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A REVIEW PAPER ON BAND-NOTCH CHARACTERISTICS IN ULTRA WIDE BAND (UWB) ANTENNAS

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Abstract

Over the last decade, ultra-wideband technology has undergone rapid growth because of its contribution to various sectors of human society. Due to its attractive features such as light weight, low cost, ease of manufacturing, integration capability with other systems, etc., printed antennas are considered the chosen platform to incorporate this technology. To avoid interference with other existing radio communication systems, antennas designed for ultra-wideband applications are needed to have notch characteristics. To boost the efficiency of the antenna, the techniques related to the design and inventions of printed band-notched antennas are continually updated. A detailed analysis of ultra-wideband antennas with band notch characteristics proposed in the last decade or so has been carried out in this paper. Based on their notch characteristics, the band notched UWB antennas available in the literature have been narrowly categorized into five different groups, such as single band-notch, dual band-notch, triple band-notch, quad/multiple band-notch, and reconfigurable/tunable band-notch. This review exercise may be useful for beginners working on ultra-wideband band-notched antennas, and the best information of the author is also not available in the open literature for such a review process.

Keywords: *Antenna, Communication, UWB antenna, Wireless Technology, Microwaves, High frequency.*

I. INTRODUCTION

In the last few decades, advancement in wireless technology has altered our lives. Technological advances have helped us to create new mobile communication services, such as voice, audio, video, and data services. In addition, it has also helped us to achieve a higher data rate between portable devices and short-range computers. By can the transmitting capacity or using broad bandwidth, this high-speed data rate can be increased. Many portable devices operating with wireless technology, however, are battery-powered, so the solution for achieving high data rate would be a broad frequency bandwidth.

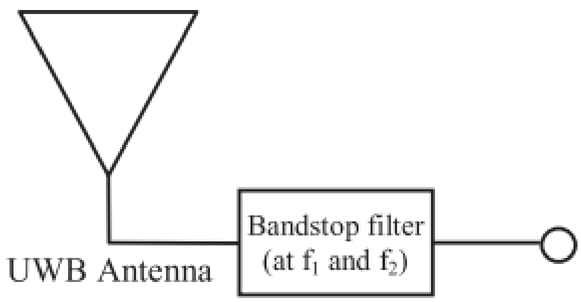

Fig. 1: Illustrates the Notched UWB aerial system by utilizing the band stop filter

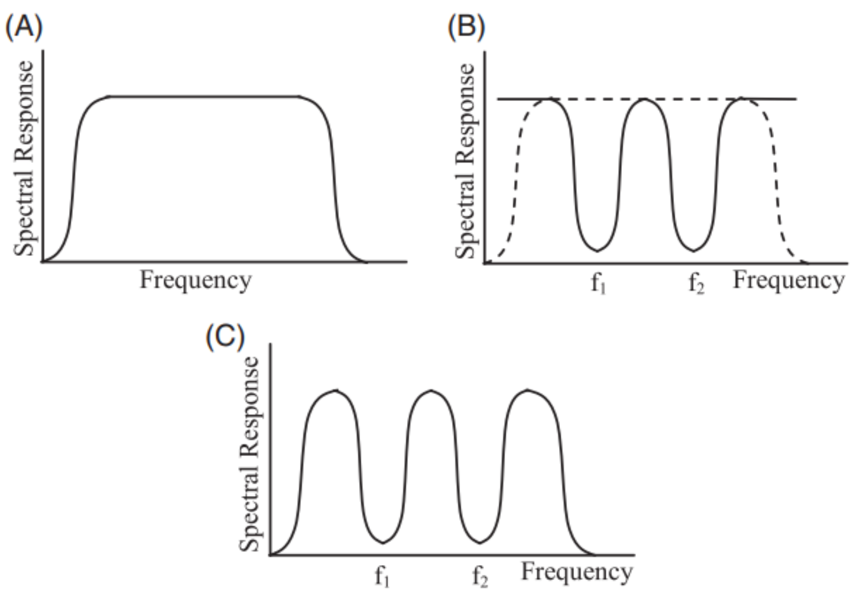

Fig. 2: Illustrates the expansion of frequency notch method by utilizing band stop filters for spectral response: (A) UWB aerial (B) Band-stop filter (C) Notched UWB [1]

