

6-Way Divider – Modeling and Analyzing in WIPL-D Pro

In this application, we will analyze 6-way divider. The divider will be simulated from 1.4 GHz to 1.6 GHz. The results of interest will be s_{11} , s_{21} , s_{31} ... s_{71} parameters.

The divider is realized in microstrip technology and its layout is shown in Figure 1.

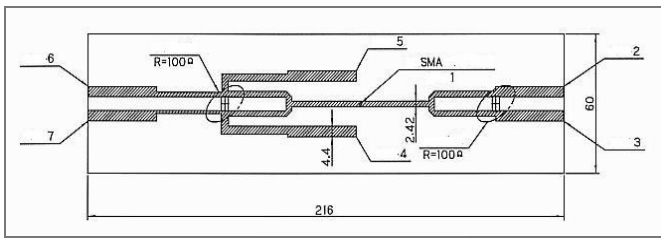


Figure 1. Layout of the divider.

Feeding port is marked using number 1 while other 6 ports are marked using numbers 2-7. The divider is fed by probe with SMA connector (Figure 2).

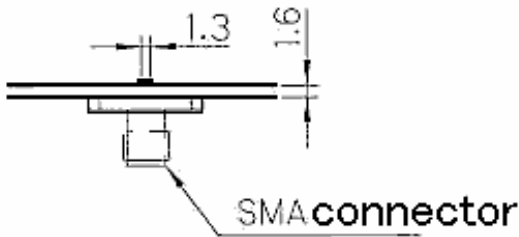


Figure 2. SMA connector on the first port.

Modeling

In WIPL-D, there are procedures for modeling the divider:

- by using WIPL-D own tool (defining symbols, nodes, creating plates...)
- by using WIPL-D own tool (defining symbols, grids; creating plates...)
- by using AW Modeler for importing .dxf file
- by using WIPL-D Pro CAD for importing .x_t, .stp, .sat, .iges...

The first procedure will be presented in this paper. It is very simple, but it takes a bit more time than the other procedures. Nevertheless, with this procedure we can obtain optimal mesh and minimize simulation time.

All dimensions are given using symbols. Table of symbols is presented in Figure 3.

Symbols		Symbol
1	1.3	Din=1.3; inner diameter of coaxial line
2	8	Nseg=8; number of segments for BOF
3	2.42	w2=2.42
4	4.4	w1=4.4
5	60	W=60
6	1.6	Hsub=1.6; substrate tickness
7	2.6	Er=2.6
8	0.0022	tgD=0.0022
9	3	y1=3
10	0	x1=0; assistant symbol
11	31	l1=31
12	29.5	l2=29.5
13	1.9	wn=1.9
14	3	wx=3
15	8.02	l3=8.02
16	29.94	l4=29.94
17	26.38	ln=26.38
18	1	xx=1; assistant symbol
19	31	l5=31
20	2.42	wy=2.42
21	62	l6=62
22	27.88	l7=27.88
23	31	l8=31
24	100	R=100; resistance [ohm]
25	3	Hbor=3; lenght of coaxial line
26	0.4	Ch=0.4; assistant symbol
27	0.3	Cr=0.3; assistant symbol

Figure 3. Table of symbols.

Layout of the Wipl-D model and clarifications of some symbols are shown in Figure 4.

