Characterization of millimeter-wave metamaterials.

K. B. Alici[1], and E. Ozbay[1, 2]

[1]Nanotechnology Research Center, Department of Physics, Bilkent University, Bilkent, 06800, Ankara, Turkey

[2] Department of Electrics and Electronics Engineering, Bilkent University, Bilkent, 06800, Ankara, Turkey

Abstract- In the present work, we demonstrate two different double negative metamaterial media, which are fabricated by using simple printed circuit board techniques, operating at the millimeter-wave region. First double negative medium was composed of split ring resonators and wires and the other medium is known as fishnet structure. The transmission based experimental characterization was supported by numerical simulations and standard retrieval analysis. Both metamaterials operate at around 100 GHz. The bandwidth and loss properties are studied by increasing the number of metamaterial layers at the propagation direction. We conclude split ring resonator based medium has larger operation bandwidth but it is relatively hard to compose.

In the first part, four different structures are fabricated: split ring resonator medium, composite metamaterial and their shorted versions. We present the transmission spectra of these structures and comment on the results. The numerical simulations are performed by using the commercial fullwave software CST Microwave Studio. The second medium (fishnet structure) analysis involves cut-wire pairs, connected cutwire pairs with wires and their shorted versions. The numerical simulations are followed by the standard retrieval analysis by which we extract the refractive index and impedance of the media. We conclude by presenting the relation between the number of metamaterial layers at the propagation direction and the transmission amplitude.

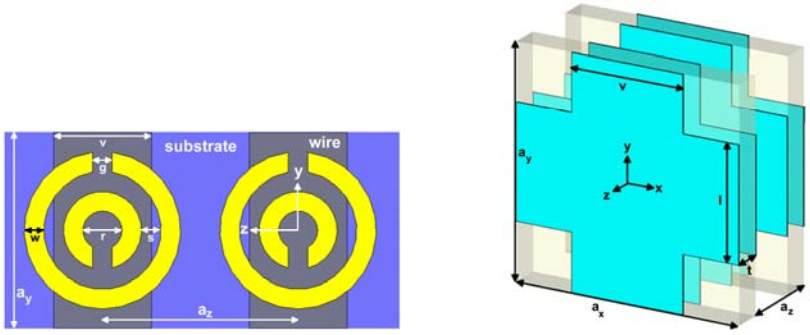

Fig. 1: Schematics of the metamaterials: the srr based composite medium (left), the fishnet structure (right).

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