

Miniaturized negative permeability medium elements

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We have studied experimental and numerical characterization of μ -negative (MNG) materials such as multi split ring resonators (MSRRs) and spiral resonators (SRs). The resonance frequency of the structures is determined by the transmission measurements and minimum electrical size of $\lambda_0/17$ for the MSRRs and of $\lambda_0/82$ for the SRs observed. These MNG materials can be easily produced by the well developed printed circuit board and optical lithography techniques. They are promising elements for the development of high resolution metamaterial lenses and electrically small antennas.

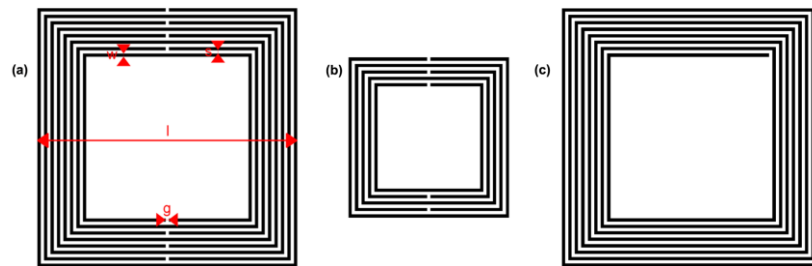


FIG. 1: Geometry of examples of MNG materials: (a) Multi split ring resonator with side length $l = 8$ mm and number of rings $N = 8$ (b) Multi split ring resonator with $l = 5$, $N = 5$ (c) Spiral resonator with $l = 8$ mm and number of turns $N = 8$.

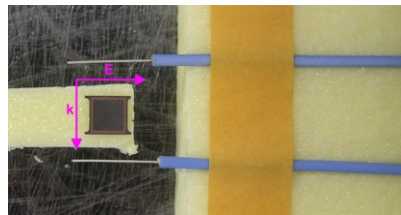


FIG. 2: Experiment setup (photo). The polarization of the incident wave is also shown.

References

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