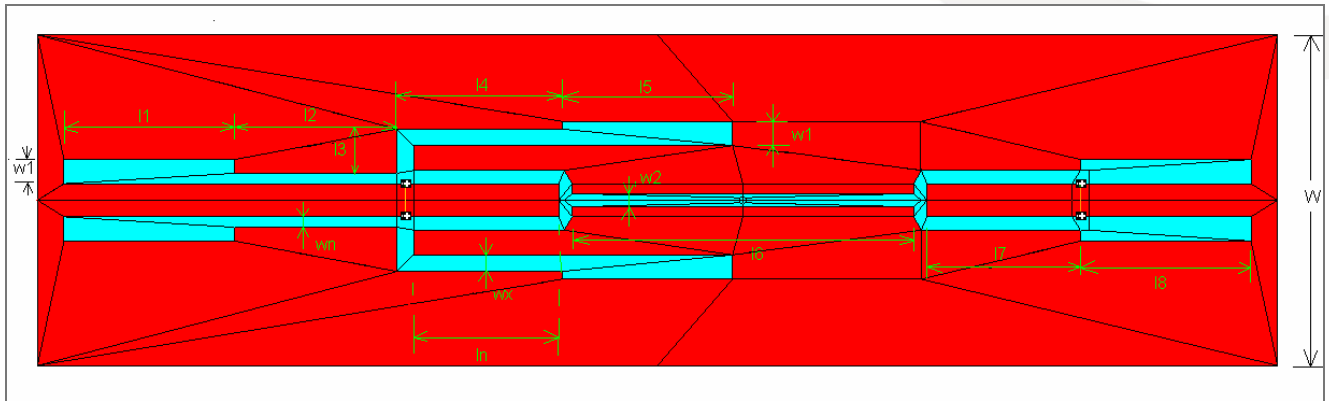


Figure 4. Layout of WIPL-D model.

Feeder on the port 1 is modeled as coaxial line using WIPL-D objects (BoR and Circle). Specifications of BoR and Circle objects are presented in Figures 5-6.

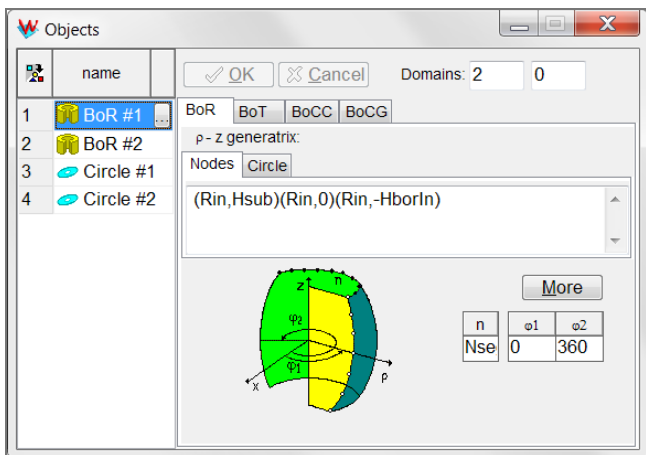


Figure 5. Specification of a BoR object.

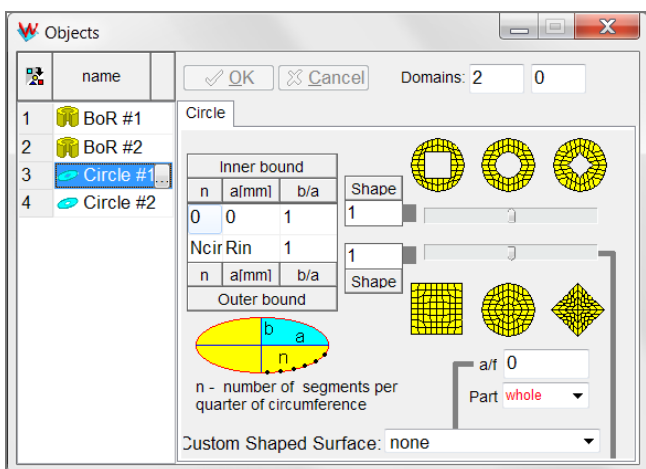


Figure 6. Specification of Circle object.

Feeder attached to the first port is shown in the Figure 7.

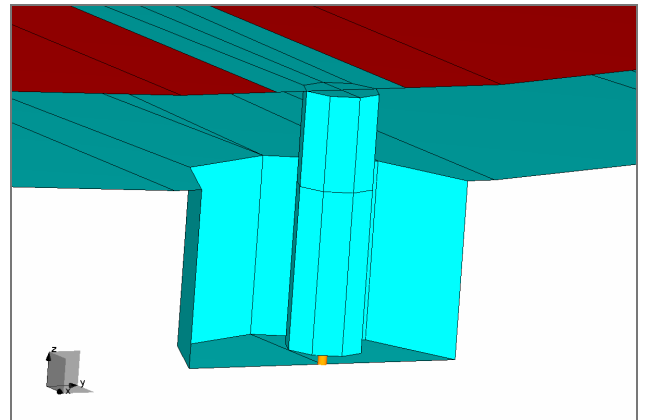


Figure 7. Coaxial feeder on the first port.

