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Triple notched coplanar waveguide-fed novel ultrawide band antenna with time domain analysis

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ABSTRACT

This research proposition introduces a novel microstrip antenna design that features triple notches for ultra-wideband (UWB) applications. The antenna, measuring 35.4 mm × 28.82 mm × 1.57 mm, incorporates rectangular and semi-circular slots, as well as a pentagonal stub. A modified U-shaped slot on the pentagonal stub creates one notched frequency band at 3.3–3.7 GHz. Additionally, two Split Ring Resonators (SRRs) are integrated into the antenna's rear surface, resulting in two more notched bands at 5.1–5.8 GHz and 7.1–7.8 GHz. Operating within a frequency range from 3 to 11.2 GHz with VSWR $\leq$ 2, the antenna effectively excludes the triple stop bands at 3.3–3.7 GHz (11.4%), 5.1–5.8 GHz (12.8%) and 7.1–7.8 GHz (9.4%). The proposed antenna has been successfully prototyped and verified. An extensive result analysis has been conducted, confirming that the developed antenna is suitable for application in a range of wireless systems. Moreover, the article includes the implementation of an equivalent circuit for the proposed antenna.

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1. Introduction

The increasing demand for compact systems integrating diverse communication protocols necessitates the development of ultra-wideband microstrip antennas with notched features. These antennas serve as crucial microwave components capable of operating at multiple frequencies. Ultra-wideband (UWB) technology has gained significant attention in research due to allocating the ultrawide-band frequency range to the Federal Communication Commission for communication applications [1], including military radar systems [2,3], medical imaging [3,4] and consumer electronics [3,4].

Various shapes [2,5–7], such as squares, circles, crescents, sectorals, and ellipses, along with their modified versions, are commonly utilized as radiation patch structures for UWB planar antennas. These structures can be seamlessly integrated with lightweight and compact microwave circuits. However, within the FCC-designated UWB range, numerous

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