A Novel, Size-Reduced Log-Periodic Dipole Array Using Spherical Top-Loading

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As the average physical size of emerging technology gets increasingly smaller, the demand for compact, broadband antennas in wireless communication systems continues to rise. During that time, the log-periodic dipole array (LPDA) has been used for its simplicity and broad bandwidth depending on how many elements are used in the antenna design. Previously, a planar, size-reduced LPDA was introduced that reduced the individual element size to 55% of the element length of a conventional LPDA (J. Chen and S. Lim, IEEE Antennas Wireless Propag. Lett., 1585-1588, 2017).

In this paper, a further size-reduced LPDA is proposed without sacrificing any of the reliable characteristics of the traditional LPDA. A six-element, compact LPDA using top-loadings is introduced. Fig. 1 shows the structure of the proposed antenna. The conventional half-wavelength dipole elements of the LPDA are replaced with top-loaded dipole structures with an electrical size, *kr*, of 0.6, which results in an element length reduction of 32.5% of its element length of the conventional LPDA. The proposed antenna keeps the same logarithmic distances in the structure. In order to minimize the physical length of the individual antenna elements, the elements are shortened and umbrella-shaped, spherical top-loadings are added to both ends of the elements. The proposed antenna has a -10-dB impedance bandwidth between 1.05 GHz and 3.15 GHz (100% fractional bandwidth) with 100 Ω matching. The average realized gain across the functional bandwidth is 4.2 dBi. The proposed antenna is similar in functional bandwidth to the traditional LPDA. More elements could be added to the proposed antenna in increase the bandwidth.

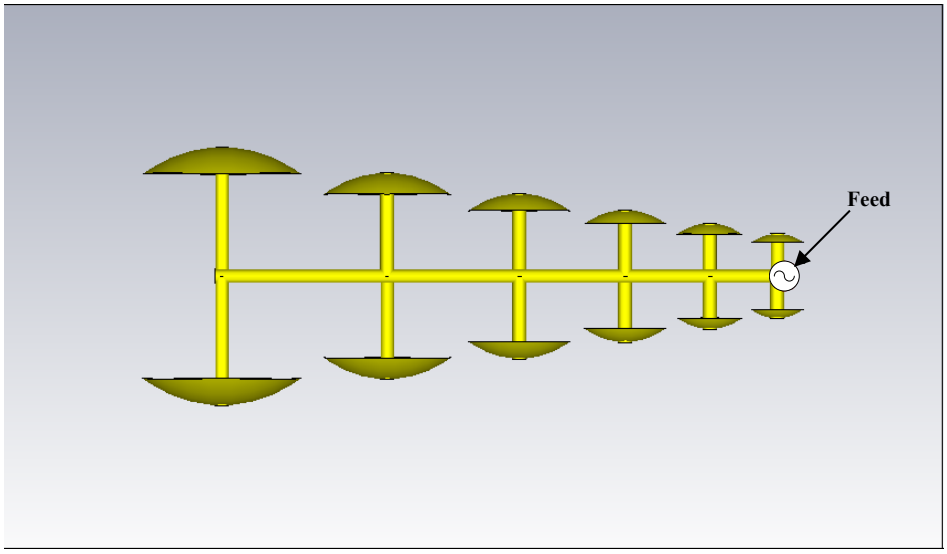

Fig. 1. The proposed six-element LPDA with spherical top-loadings.