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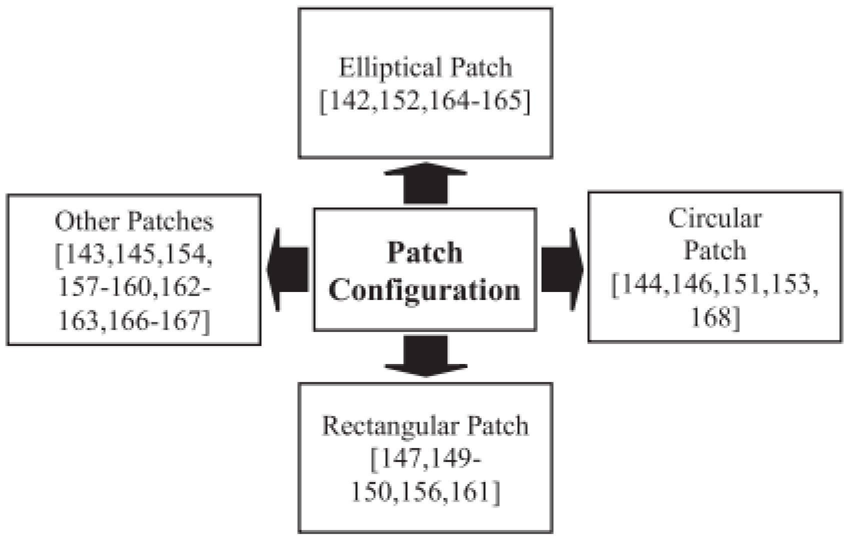

Fig. 3: Illustrates the patch geometry for three-way notch aerials [2]

The width W of the microstrip patch antenna is calculated by using the following equation [3].

$$w = \frac{c}{2\, f_r \sqrt{\frac{(\varepsilon_r + 1)}{2}}}$$

Where,

f_r denotes the resonant frequency, and

r represents substrate dielectric constant

The effective dielectric constant (ε_{reff}) of antenna is derived by applying the given equations [4].

$$\varepsilon_{reff} = \frac{(\varepsilon_r + 1)}{2} + \frac{(\varepsilon_r - 1)}{2} \sqrt{\left(1 + 12\frac{h}{W}\right)}$$

Where h denotes the height of the antenna and W denotes the width.

The length of the antenna may be measured by applying the following equation[5].

$$L = \frac{c}{2\, f_r \sqrt{\varepsilon_{reff}}}$$

The antenna length extension is calculated by applying the equation below[6].

$$\Delta L = 0.412\, h\, \frac{\left(\varepsilon_{reff} + 0.3\right)\left(\frac{W}{h} + 0.246\right)}{\left(\varepsilon_{reff} - 0.258\right)\left(\frac{W}{h} + 0.8\right)}$$

Here W represents the width and h denotes the height.

The real length (L_{eff}) of the antenna can be calculated by using the following formula [7].

$$L_{eff} = L + 2\Delta L$$

II. LITERATURE REVIEW

A survey was conducted by Ma et al. on the microstrip patch antenna. In this article, an overview of the microstrip patch antenna and its design techniques is given. A microstrip patch antenna essentially consists of a trace on one side of a standard printed circuit board substratum of some geometry of copper or some other metal with another side grounding. The antenna is fed using various methods of feeding, such as coaxial, strip line, aperture coupling or proximity coupling techniques. It has also established the working theory and the mechanism of radiation. The microstrip patch antenna is widely used in the military, manufacturing and commercial industries [8].

III. DISCUSSION AND CONCLUSION

The efficiency of various notch antennas designed for use in UWB systems and their ability to avoid interference from existing narrowband communication systems were discussed in this survey paper. In this post, almost all of the main techniques used to acquire notch behavior are outlined and comprehensively discussed. In addition, it has been noted that in the literature, the notch antennas built to reject frequency bands such as X-band, C-band, ISM band, etc. are very smaller. Notch antennas with quadruple characteristics and reconfigurable capability are also fewer than single/dual/ and triple-notch antennas in literature. Researchers may further carry out work in this aspect. For researchers working on notch antennas, the authors hope that this analysis will be beneficial. While the authors have tried at their best to include in this review article the important and fresh contribution of the researchers, the authors also apologies to the research community if any significant contribution is unknowingly and inadvertently missed.

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