

A Novel Wind Proof Log-Periodic Dipole Array Antenna for the Study of Magnetic Field and Some Important Antenna Parameters in Azimuth and Elevation Pattern Analysis

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ABSTRACT: - Log Periodic Dipole Array (LPDA) is comprised of two crossed logarithmic periodic dipole antennas, arranged in north-south and east-west direction. In this paper we have presented the study of magnetic field and some important antenna parameters in Azimuth and Elevation pattern analysis for a frequency range of 50MHz – 300MHz. A significantly high directivity, front-to-back ratio, broadband operation, low cost, easy fabrication and good radiation patterns across a very wide frequency range made the LPDA antenna very useful for monitoring solar radio observations.

KEYWORDS: LPDA, Azimuth pattern, Elevation pattern, Reflection coefficient, Return loss, SWR

I. INTRODUCTION

The LPDA is utilized in broad band communication in the VHF and UHF range [1- 4]. For LPDA antenna the input impedance or the gain alters periodically in the logarithm of the frequency domain. The basic thought is that a slowly expanding periodic structure array emits mainly when the array elements (dipoles) are close to resonance so that with alterations in frequency the active (radiating) region shifts throughout the array. For a specified frequency, the elements with lengths near to half wavelength resonate [5]. The longest dipole resonates at the lowest frequency (f_L) and the shortest dipole resonates at the highest frequency (f_U) of functioning. The longer dipole works as a reflector whereas the shortest dipole functions as a director. The right phase of the currents on the dipoles is set up by a phase shift of 180° which is initiated by criss-crossing the transmission lines in such a way that the maximum is by the side of the direction of the smallest dipole, which is fairly same to how the reflector and directors act in a Yagi-Uda array.

The radiating (active) region shifts **all along the** built up with varying frequency. The dipole elements whose wavelengths are $\lambda/2$ at the resonant frequency constitute the active region and almost all the antenna currents are focused in this region [5, 6]. The residue elements of the array which consist of directors and reflectors are regarded as parasitic. The LPDA antenna is greatly directional in its radiating and receiving patterns in consequence of the actions of the directors and reflectors. It is essential at first to specify the coordinate system for elucidating the antenna and the related electromagnetic fields so as to facilitate the discussion about radiation from antennas. The usual coordinate system for this type of task is the spherical coordinate system comprised of a radial distance, an elevation angle and an azimuth angle. Only 2 or 3 are active at any specified frequency in the operating range though an LPDA consists of a huge number of dipole elements.

II. SIMULATED RESULTS

We have designed time-shared LPDA and it was simulated using EZNEC software and it was considered under free space. In Figure 1 and 2 the variation of Magnetic (H) field (A/m RMS) in Azimuth & Elevation pattern analysis [7, 8]

at different frequencies are shown. Figure 3 shows the variation of R, X, Reflection coefficient, Return loss and SWR VS Frequency (MHz) in Azimuth Pattern Analysis while Figure 4 shows the variation of R, X, Reflection coefficient, Return loss and SWR VS Frequency (MHz) in Elevation Pattern Analysis.

