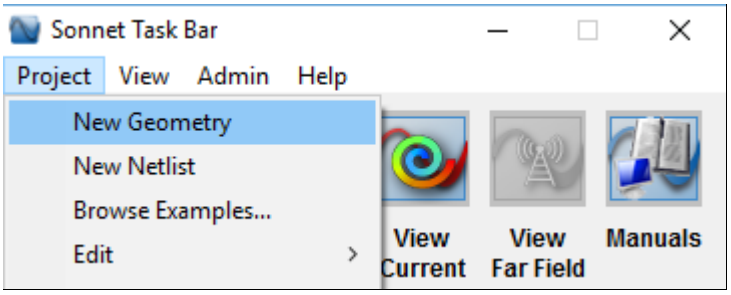
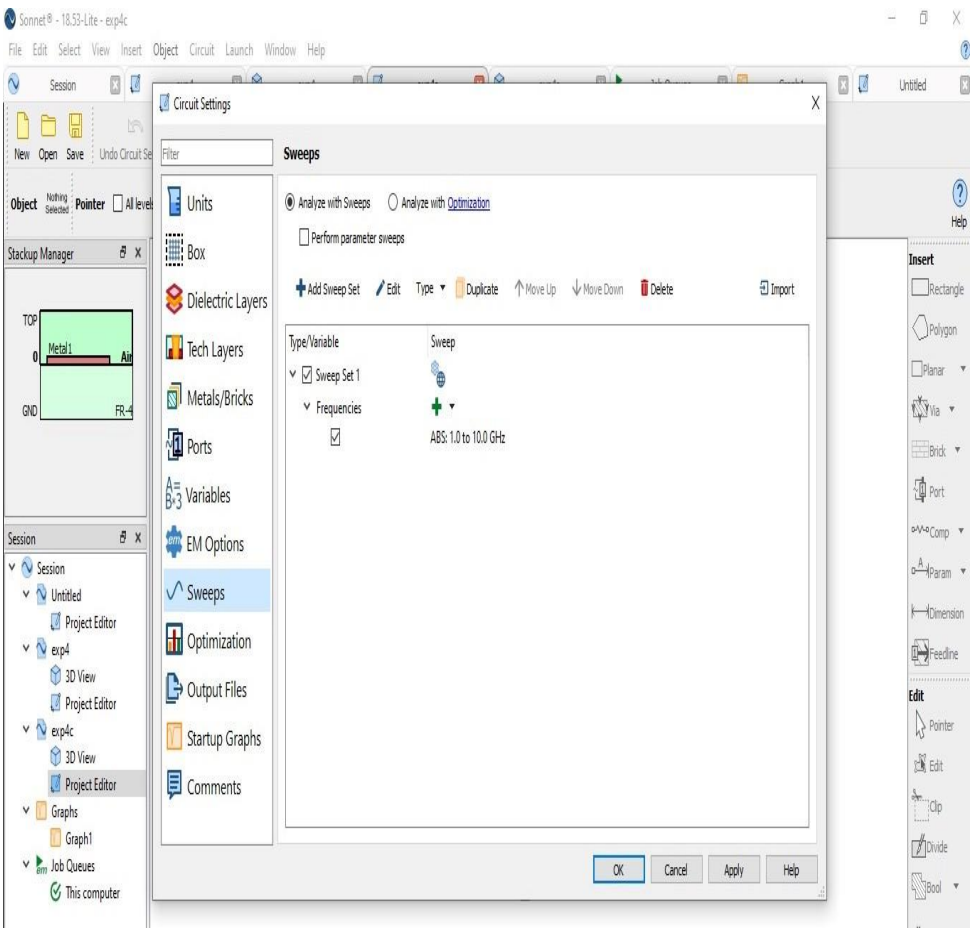
Procedure

