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Radar cross section analysis for meander line frequency selective surfaces

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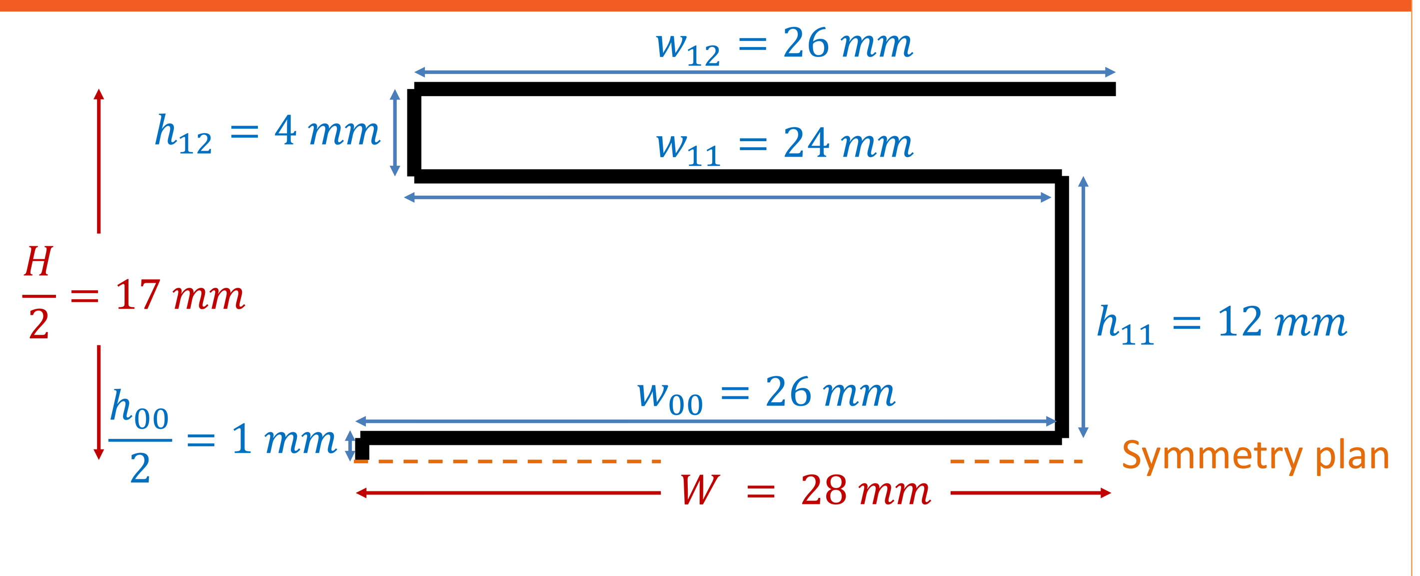
INTRODUCTION

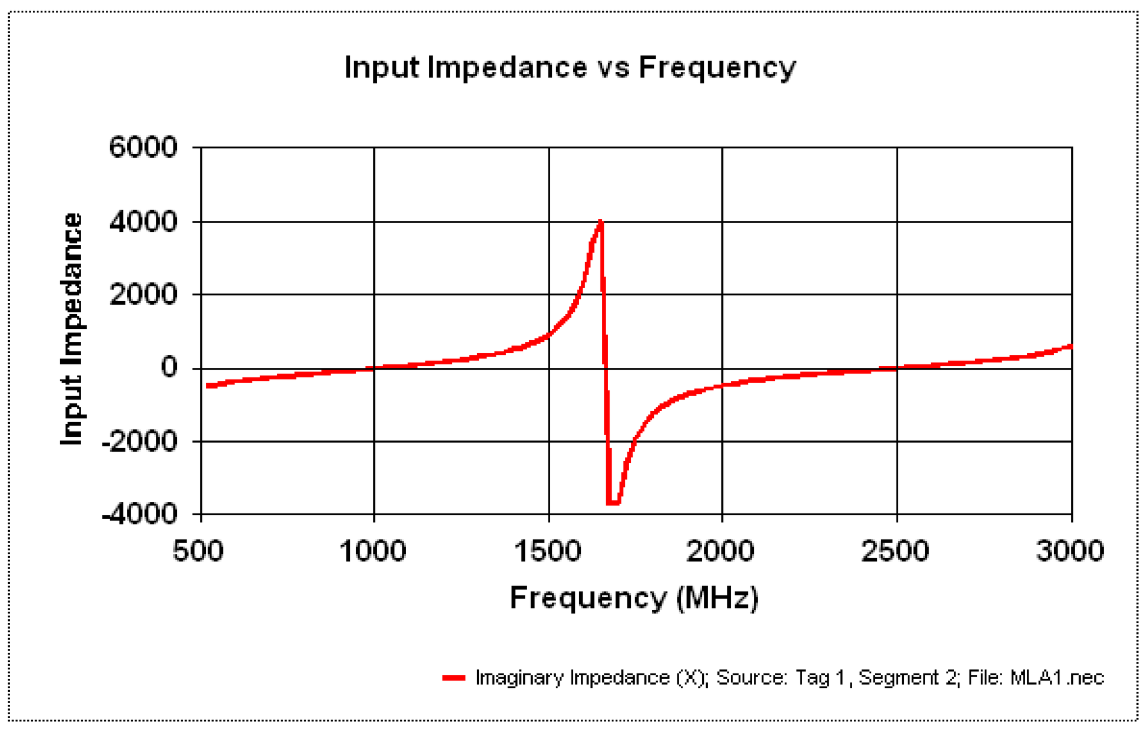
- FSS are 2D planar structures consisting of one or more metallic patterns, each backed by a dielectric substrate. Generally, they are periodic structures and their frequency response is determined by the geometry of the elements.
- In order to measure the backscattered power, we evaluate the radar cross section (RCS) of the passive MLA using a plane wave simulation setup.
- The unit cell consists of a non-uniform, one-meander line antenna (NU-MLA1).