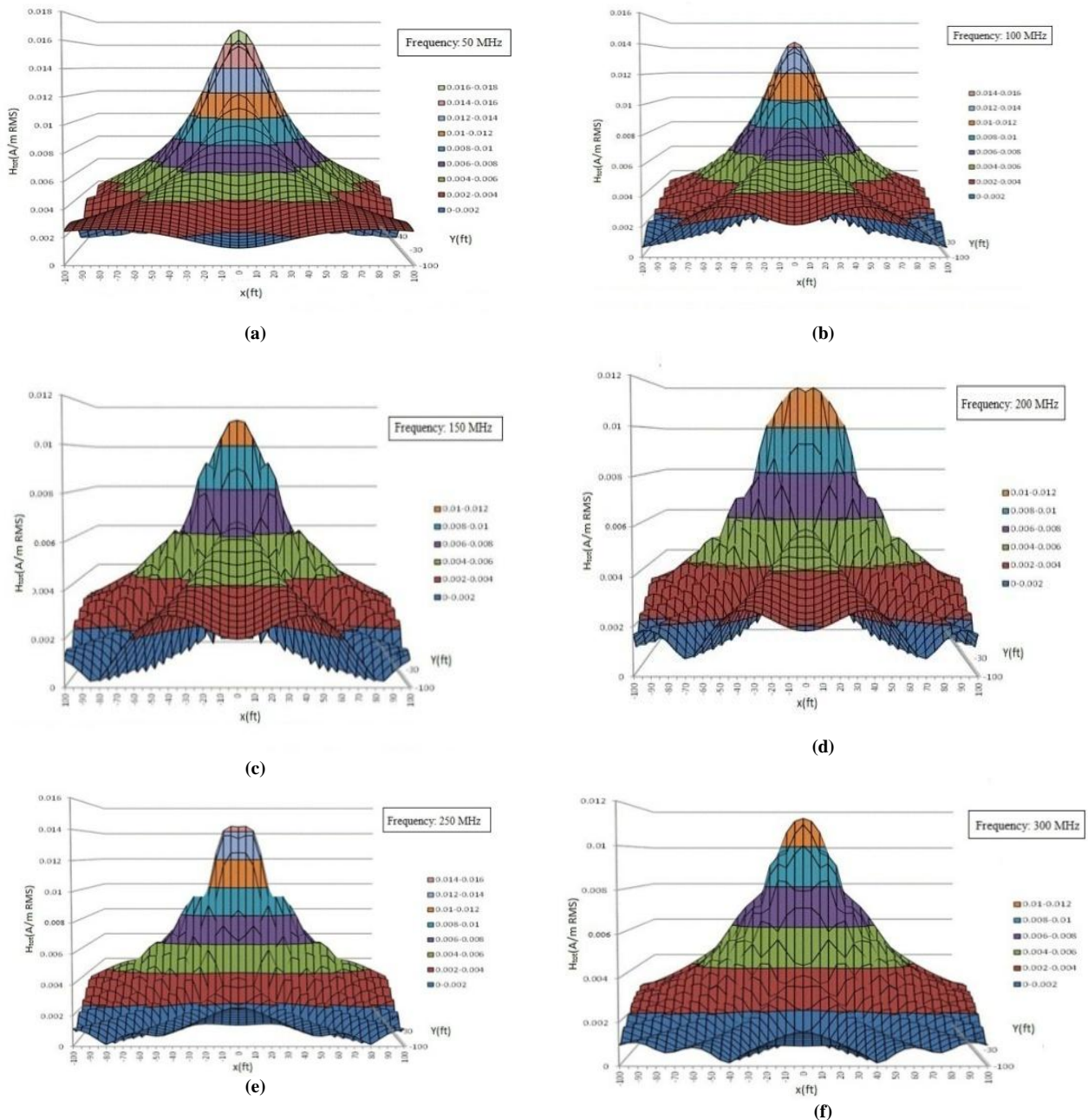


Fig. 1. Magnetic (H) field (A/m RMS) in Azimuth Pattern Analysis at different frequency of: (a) 50 MHz (b) 100 MHz (c) 150 MHz (d) 200 MHz (e) 250 MHz (f) 300 MHz, respectively

