MEASUREMENT OF EFFECTS OF STANDARD TUBING SIZES OF A LOG-PERIODIC DIPOLE ARRAY

K.A.M. Dhanuranga and M.A.A. Karunarathna

Department of Electronics, Faculty of Applied Sciences, Wayamba University of Sri Lanka, Kuliyapitiya (NWP), Sri Lanka

Corresponding author: asanka55@yahoo.com

Use of the Tubing sizes for a Log Periodic Dipole array is an opinion led to debate where some claimed that diameter of the tubes used in Log periodic Dipole arrays are not much significant, and it does not pose a considerable variation in the performance of the Array. However a comprehensive study had not been carried out to comprehensively monitor the effects of neglecting the tubing sizes when designing the antenna. This study focuses on monitoring the effect of using different tubing sizes for a Log Periodic Array, reconcile and propose the most effective method of using different tubing sizes for LPDAs to get the maximum performance from the antenna design and provide justifications to the arguments made by Carrel and De vito and Stracca, and Peixeiro. Different set of antennas were simulated using MATLAB and the gain response of each design was plotted for a range of tubing sizes across each element of the designed antenna. The designs were varied from frequency 1MHz to 800MHz, each of the selected model was recreated and simulated for each element in the antenna. Efficiency was calculated for each model of the antennas and it was plotted against each configuration of elements. Impedance of the antenna and the impedance of the active region elements were plotted against the scale factor for different length to diameter ratios and it was observed that the impedance tends to settle on a fixed value as the length to diameter ratio was increased. A pattern was observed in designing the antennas with optimum efficiency and gain in the derived facts. However the Standard tubing sizes for Aluminium tubes considered for the study. Diameter effect comes directly in to play with the Length to diameter ratio of each element used in the array. The approximation of the antennas input impedance is predicted with the impedance of the unloaded transmission line formula. A graph was plotted representing the variation of impedance against the Average Length to diameter ratio. Another graph was plotted representing impedance of the active region elements against the average length to diameter ratio. In the first graph it was observed that graph seems to stabilize after length to diameter ratio is 50 However obtaining high value of length to diameter ratio means the diploe length has to be extended either diameter has to be reduced. Both solutions have its limitations. This concludes that for antenna designs which the length to diameter ratio is less than 50 are prone to the effect of length to diameter ratio on antenna performance. Additionally, with longer elements and smaller diameters impose a limit on the minimum diameter which could be used. Solution to this is Preserving the log periodicity of length to diameter ratio throughout the antenna array from the smallest element to the longest was proven to be the most feasible solution which could be provided. In higher frequencies this factor influences the gain parameter of the antenna and compensating the trade-offs. The limitation of the higher frequencies was the fabrication difficulty of the antenna. Limiting the study to the use of higher MHz frequencies and using standard aluminium tubes.

Keywords: Diameter ratio, LPDA, Optimum efficiency, Standard tubing sizes