ANTENNAS AND WAVE PROPAGATION

LAB ASSIGNMENT 7

EXPERIMENT 7

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BATCH: 2018-2022
DIVISION: G2; EA 3

AIM: Design and analyze a MSA with slots.

THEORY: A slot antenna consists of a metal surface, usually a flat plate, with one or more holes or slots cut out. When the plate is driven as an antenna by an applied radio frequency current, the slot radiates electromagnetic waves in a way similar to a dipole antenna.

Babinet's principle states that- "When the field behind a screen with an opening is added to the field of a complementary structure, the sum is equal to the field when there is no screen".

The above images clearly explain the principle. In all the regions, which are non-collinear with the beam, the above two screens, in figures 1 & 2, produce the same diffraction pattern.

Case 1 – Consider a light source and a conducting plane (field) with an aperture before a screen. The light does not pass through the opaque area, but passes through the aperture.

Case 2 – Consider the light source and a conducting plane of the size of the aperture in the previous case, being held against the screen. The light does not pass through the plane but through the remaining portion.

Case 3 – Combine these two conducting planes of both the cases and put before the light source. The screen is not placed to observe the resultant combination. The effect of screen gets nullified.

Advantages:

The following are the advantages of Slot antenna –

- It can be fabricated and concealed within metallic objects
- It can provide covert communications with a small transmitter

Disadvantages:

The following are the disadvantages of Slot antenna –

- Higher cross-polarization levels
- Lower radiation efficiency

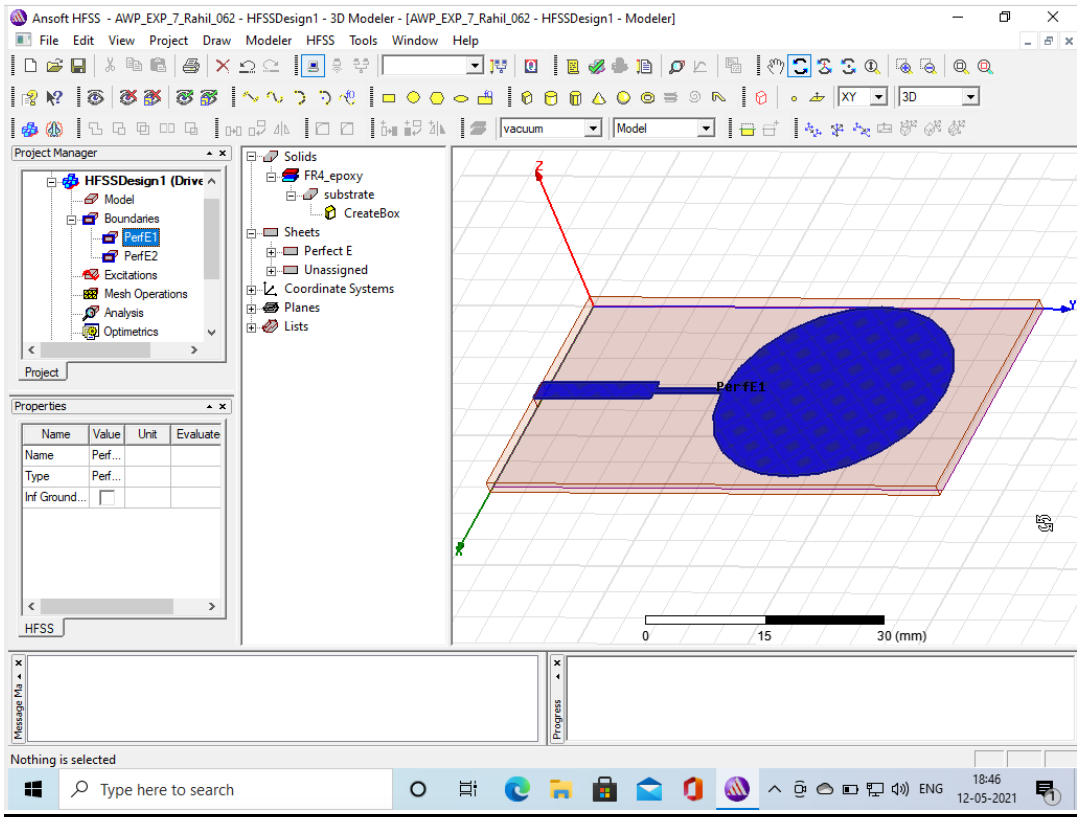
Applications:

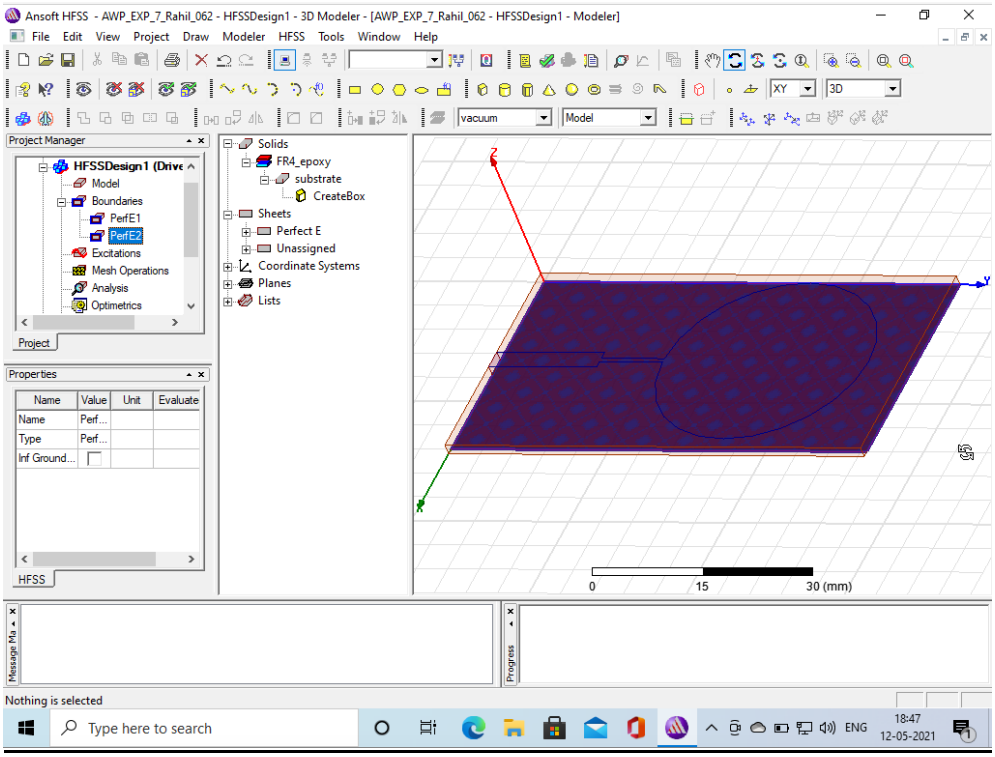
The following are the applications of Slot antenna –

- Usually for radar navigational purposes
- Used as an array fed by a wave guide

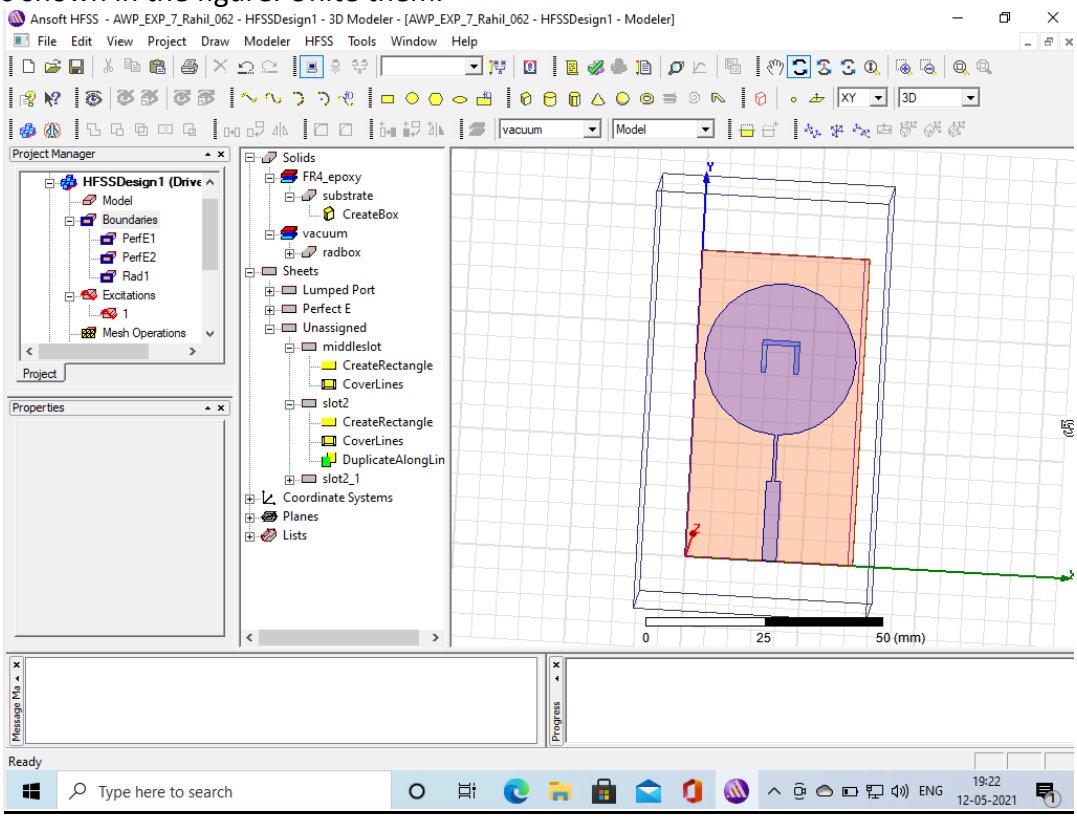
PROCEDURE AND SCREENSHOTS OF THE DESIGN [IN BRIEF]:

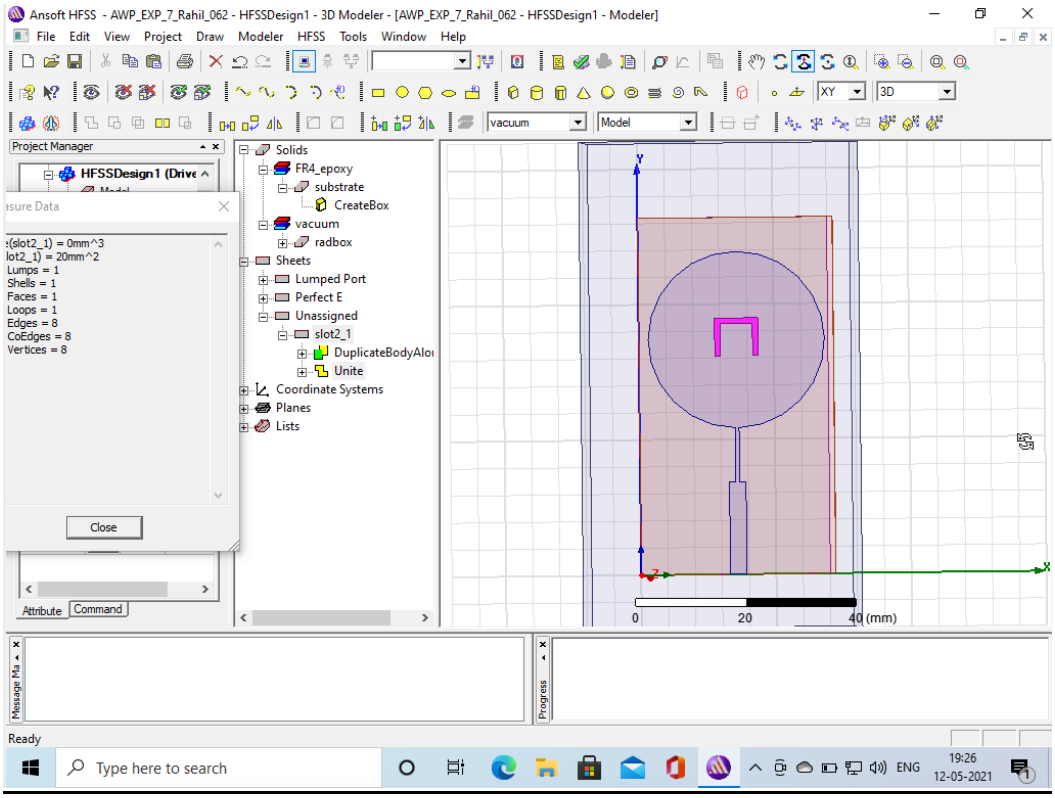
1. The antenna will be of 2.4 GHZ.
2. We will first design a Substrate Box. Then we give the dimensions to it which were calculated by the dimension calculator.
3. So basically we have first designed a simple patch antenna that we have already designed in the previous experiments. As shown in the figure.



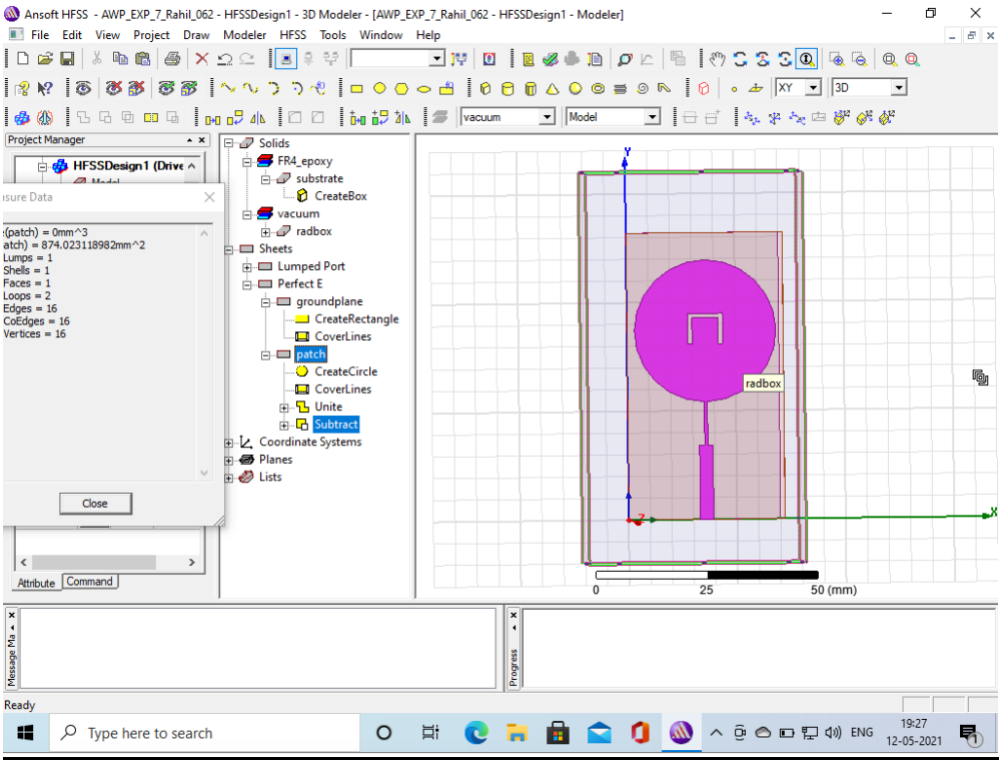


4. Now we will design the slots for the Antenna. Where we draw a rectangle towards the X-Axis.
5. Then we design a smaller rectangle towards the Y-Axis and then we duplicate it. Design it as shown in the figure. Unite them.

