Antenna and Radio Propagation

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Experiment: 6

Design & Analysis of a Loop Antenna

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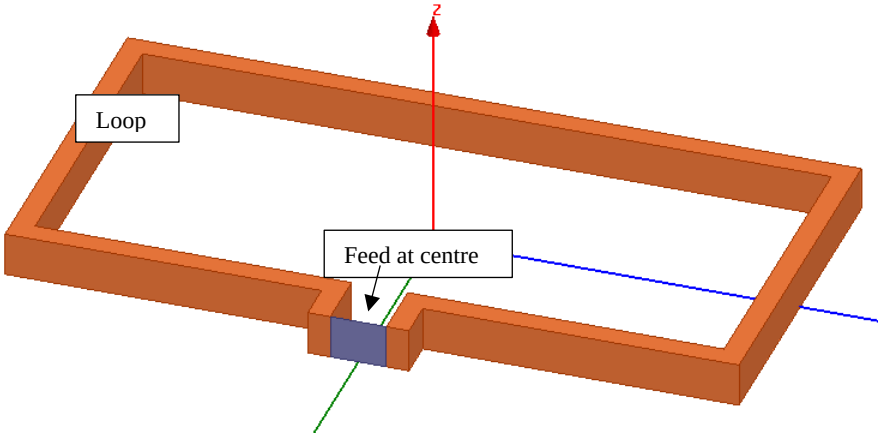
1 (a) Design & Analysis of a Loop Antenna

This guide leads you step-by-step through creating, solving, and analysing the results of a microstrip patch antenna.

By following the steps in this guide, you will learn how to perform the following tasks in HFSS:

- Draw a geometric model.
- Modify a model's design parameters.
- Assign variables to a model's design parameters.
- Specify solution settings for a design.
- Validate a design's setup.
- Run an HFSS simulation.
- Create a 2D x-y plot of S-parameter results.
- Create a 2D x-y plot of gain, efficiency results.
- Create a 2D Polar/Rectangular plot of radiation pattern.
- Create a 3D plot of radiation pattern.
- Create a field overlay plot of results.