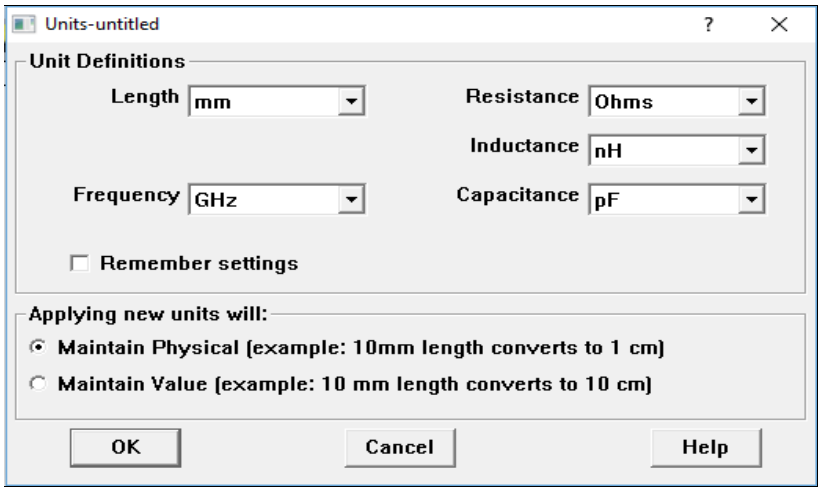
1. Open sonnet software. In sonnet Task bar click on project and select New Geometry.



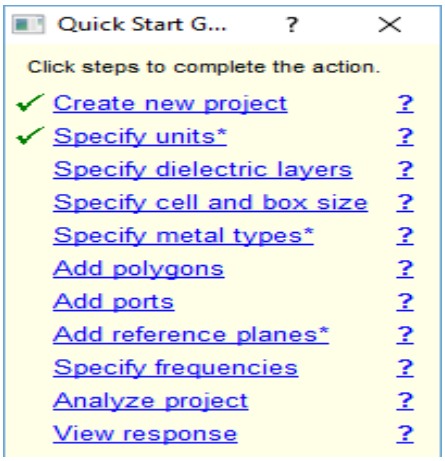
2. Now we see the Sonnet Project Editor window on which we have to draw the transmission line geometry according to calculations. In the Sonnet Project click on settings. A circuit settings window will appear as follows.



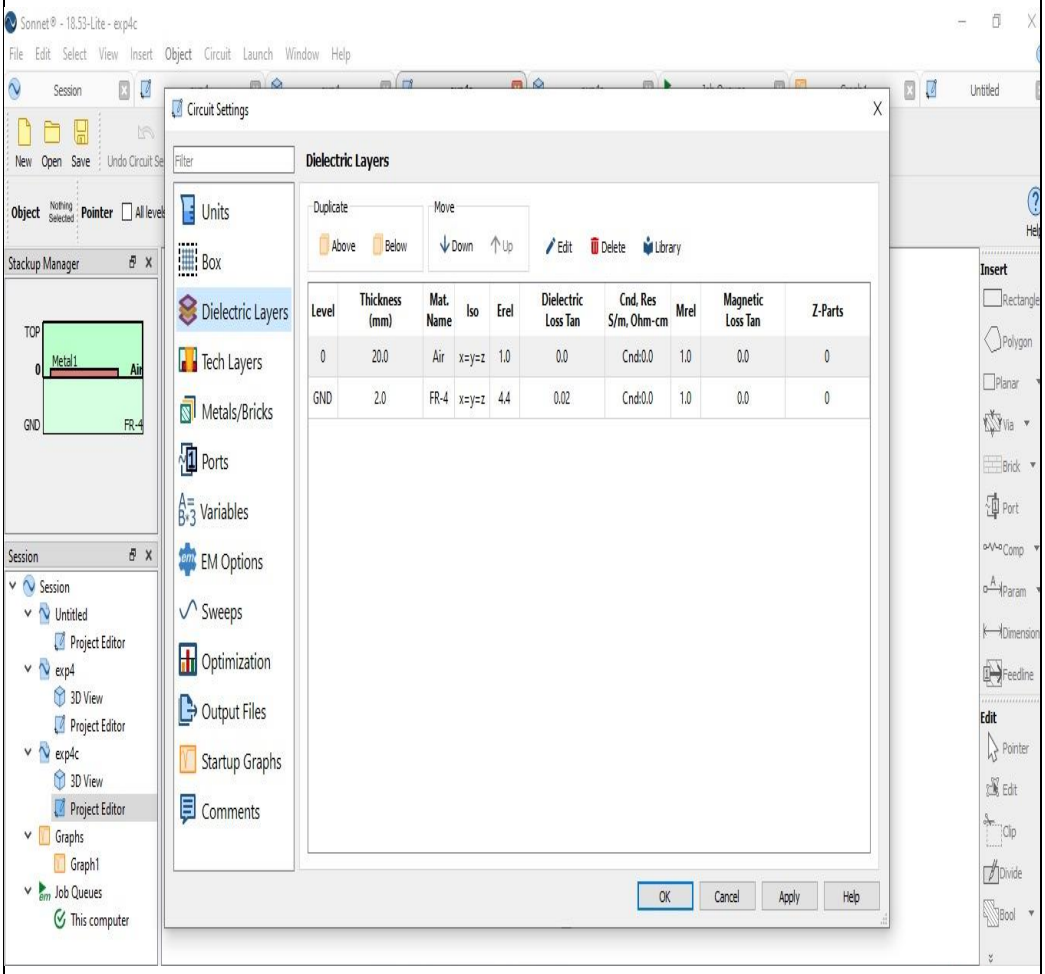
3. Specify units: In the Sonnet Project Editor window under the circuit click on units. Chose Length and Frequency unit. (Note-If you chose Length unit in mm then you have to enter all dimensions in mm)