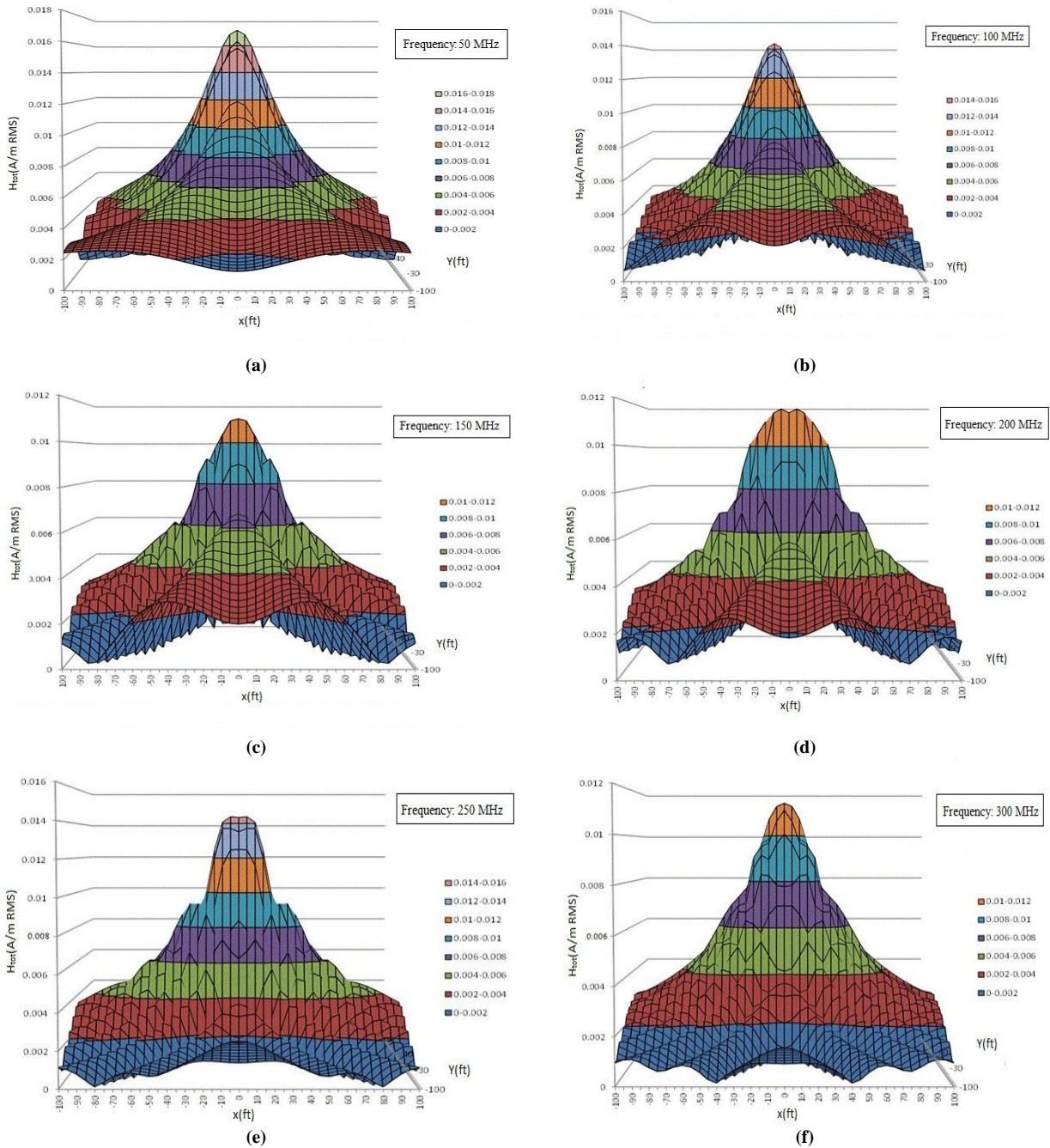


Fig. 2. Magnetic (H) field (A/m RMS) in Elevation Pattern Analysis at different frequency of: (a) 50 MHz (b) 100 MHz (c) 150 MHz (d) 200 MHz (e) 250 MHz (f) 300 MHz, respectively