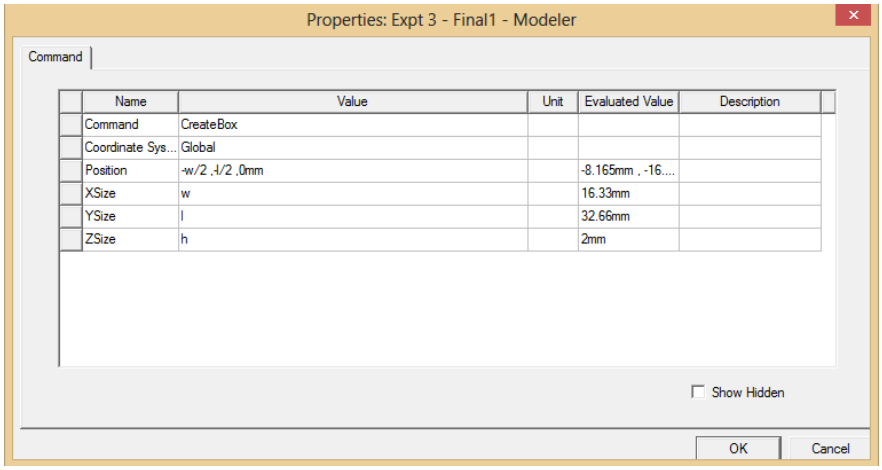
1 (b) Project overview



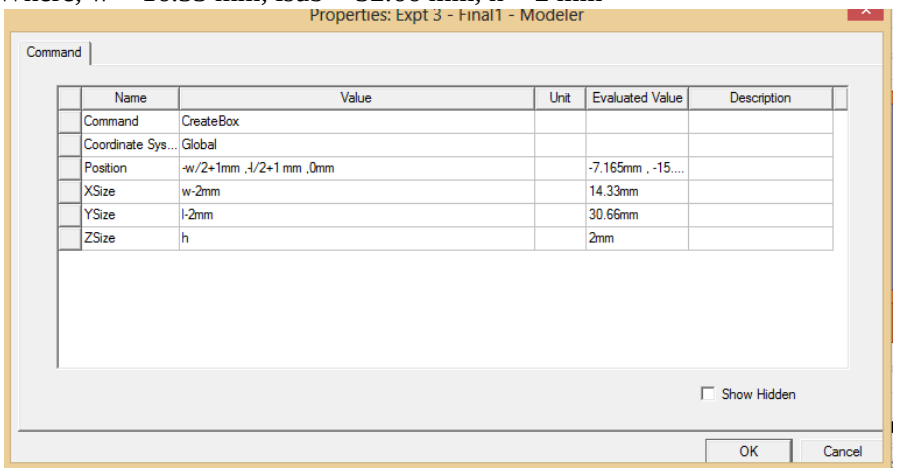
- Loop is made up of copper material.
- Feed is given at the centre

2 (a) Create the Model

1. Create a Rectangular Box1. Centre (-w/2 ,-l/2 ,0mm), X size = w, Y size= l, Z size = h
   Where; w = 16.33 mm, lsub = 32.66 mm, h = 2 mm

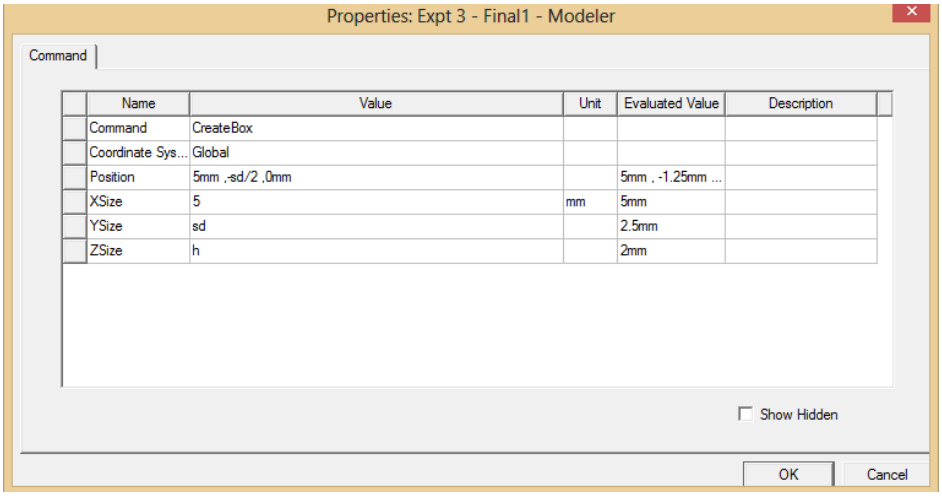


2. Create Rectangular Box2. Centre (-w/2+1mm ,-l/2+1 mm ,0mm), X size = w-2 mm, Y size= l-2 mm, Z size = h. Where, w = 16.33 mm, lsub = 32.66 mm, h = 2 mm