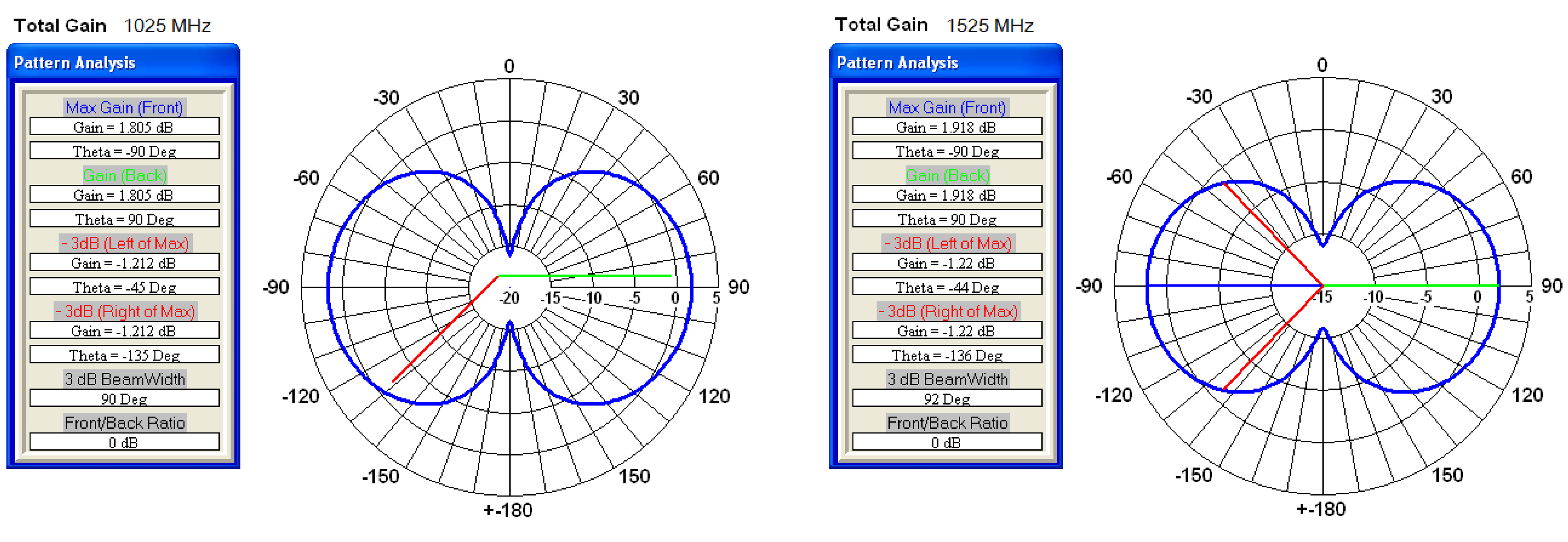
Structure of a non-uniform, one-meander line antenna

ANTENNA CHARACTERIZATION

- In order to determine the frequency selective behavior, the proposed design is analyzed in the UHF band form 525 MHz to 3 GHz, as an active wire antenna. There are two resonating frequencies, f_1=1025 MHz and f_2=2525 MHz.
- The radiation of a meander line antenna is related to the vertical segments. As long as the horizontal segments have out of phase currents, the contribution to the radiated power can be neglected. As the frequency increases, the radiation pattern presents an increase of the total gain.



