CANADIAN UNIVERSITY OF BANGLADESH

Inspiring Applied Knowledge

Microwave Engineering LAB

Course Code: EEE 494.L

Submitted To

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A 2.4 GHz rectangular microstrip Wi-Fi patch antenna with a microstrip feed line (inset-fed), consists of a thin metallic patch (the radiating element) on a dielectric substrate (often FR4) backed by a ground plane. It's popular due to its low profile, ease of fabrication, and conformability to curved surfaces. This feeding technique involves a microstrip line (a narrow conductor on the same substrate) that's inset into the patch, rather than connecting directly to an edge. This improves impedance matching and reduces losses.

Advantages

- Simple and Inexpensive to Fabricate: Using standard PCB manufacturing techniques.
- Low Profile: Ideal for space-constrained applications.
- Conformable to Curved Surfaces: Suitable for mounting on various devices.
- Planar Structure: Compatible with other planar circuits.

Applications

- Wi-Fi Devices: Routers, access points, wireless cards
- Bluetooth Devices: Headsets, speakers, car kits
- Other Wireless Applications: RFID, GPS, ISM band devices

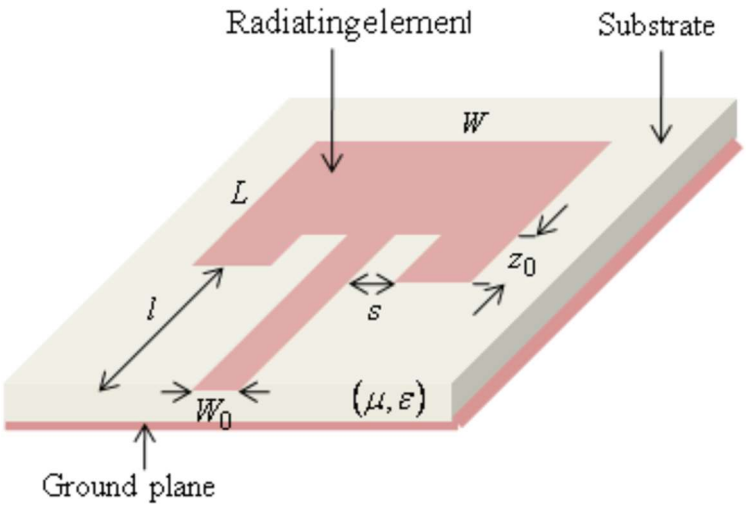


Fig: Inset-fed rectangular microstrip patch antenna with dimensions

The project here illustrates how a patch antenna is constructed step by step. It also provides the simulation, necessary calculations and 3D radiation diagram of the provided patch antenna. It includes calculation like:

- Waveguides and Resonant Structures
- Impedance Matching:
- Radiation Patterns
- Antenna Parameters
- Design Optimization
- Solver Settings
- VSWR
- S Parameters

Materials Used:

- Ground: Copper(annealed)
- Dielectric: FR -4 (lossy)
- Antenna Patch: Copper(annealed)
- Inset: Copper(annealed)
- Transmission: Copper(annealed)

Calculations

S parameters: The antenna's performance is good at **2.0496 GHz, means it** operates effectively at this frequency.

Impedance Matching: We found 50 ohms, means there is a standard power transfer according to the RF(systems).

