

Simulation of Resonant Transmission Enhancement of Plasma Wire Grid

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Wire grid array are used in polarization selection of microwave waveguides, as well as optical lens. The insertion of wire grids usually introduces several dB of loss. We replace metal wires with plasma column, in a hope to be able to tune the transmission spectrum, and found the transmission in some frequency is enhanced rather than attenuated (fig.1). The transmission is amplified when attenuation is positive in figure 1, and attenuated when negative. From this figure, we can see the attenuation is very sensitive to the distance between the plasma wire grid and the receiving antenna.

The amplification and attenuation can not be simply explained by the characteristic plasma frequency of the plasma. We believe it is related to the interference between plasma column, and at some frequency the incoming electromagnetic wave is able to extract energy from the plasma and is amplified. The main peak at ~12 GHz may be the resonance of plasma characteristic frequency, and the rest is more difficult to explain. We will try to compare it with a HFSS simulation result.

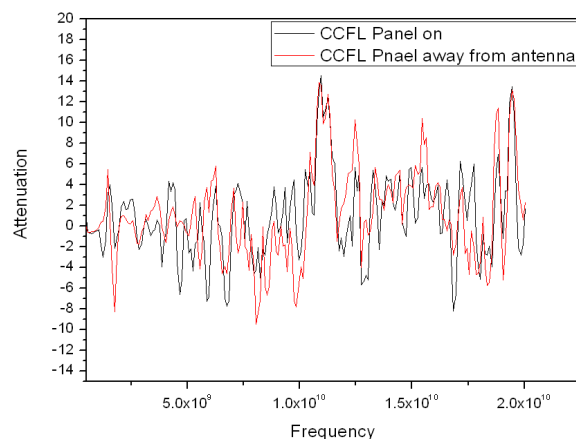


Fig. 1: Attenuation of a plasma wire grid composed of 24 CCFL light tubes separated at 5 mm spacing. The measurement was performed in an anechoic chamber with two wide band double ridge antenna as transmitting and receiving antenna. The plasma wire grid is placed directly in front of the receiving antenna, which is about 3 m away from the transmitting antenna.

Reference

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