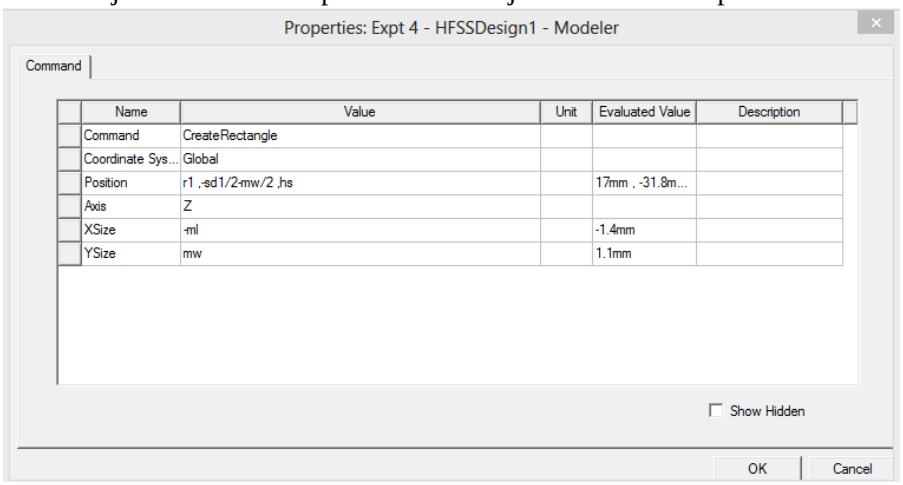


3. Now subtract the Object created in Step 2 from the Object created in Step 1.

4. Create Rectangular Box2. Centre (- 5mm ,-sd/2 ,0mm), X size = 5 mm, Y size= sd, Z = h, Where, sd = 2.5 mm, h = 2 mm

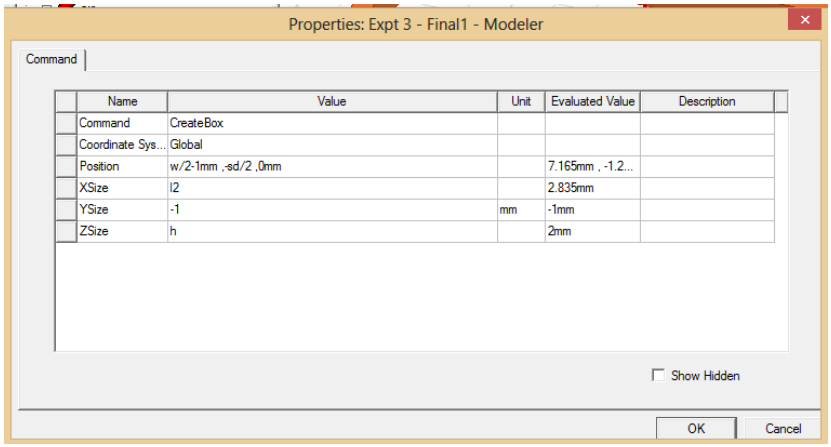


5. Now subtract the Object created in Step 4 from the Object created in Step 3.

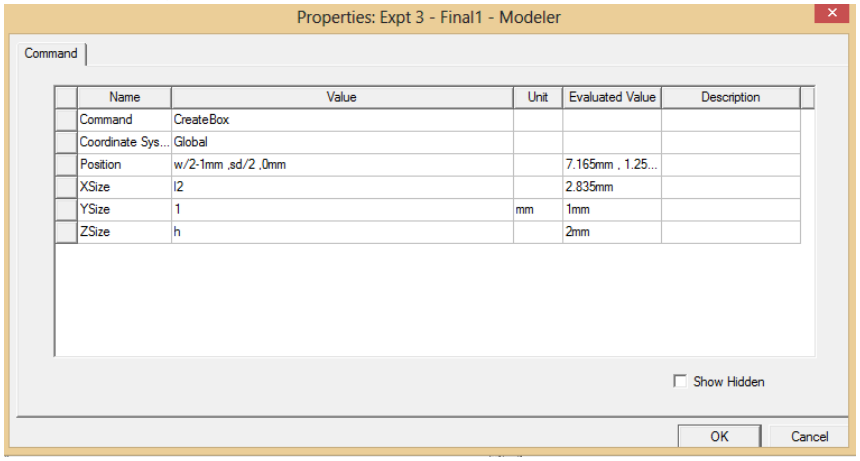


6. Now subtract the Object created in Step 4 from the Object created in Step 3.

7. Create another Rectangular Box. Centre (w/2-1mm ,-sd/2 ,0mm), X size = l2 mm, Y size= -1 mm, Z = h, Where, l2 = 2.835 mm, h = 2 mm