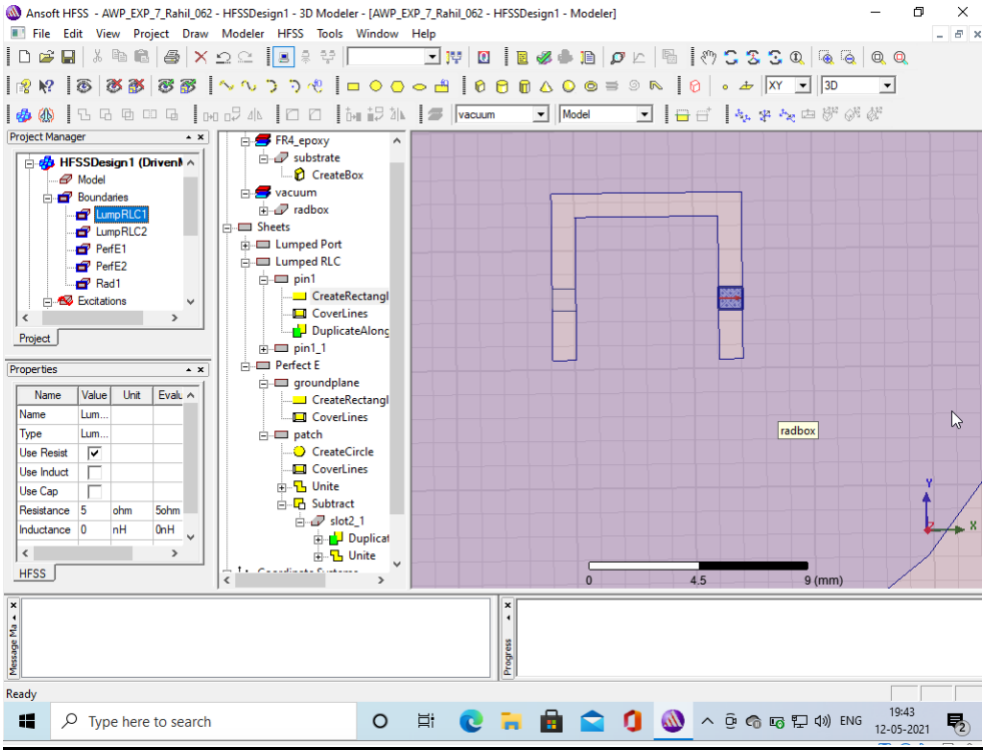


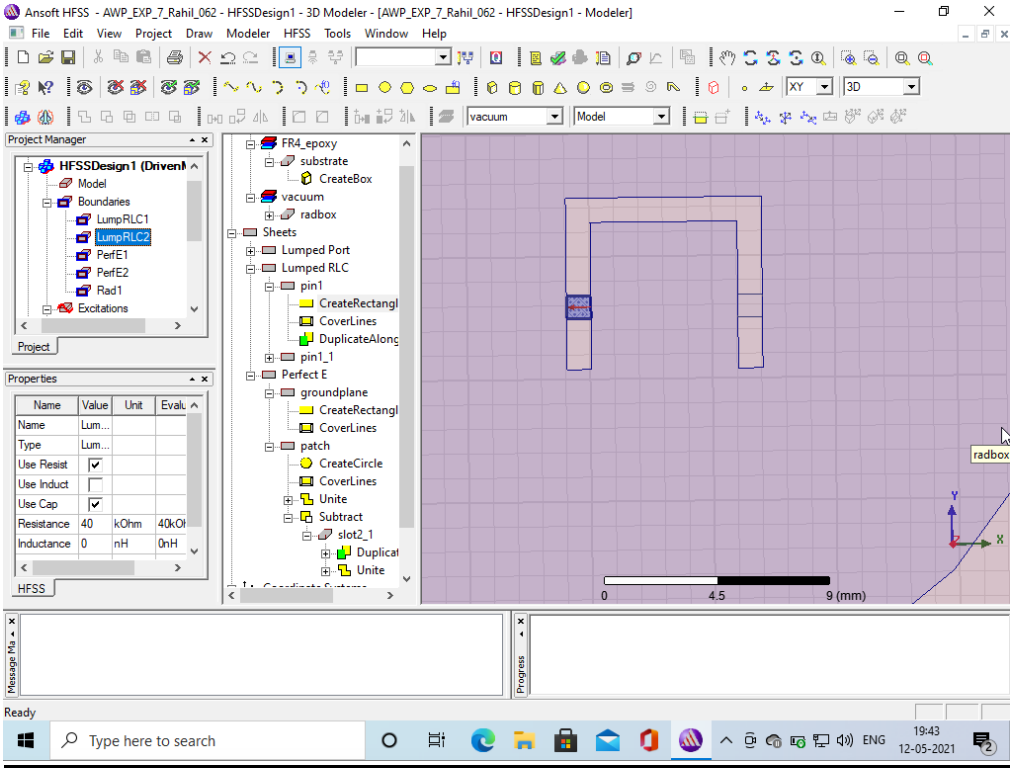


6. After step 5 we will subtract the Slot layer we have created from Patch layer. As shown in figure.

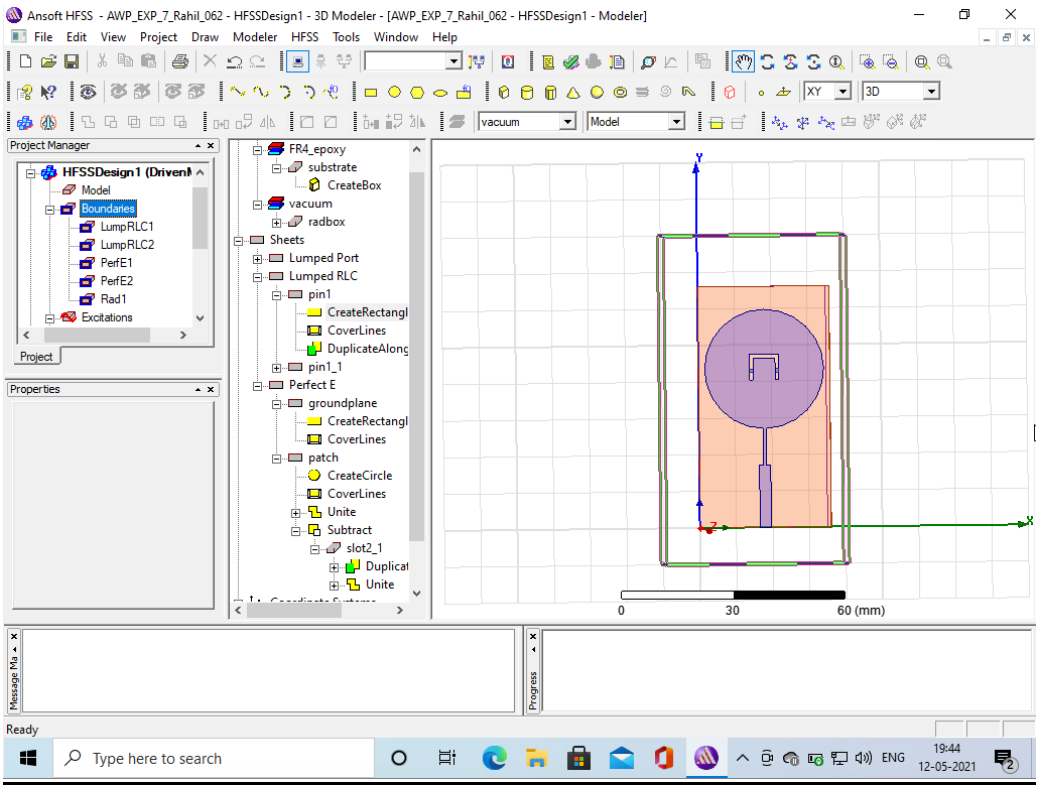


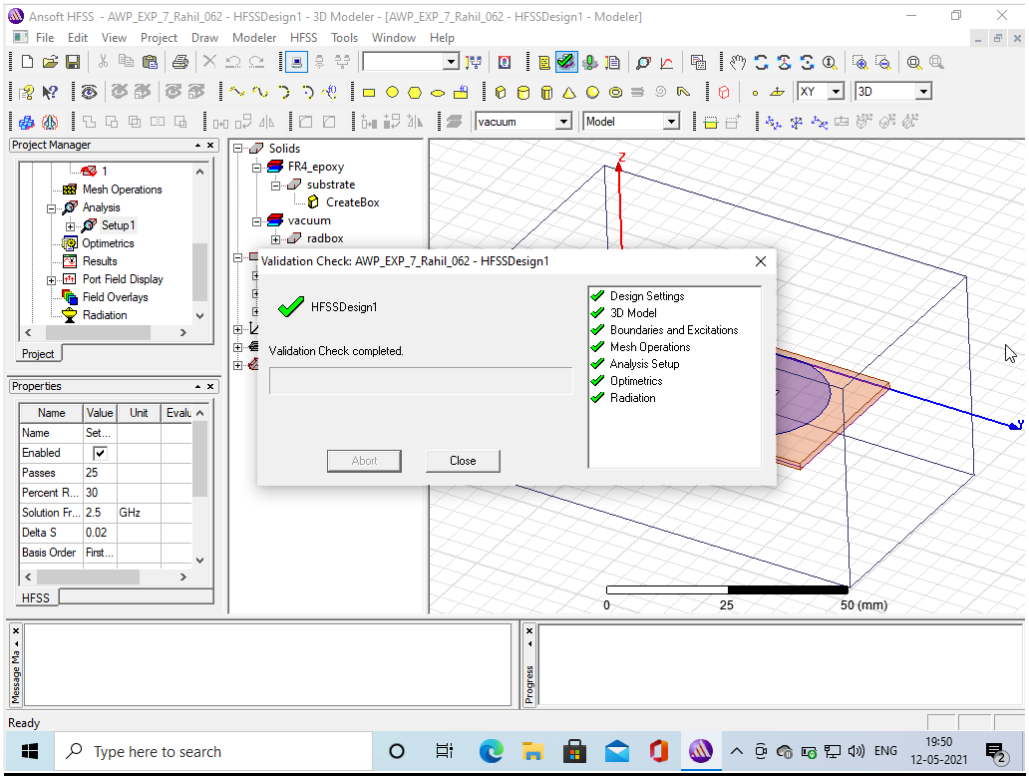
7. Then we will create two Pins and assign Lumped Port radiation to it.



