

A DUAL STOPBAND FREQUENCY SELECTIVE SURFACE FOR ELECTROMAGNETIC SHIELDING IN DENSE IOT AND EDGE COMPUTING ENVIRONMENTS

Pratik Dey¹, Kousik Roy^{2*}, Kamlesh Kumar Chaurasia¹, Pankaj Kumar Mandal¹, Sandeep Kumar Mahto¹, Vishal Kumar¹, Keshab Goswami¹ and Subrata Kumar Majumdar³

¹K.K. Group of Institutions, Dhanbad-828109 (Jharkhand), India

²Department of Computer Science and Engineering, Bengal College of Engineering and Technology, Durgapur-713212, West Bengal

³Department of Mechanical Engineering, Sanaka Educational Trust, Durgapur-713212, West Bengal

*Corresponding Author Email ID: kousikroy002@gmail.com

ABSTRACT

This paper presents a dual stopband frequency selective surface for electromagnetic shielding in dense IoT and edge computing environments. The structure is developed on an FR4 sheet of height 1.6 millimetres with a unit cell of 16 millimetres by 16 millimetres. The surface generates two stopbands from 7.72 to 11.10 gigahertz and from 14.52 to 15.84 gigahertz which cover essential parts of the C band the X band and the lower Ku band. The reflection phase shows a smooth linear profile while the shielding effectiveness reaches 85 decibel in the lower band and 55 decibel in the upper band. The transmission response remains symmetric for transverse electric and transverse magnetic fields. The current distribution at 9.84 gigahertz confirms the formation of the resonant path. The compact structure simple geometry and stable behaviour make it suitable for IoT gateways edge processors and high density wireless platforms.

Keywords: *Frequency selective surface, Dual stopband, Electromagnetic shielding, IoT environment, Edge computing*

1. INTRODUCTION

The rapid proliferation of Internet of Things (IoT) and edge computing devices has led to increasingly dense electromagnetic (EM) environments, raising significant concerns about electromagnetic interference (EMI) and the need for effective shielding solutions [1]. Conventional approaches for shielding like hand made enclosures and absorbing materials generally are selective and can block the transmission of the desired signals thus making them unsuitable for modern multi frequency wireless systems [2]. FSSs have come out as a viable substitute which is capable of serving such needs in terms of EM filtering offering periodic metallic structures that are designed to particular characteristics of stopband and passband [3]. The field of FSS design has not only given attention to the dual stopband responses recently but also to the miniaturization, angular stability and polarization insensitivity which are necessary to fulfill the requirements of the next generation wireless environments [4]. Dual stopband FSSs are of great help for EMI alleviation in communication systems operating at different frequency bands since they can suppress the interference from two distinct frequency ranges at the same time and thus not affect the system performance [5]. Chatterjee et al. [6] presented a novel wideband monolayer FSS that guarantees very good out-of-band suppression with a wide range of angular performance thus allowing for efficient EM shielding. Roy et al. [7] proposed a straightforward and efficient FSS design that is characterized by the reliable resonance behaviour for compact IoT and communication platforms. In addition the conformal and optically transparent FSSs have opened many more possibilities for their use in IoT and edge computing, where the issues of device integration, unobtrusiveness and wideband operation are very important [8]. The production of tunable and active FSSs that use varactor diodes has granted the independent and