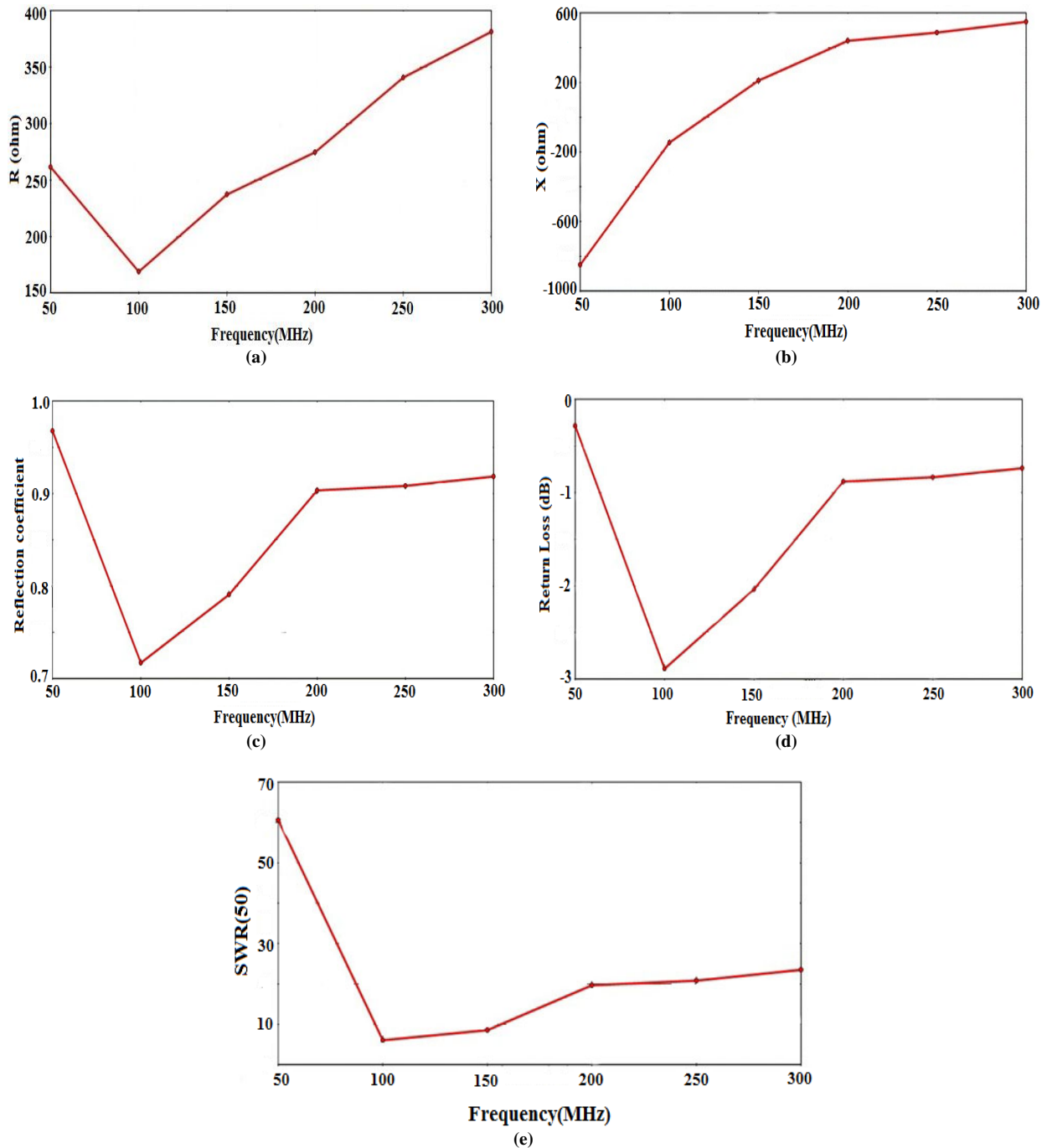


Fig. 3. Variation of (a) R(ohm), (b) X(ohm), (c) Reflection Coefficient, (d) Return Loss (dB) and (e) SWR (50) VS Frequency (MHz) in Azimuth Pattern Analysis

