

# UWB Antennas with Band Notch Characteristics - A Study

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**Abstract – This study considers the different UWB antenna designs with band notch characteristics. Different antennas designs to reject interference from WLAN, WiMAX, DSRC, and HIPERLAN/2A are considered and listed in table.**

**Index Terms – UWB, WLAN, WiMAX, HIPERLAN/2A.**

## 1. INTRODUCTION

Ultra wide band systems are very suitable for short range high speed indoor data communication applications [1]. There was 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 technology has several advantages like low cost, simple RF circuitry, high data rates and low average radiated power [2][3]. 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 [4]. UWB applications can coexist with other narrowband communication standards that occupy the same spectrum due to the limitation of power level. But this will result in severe interference between the UWB systems and narrow band services 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 [5]. Many methods to achieve band notch characteristics for UWB antennas are available in literature. In this study, some of these methods are considered..

The remainder of this paper is organized as follows. In section 2, the various methods for achieving band notch characteristics are reviewed and grouped them. Section 6 presents our conclusions.

## 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. For a micro strip fed annular ring UWB 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 [5]. By varying the width and position of the annular slot we can control the band width and Centre frequency of the notched band. This antenna also has good UWB performance. A planar UWB patch antenna with band notch characteristics and integrated band pass filter can avoid interference from WLAN and WiMAX [6]. The antenna operates in the frequency range 3.098-10.615 GHz. Band notch characteristics are achieved using a square slot with a coupling strip. Two band notches can be introduced in a planar monopole UWB antenna using two different types of slots [7]. A half wavelength slot in the radiator is used to reject the WiMAX band and two symmetrical open ended quarter wavelength slots in the ground plane are used to reject the WLAN frequency band.

5 GHz WLAN band notch characteristics for a coplanar waveguide fed planar monopole staircase shaped antenna can be achieved by etching a U-shaped slot in the feed line of the antenna [8]. This antenna can effectively avoid interference from lower (5.15-5.35 GHz) and upper (5.725-5.825 GHz) WLAN bands and uses cost effective substrate FR4. An ultra-wide band attached with two parasitic patches to the bottom layer can reject the frequency band 5.15-5.825 GHz [9]. This micro strip line fed antenna satisfies all the UWB bands and has planar structure with omnidirectional pattern. A planar printed monopole UWB antenna with PI shaped notch can reject the 5 GHz WLAN in the range 5.42-5.74 GHz [10]. Bevel shaped symmetrical slots are used in the lower and upper parts of the radiating element of the antenna. This antenna has an impedance bandwidth ranging from 3.52 GHz to 11.06 GHz and has gain of 2.5 dBi.

Sl No	Antenna Type	Notched Bands	Technique Used	Reference Paper
1	Compact UWB micro strip fed annular ring antenna	WLAN DSRC	A partial annular slot at the lower portion of the ring radiator	[5]

2	Planar UWB patch antenna	WLAN WiMAX	Square slot and coupling strip	[6]
3	Planar monopole UWB antenna	WLAN	2 symmetrical open ended quarter wavelength slots in ground plane	[7]
		WiMAX	Half wave length slot in the radiator	
4	CPW fed symmetrical staircase shaped planar monopole UWB antenna	5GHz WLAN	U-shaped slot resonator in the feed line	[8]
5	Micro strip line fed planar monopole UWB antenna	5.15-5.825 GHz	Attaching 2 parasitic patches to the bottom layer of the antenna	[9]
6	Micro strip fed planar UWB antenna	5.5 GHz WLAN	2 T-shaped stubs inside an ellipse slot cut in the radiation pattern	[11]
7	Micro strip fed UWB planar monopole antenna	5.1-5.9 GHz	Modified H-shaped conductor backed plane	[12]
8	Planar monopole UWB antenna	5 GHz WLAN	Using a resonator at the centre of fork shaped antenna	[13]
9	CPW fed planar monopole UWB antenna	WLAN HIPERLAN/2A	Split ring resonator	[14]

10	UWB planar printed compact monopole antenna	5 GHz WLAN	Symmetrical slots and PI notched with parasitic	[10]
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Table 1: Comparison between band notch antennas

Another band notching method available in literature is a micro strip fed planar monopole UWB antenna with T-shaped stubs inside an ellipse slot cut in the radiating patch [11]. The impedance matching and radiation characteristics are improved by the addition of two semi-circle slots cut on the bottom edge of ground plane. The antenna has compact size, omnidirectional pattern, and a notch around the 5.5 GHz WLAN band. Also a micro strip fed planar monopole UWB antenna with variable frequency band notch function can be achieved using a H-shaped conductor backed plane [12]. Shapes of patch or feed line are not changed to get the band notch characteristics in the range 5.1-5.9 GHz.

For a planar monopole UWB antenna a notched band around 5GHz WLAN can be obtained using an open looped resonator and two tapped lines [13]. The antenna has a fork shape, fast roll-off rates of return loss, good gain suppression ability and small varied group delay. This antenna has appreciable band notch performance and band stop filter like response in the target band with the open looped resonator. Split ring resonators (SRR) are another solution for obtaining band notch characteristics for coplanar waveguide (CPW) fed planar monopole UWB antennas [14]. The split ring resonator is placed at the slot region between antenna and ground plane of monopole to reject WLAN and HIPERLAN/2A..

The table 1 shows the comparison between the bands notched UWB antennas.

### 3. CONCLUSION

Band notching methods for UWB antennas are considered in this study. Most of the antennas considered here are planar monopole UWB antennas. Most of these designs aim at the rejection of narrow frequency bands like WLAN, WiMAX, DSRC and HIPELAN/2A that may cause serious interference with the UWB system. Using the method of slots, split ring resonators, and the other methods these antenna designs achieve band notch characteristics without compromising the antenna performance.

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