

Dual-Band GPS Antenna

Most of the modern Global Position System (GPS) receivers operate in L_1 frequency band (1575 MHz) with right hand circular polarization. Furthermore, many applications require more accurate information and use GPS operating in L_1 and L_2 (1227 MHz) bands. That is why dual-band antenna [1] seems to be irreplaceable part of any GPS system. This application note presents WIPL-D Pro simulation of a dual-band antenna intended to operate in GPS.

WIPL-D Pro is EM Solver, based on Method of Moments (MoM) and empowered with quadrilateral mesh and high-order basis function (HOBFs). A unique combination of HOBFs and Method of Moments allows us to accurately simulate larger models than traditional MoM, because HOBFs decreases number of required unknowns and speed up simulation time.

Dual-Band Antenna

The geometry of the dual-band GPS antenna is shown in Figure 1. The antenna represents slot loaded microstrip patch antenna with coaxial feed. Dimensions of the model are shown in Table 1. Electrical permittivity of the substrate is $\epsilon_r = 3.3$.

WIPL-D Pro model of the GPS dual-band antenna is shown in Figure 2. Top view and side view of the structure are presented. Feeding area is highlighted.

Simulations and Results

The dual-band antenna simulation was carried out on Intel® Core™ i7-7700 CPU @ 3.60 GHz. Simulation results of dual-band GPS receiver are displayed in the Figure 3. Figure 3 shows S-parameter which is lower than -20 dB in the L_1 and L_2 bands. Presented result was obtained with default numerical kernel settings at 21 frequency points. Number of unknowns and simulation time per frequency point are presented in Table 2.

The number of simulated frequency points is rather low, due to built-in interpolation. The simulation is carried out at regular desktop PC. WIPL-D eliminates any need for expensive workstations.

Table 1. Dimensions of dual-band GPS antenna.

Parameter	Value [mm]	Parameter	Value [mm]
L	99	h_2	5
X_0	39	l_1	20
w	2	l_2	39
d	2	w_2	5
l	10	l_s	33.6
h_1	0.6	w_s	2

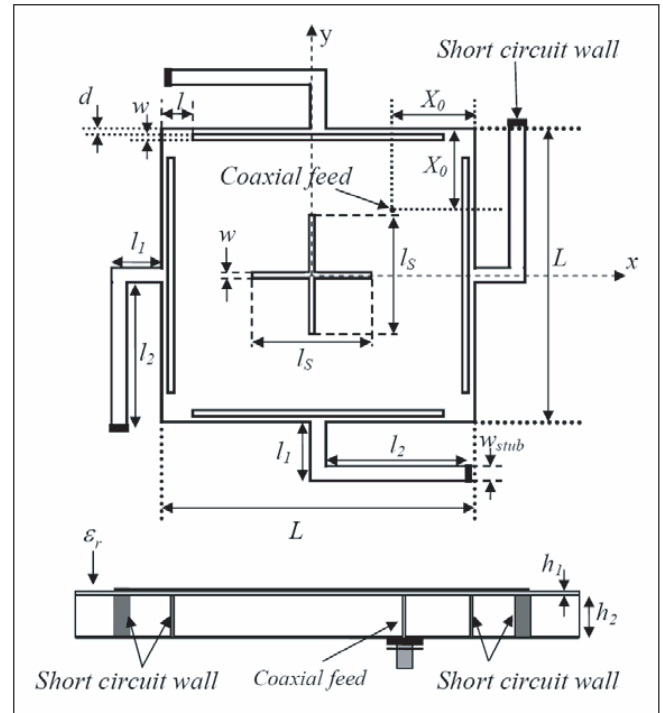


Figure 1. Geometry of the dual-band GPS antenna.

Table 2. Number of unknowns and simulation time per frequency.

Feeder	Number of Unknowns	Simulation Time per Frequency [sec]
Coaxial	4,744	18

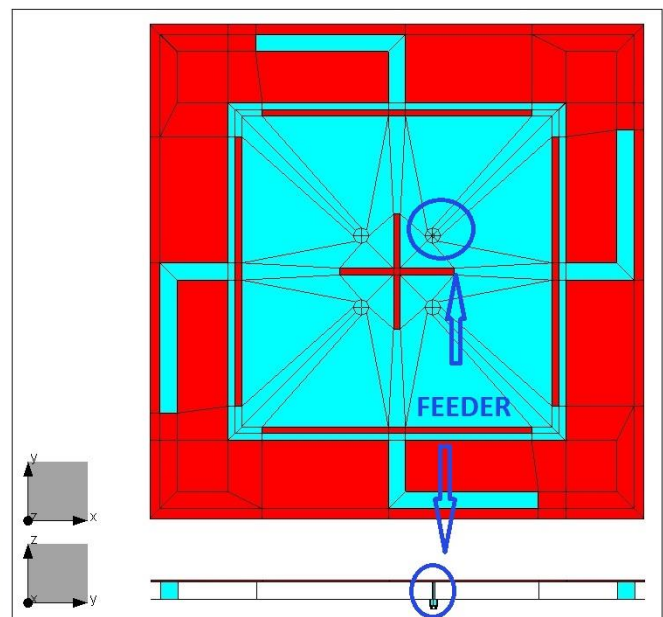


Figure 2. WIPL-D model of dual-band GPS antenna.

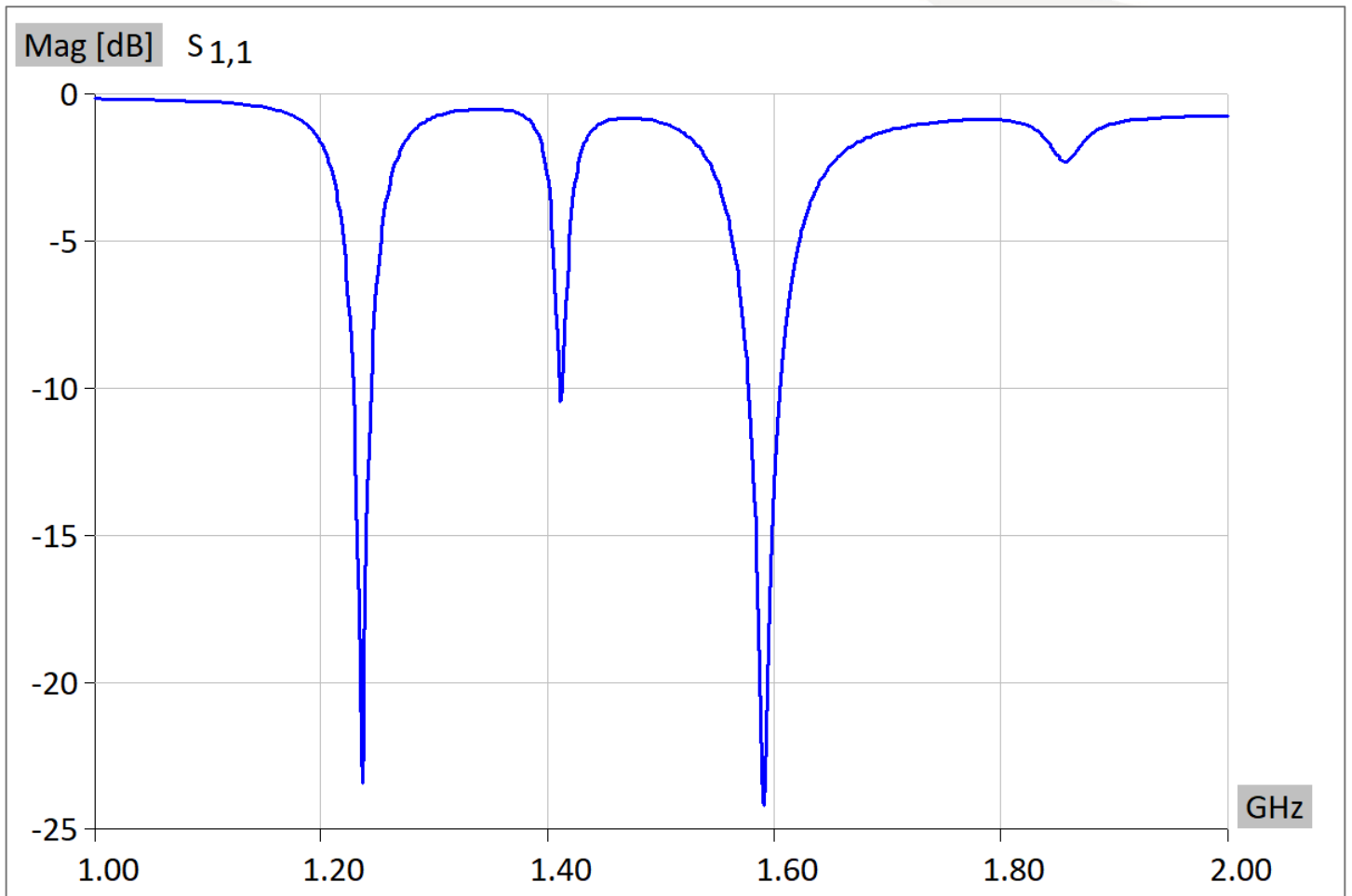


Figure 3. S-parameter at 21 frequency points.

References

- [1] https://www.idc-online.com/technical_references/pdfs/electronic_engineering/A%20DUAL-BAND%20CIRCULARLY%20POLARIZED%20STUB.pdf