Feeders on the other ports (ports 2-7) are the same. Model of this feeder is shown in Figure 8.

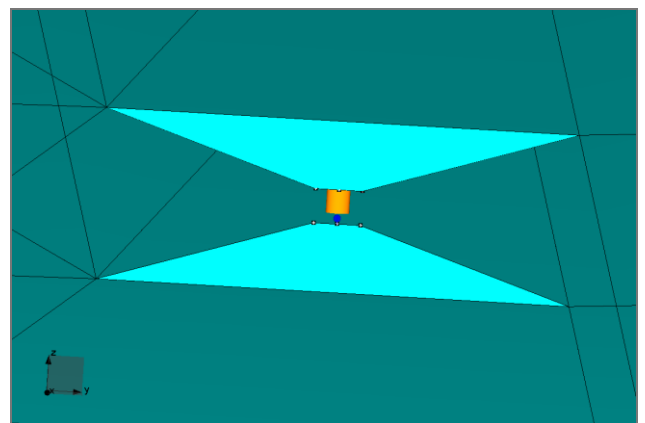


Figure 8. Feeder on the port 2.

Simulation settings

Frequency range mentioned above (1.4 GHz to 1.6 GHz) was divided into 11 frequency points. Operation mode ANTENNA (One generator at time) is chosen.

As we can see from Figure 1 and Figure 3, model is symmetrical versus xOz plane. Anyway, we simulated the whole model.

Simulation Results

The simulation was carried out on Intel® Core™ 2 Quad 64 bit processor (2.66 GHz) with 4 GB of RAM. The tool used for simulation is WIPL-D Pro on Windows XP platform.

Table 1. Simulation time and number of unknowns.

Simulation time per frequency	Number of unknowns
99 sec	2487

Magnitude of s11 (in dB) parameters is shown in Figure 8.

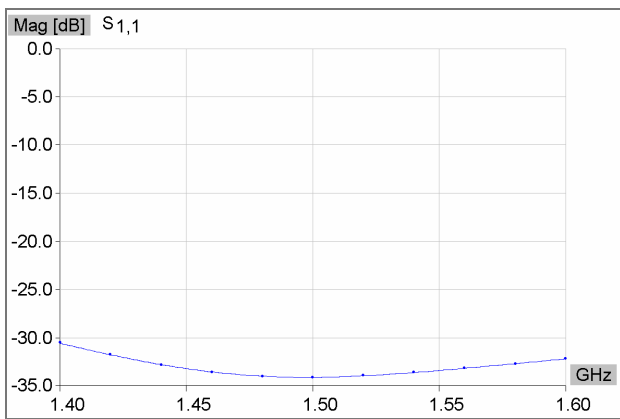


Figure 9. Magnitude of S11 parameters.

Results for the other parameters of interest are shown in Figures 10-11. Because of symmetry of the structure, parameters s21 and s31, s41 and s51 and finally, pair of s61 and s71 are with the same values. Thus, only parameters s21, s41 and s61 are displayed here.

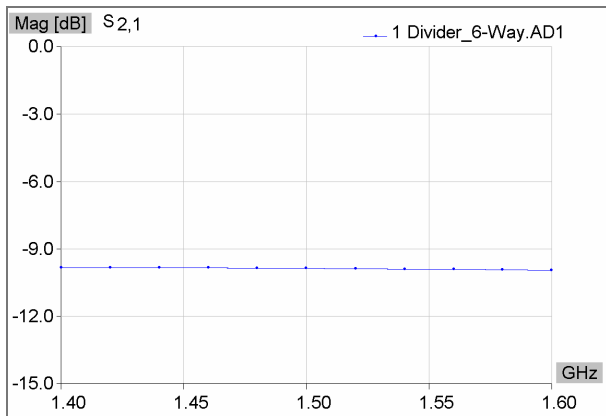


Figure 10a. Parameter s21 - magnitude.