VSWR = 1: Perfect impedance match, no reflections

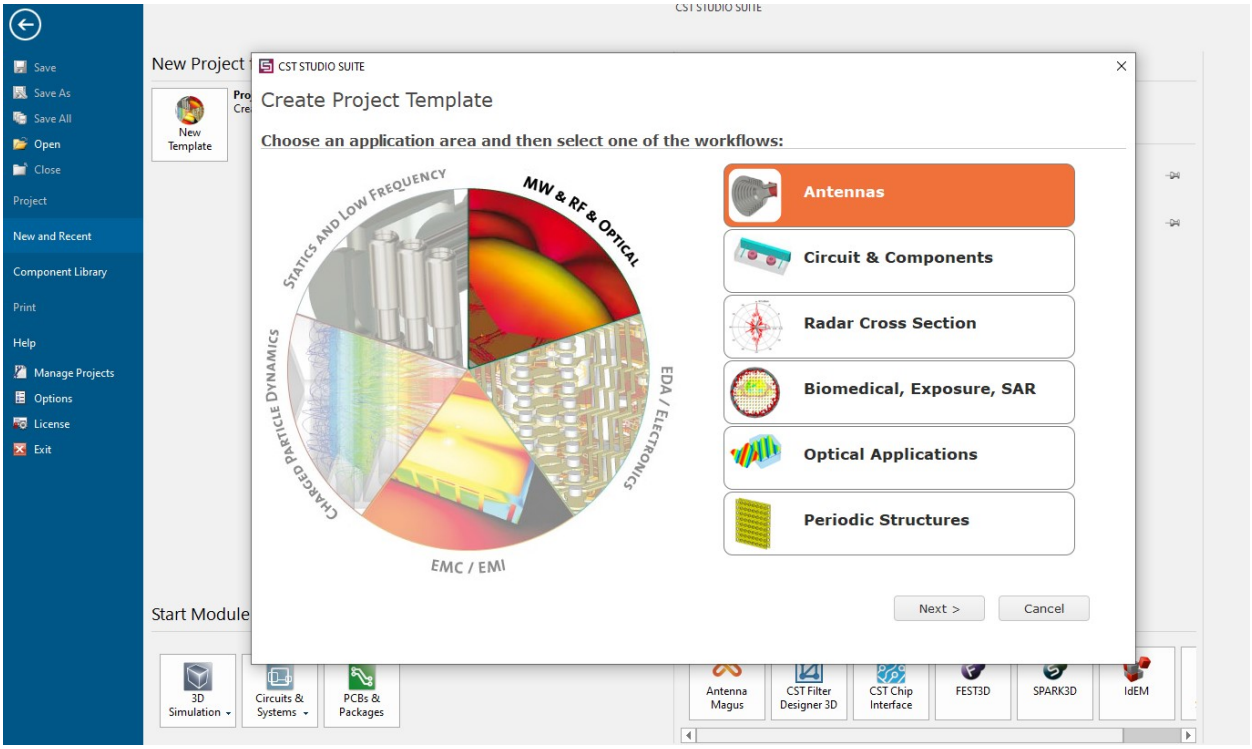
Bandwidth Calculation

BW = (FH - FL) / FC x 100%

