DESIGN OF A SUPERDIRECTIVE MINIATURE ENDFIRE PCB ANTENNA

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The creation of small-size directive antennas is one of the most interesting problems in applied electromagnetics. Intensive investigations in this field have led to the appearance of terms such as “superdirectivity. This paper presents a new class of superdirective small antenna integrated on a PCB. It consists of two-element parasitic with a total dimension of 54 × $24mm^2$ corresponding to λ/13.8 × λ/6.1 for its resonance frequency of 905MHz. This array, achieves a maximum directivity of 7.1dBi and a radiation efficiency of 7%. Figure 1(a) shows the antenna geometry and dimensions. In this array, the first element is excited while the second one is loaded with a capacitor of 5.1pF . Figure 1(b) shows that the antenna has a resonance frequency at 905MHz. Figure 1(c) shows the array end-fire directivity versus frequency. As it can be noticed, this directivity is maximal at the antenna resonance frequency and rapidly decreases afterward. Finally, Figure 1(d) shows the array simulated total directivity radiation pattern at the resonance frequency. The figure shows a superdirective radiation pattern with a maximum directivity of 7.1dBi in the end-fire direction (θ = 90o, φ = 270)). In this paper, the integration of superdirective ESAs in PCBs was investigated. Different scenarios were studied in order to improve its efficiency and maintain its superdirective behavior; The obtained results showed that the PCB configuration has a significant impact on both the array directivity and radiation efficiency. Adding a slot to the PCB can modify its current distribution and obtain a constructive contribution. This leads not only to maintain the antenna’s superdirectivity but also to increase its efficiency.

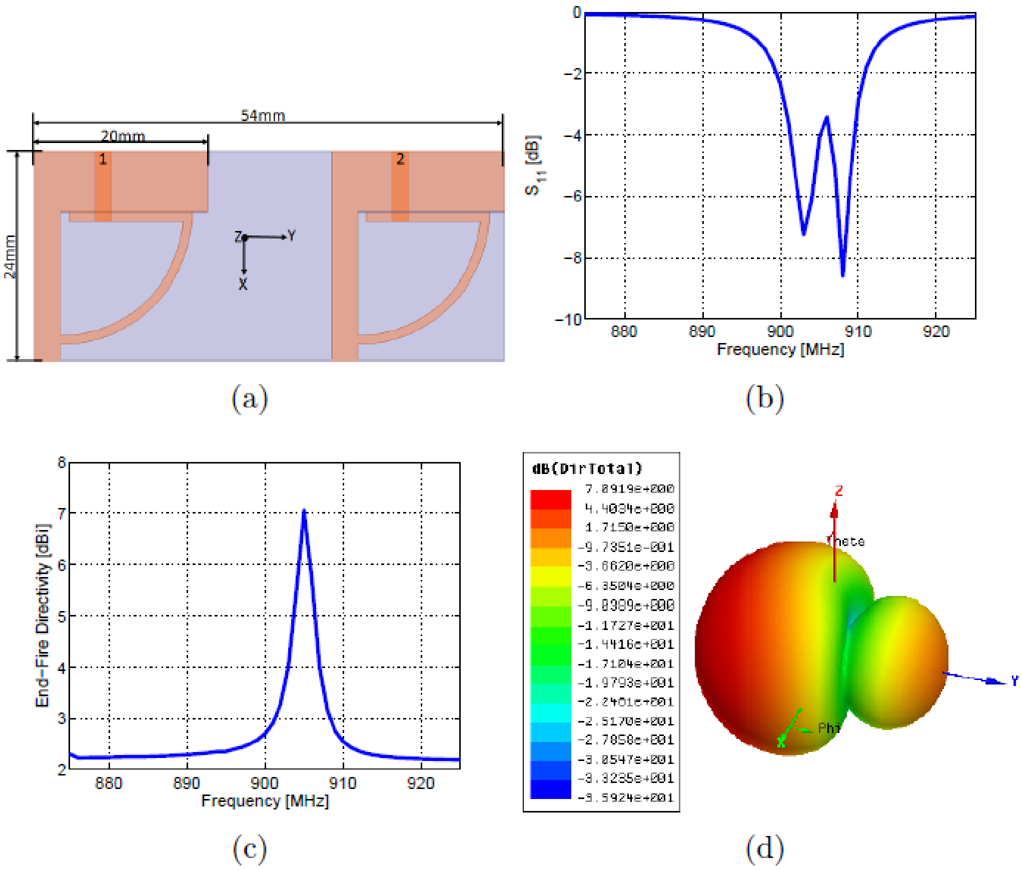

Figure 1: The proposed array geometry and simulated parameters. (a) Ge-ometry and dimensions, (b) input reflection coefficient, (c) End-fire directivity vs. frequency and (d) 3D total directivity radiation pattern.