

Log-Periodic Dipole Antenna in WIPL-D Pro CAD

This application notes presents a model of Log-Periodic Dipole Antenna (LPDA) in WIPL-D Pro CAD software. S-parameter, CPU and GPU simulation times at various frequencies and radiation pattern results at various frequencies are also presented.

Antenna Model

Log-Periodic Dipole Antenna with 52 printed dipoles is created from the scratch and simulated using WIPL-D Pro CAD. The antenna is printed on 0.817 mm thick dielectric substrate with dielectric permittivity 2.33. The length of the antenna boom is 261.5 mm. The longest arm of the antenna is about 84 mm long, while the length of the shortest arm is about 2 mm.

The modelling process is straightforward. The first step is to define symbols and then the antenna is drawn easily. All WIPL-D files are ASCII, so customers can use other tools (such as Notepad or Excel) to speed up model generation. The entire process requires around 30 minutes to complete.

The WIPL-D Pro CAD model of the antenna is displayed in Figure 1. The feeding of the antenna is performed as shown in the Figure 2.

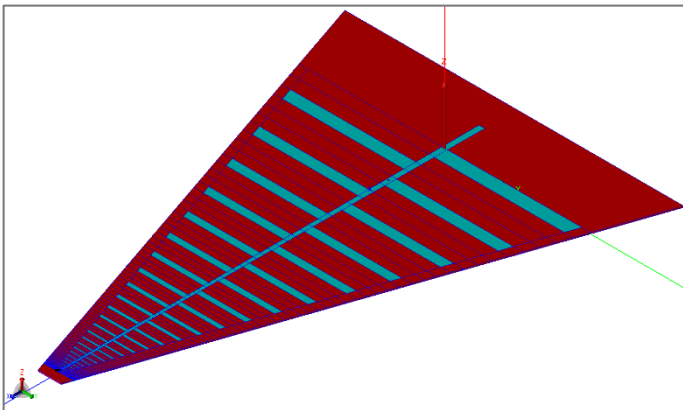


Figure 1. LPDA Antenna

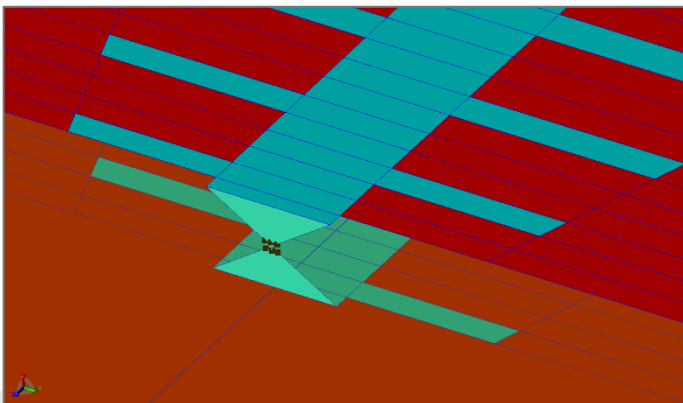


Figure 2. Feeding of the LPDA Antenna

Simulation and Results

Simulation times and number of unknowns necessary for simulating LPDA antenna at various operating frequencies in the frequency range from 1 GHz to 18 GHz, are presented in Table 1.

The simulation in wide frequency band is tremendously faster if at each frequency the model is meshed again, and the number of unknowns is adjusted (owing to special feature). The built-in interpolation allows to simulate return loss with minimum number of frequency points (here 25 runs was performed).

Computer used for these simulations is Intel® Core™ i7 CPU 7700@3.60 GHz and single GPU card Nvidia GeForce GTX 1080. This is a regular desktop PC, enhanced with low-end Nvidia GPU card (CUDA enabled). Simulation time mainly consists of time necessary for matrix fill-in and matrix inversion. The GPU solver has been used to speed up matrix inversion. Matrix fill-in was performed at CPU (*CPU time* assumes that matrix inversion is done at CPU, while for *GPU time* it is done at GPU).

Table 1. Simulation times and required number of unknowns

Frequency [GHz]	Number of unknowns	CPU time [s]	GPU time [s]
1	4,847	15.1	15.2
3	5,967	17.9	18.1
5	8,093	26.2	24.1
8	15,177	60.7	39.9
12	22,123	128.4	60.7
18	38,619	531.1	130.0

Antenna S-parameter is shown in Figure 3. Radiation patterns at various frequencies in the horizontal plane of radiation, are shown in Figures 4-9.