Reactance of the proposed structure as an active radiator

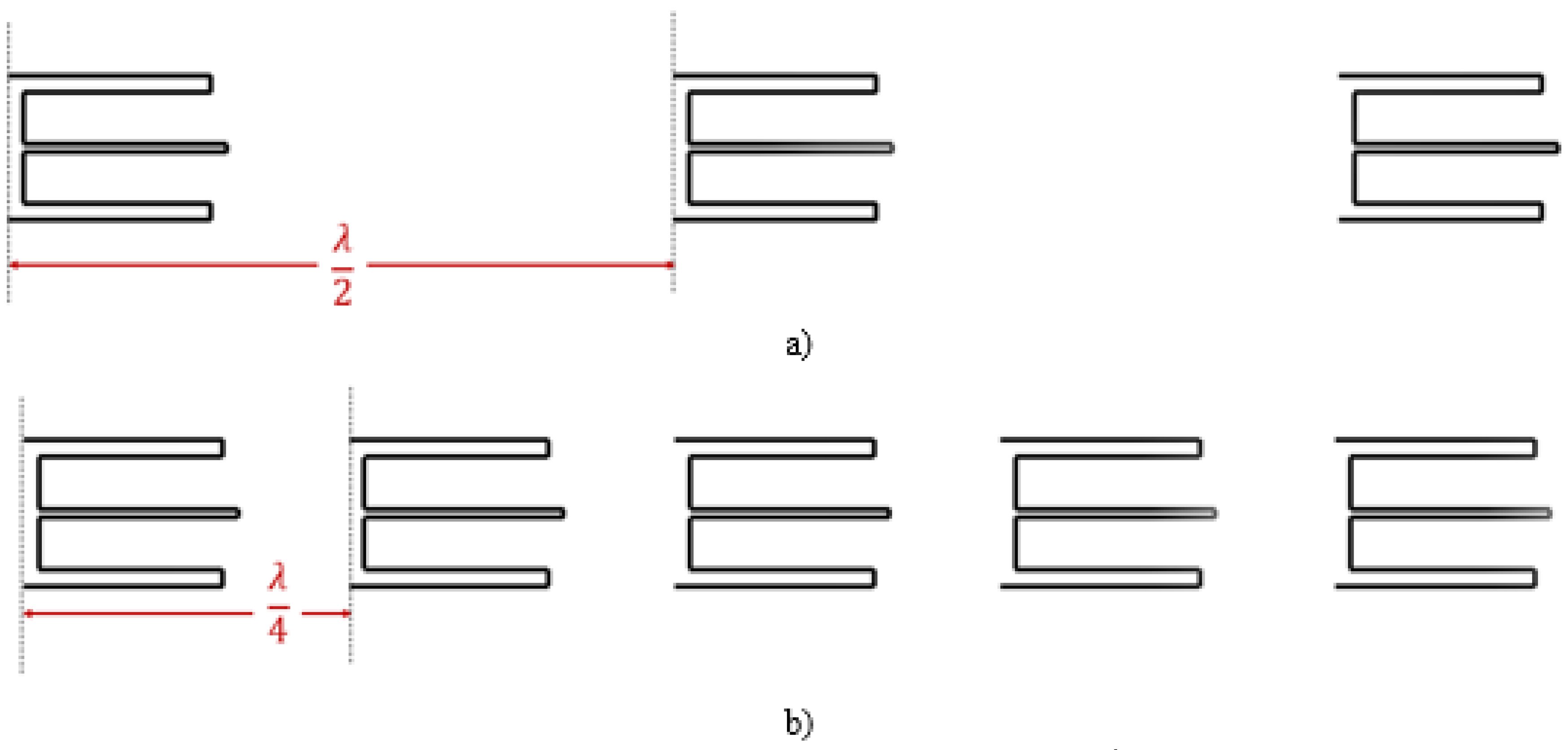


a) b)

