoid interference. The different band notching techniques are discussed in this paper.

2. DIFFERENT METHODS FOR ACHIEVING BAND NOTCHING CHARACTERISTICS

Notching will help to mitigate the probable interference between existing system (UWB) and different narrow bands (WiMAX, WLAN etc.).In [4], A L-shaped stub is introduce to obtain band-notched function C-band (3.62–4.77 GHz) and antenna is operative from 2.9 to 20 GHz .Small printed slot antenna is simply made up of L-shaped slot embedded at the centre of the ground plane, a rectangular slit is attached with the slot having L-shaped and rectangular slit at the bottom of the ground plane. Antenna operates from 3.1 ~ 10.6 GHz, which satisfies two rejected bands having range from 3.3–3.73 and 5.15–5.9 GHz in [5].In [6], By cutting two slots from the radiating patch and inserting two positive-intrinsic-negative (PIN) diodes along these slots, single and dual switchable notch band characteristics are added to the antenna performance. The band stop functions at 3.15 to 3.85 and 5.43 to 6.1 GHz which can mitigate the UWB frequency band interference with the WiMAX, the C-band and the WLAN systems.

In [7],In this geometry, engraving two split-ring resonator (SRR) slots on the radiators, the band-notched property(notched band at 5.5 GHz) is achieved and antenna covers frequency band from 2.5 to 12 GHz. In [8], the proposed antenna consists of a ground plane with two slots of E-shaped and a W-shaped conductor backed-plane a square patch with a modified T-shaped slot, ranging from (2.73–13.3GHz).Single band-notched characteristic is obtained by inserting W-shaped conductor backed-plane structure on the other side of the substrate. Also by cutting a modified T-shaped slot in both radiating patch and microstrip feed-line, a band-stop function for dual band is achieved. The measured consequences reveal that the presented dual notch band monopole antenna gives an enhanced bandwidth with two notched bands, covering all the 5.2~5.8 GHz wireless LAN, 3.5/5.5 GHz WiMAX and 4 GHz C bands.

In [9], in order to create triple band-notched characteristics in 5.15–5.825 GHz for WLAN ,3.3–3.7 GHz for WiMAX , and 7.25–7.75 GHz for downlink of X-band satellite communication systems the antenna uses three open-ended quarter-wavelength slots. A switched antenna that has a potential to operate in the dual-band WLAN frequency bands (2.4 to 2.485, 5.15 to 5.35, and 5.725 to 5.825 GHz) and the band-notched ultra wideband (UWB) frequency band (the stop band covers the band of frequency ranging from 5.15 to 5.825 GHz) is presented. The proposed antenna consists of a four switches , rectangular ring slot, a coplanar waveguide (CPW) feed line, a T-shaped stub, and two inverted S-shaped slots in [10].

In [11], the band rejection property is achieved by inserting an inverted V-shaped slot with folded ends. The proposed antenna covers the frequency range of 3.04–20.22 GHz for reflection coefficient below -10db, and band rejection of 5–6 GHz.

In [12], the UWB slot antenna, covering 3.1–11 GHz, is in the octagonal shape and is fed by a rectangular patch with a beveled bottom periphery. A stub, having quarter wavelength is attached to the high current area in the ground plane to create an extra band outside the UWB frequency range, centered at the 2.4-GHz (Bluetooth band). Two notch bands, centered at 3.5-GHz WiMAX and 5.8-GHz WLAN, are created by placing two similar stubs to that of the extra band. A compact UWB polygon slot antenna with enhanced band-notched characteristics using a parasitic strip and a parasitic slit is presented. The antenna has a polygon slot inside which parasitic strip embedded and an isolated slit employed in the beveled T-stub in [13]

In [14], a novel ultra-wideband (UWB) circular slot antenna with a parasitic strip for exception at 5.2/5.8 GHz is proposed. The antenna consists of circular slot with an inverted C-shaped parasitic strip inserted and an indented circular stub.

Table 1: Comparison between band notch antennas

Antenna Type	**Notched Band**	**Techniques Used**	**Ref. Paper**
MIMO/ diversity antenna	C band (3.6-4.77GHz)	L-shape stub in the ground plane	[4]
Slot antenna	WiMAX (3.3–3.73), WLAN (5.15–5.9GHz)	rectangular slit	[5]
Slot antenna	WiMAX (3.15–3.85), WLAN (5.43–6.1GHz)	cutting two slots on patch and embedding two(PIN) diodes along these slots	[6]
Slot antenna	WLAN center freq 5.5 GHz	etching two split-ring resonator (SRR) slots on the radiators	[7]
Monopole Antenna	WLAN (5.2/5.8 GHz), WiMAX (3.5/5.5 GHz) and C bands (4 GHz)	W-shaped conductor backed-plane structure on the other side of the substrate and cutting a modified T-shaped slot on other side of substrate	[8]
Printed monopoe antenna	WiMAX (3.3–3.7 GHz), WLAN (5.15–5.825 GHz) and X-band downlink (7.25–7.75 GHz)	three open-ended quarter-wavelength slots	[9]
Switched antenna	WLAN (5.15 to 5.825 GHz)	Switches	[10]
Slot antenna	WLAN (5–6 GHz)	embedding an inverted V-shaped slot	[11]
Slot antenna	WiMAX Center freq.(3.5 GHz) WLAN (5.8 GHz)	placing two stubs	[12]
Slot antenna	WLAN (5.05–6 GHz)	parasitic strip and slit	[13]
circular slot antenna	WLAN (5.2/5.8 GHz)	C-shaped parasitic strip embedded inside the circular slot	[14]