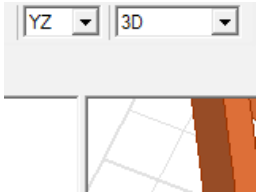


8. Create another Rectangular Box. Centre (w/2-1mm , sd/2 ,0mm), X size = l2 mm, Y size= 1 mm, Z = h, Where, l2 = 2.835 mm, h = 2 mm

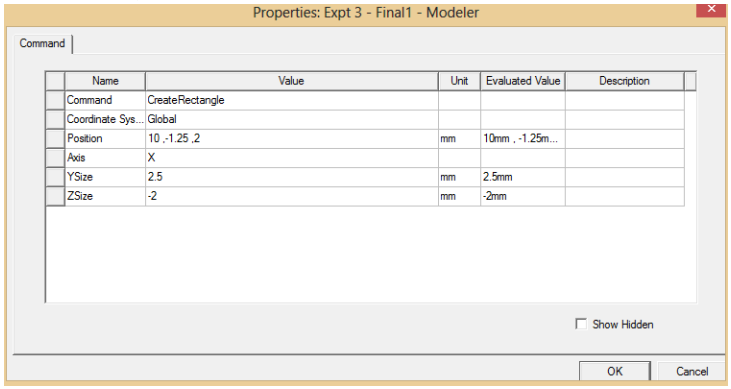


9. Unite the object created in Step 6 with objects created in Step 7 and Step 8.
10. Now assign material Copper to the object created in Step 9.

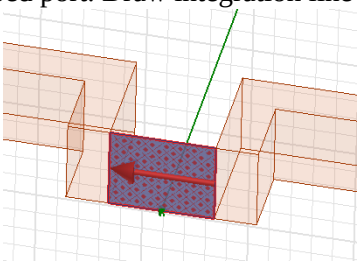
11. Now change the co-ordinate to Y.



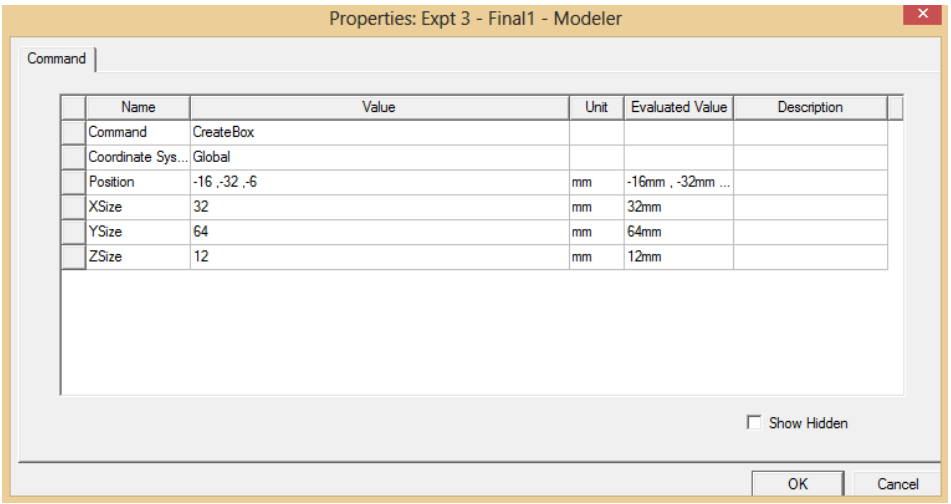
12. For excitation create a rectangular sheet between the two ends of the loop. Centre (10 mm ,-1.25 mm , 2 mm), Y size = 2.5 mm, Z size = -2 mm.



