

WIDEBAND FREQUENCY SELECTIVE SURFACE FOR ELECTROMAGNETIC SHIELDING IN ADVANCED COMPUTING SYSTEMS FROM 9.04 TO 13.84 GHz

Kousik Roy^{1*}, Pratik Dey², Kamlesh Kumar Chaurasia², Vishal Kumar², Sandeep Kumar Mahto²,
Pankaj Kumar Mandal², Deblina Roy¹ and Subrata Kumar Majumdar³

¹Department of Computer Science and Engineering, Bengal College of Engineering and
Technology, Durgapur-713212, West Bengal

²K.K.Group of Institutions, Dhanbad-828109 (Jharkhand), India

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

*Corresponding Author Email ID: kousikroy002@gmail.com

ABSTRACT

The presented paper describes a wideband frequency-selective surface that can be used for electromagnetic shielding in computing systems operating in the range of 9.04 to 13.84 GHz. The surface is built on an FR4 substrate that is 1.6 mm thick and consists of a compact unit cell that measures 10 mm × 10 mm. The structure exhibits a clearly defined stopband and good transmission properties and a linear reflection phase that enables compatibility with computer enclosures. The shielding efficiency is as high as 85 dB which indicates a very good isolation in the X band and part of the Ku band. Moreover, the response is similar for both TE and TM fields. The surface current at 11.64 GHz provides evidence of the resonant path that results in the stopband. The design presents a simple and reliable approach to provide electromagnetic protection for computing platforms, radar assisted modules and embedded communication devices.

Keywords: Frequency selective surface, Electromagnetic shielding, Advanced computing systems, Wideband stopband, effectiveness

1. INTRODUCTION

The fast progress of wireless communication and high-speed electronic systems has caused an increase in the level of electromagnetic interference (EMI), which is a problem that can either lead to a decline in the performance of devices or, in the worst case, pose health hazards to humans [1]. Among the wide range of shielding methods available, the traditional ones such as conductive sheets and metal enclosures often block signals completely and add bulk, which makes them less appropriate for modern, compact computing environments [2]. Consequently, the use of Frequency Selective Surfaces (FSSs) has proven to be a good solution, because they offer selective shielding, miniaturized design, and stable frequency responses, which the advanced computing systems operating in crowded frequency bands require [3]. FSSs are composed of metallic elements arranged at regular intervals that can be designed to either permit or obstruct specified frequency ranges thereby providing targeted EMI suppression without the loss of system functionality [4]. Recent advancements in FSSs have led to the creation of designs with wideband shielding, polarization insensitivity, and angular stability making them very powerful for use in the X- and Ku-bands, which the 9.04 to 13.84 GHz range is part of [5]. Chatterjee et al. [6] have shown a single-layer FSS that gives widespread shielding with high out-of-band separation and stable response under angular change, thus revealing efficient attenuation through a wide frequency range. Roy et al. [7] introduced a straightforward and effective FSS setup that delivers dependable resonance and is practically apt for small IoT and communicative networks. The mentioned studies indicate the significance of compact FSS designs which preserve stable stopband behavior and strong isolation thus creating a very base for dual-band shielding