4. After completing the step, we observe mark on Quick Start Guide window corresponding to the completed steps.

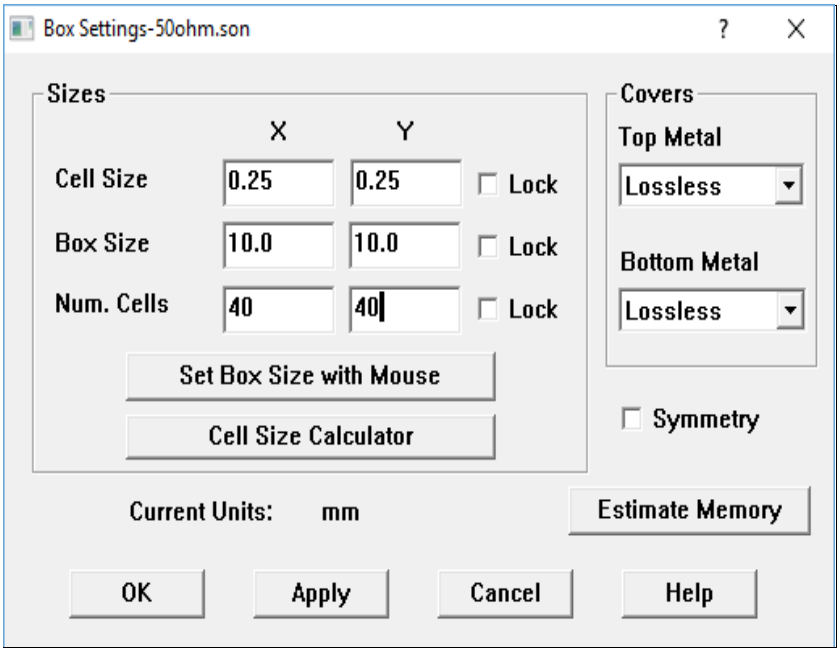


5. **Specify dielectric layers:** In the Sonnet Project Editor window under settings click on dielectric layers. We design the microstrip line on the substrate (Normally FR-4 substrate is used) and for simulating the design we assume that the substrate is inside an imaginary box that is filled with air. In the dielectric layer, we specify the type of material and their height.


Sonnet® - 18.53-Lite - exp4c
File Edit Select View Insert Object Circuit Launch Window Help
Session
Untitled
New Open Save
Object Pointer
Stackup Manager
TOP
Metal1
Air
GND
FR-4
Session
Session
Untitled
Project Editor
exp4
3D View
Project Editor
exp4c
3D View
Project Editor
Graphs
Graph1
Job Queues
This computer
Circuit Settings
Filter
Units
Box
Dielectric Layers
Tech Layers
Metals/Bricks
Ports
Variables
EM Options
Sweeps
Optimization
Output Files
Startup Graphs
Comments
Dielectric Layers
Duplicate
Above
Below
Move
Down
Up
Edit
Delete
Library
Level
Thickness (mm)
Mat. Name
Iso
Erel
Dielectric Loss Tan
Cnd, Res S/m, Ohm-cm
Mrel
Magnetic Loss Tan
Z-Parts
0
20.0
Air
x=y=z
1.0
0.0
Cnd:0.0
1.0
0.0
0
GND
2.0
FR-4
x=y=z
4.4
0.02
Cnd:0.0
1.0
0.0
0
OK
Cancel
Apply
Help
Insert
Rectangle
Polygon
Planar
Via
Brick
Port
Comp
Param
Dimension
Feedline
Edit
Pointer
Edit
Clip
Divide
Bool