13. Now assign excitation using Lumped port. Draw integration line between the two ends of the loop.



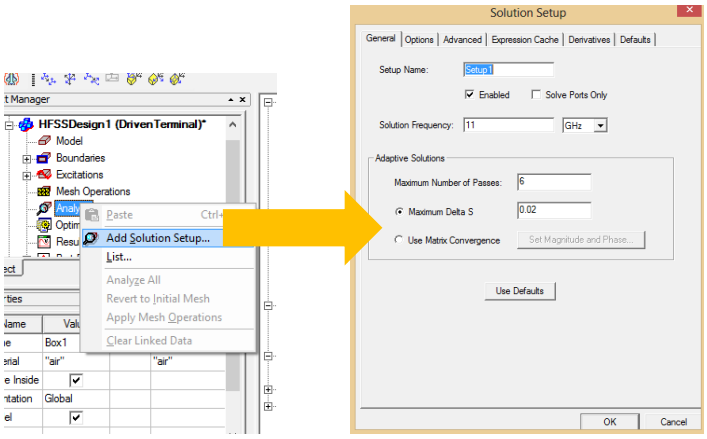
14. Now create the radiation box with dimension as shown below. All are in millimeter.



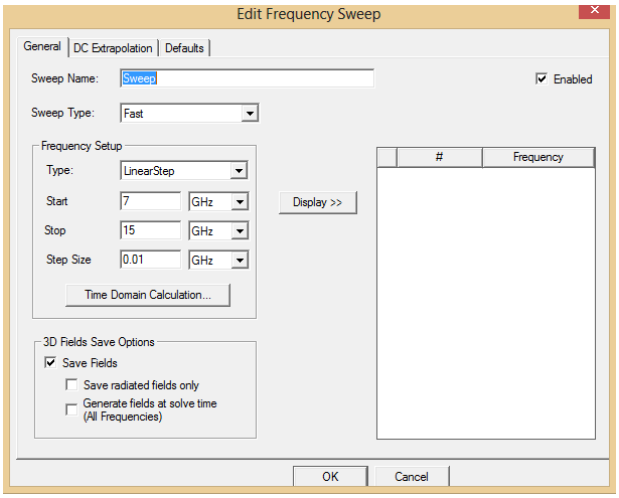
15. Assign material ‘Air’ to the radiation box.

16. Assign radiation only boundary to the radiation box. Right click > Assign boundary > Radiation

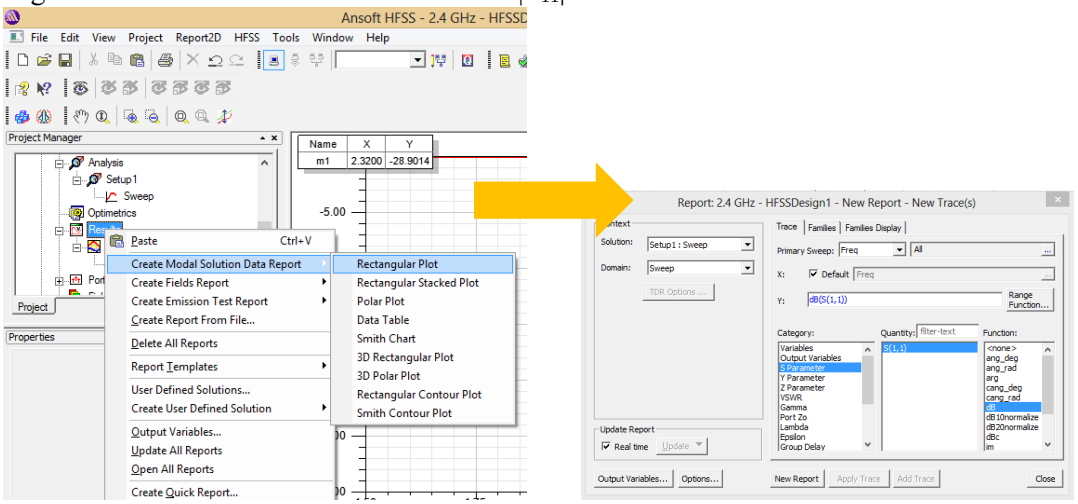
17. Right Click on analysis > Add solution setup → add 10 GHz > Ok