3. CONCLUSION

A different band notching techniques for UWB slot antenna has been presented. Without compromising antenna performance the design antenna represent band notch characteristics. To remove interference between different narrow bands like WiMAX, WLAN, C band etc. from UWB band notching is essential. Widely used notching techniques are embedding parasitic stubs and inserting slots.

REFERENCES

1. Federal Communication Commission(FCC),Washington, DC, "***First report and order in the matter of revision of Part 15 of the commission's rules regarding ultra-wideband transmission systems***", ET-Docket 98-153,2002.
2. Daniel Valderas,Juan Iqnacio Sancho,David Puente,Cong Ling and Xiaodong Chen,"***Ultrawideband Applications***", World Scientific Publication,London,2011.
3. Ghavami M.,Michael L.B.,and Kohno R,"***Ultra-wideband Signals & Systems in Communication Engineering***",2nd edition,Wiley,New York,2008.
4. R. Chandel and A.K. Gautam. **Compact MIMO/diversity slot antenna for UWB applications with band-notched characteristic**, *Electronics Letters*, 3rd March 2016 Vol. 52 No. 5 pp. 336–338.
5. Yong-Ping Zhang and Chun-Mao Li. **Design of small dual band-notched UWB slot antenna**, *Electronics Letters* , 22nd October 2015 Vol. 51 No. 22 pp. 1727–1728.

6. Bahareh Badamchi, Javad Nourinia, Changiz Ghobadi, Arash Valizade Shahmirzadi. **Design of compact reconfigurable ultra-wideband slot antenna with switchable single/dual band notch functions**, *IET Microw. Antennas Propag*., 2014, Vol. 8, Iss. 8, pp. 541–548 doi: 10.1049/iet-map.2013.0311.
7. Peng Gao, Shuang He, Xubo Wei, Ziqiang Xu, Ning Wang, and Yi Zheng. **Compact Printed UWB Diversity Slot Antenna With 5.5-GHz Band-Notched Characteristics**, *IEEE Antennas And Wireless Propagation Letters*, Vol. 13, 2014.
8. Nasser Ojaroudi, Mohammad Ojaroudi, Noradin Ghadimi. **Dual band-notched small monopole antenna with novel W-shaped conductor backed-plane and novel T-shaped slot for UWB applications** , *IET Microw. Antennas Propag.*, 2013, Vol. 7, Iss. 1, pp. 8–14, doi: 10.1049/iet-map.2012.0180
9. Dang Trang Nguyen,Dong Hyun Lee,and Hyun Chang Park. **Very Compact Printed Triple Band-Notched UWB Antenna With Quarter-Wavelength Slots,** *IEEE Antennas And Wireless Propagation Letters*,Vol.11,2012.
10. Bing Li, Jingsong Hong, and Bingzhong Wang.**Switched Band-Notched UWB/Dual-Band WLAN Slot Antenna With Inverted S-Shaped Slots** *IEEE Antennas And Wireless Propagation Letters*, Vol. 11, 2012.
11. S. Mohammadi, J. Nourinia, C. Ghobadi and M. Majidzadeh. **Compact CPW-fed rotated square-shaped patch slot antenna with band-notched function for UWB applications**, *Electronics Letters* ,24th November 2011 Vol. 47 No. 24.
12. Mohammad Mehdi Samadi Taheri, Hamid Reza Hassani, and Sajad Mohammad Ali Nezhad. **UWB Printed Slot Antenna With Bluetooth and Dual Notch Bands**, *IEEE Antenns And Wireless Propagation Letters*, Vol. 10, 2011.
13. L.-H. Ye and Q.-X. Chu. **Improved band-notched UWB slot antenna**, *Electronics Letters*, 3rd December 2009 Vol. 45 No. 25.
14. C.-Y. Huang, S.-A. Huang and C.-F. Yang. **Band-notched ultra-wideband circular slot antenna with inverted C-shaped parasitic strip**, *Electronics Letters* ,17th July 2008 Vol. 44 No. 15