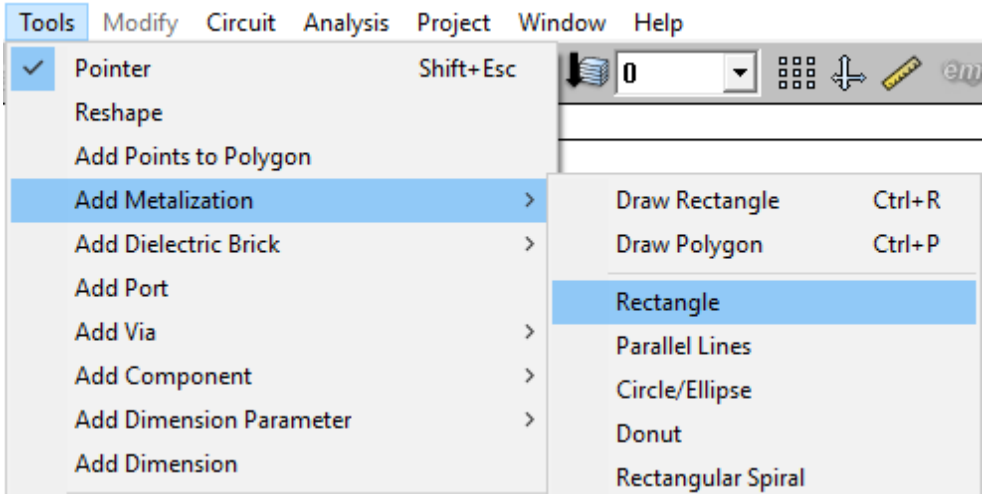
Click on the material Name. i.e. is unnamed and renamed as Air and enter thickness 20(it accepts 20mm because we have specified the Length unit as 'mm').
Similarly double click on unnamed and click on Select dielectric from library. Now select FR-4 as a dielectric material and click on OK.

5. **Specify cell and box size:** We will define the analysis box next. This sets the X*Y size of the dielectric layers. To access this dialog box click Circuit > Box



In this example we will use a 10 x 10 mm box size (grid). The idea is to have a large enough PCB size to allow for your circuit and use a fine enough grid to handle the dimensions you plan to use. **The grid size is inversely proportional to your model size, so it must be selected carefully.**

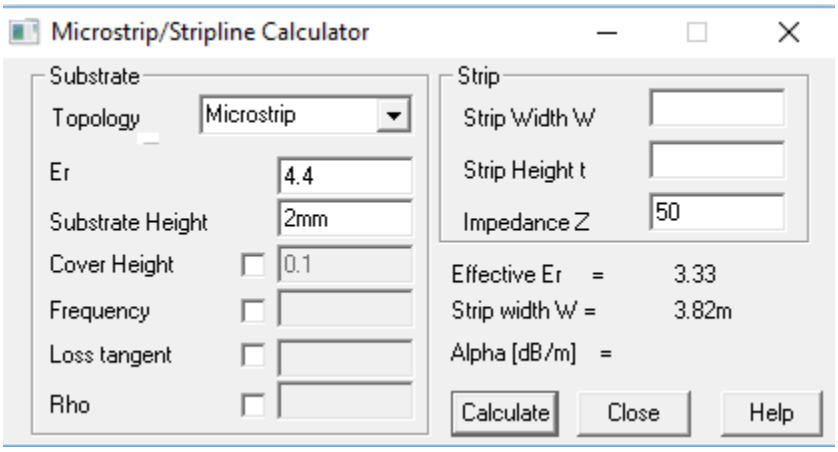
6. **Adding a Rectangle**: The impedances are converted into a transmission line and each transmission line is drawn using a Rectangle made up of metal.
   Go to Insert > Metallization > Rectangle