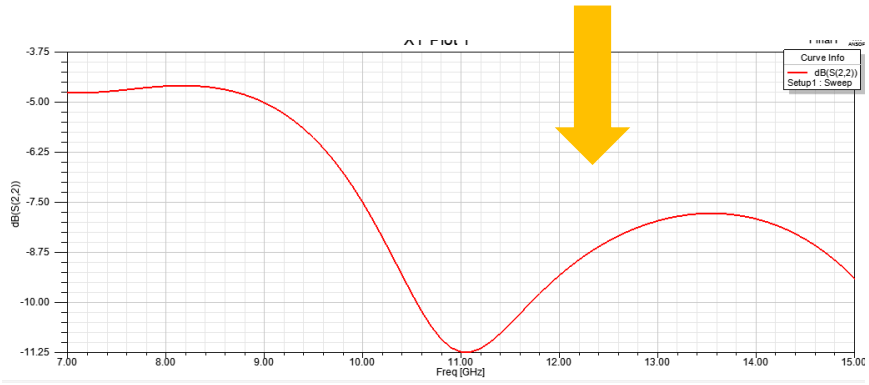


18. Click '+' of the analysis → Right click on setup → Add frequency sweep → Edit frequency sweep (Sweep type Fast, Frequency range 5 GHz to 15 GHz, Step size 0.01 GHz) → Ok