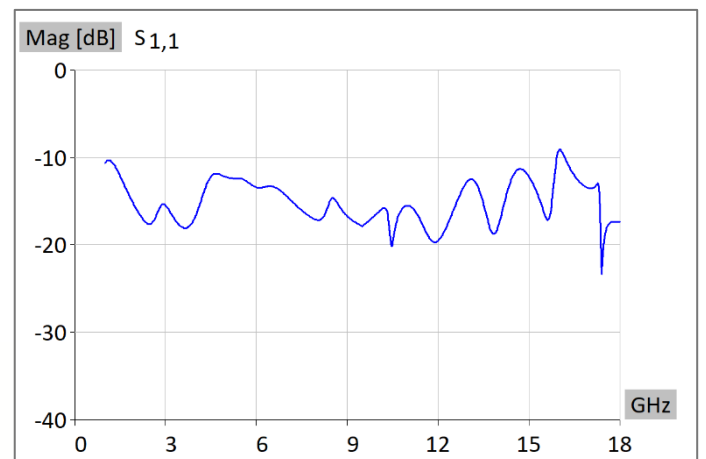


Figure 3. Antenna S-parameter

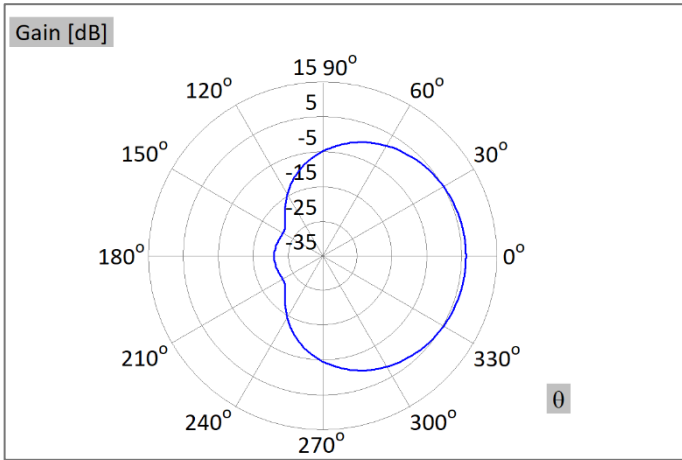


Figure 4. Radiation pattern in horizontal plane at 1 GHz

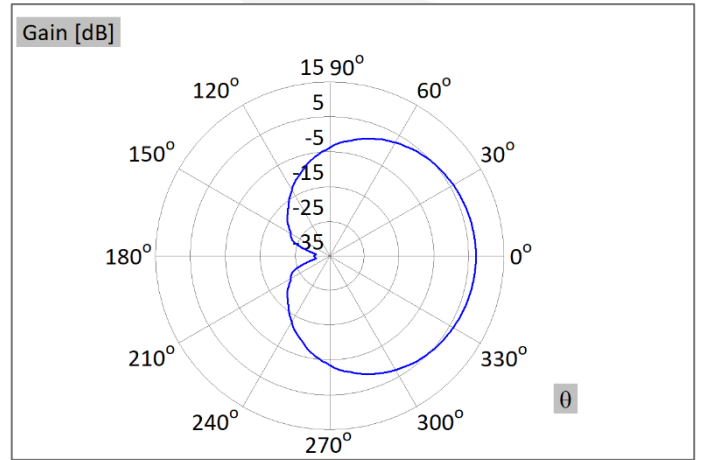


Figure 7. Radiation pattern in horizontal plane at 8 GHz

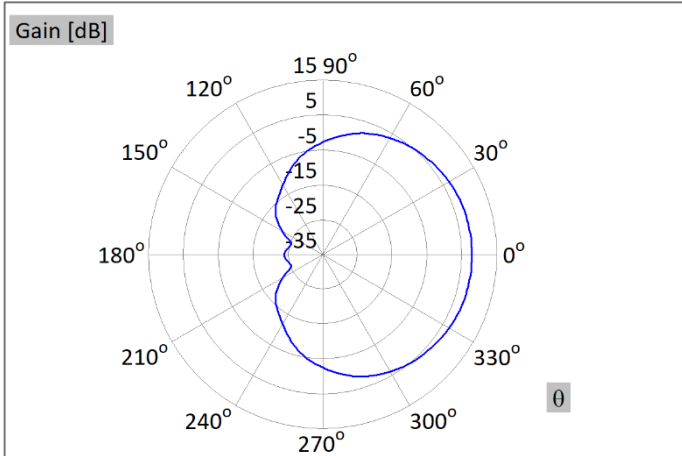