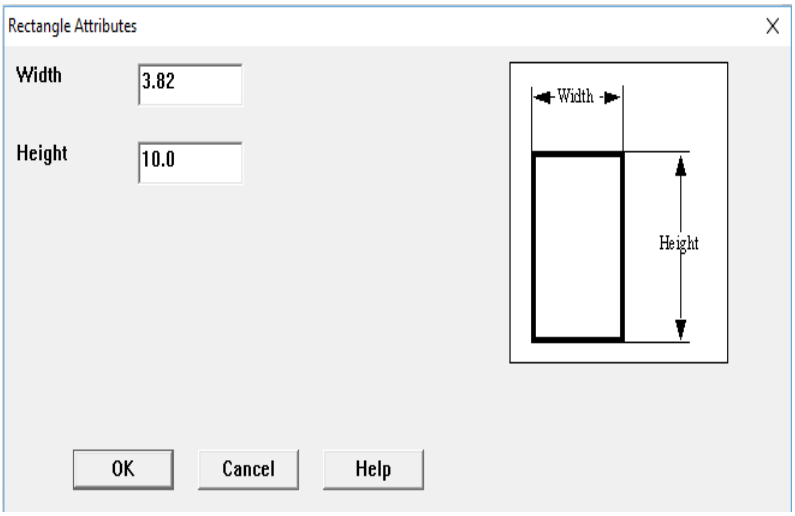


Enter the Rectangular attributes i.e. its width and Height.

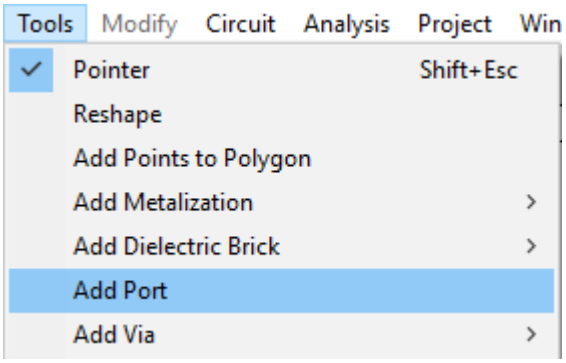
Width Calculation:

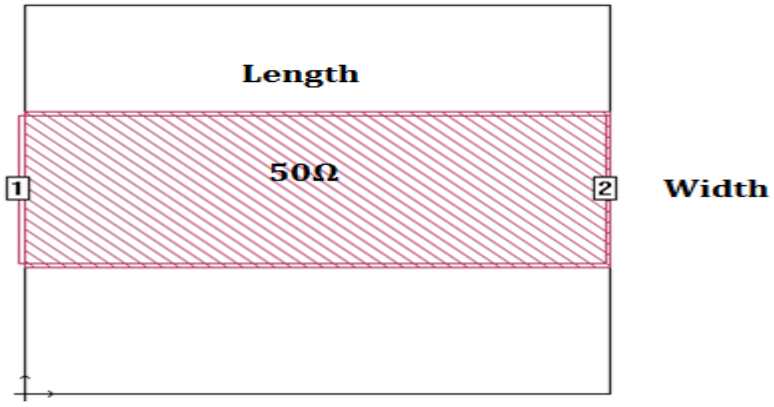
- Width is calculated by using APLAC calculator.
- Open APLAC software >In Aplac Editor Window under Tools> Select Microstrip Calculator.
- In Microstrip Calculator enter substrate Er (4.4 for FR-4 substrate), substrate Height (2mm) and enter the Impedance of transmission line.
- Click on Calculate.





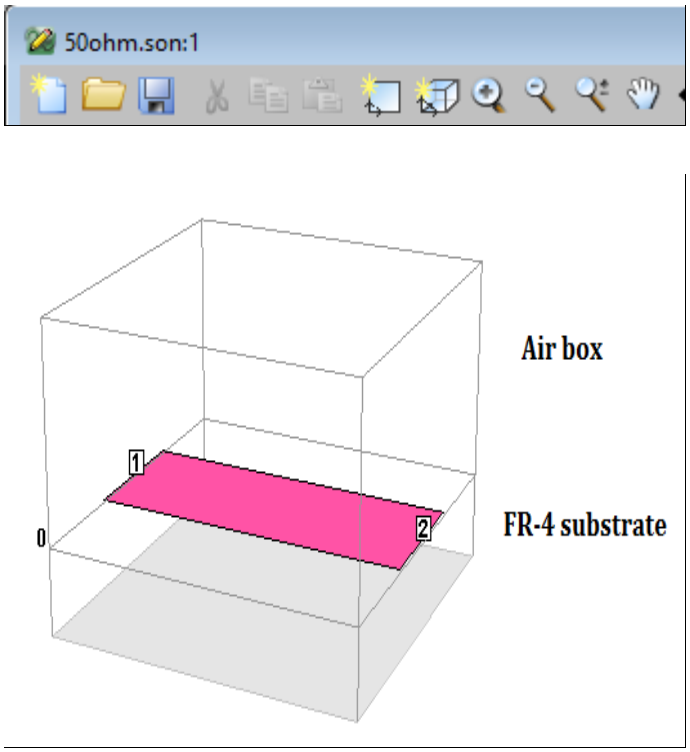
7. **Add Ports:** In Sonnet Project Editor window >under Insert >select Add ports and drag the port (input port) at the left edge of the 50 Ω transmission line. Similarly, select the port (output port) and drag it at the right edge of the 50Ω transmission line.