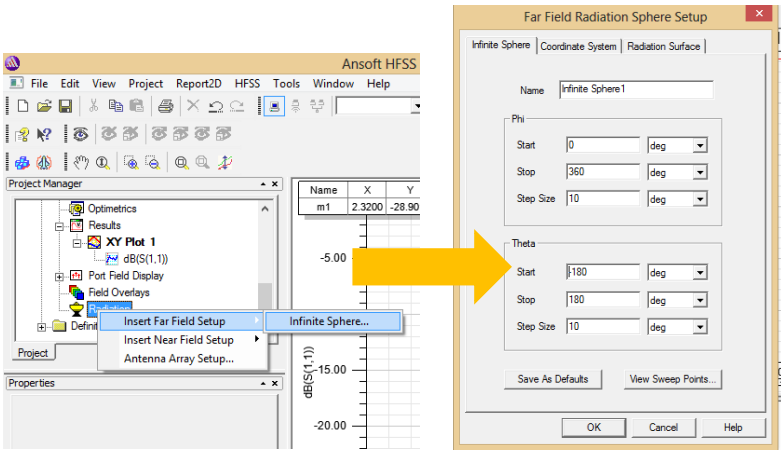


19. Right click on results > Do as follows…for $|S_{11}|$

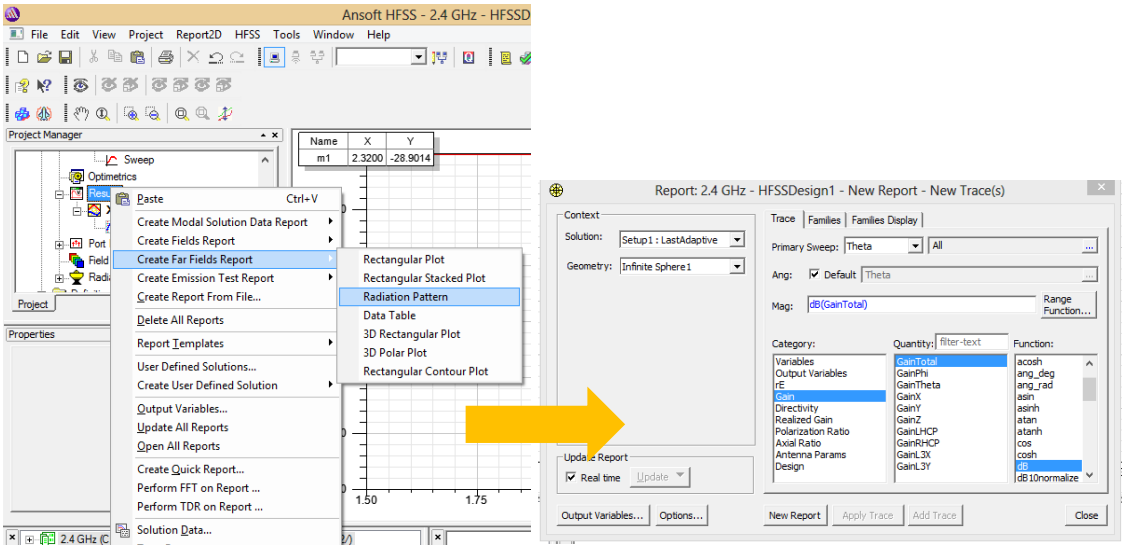




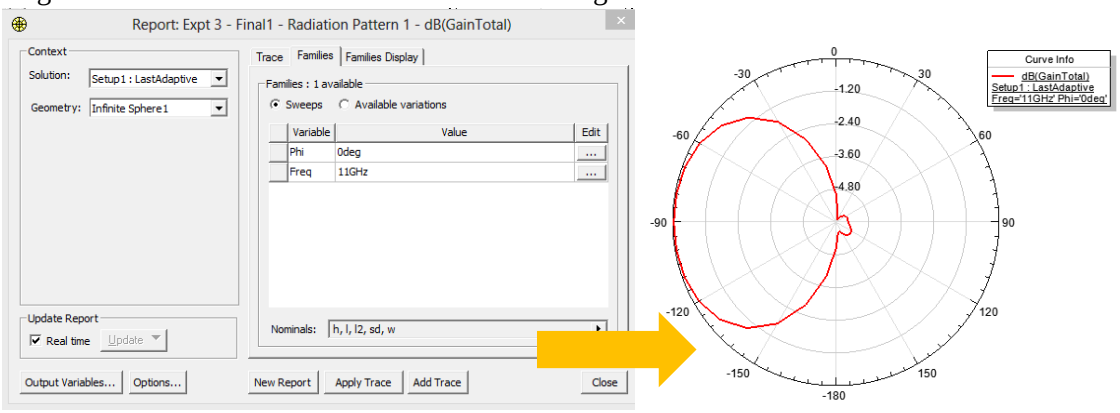
20. Right click on Radiation > Do as follows…for radiation pattern



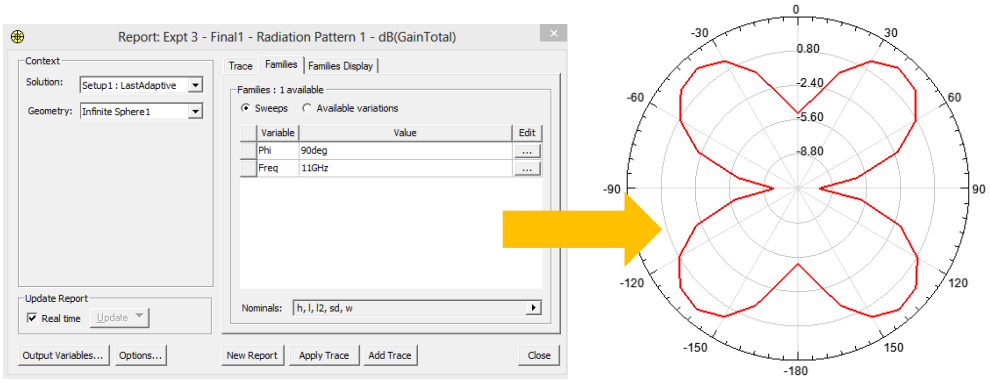
21. Then Right click on Results > Do as follows…for radiation pattern



Then go to Families and do as follows for Phi = 0 Degree



Then go to Families and do as follows for Phi = 90 Degree



22. Draw 3D polar plot. Follow the below procedure: