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OVERVIEW OF BAND NOTCHING METHODS USED IN UWB ANTENNA

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ABSTRACT:

The Federal communication commission (FCC) allocates the 3.1 - 10.6 GHz band the ultra-wideband (UWB) applications. But due to some already existing systems such as WiMAX (IEEE802.16:3.3-3.7GHz), C-band satellite communication (3.7-4.2GHz), WLAN (IEEE802.11a: 5.15-5.825GHz), X-band satellite communication (7.25-7.75GHz), ITU (International Telecommunication Union: 8.025-8.4 GHz) band causes electromagnetic interference with UWB. So to remove such a interference between UWB and other narrow bands different notching techniques used such as tuning stub, shaped slot, parasitic element, and the fractal geometry. In this paper a comparison will be done between these techniques.

KEYWORDS: UWB, slot antenna, band notching characteristics.

INTRODUCTION:

Regarding to the allocation and permits of the 3.1 GHz to 10.6 GHz unlicensed frequency band with 7.5 GHz wide bandwidth by the FCC, for the commercial use as a UWB[1].This UWB system holds the attention of all researchers day by day increases due to its advantages such as small size, light in weight, low cost, and high radiation efficiency. Small planar monopole antenna with different geometries is suitable to fulfill all advantages of UWB antenna.

METHODS FOR ACHIEVING BAND NOTCH CHARACTERISTICS:

In reference [2], to create an extra band outside the UWB frequency range, centered at the 2.4-GHz Bluetooth band, a quarter-wavelength stub is attached to the high concentrated current area in the ground plane. Two notch bands, centered at 3.5-GHz WiMAX and 5.8-GHz WLAN, are also created by placing two stubs similar to that of the extra band.

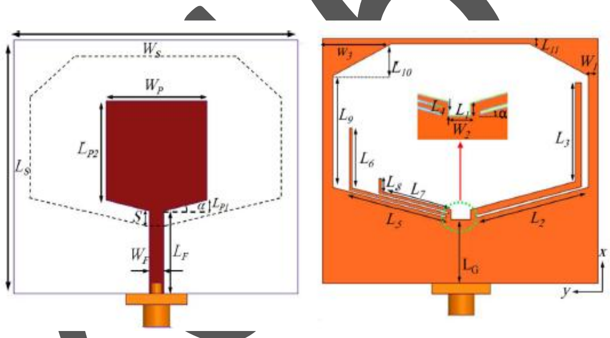

Fig.1: Geometry of the antenna. (a) Top view (b) Bottom view.[2]

In reference [3], single band-notch function is provided by cutting a pair of L-shaped slits in the corners of a square radiating patch, and dual band notch characteristic is obtained by cutting an E-shaped slot in the radiating patch

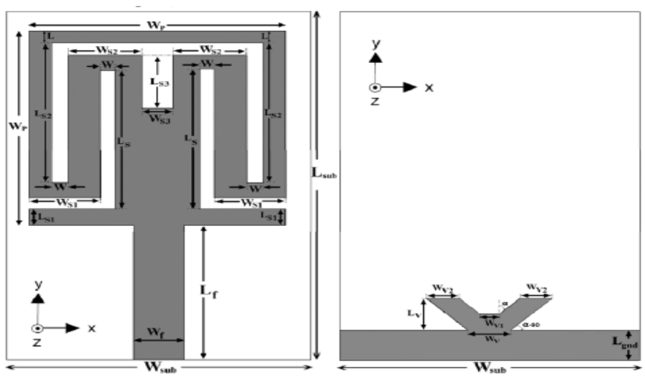

Fig. 2. Geometry of the dual band notched antenna. (a) Top view. (b) Bottom view. [3]

In reference [4], to achieve dual notched bands characteristics, a T-shaped stub embedded in the square slot of the radiation patch and a pair of U-shaped parasitic strips beside the feed line is used.

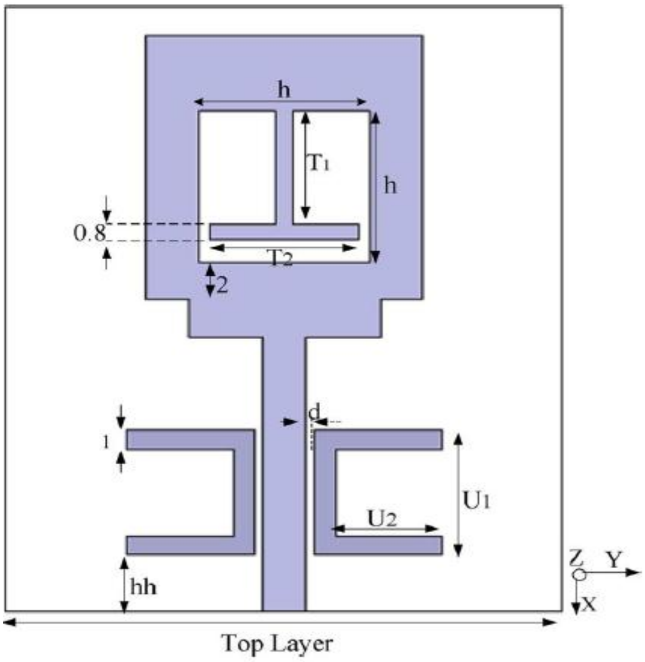

Fig. 3. Geometry of the dual band notched antenna. [4]