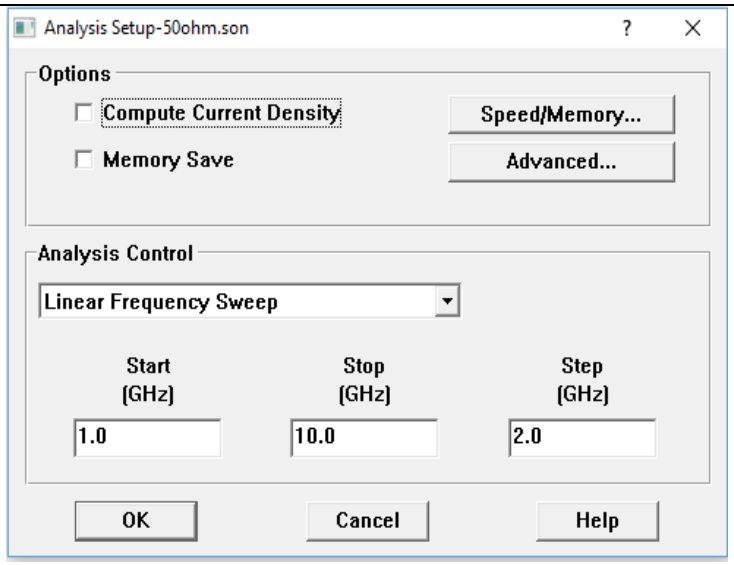


(Note: Take any length for a 50Ω transmission line. Here we adjust the length according to the length of box).

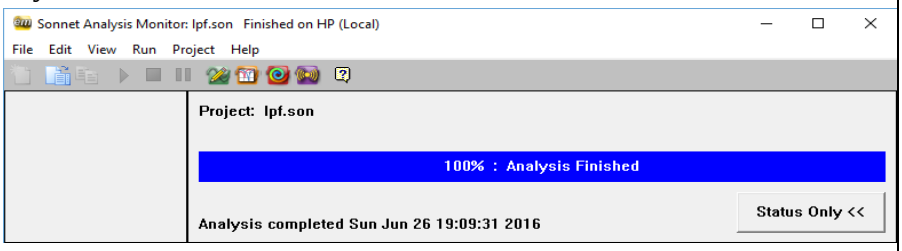
We can also observe the 50Ω line in 3D by clicking on view 3D.



8. **Specify Frequency:** In the Sonnet Project Editor window >under Settings> click on
   Sweeps.
   In Analysis Setup under Analysis Control select Linear Frequency Sweep and enter the Star, stop and give Step frequencies.



8. **Analyze and View Response**: In Sonnet Project Editor window> Launch > click on Analyze> save > run
9. **To view graphs:** click on the graph > click on curves> then add S_{12}, S_{21} and S_{22} parameters by clicking on S_{11} and then edit it. We get the following window. If there is no error then we get a message as 100% Analysis Finished



View Response: In Sonnet Analysis Monitor > click on View Response.

(Note: If you are using Sonnet software student version setup then it will simulate file having maximum size of 1MB, so if you run a file that is greater than 1MB then it will give an error. To solve this problem, adjust the size of the air box and substrate (make cell size coarse) so that the area of simulation will be reduced. Otherwise, register the Sonnet Lite software which will allow you to simulate a maximum of 32MB of file.)

10. By default a cartesian graph of S_{11} in dB will be plotted in the Response Viewer. We can change the displayed data type by double clicking on the quantity in the left legend and selecting the command Edit curve group.