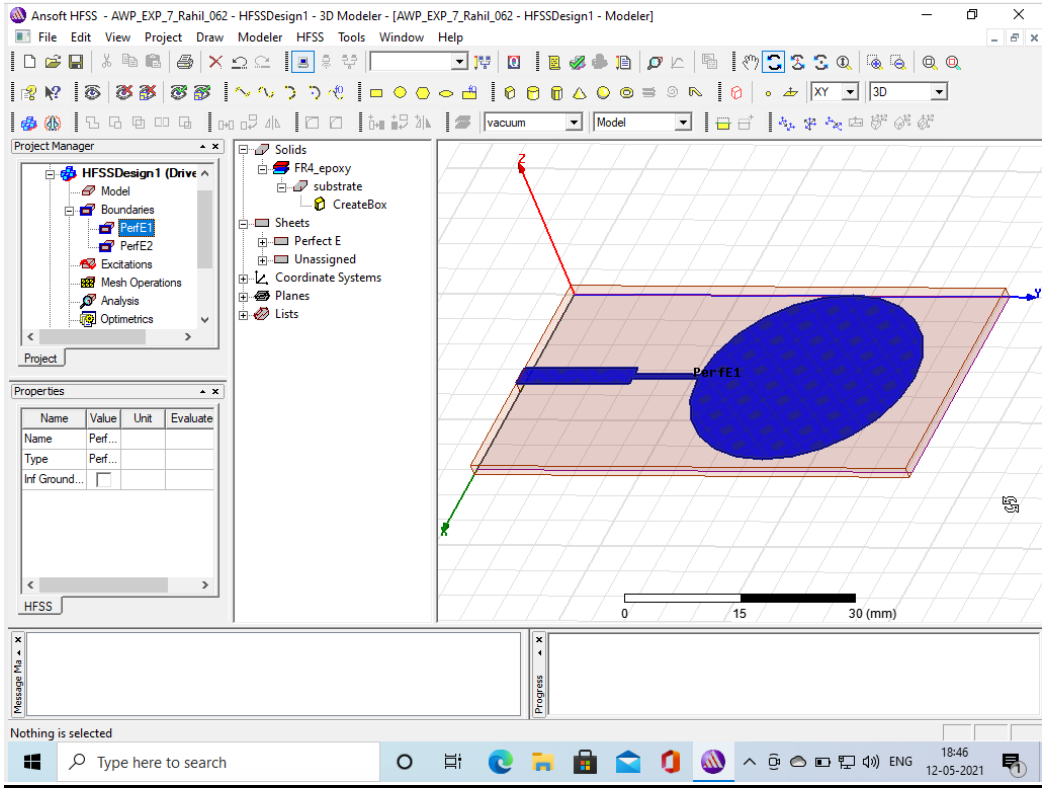


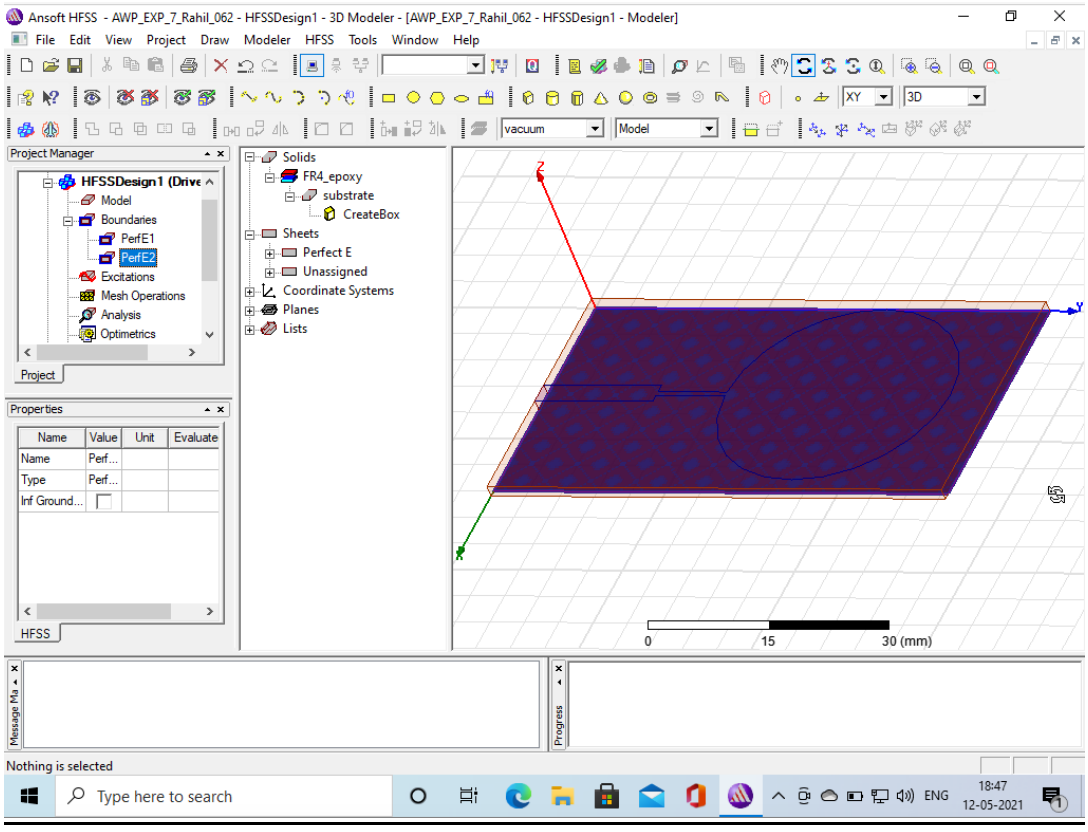
8. Now our final design is done and let us validate the design.

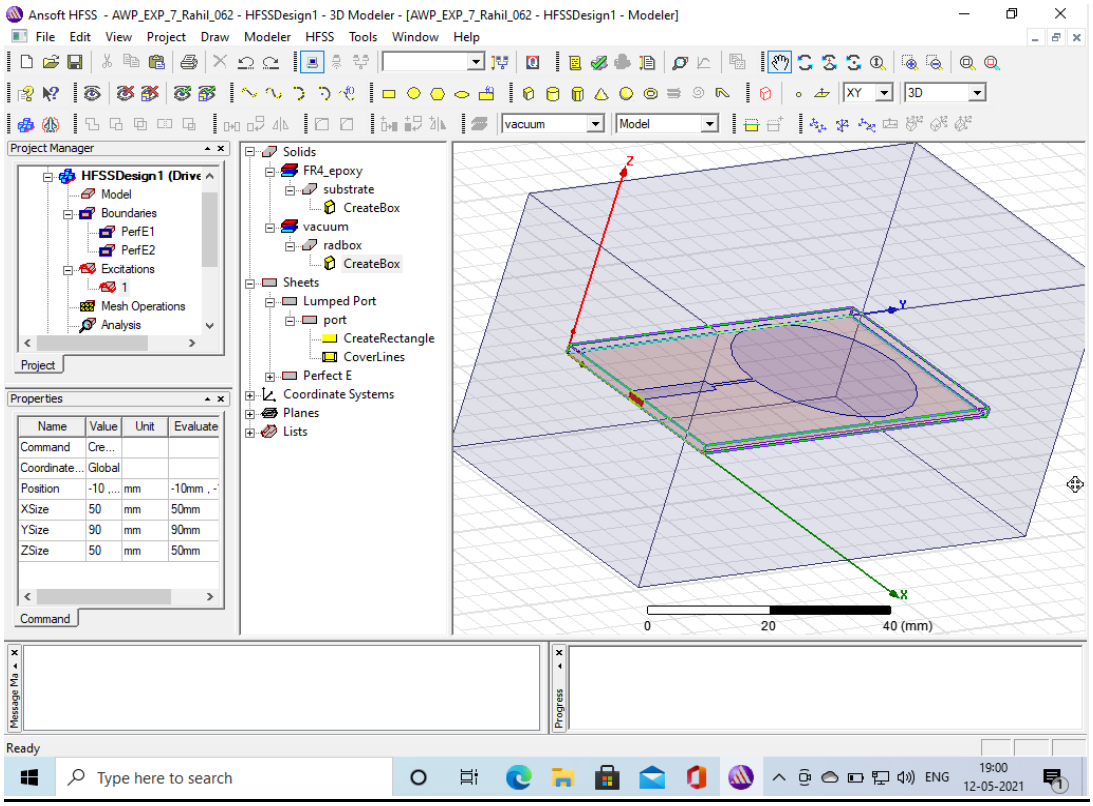




FINAL DESIGN SCREENSHOTS:



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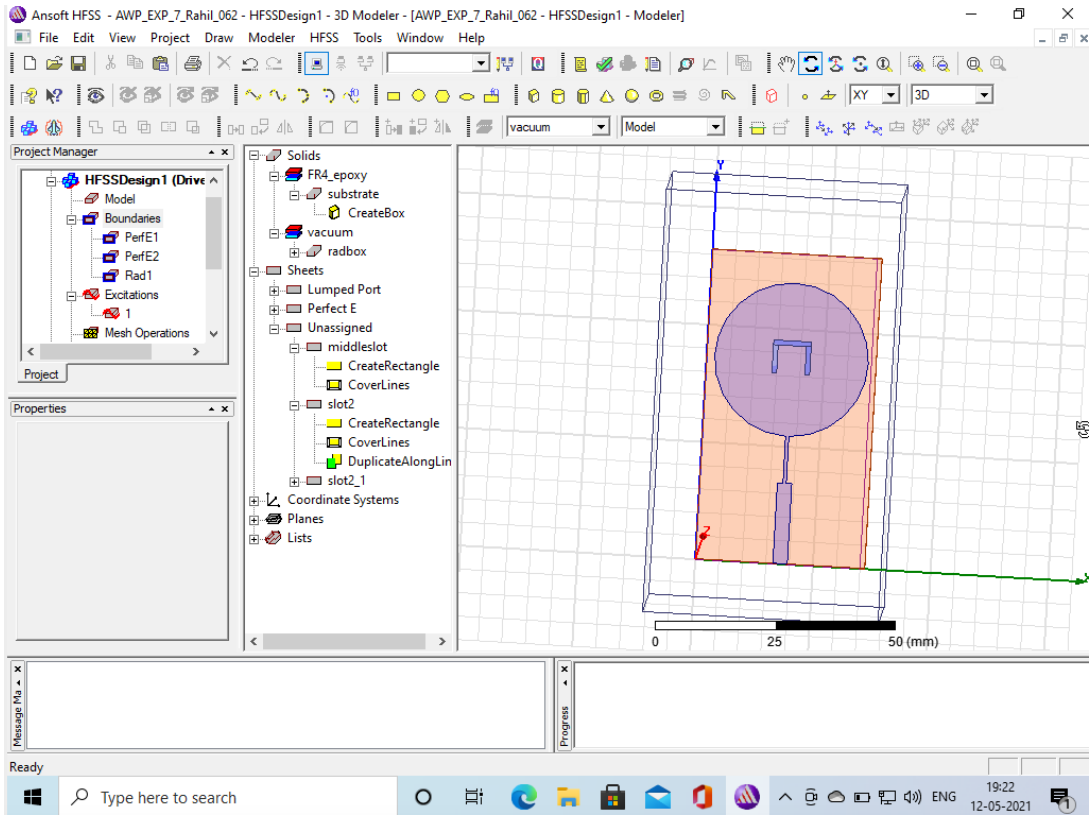
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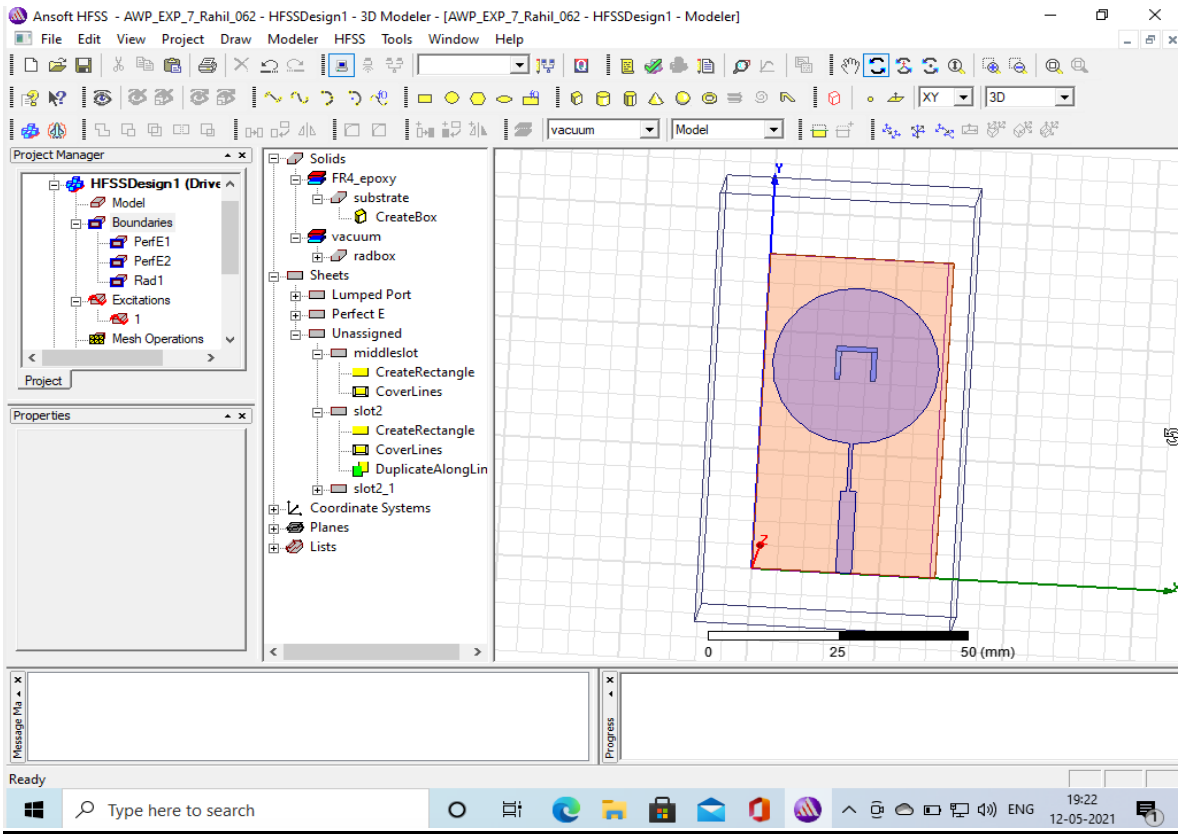
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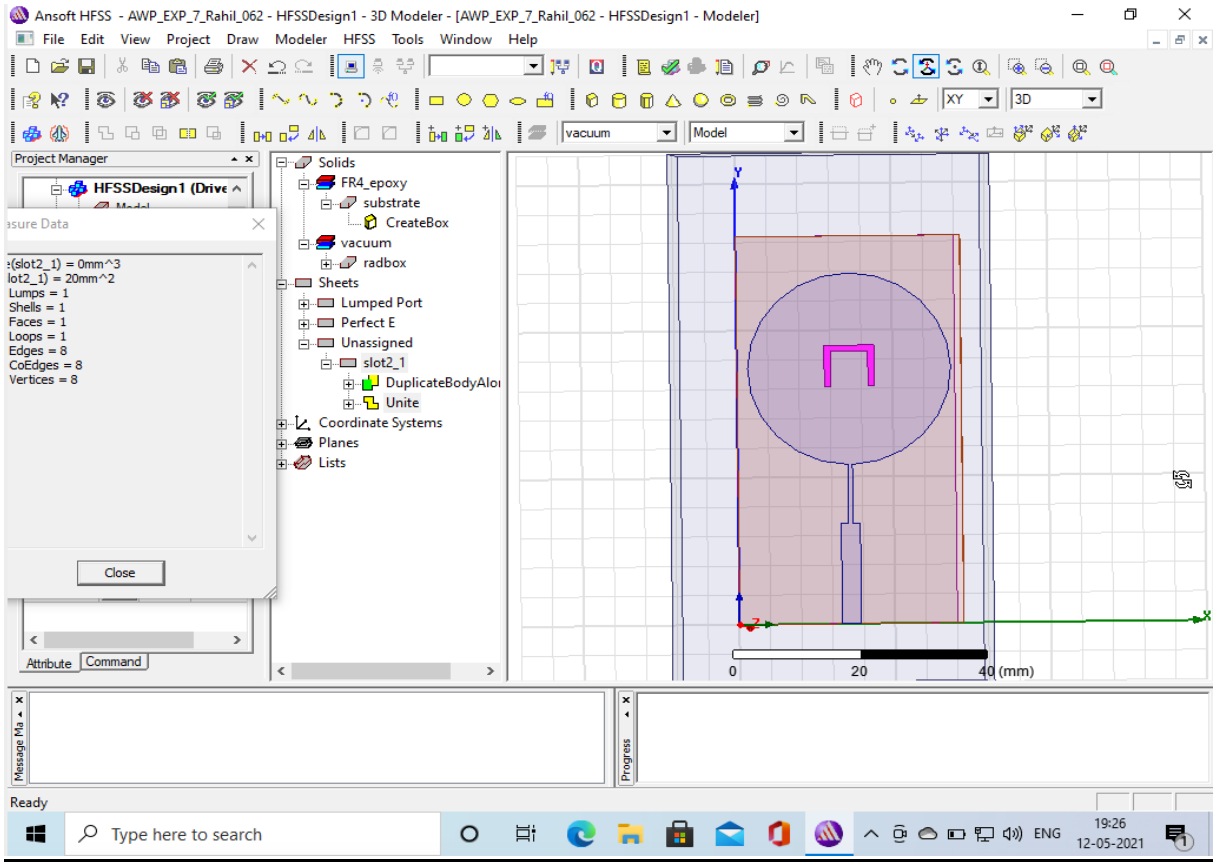
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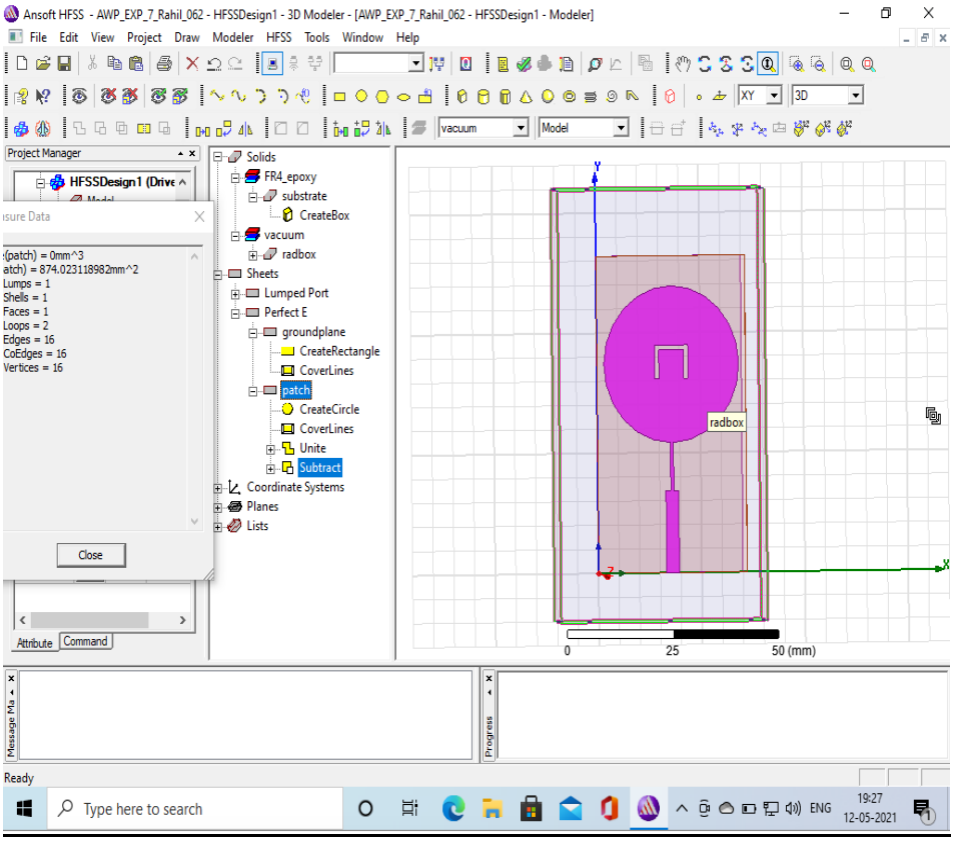
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Faces = 1
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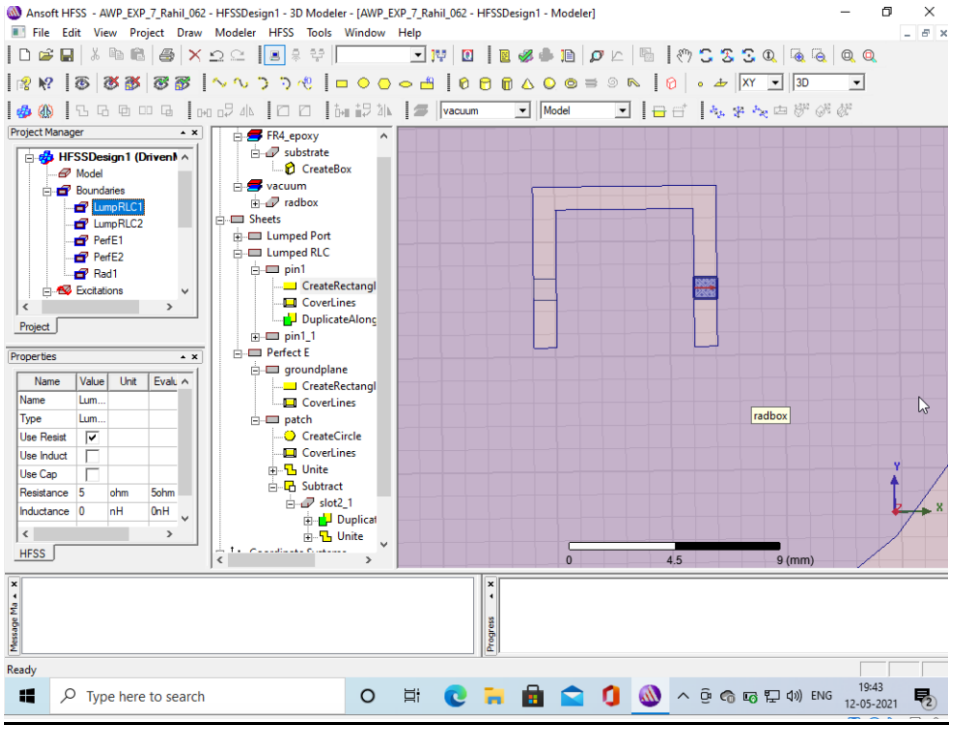
