A COMPACT DUAL BAND FREQUENCY SELECTIVE SURFACE FOR ELECTROMAGNETIC ISOLATION IN MODERN SATELLITE AND HIGH DATA RATE COMMUNICATION BANDS

Kousik Roy[1*], Pratik Dey[2], Kamlesh Kumar Chaurasia[2], Sandeep Kumar Mahto[2] , Pankaj Kumar Mandal[2], Vishal Kumar[2], Shruti Pandey[1]and Subrata Kumar Majumdar[3]

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

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

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

*Corresponding Author Email ID: kousikroy002@gmail.com

ABSTRACT

This article depicts a miniaturized frequency-selective surface in dual band that is specified for electromagnetic isolation in modern satellite and high data rate communication bands. The design utilizes a 1.6 mm thick FR4 substrate and a 16 mm × 16 mm unit cell, respectively, and generates two stopbands from 6.75 to 10.50 GHz and from 14.32 to 15.61 GHz. The two aforementioned bands include parts of C, X and Ku bands. The surface has a very good attenuation with shielding effectiveness of 88 dB in the first band and 64 dB in the second band. The progression of reflection phase illustrates a uniform linear character and the transmission response is still stable for both TE and TM illumination. The surface current analysis at 8.9 GHz verifies the desired resonant behavior. The design is made simple and light in weight which also makes it suitable for satellite terminals, radar systems, and high-capacity communication platforms that need selective suppression of interference.

Keywords: *Compact dual band FSS, Satellite communication, High data rate communication, Dual band shielding, Ku band communication, Electromagnetic isolation*

1. INTRODUCTION

The constant changes in wireless communication technologies, such as satellites and highspeed data, have made it necessary to find effective electromagnetic (EM) isolation solutions in order to maintain reliable performance in the already overcrowded spectral areas [1]. Electromagnetic interference (EMI) that happens between the already very close frequency bands and the increasing number of wireless devices can cause the system's performance to degrade, thus resulting in system failures and health hazards [2]. Shading techniques like using conductive sheets and metal screens sometimes do not work well and they may be big, thus making their use in modern small systems more difficult [3]. Frequency selective surfaces (FSSs) have been recognized as an attractive option, providing selective filtering, reflection or absorption of EM waves and at the same time being compact, low cost, and easy to fabricate [4]. FSS designs that operate on two bands are most appropriate for satellite and high data rate communications since they provide the targeted isolation at more than one frequency band which supports multitasking systems thereby improving coverage [5]. The latest development has yielded simultaneous FSS structures that are highly angular stable, polarization insensitive, and consist of reduced cell sizes, thus becoming appropriate for the advanced wireless and satellite platforms integration [6]. Furthermore, the development of small-size, dual-band FSSs has resulted in a remarkable reduction in path loss, improvement in coverage, and suppression of mutual coupling in antenna arrays which are the main characteristics of high-speed satellite and 5G/6G communication systems [7]. These advancements contribute to the growing demand for effective EM isolation and thus the continued growth of modern communication networks [8]. Chatterjee et al. [9] introduced a monolayer FSS that offers wideband shielding with clear out-of-band