In reference [5], the antenna uses three open-ended quarter-wavelength slots to create tripleband-notched characteristics in 3.3–3.7 GHz for WiMAX,5.15–5.825 GHz for WLAN, and 7.25–7.75 GHz for downlinkof X-band satellite communication systems, respectively.

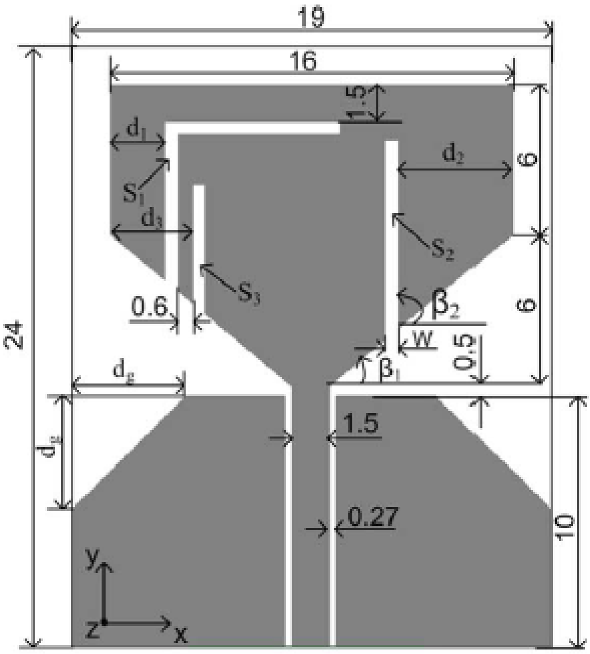

Fig. 4: Geometry of the antenna..[5]

In reference [6], by employing a pair of C-shaped stubs on the back surface ofthe substrate, dual band-notch function can be obtained through5.1–6.2-GHz (WLAN) and 3–3.8-GHz (WiMAX) bands.

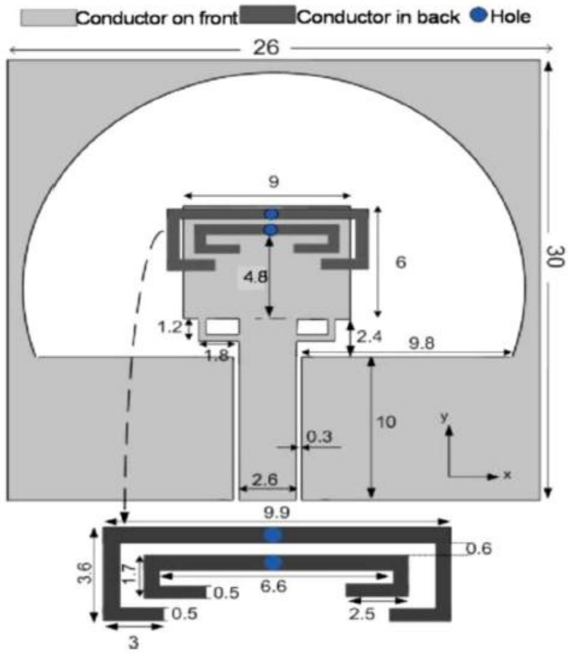

Fig. 5. Geometry of the antenna. [6]

In reference [7], to generate single band-notchedcharacteristics, we use an inverted T-shaped slot, surrounded bya C-shaped slot, in the radiating patch. By adding an invertedT-shaped parasitic structure inside the inverted T-shaped slot onthe radiating patch, a dual band-notched function is achieved,and also by inserting this parasitic structure, additional resonanceis excited, and hence much wider impedance bandwidth can beproduced, especially at the higher band.

