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BAND NOTCHING METHODS USED IN UWB ANTENNAS- A STUDY

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Abstract - ***According to federal communication commission (FCC) rules, the 3.1 - 10.6 GHz band is allocated to the ultra wideband (UWB) applications. Due to the overlap of the currently allocated UWB frequency band with the communication systems such as Wireless Local Area Network (WLAN) bands in the 2.4GHz(2.4–2.484GHz), 5.2GHz (5.15–5.35GHz),and 5.8GHz(5.725–5.825GHz) bands, and the World Interoperability for Microwave Access (WiMAX) system bands 2.5GHz(2.5–2.69GHz), 3.5GHz (3.4–3.69GHz), and 5.8GHz (5.25–5.825GHz). Therefore, an unwanted intrusion will be expected between these frequencies, now a day's many systems operate across several frequency bands, requiring a band-notched or band-rejected function. The band notching techniques used in the recent papers are tuning stub,shaped slot, parasitic element, and the fractal geometry. In this paper a comparison will be done between these techniques.***

Key Words: *UWB, Band Notching, UWB Microstrip Antenna, Study.*

1. INTRODUCTION

There is a rapid development in UWB technology in recent years since the use of UWB in the range of 3.1 to 10.6 GHz was unlicensed by the Federal Communication Commission (FCC) in 2002. UWB has a very wide bandwidth of 7.5 GHZ (from 3.1 to 10.6 GHz) compared to many other existing wireless communication standards. Ultra wideband technology has been used in a wide range of applications such as radars, telemetry, navigation, biomedical systems, mobile satellite communications, the direct broadcast system (DBS), global positioning systems (GPS), and remote sensing UWB technology has several advantages like low cost, high data rates and low average radiated power

UWB applications can coexist with other narrowband communication standards that occupy the same spectrum due to the limitation of power level. But this will causes a severe interference between the UWB systems and narrow band like WLAN and WiMAX. Therefore some means should be provided for avoiding this interference. One of the most suitable solutions is a UWB antenna integrated with band notch characteristics. There are different methods to achieve band notch characteristics for UWB antennas which are available in literature.
In this paper, some of these methods are considered.

This paper is organized as follows. In Section 2 the various methods for achieving band notch characteristics are reviewed and the in table 1 shows the comparison between the bands notched UWB antennas, section 3 present our conclusion.

2. METHODS FOR ACHIEVING BAND NOTCH CHARACTERISTICS

To reduce the effect of interference from narrow band services like WLAN and WiMAX, UWB antennas with band notch characteristics are good solution
In reference [3] inserting a U-shaped slot in the half elliptical ring radiating patch a notch band 5.12 GHz to 5.99 GHz was realised. in reference [4]The band-notch functions are realized by Loading two approximate half-wavelength U-shaped slots which change the current distribution on the Y-shaped patch. In reference [5], For a micro strip fed annular ring UWB a antenna, band notch property for WLAN and DSRC (dedicated short range communication) can be achieved by etching a partial annular slot in the antenna radiator.
In reference [6] a CPW fed UWB by etching two nested C-shaped slots in the patch, band-notching in the WiMAX/WLAN bands are achieved. It is seen that by adjusting the total length of the C-shaped slot to be approximately half-wavelength of the desired notched frequency, a destructive interference can take place, causing the antenna to nonresponsive at that frequency. Therefore it is easy to tune the notch centre frequency by changing total length of C-shaped slot.
In reference [7] a compact UWB monopole antenna with two meandered slots on a semi-elliptical radiator. This produces notch at 3.5 GHz and at 5.25 GHz.
In this reference [8] Hilbert-curve slots are etched on the radiating patch is to have band-notched properties in the

WiMAX/WLAN bands. The notched bands are from 3.3 to 3.7 GHz and from 5.4 to 6 GHz .The Hilbert-curve slots works as the LC resonator whose resonance frequency depends on its geometrical size.