Figure 5. Radiation pattern in horizontal plane at 3 GHz

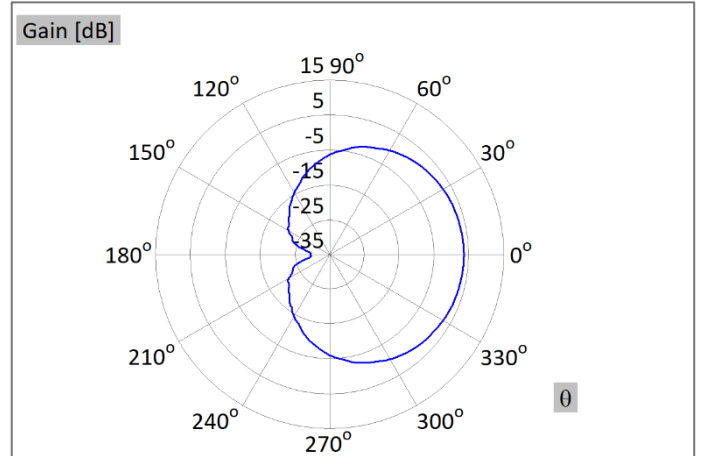


Figure 8. Radiation pattern in horizontal plane at 12 GHz

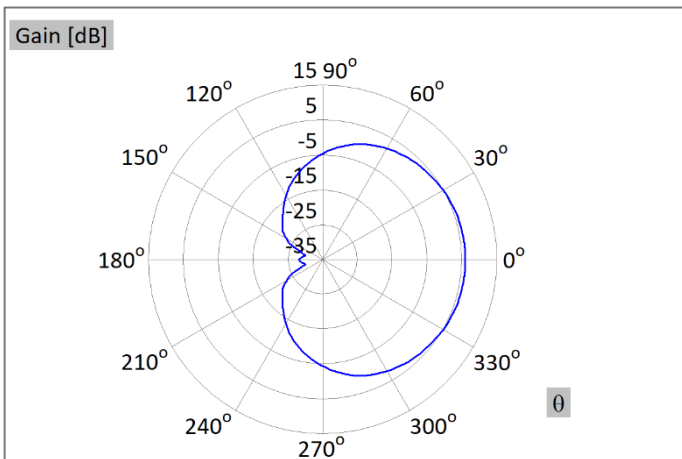


Figure 6. Radiation pattern in horizontal plane at 5 GHz

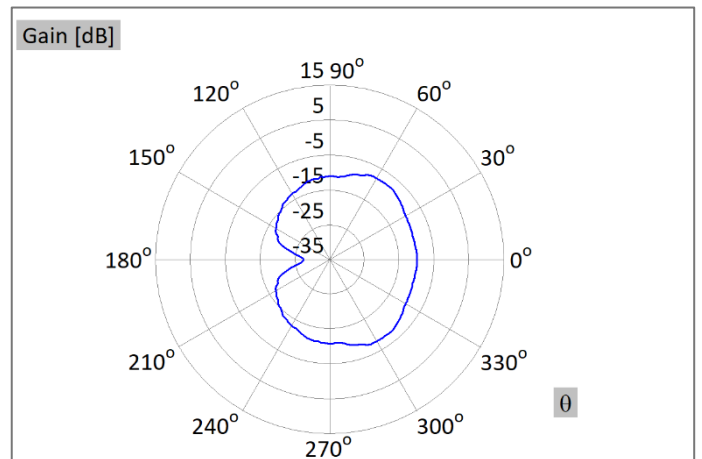


Figure 9. Radiation pattern in horizontal plane at 18 GHz