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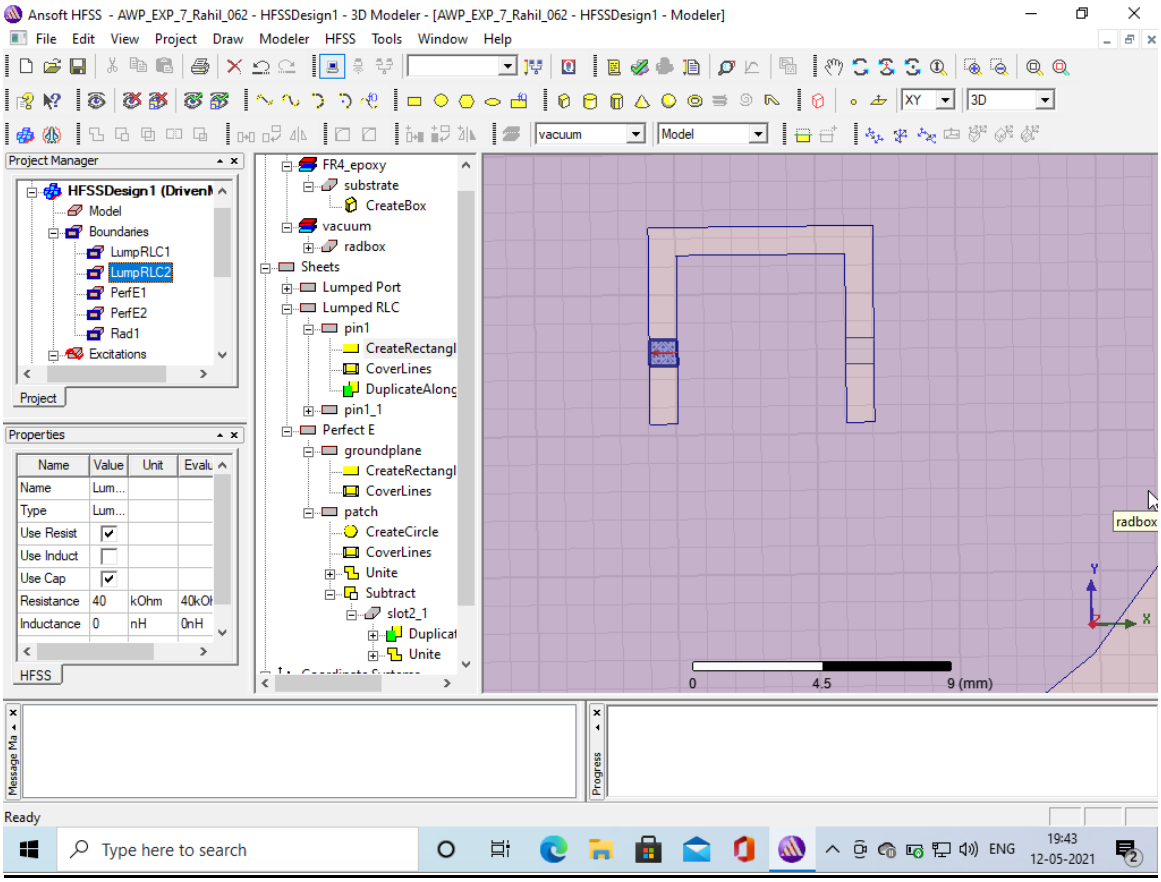
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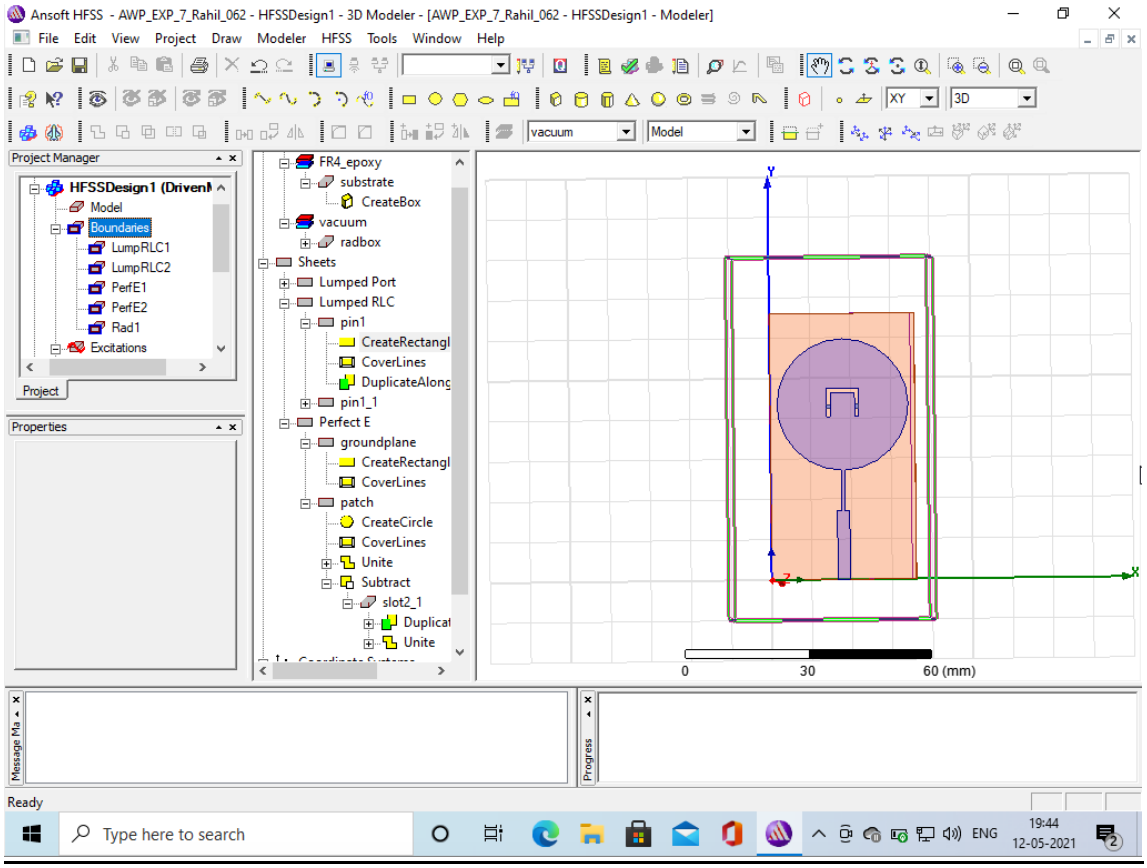
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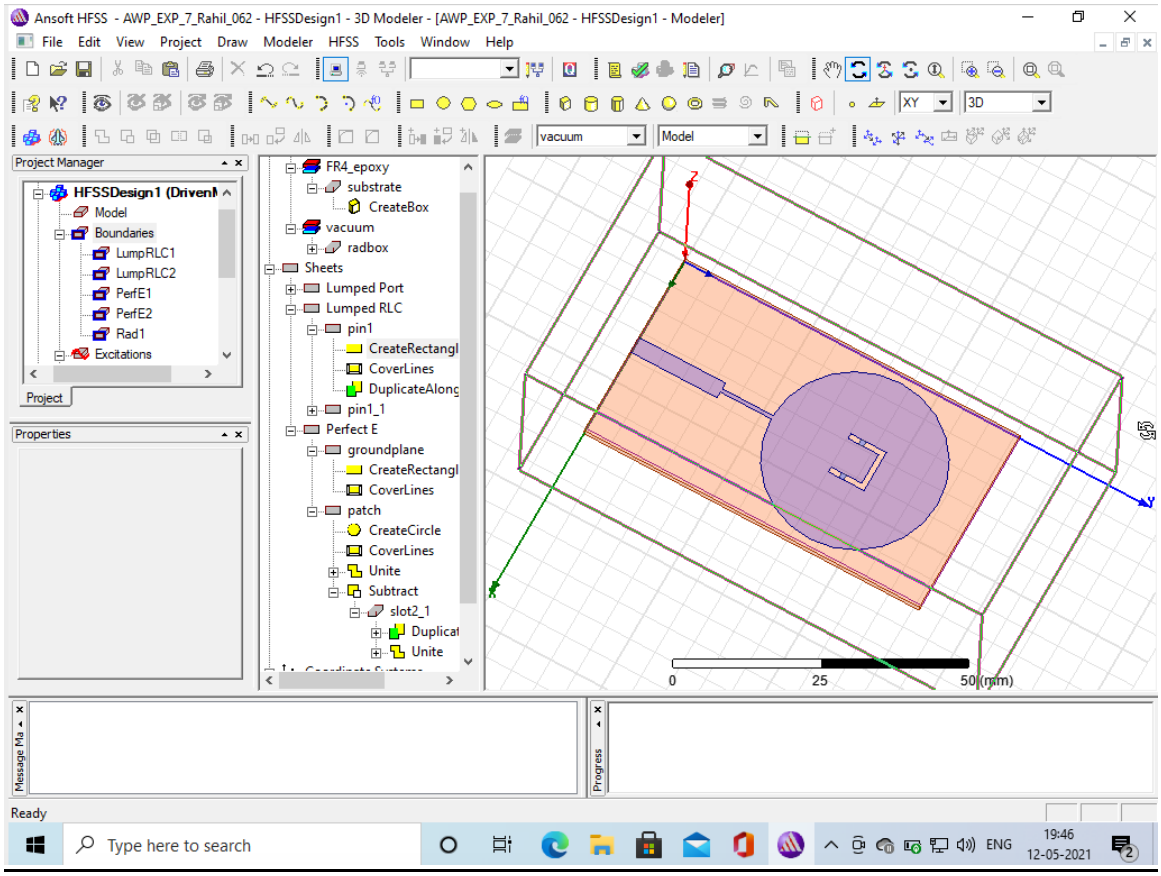
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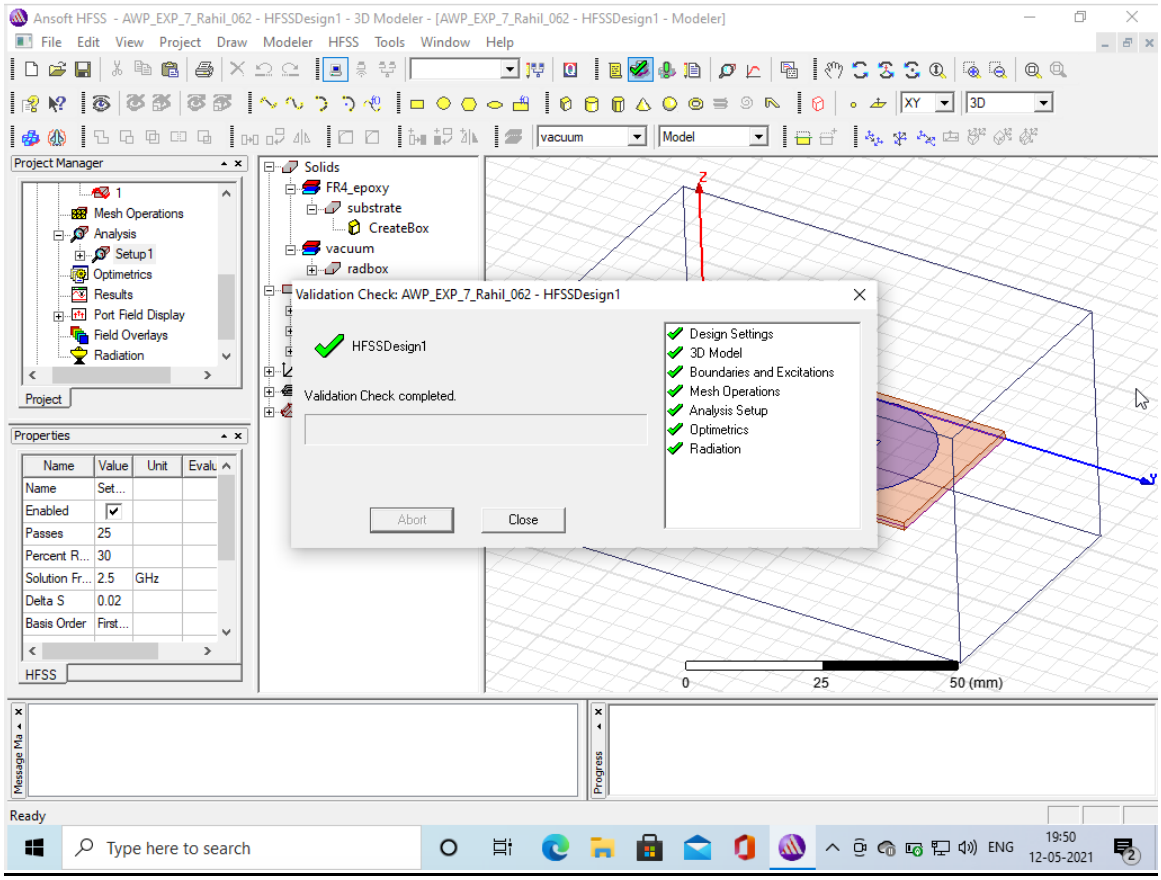
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Project Manager
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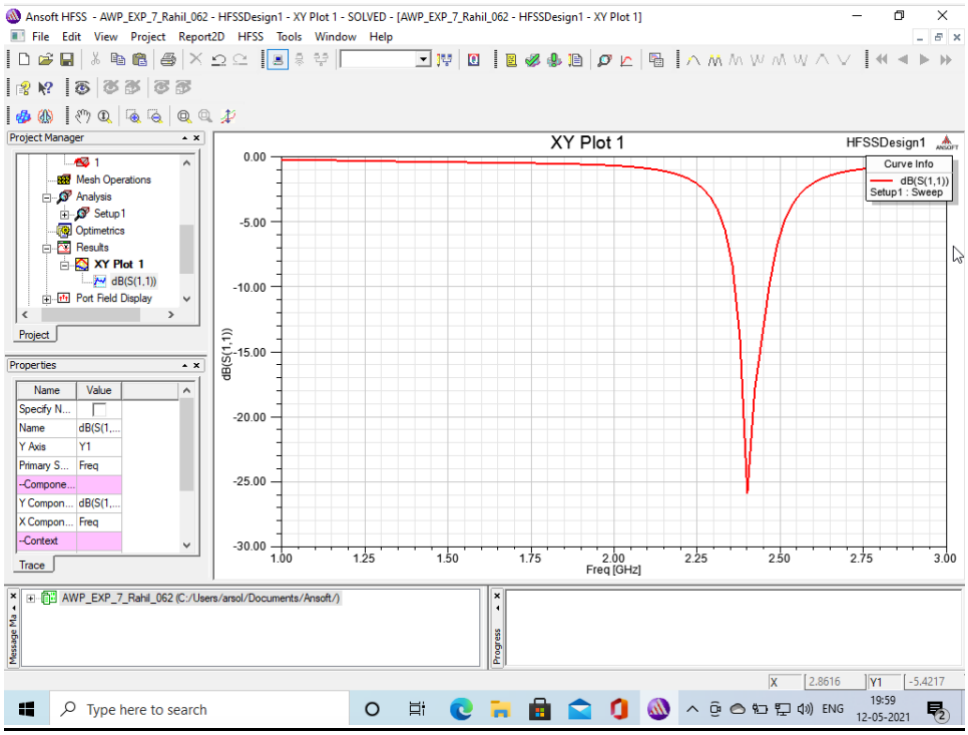
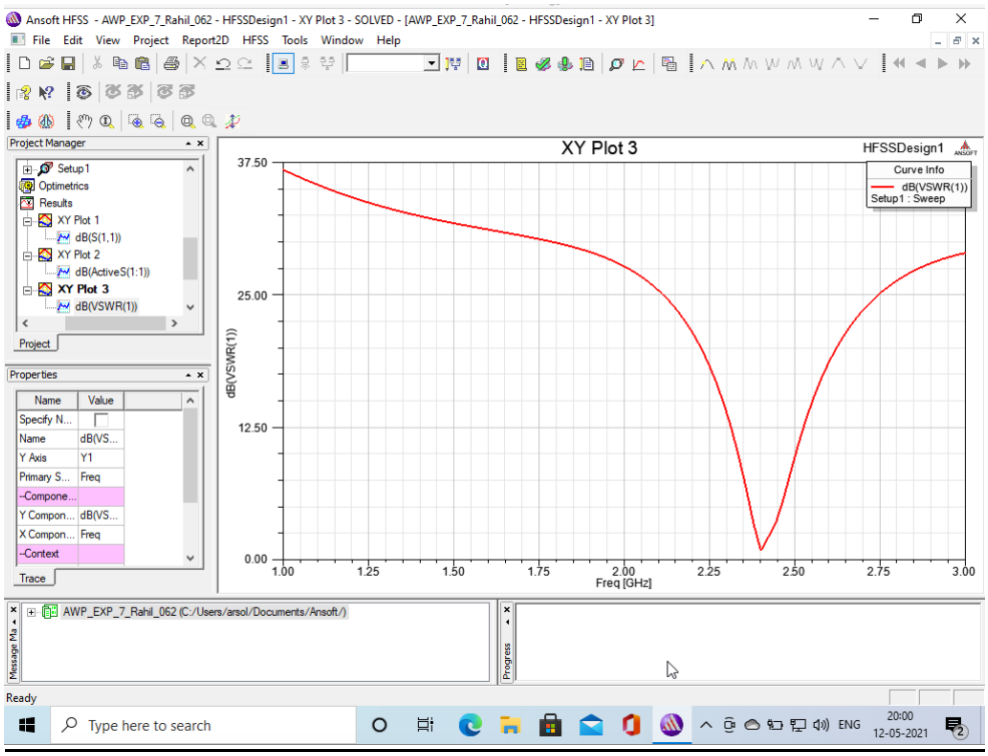
12-05-2021