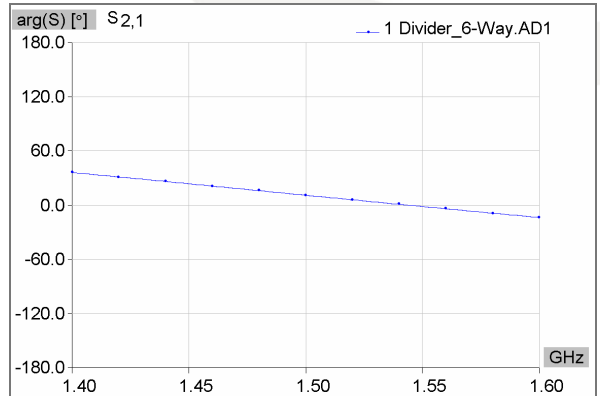


Figure 10b. Parameter s11 - phase.

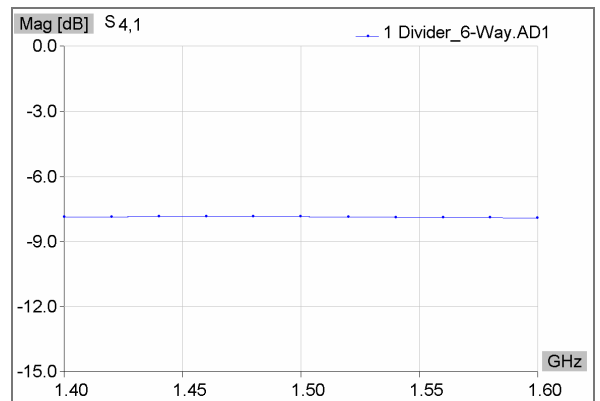


Figure 11a. Parameter s41 - magnitude.

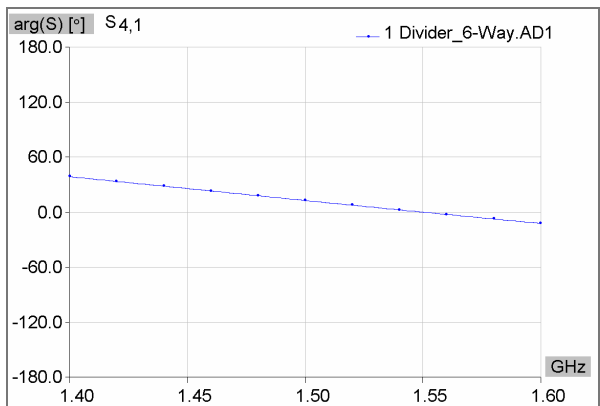


Figure 11b. Parameter s41 - phase.

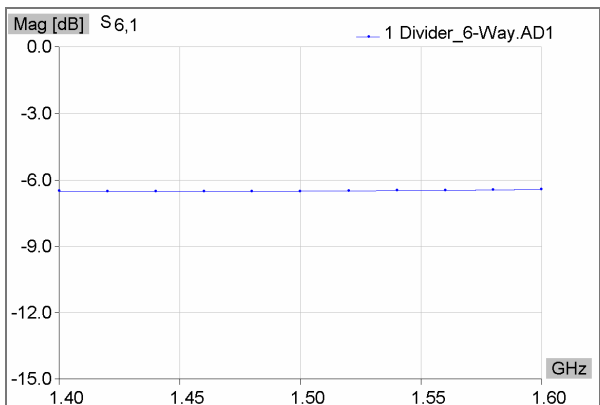


Figure 12a. Parameter s61 - magnitude.

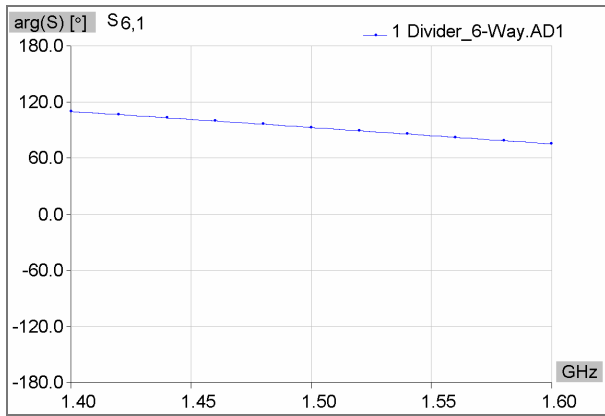


Figure 12b. Parameter s41 – phase.