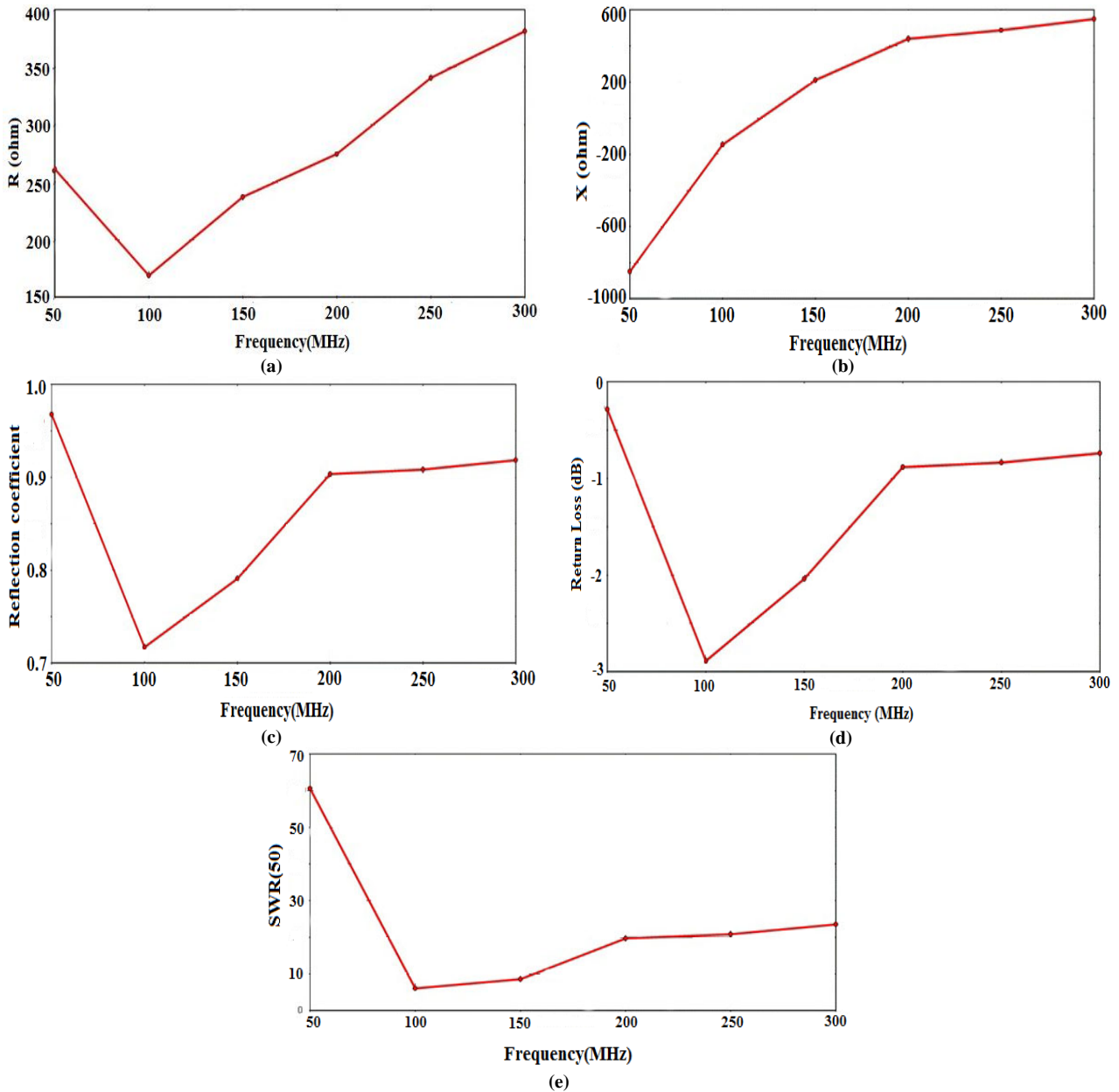


Fig. 4. Variation of (a) R(ohm), (b) X(ohm), (c) Reflection Coefficient, (d) Return Loss (dB) and (e) SWR (50) VS Frequency (MHz) in Azimuth Pattern Analysis

III.CONCLUSION

The simulated performance study of the magnetic field, variation of R and X, reflection coefficient, Return loss, VSWR of LPDA at 50MHz – 300MHz has been depicted. The LPDA demonstrates a comparatively low SWR (generally not more than 2 to 1) over a wide band of frequencies. Its benefit is that within the design band its performance is basically frequency-independent incorporating radiation resistance (hence VSWR) and radiation pattern (hence gain). A significantly high directivity and front-to-back ratio across a very wide frequency range is possessed by the LPDA [9, 10]. The recommended antenna would be very essential for monitoring solar radio observations because of its broadband operation, low cost, easy fabrication, and good radiation patterns [11, 12]. The EZNEC software has been

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utilized to optimize the length of the elements and to study the characteristics of the designed antennas like return loss, and gain.

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