FINAL GRAPH OUTPUTS:

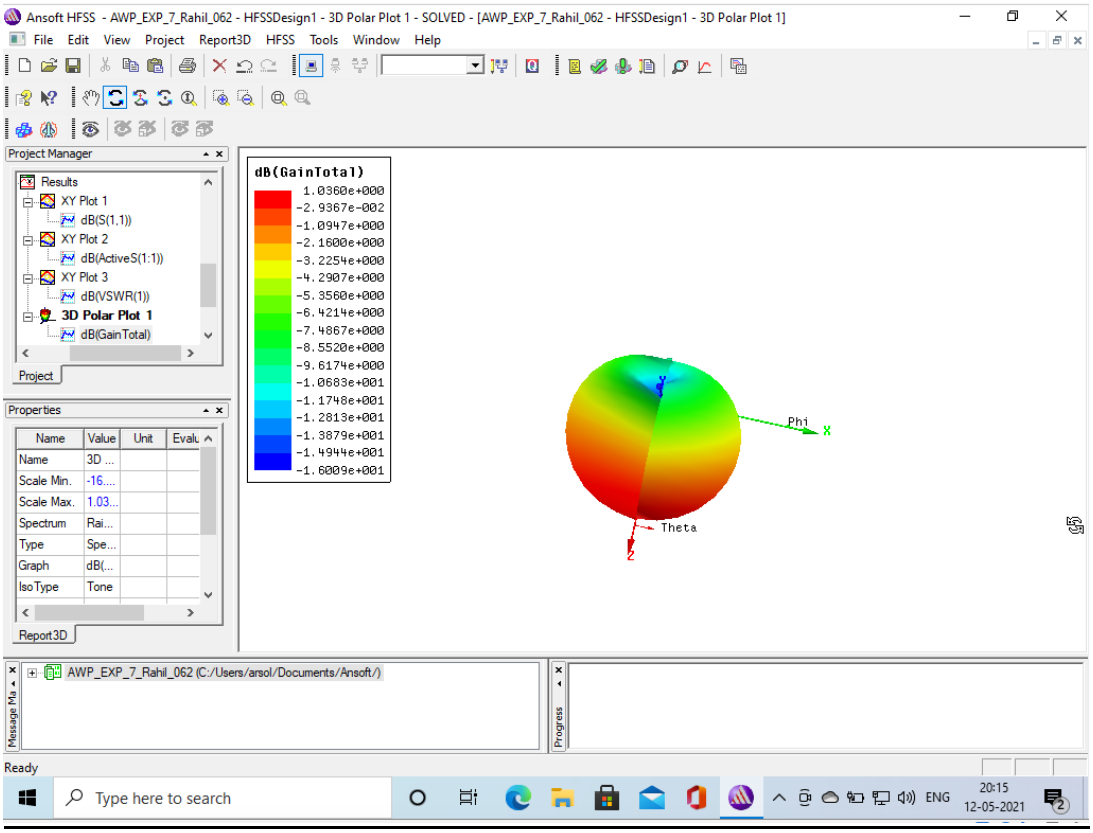
1. S-Parameters Plot:



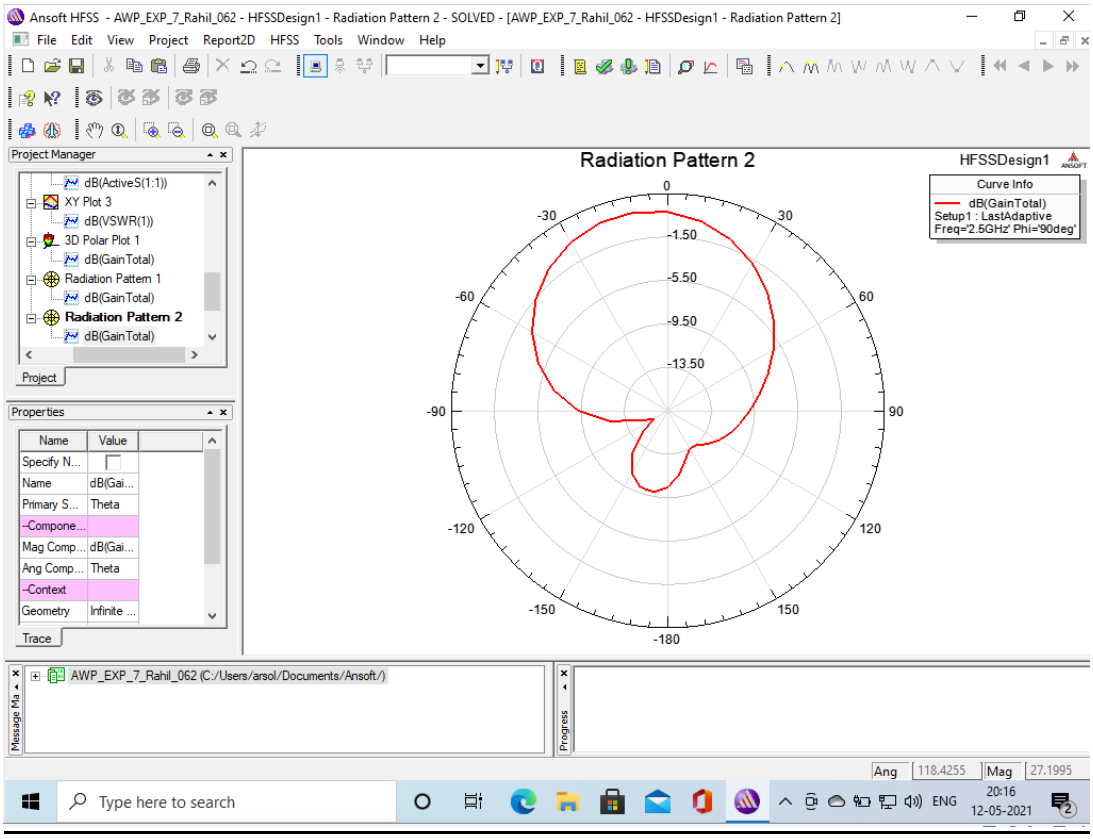
2. VSWR Plot:



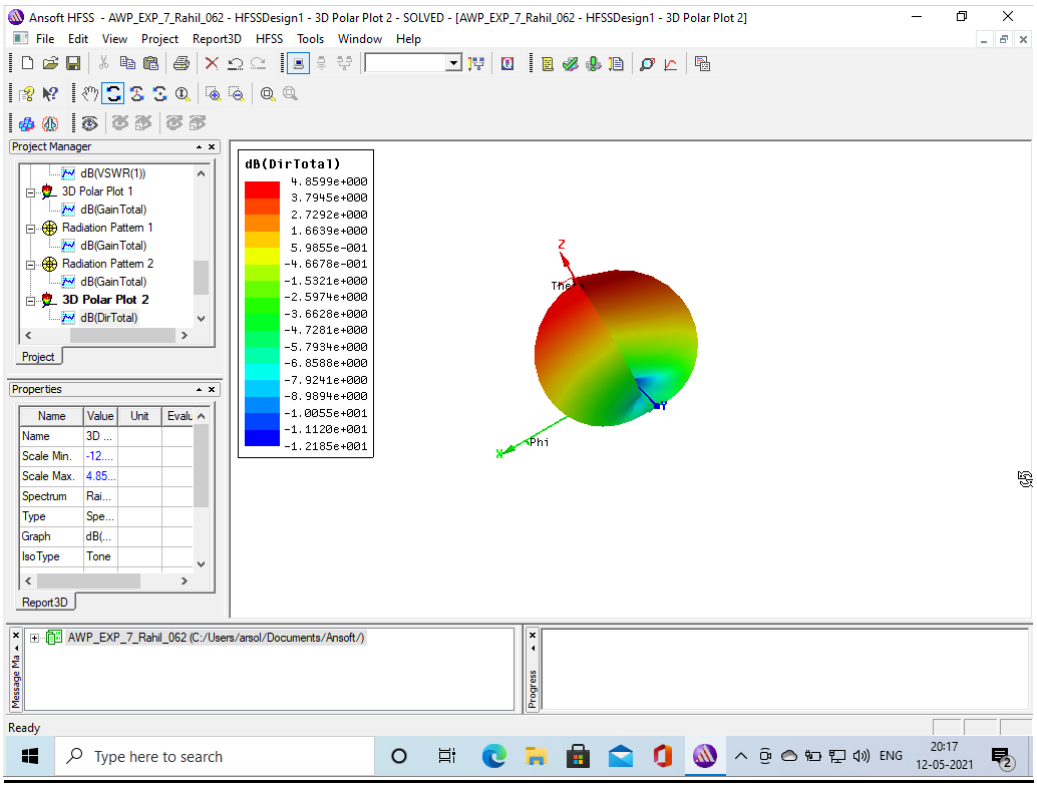
3. Gain 3-D Polar Plot:



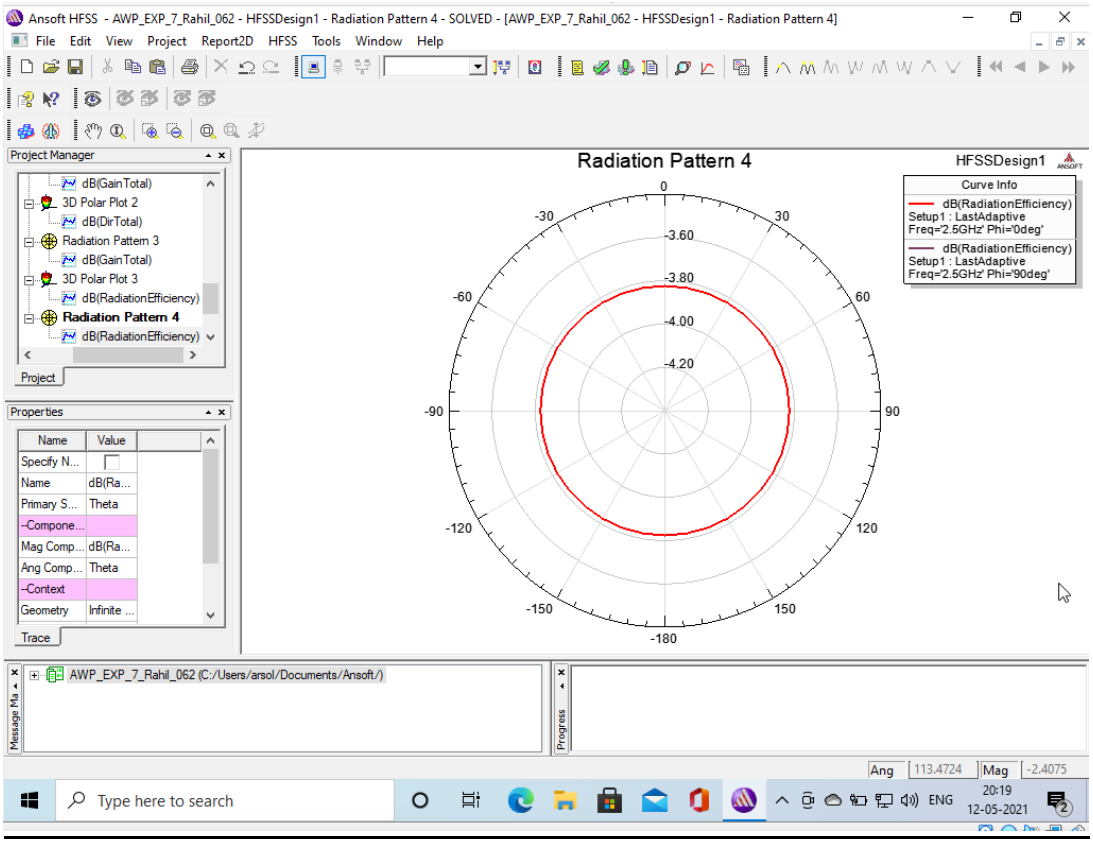
4. Gain Total Radiation Pattern:



5. Directivity 3-D Polar Plot:



6. Radiation Pattern for Radiation Efficiency:



Conclusion: From this experiment we have learnt how to design and obtain the outputs of a Micro Strip Patch Antenna with Slots.