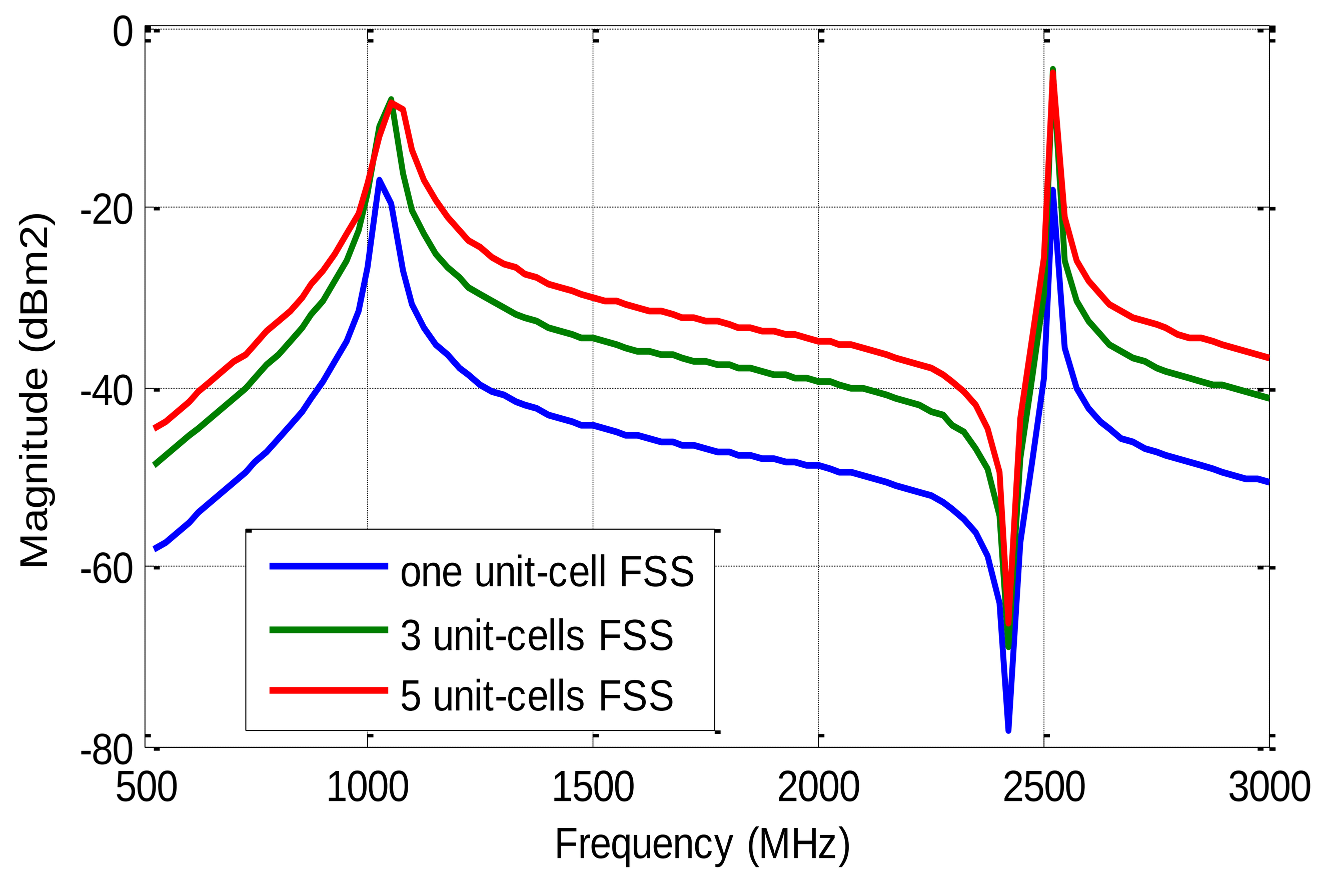
a) Total gain for f_1=1025 MHz; b) Total gain for f_2=2525 MHz

RADAR CROSS SECTION CHARACTERIZATION

- There are two FSS configurations: one with three elements equally spaced at λ/2, and the other one with five elements by keeping the same array length.



a) 3 elements FSS; b) 5 elements FSS



RCS comparison of the three FSSs

CONCLUSIONS

- As the number of unit cells increases while keeping the aperture constant, the peak RCS increases from -16.85 dBm^2 for the one element FSS, to -8.09 dBm^2 for the three elements FSS and -8.39 dBm^2 for the five elements FSS at the first resonant frequency f_1=1025 MHz, while for the higher resonant frequency f_2=2525 MHz, the peak RCS increases from -17.96 dB^2 for the one element FSS, to -4.83 dBm^2 for the three elements FSS and -5.23 dBm^2 for the five elements FSS, hence showing a frequency selective behavior.

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