

# DESIGN OF A MULTIFREQUENCY ANTENNA ARRAY WITH THE USE OF LEFT-HANDED SUPERSTRATES

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## *Abstract*

In this paper, the radiation performances of different antenna configuration based on Left-Handed superstrates are presented. First of all, the behaviour of a Left-Handed (LH) unit cell is analysed, showing a resonant response with pass band and stop band frequencies. In order to improve the radiation performances of a single dipole, ie., to increase the directivity and efficiency and to reduce the back radiation, diverse LH superstrates working at the resonant frequency of the dipole are analysed. With these configurations, improvements in terms of directivity higher than 6 dB with efficiency closer to 100 % have been obtained.

By means of LH unit cells with different resonant frequency, non-uniform superstrates can be created. Placing dipoles tuned to the resonant frequency of the cells under them, multifrequency antenna array (MFAA) can be formed. Due to the pass band and stop band properties of the cells, the power radiated by each dipole will only be transmitted by the cells with the same resonant frequency of this dipole, producing a very uniform illumination that enhance the radiation performances of the whole structure, meaning in a high directivity, high efficiency, low back radiation and low coupling between dipoles. Taking into account this idea, MFAA with two and three dipoles have been analysed. In the case of an array with three dipoles, two tuned to a lower frequency and one tuned to a higher one, directivity values of 10 dB when the two low resonant frequency dipoles are radiating and 8.1 dB when the high resonant frequency dipole is radiating have been obtained, with a gap between dipoles of  $0.25 \lambda_0$  at the low resonant frequency and a coupling between elements smaller than - 15 dB.