Design of X-band Absorbers for Simultaneous Attenuation of Impinging Waves at Grazing Angles

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Abstract—In this paper, classical resistive FSS absorbers are studied against the capability to simultaneously reduce the coupling level related to grazing angles impinging waves, travelling on their surface. The operative frequency band spans from 6 to 14 GHz (i.e., X-band). In order to evaluate the attenuation along the waves propagation direction, parallel to the absorber plane, the transmission coefficient (S21) of the transverse EM wave is evaluated by using the waveguide method through accurate full wave simulations. The transverse attenuation level can be used as a further metric, beside absorption, to adopt the most suited solution for coupling reduction in a given application.

Microwave absorbers, frequency-selective surfaces, electromagnetic interferences, coupling reduction, waveguide.

I. INTRODUCTION

The demand of microwave absorbers (MAs) is increasing as the fabrication of electromagnetic (EM) based devices, such as microwave integrated circuits (MICs), is raising as well. In these cases, analysis of surface wave attenuation in the transverse wave is also important for the interference problem [1].
In this work, we evaluate the behavior of two different resistive FSS absorbers against impinging waves at grazing angles. This capability can be combined, together with absorption, to develop the most suited solution to reduce electromagnetic coupling in a given application.

II. PRELIMINARY RESULTS

The transmission coefficient (S_{21}) of the transverse EM wave is analyzed in the first dominant mode of a parallel plate waveguide. The simulation of the waveguide is carried out in a full-wave environment with the dimension of (Width × Height × Length) 70mm × 17.5mm × 206mm. The boundary conditions are applied by giving PMC and PEC at the sidewalls and the top-bottom walls of the waveguide, respectively.
In Fig. 1(a), we reported the absorption level of the two resistive FSS absorbers; as evident, they present a similar absorbing behavior in the X-band. Beside, Fig. 1(b) shows also the attenuation retrieved with the waveguide method for grazing angles impinging waves. As evident, the patch FSS shape behaves better than the simple cross in this sense; therefore it presents more advantages, since it can combine absorption and attenuation for impinging waves at grazing angles.

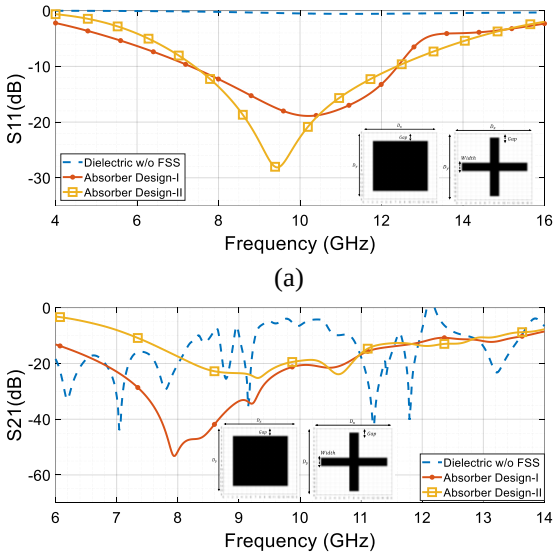

Figure 1. Reflection coefficient of Lossy dielectric without FSS, Absorber Design-I and II (a). Attenuation level for grazing angles incidence obtained through waveguide full-wave simulation, design I and II (b).

REFERENCES

[1] V. Mishra, F. Costa and A. Monorchio, "Surface Wave Attenuation in Multilayer Structures With Lossy Media and Impedance Surfaces," in IEEE Access, vol. 9, pp. 130627-130637, 2021.