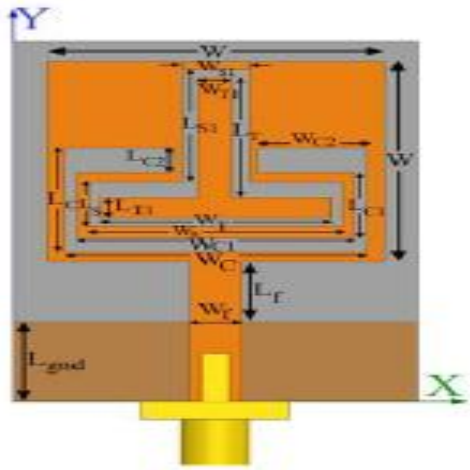

Fig. 6: Geometry of the antenna..[7]

In reference [8], a 1/3 λ rectangular metal strip producing a 1.0 λ loop path with the corresponding antenna element is used to obtain the notched frequency from 5.15 to 5.85 GHz.For the rejected band of 3.30–3.70 GHz, a 1/4λ open slot is etched in to the radiator.

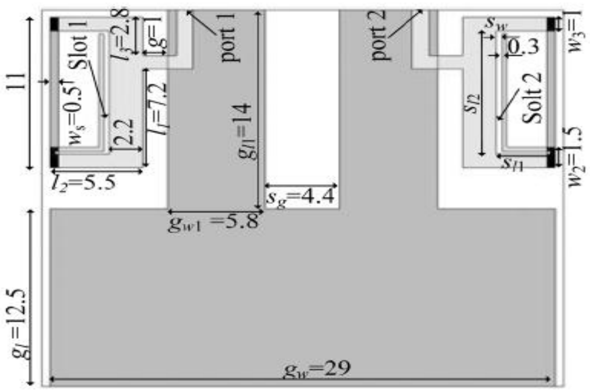

Fig. 7: Geometry of the antenna..[8]

In reference [9] the proposed antenna is fed by micro strip 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 [10] 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.

In reference [11], a simple and compact coplanar waveguide (CPW)- fed ultra wideband is presented. The proposed antenna consists of a circular patch with triangular slot, which is etched onto FR4 printed circuit board (PCB).

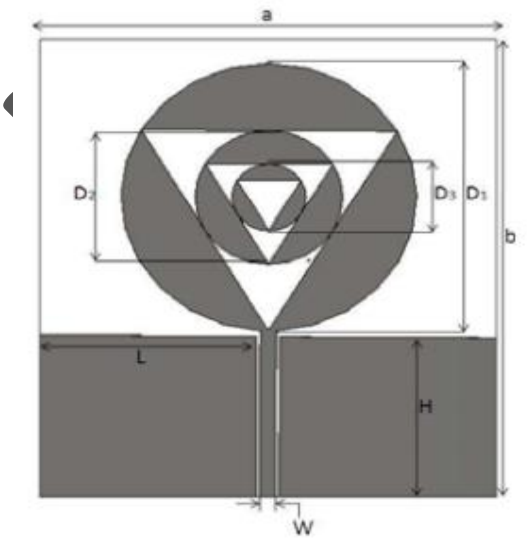

Fig. 8: Geometry of the antenna.[11]

Antenna Type	Notched Band	Techniques Used	Ref. Paper
Slot antenna	WiMAX (3.5GHz), WLAN (5.8GHz)	Two stubs in the ground plane	[2]
Monopole antenna	WiMAX (3.47–4.33), WLAN (5.11–5.94GHz)	By adding L and E shaped slots in patch	[3]
Novel antenna	WiMAX (3.3-4.0GHz), WLAN (5.05–5.90GHz)	T-shaped stub embedded in the square slot of the radiation patch and a pair of U-shaped parasitic strips beside the feed line	[4]
Monopole antenna	WiMAX (3.3–3.7GHz), WLAN(5.15–5.825GHz) X-band satellite communication systems (7.25–7.75GHZ)	three open-ended quarter-wavelength slots	[5]
Novel Antenna	WLAN(5.1–6.2 GHz), WiMAX(3–3.8GHz) and	inserting a pair of nested C-shaped stubs on the back surface of the substrate	[6]
Printed monopoe antenna	WiMAX(3.5/5.5 GHz), WLAN (5.2/5.8 GHz) and C-band (4-GHz)	Inverted T-shaped parasitic structure inside the inverted T-shaped slot on the radiating patch	[7]
MIMO antenna	WiMAX (3.30–3.70GHz) WLAN (5.15 to 5.825 GHz)	metal strip and open slot are etched into the radiator	[8]
Microstrip fed UWB Antenna	WLAN (5.15- 5.825 GHz)	Parasitic Element	[9]
CWP fed UWB Antenna	WLAN (4.65- 6.08 GHz)	fractal patch	[10]
Fractal Antenna	WiMAX(3.3-3.6GHz) WLAN (5–6 GHz)	fractal patch	[11]

CONCLUSION:

The UWB system covers the wide frequency band from 3.1GHz to 10.6GHz.There are some narrow band communication systems such as WiMAX, WLAN, X-band Satellite Communication etc. generated electromagnetic interference with UWB system. So it is very essential to notched these bands. In this study different band-notched characteristics for compact UWB antennas have been presented. 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.

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