LPDA Antenna for LTE (B1, B3, B7)

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1 Introduction

In this document, I present a model of an LPDA (Log-Periodic Dipole Array) antenna designed for receiving LTE signals. The LPDA is a broadband antenna mainly used in the VHF and UHF frequency ranges. It is a relatively simple antenna to construct, which can be designed and built by anyone using readily available materials such as aluminum tubes or aluminum profiles. The presented solution offers a straightforward antenna design that can be implemented even by individuals without advanced technical knowledge.

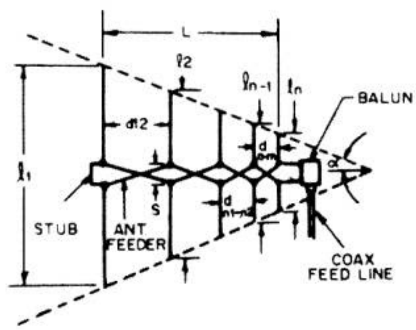

Figure 1: Model of LPDA and symbols used in equations used to design

2 Calculations

The main design decision an antenna maker needs to make while constructing an LPDA is to determine its size. The LPDA dimensions are determined by the τ factor, whose value is usually in the range of 0.8 to 0.99. As τ increases, the antenna size and gain also increase. In case of this project $\tau = 0.92$, whatsoever

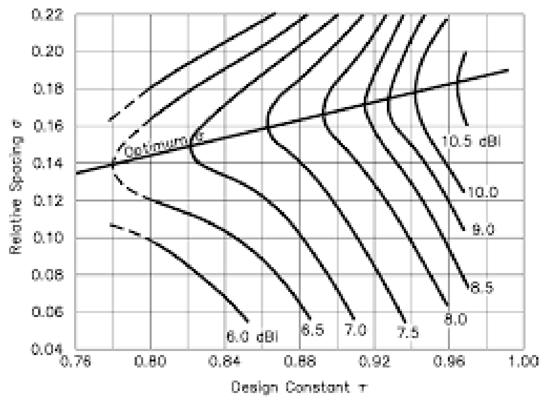

Figure 2: Function of Gain with respect to τ and σ

Gain obtained from this antenna ranges betweeen 7 to 10 dB.
Another important factors are α and σ. Sigma is spacing factor used in formula for alpha. It is used to determine lenght of boom of antenna. Alpha is value of angle between last dipole and end of boom.

$$\alpha = tan^{-1}[\frac{1-\tau}{4\sigma}] \tag{1}$$

Equation 1: Formula to calculate α degree

Length of elements and spacing between them is computed while using equation below

$$\frac{L_{n+1}}{L_n} = \frac{d_{n+1}}{d_n} \tag{2}$$

Equation 2: Tau formula

The very important value for desing of LPDA is active region of antenna. Active region is an area of antenna that is radiating. Active region B_{ar} is determined by formula:

$$B_{ar} = 1.1 + 7.7(1-\tau)^2 cot\alpha \tag{3}$$

Equation 3: Active region value

In reality, larger bandwidth is being desinged in comparasment to required. It is defined by

$$B_s = BB_{ar} = B[1.1 + 7.7(1-\tau)^2 cot\alpha] \tag{4}$$

Equation 4: Designed bandwith

where B_s is designed bandwidth,
B is desired bandwidth
B_{ar} is active region of antenna.

Total lenght of antenna (boom) is calculated using formula:

$$L = \tag{5}$$