In reference [9] the antenna consists of etching three CSRRs a large portion of electromagnetic energy of the antenna at 2.37-2.9, 3.27-3.76, 5.2-5.89, and 8.06-8.8 GHz bands has been stored in each CSRR as a non-radiating energy so that the radiation efficiency was dropped over the rejection bands. The mutual coupling among the band rejection elements is minimized.

In this paper [10] a CPW fed UWB planar monopole band-notched characteristics are obtained by embedding split ring resonator (SRR) array at the slot region between antenna and ground plane. The presence of SRR array acts as cascaded parallel LC circuit. This gives high input impedance to the incoming signal corresponding to its resonance frequency thereby causing reflection. This reflection of signal in the unwanted region creates the band notch to reject the IEEE 802.11 and HIPERLAN/2A frequencies.

In reference[11]band-notched characteristics are obtained by placing Microstrip feed line between two pairs of EBG cells which acts as stop-band filters with good rejection at two frequency bands of WiMAX from3.375 GHz to 3.875 GHz LAN from 5.325 GHz to 6.150 GHz. It is also seen that the radiation efficiency of the antenna with EBGs was slightly decreased because of the effect of the EBG structure.

In reference [12],a tuning line resonator is used in the CWP fed of antenna to act as a band-stop filter, hence enabling the rejection of any undesired band within the pass band of the antenna. The tuning stub is folded over the transmission line. Therefore the electro-magnetic field will be coupled and the effective length of the stub would be slightly more than its actual size the use of the resonator in the feeder of the antenna efficiently rejects undesired sub-band of 4.9-5.9 GHz.

In reference [13] the proposed antenna is fed by microstrip line, and it consists of square radiating patch on the top layer with a slotted-parasitic patch on the bottom layer of the antenna. The parasitic patch acts as a notch filtering element to reject the desired frequency band 5.15 - 5.825 GHz. In [14] a CPW fed UWB antenna which is terminated to a fractal patch. It has a simple structure with only one layer of dielectric substrate and metallization. It has notched band from 4.65 to 6.08 GHz. The table-1 gives the comparison of band notch antennas.

Table -1: Comparison between band notch antennas

Sr no	Antenna type	Notched band	Technique used	Reference paper
1	UWB monopole antenna	5.12 GHz to 5.99 GHz	U-shaped slot inserted in the radiation patch	[3]
2	Microstrip fed UWB Antenna	WLAN and WiMAX	loading two approximate half wavelength U-shaped slots	[4]
3	UWB micro strip fed antenna	WLA N DSRC	A partial annular slot at the lower portion of the ring radiator	[5]
4	CPW-fed planar UWB antenna	3.3–3.8 GHz 5–6 GHz	Etching of two nested C-shaped slots in the radiating patch.	[6]
5	compact UWB monopole antenna	3.3–3.7 GHz and 5.12–5.37 GHz	Two meandered slots	[7]
6	CPW fed UWB antenna	3.3–3.7 GHz and 5.4-6 GHz	Hilbert-curve shaped slot	[8]
7	CPW fed UWB antenna	2.37-2.9 GHz, 3.27-3.76 GHz 5.2-5.89 GHz 8.06-8.8 GHz	three co-directional CSRRs	[9]
8	CPW fed monopole UWB antenna	WLAN HIPERLAN/2A	Split ring resonator	[10]
9	Microstrip fed UWB Antenna	3.375 – 3.875 GHz and 5.325 – 6.150 GHz	two pairs of EBG cells are placed along the Microstrip feed line	[11]
10	CPW fed UWB antenna	4.9 - 5.9 GHz	tuning stub	[12]
11	Microstrip fed UWB Antenna	5.15-5.825 GHz	Parasitic Element	[13]
12	CWP fed UWB Antenna	4.65 to 6.08 GHz	fractal patch	[14]

3. CONCLUSIONS

In this study different band-notched characteristics for compact UWB antennas have been presented. Most of these designs focus on the rejection of narrow frequency bands like WLAN, WiMAX, DSRC and HIPELAN/2A that may cause serious interference with the UWB system. The band-notched characteristics using the shaped slot, meandered slots, split ring resonators,, EBG, tuning stub parasitic element, and fractal geometry and other methods of antenna designs are used to achieve band notch characteristics without compromising with the antenna performance.

REFERENCES

[1] Federal Communications Commission, *"Revision of part 15 of the commission's rules regarding ultra-wideband transmission system from 3. 1 to 10. 6 GHz,"* in Federal Communications Commission, pp. 98–153, ET-Docket, Washington, DC, USA,2002.

[2] Mohammad Jahanbakht1, Abbas Ali Lotfi Neyestanak *"A Survey on Recent Approaches in the Design of Band Notching UWB Antennas"* Journal of Electromagnetic Analysis and Applications, 2012, 4, 77-84

[3] 7 X. Kang, H. Zhang, Z. Li et al "*A band-notched UWB printed half elliptical ring monopole antenna*," Progress in Electromagnetic Research , vol. 35, pp. 23–33, 2013.

[4] S. M. Zhang, F. S. Zhang, W. Z. Li, T. Quan, and H. Y.Wu, *"A compact UWB monopole antenna with WiMAX and WLAN band rejections,"* Progress in Electromagnetics Research Letters,vol. 31, pp. 159–168,2012.

[5] R. Azim and M. T. Islam, *"Compact Planar UWB Antenna With Band Notch Characteristics for WLAN And DSRC* ",Progress In Electromagnetics Research, Vol. 133, 391-406, 2013

[6] Qing-Xin Chu, Member, IEEE, and Ying-Ying Yang "*A Compact Ultra wideband Antenna With 3.4/5.5GHz Dual Band-Notched Characteristics"*IEEE Transactions on Antennas and Propagation, VOL. 56, NO. 12, December 2008,pp 3637-3644.

[7] L. Xie, G. Zhao, Y.-C. Jiao, And F.-S. Zhang *"Ultra-Wideband Antenna Using Meandered Slots For Dual Band-Notched Characteristics"* Progress In Electromagnetics Research Letters, Vol. 16, 171-180, 2010.

[8] D. O. Kim and C. Y. Kim "*Planar UWB Antenna with WLAN/WiMAX Dual Band-notched Characteristics Using the Hilbert-curve Slots"* PIERS Proceedings, Kuala Lumpur, MALAYSIA, March 27-30,pp 1494-1497 2012

[9] D.-O. Kim, N.-I. Jo, H.-A. Jang and C.-Y. Kim, *"Design of the ultra wide band antenna with a quadruple-band rejection characteristics using a combination of the complementary split ring resonators,"* Progress in Electromagnetics Research, vol. 112,pp. 93–107, 2011

[10] Rowdra Ghatak, R Debnath, D R Poddar, R K Mishra and S R Bhadra Chaudhuri, *"A CPW Fed Planar Monopole Band Notched UWB Antenna with Embedded Split Ring Resonators*", 2009 Loughborough Antennas & Propagation Conference.

[11] Son Trinh-Van, Chien Dao-Ngoc, *"Dual Band-Notched UWB Antenna based on Electromagnetic Band Gap Structures "* , REV Journal on Electronics and Communications, Vol. 1, No. 2, April – June, 2011

[12] A. M. Abbosh, *"Design of a CPW-Fed Band-Notched UWB Antenna Using a Feeder-Embedded Slot Line Resonator,"* International Journal of Antennas and Pro pagation, Vol. 2008, 2008, Article ID: 564317

[13] N. H. M. Sobli and H. E. Abd-El-Raouf, *"Design of a Compact Printed Band-Notched Antenna for Ultra Wide-band Communications," Progress in Electromagnetic Research M*, Vol. 3, 2008, pp. 57-78

[14] A. A. Lotfi Neyestanak, M. R. Azadi Naeini, M. Naser-Moghadasi and Gh. Dadashzadeh, *"Band Notched CPW Fed Hexagonal Fractal Antenna,"* Journal of Electro-magnetic Waves and Applications, Vol. 23, No. 17, 2009, pp. 2461- 2470