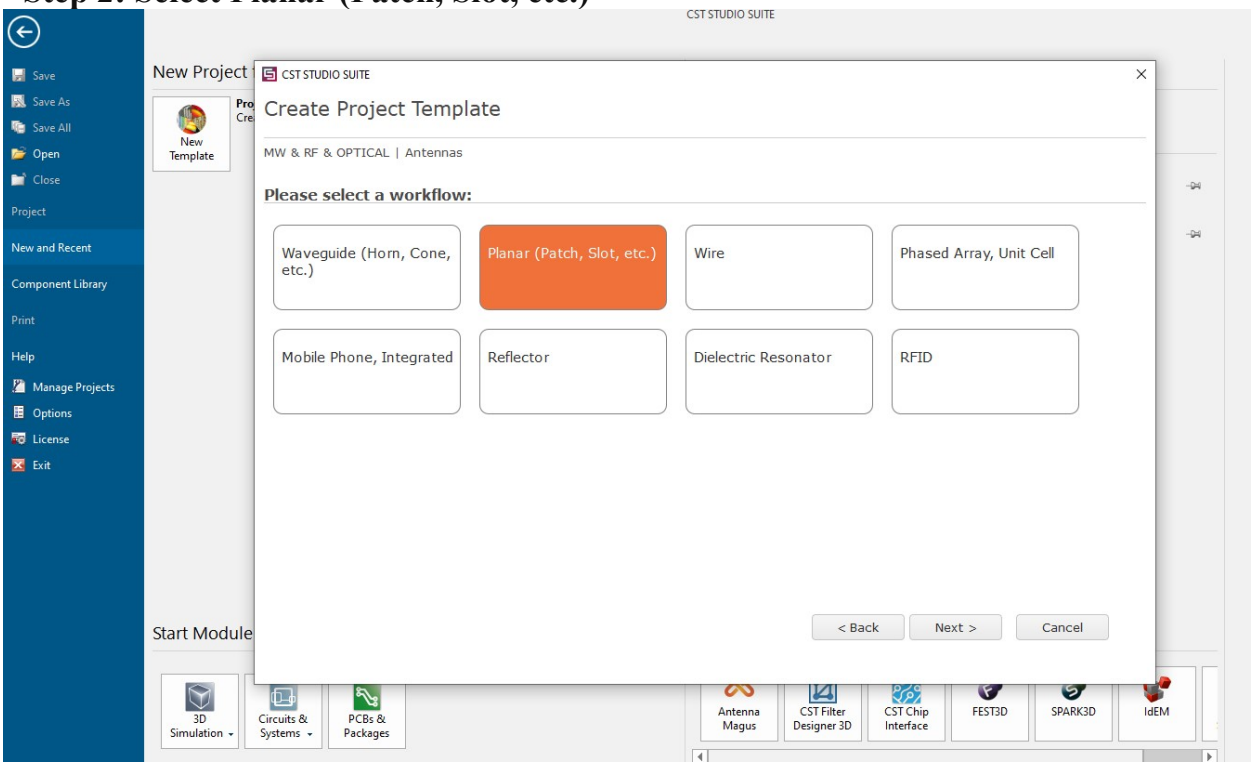
BW = (2.4427 - 2.3763) / 2.4096 x 100%

BW = 2.76%

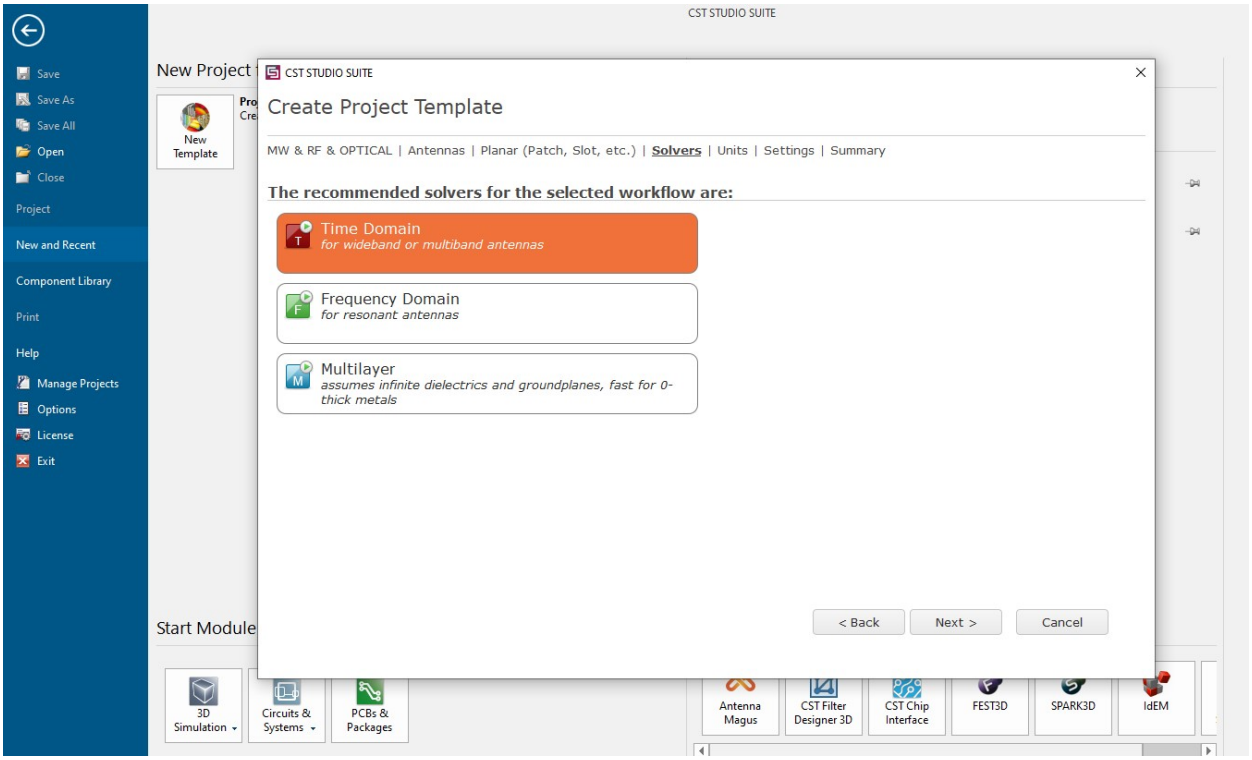
Step 1: Select MW & RF then Antennas



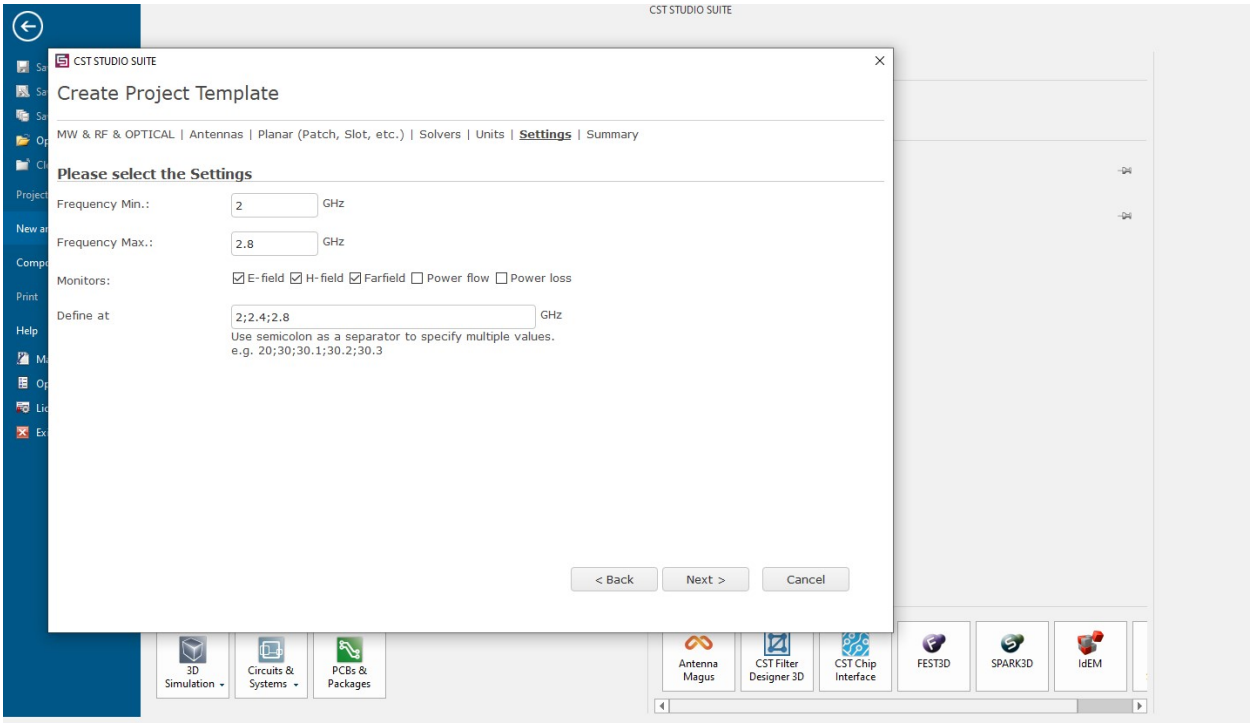
Step 2: Select Planar (Patch, Slot, etc.)



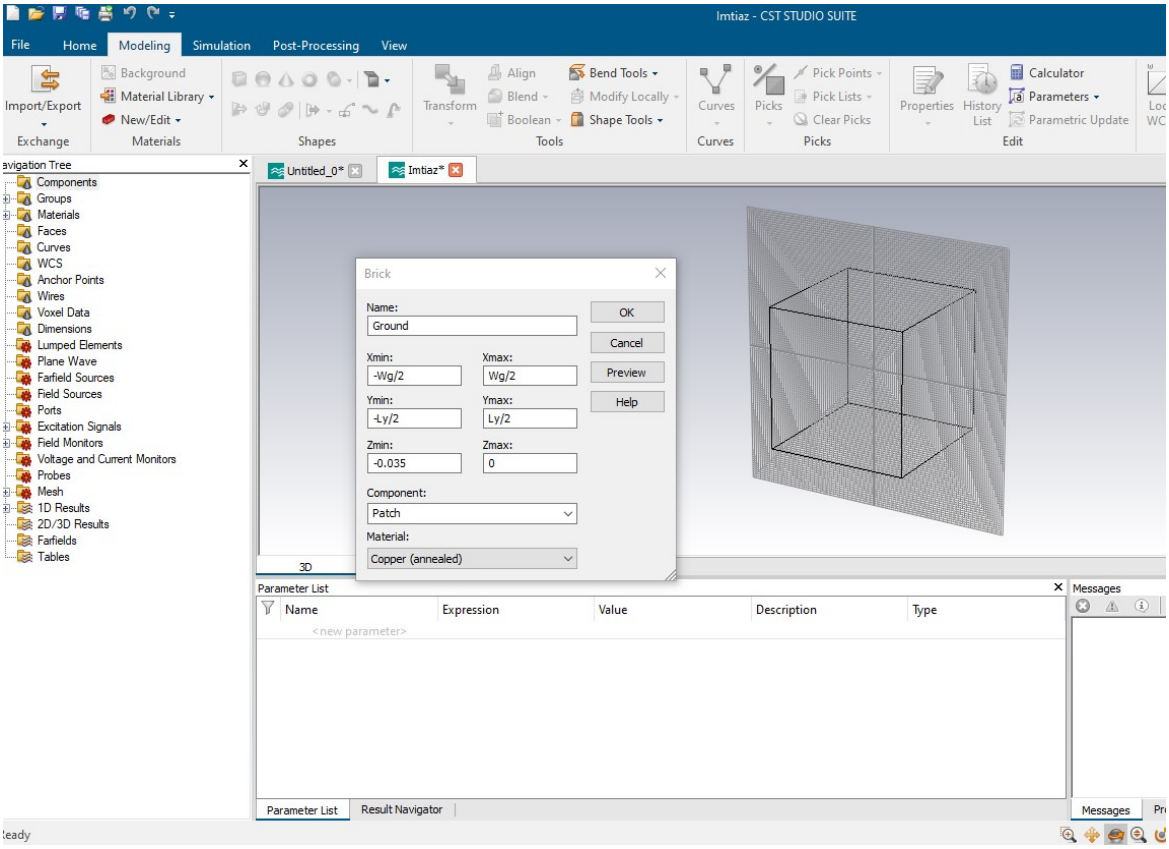
Step 3: Time Domain Design



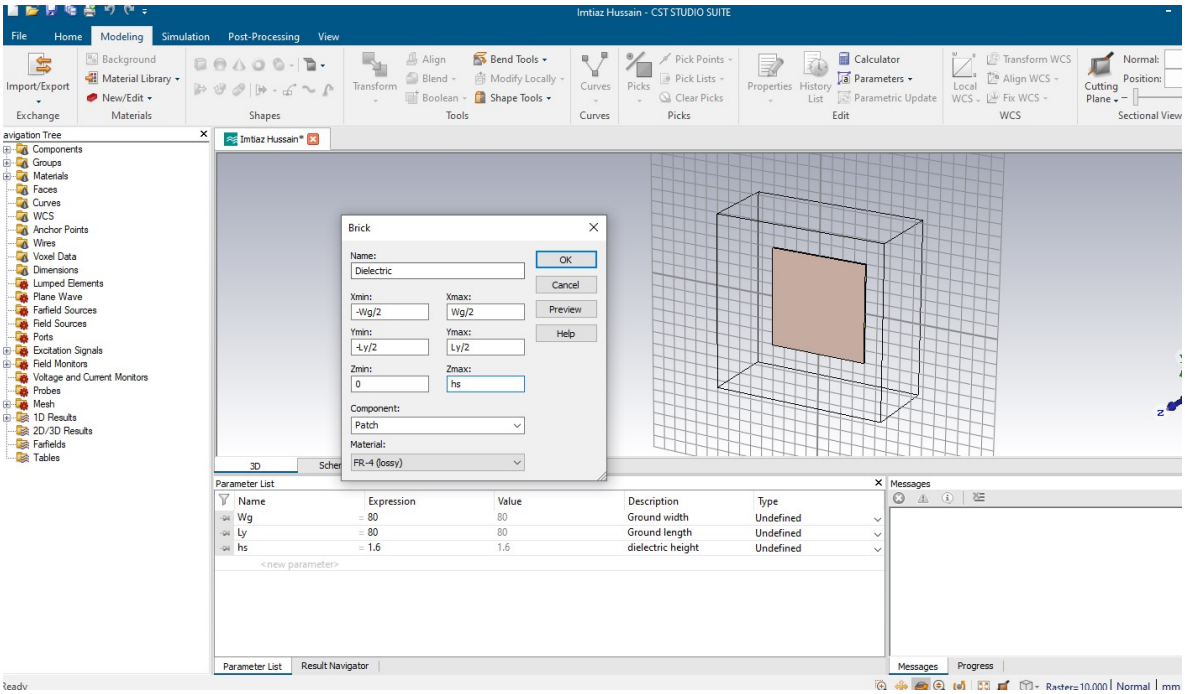
Step 4: Frequency Range 2.0 GHz – 2.8 GHz



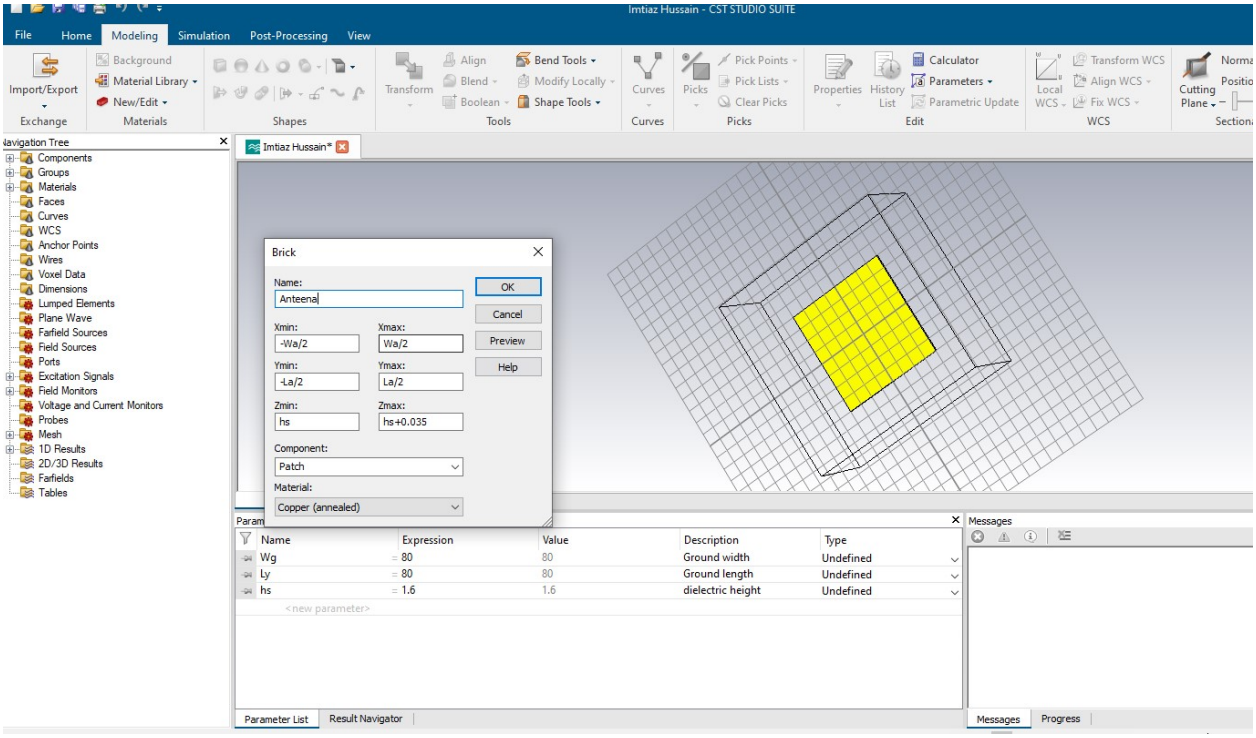
Step 5: Ground, Copper(annealed)



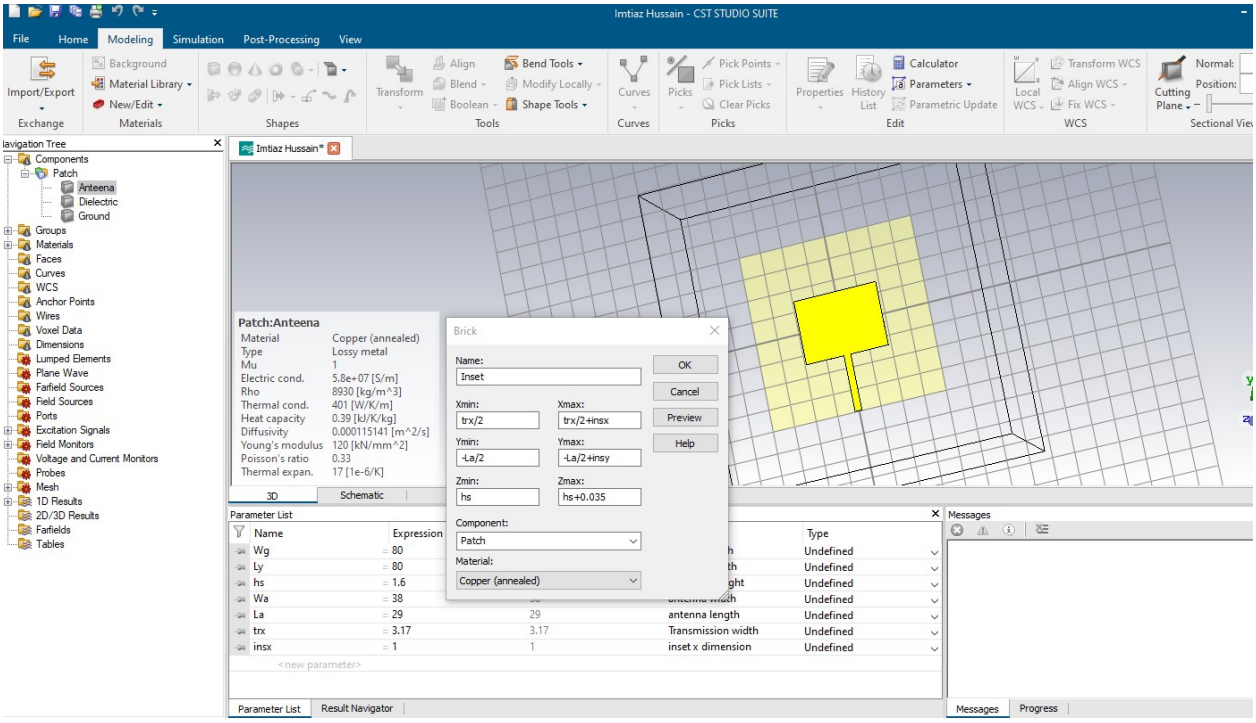
Step 6: Dielectric, FR-4(lossy)



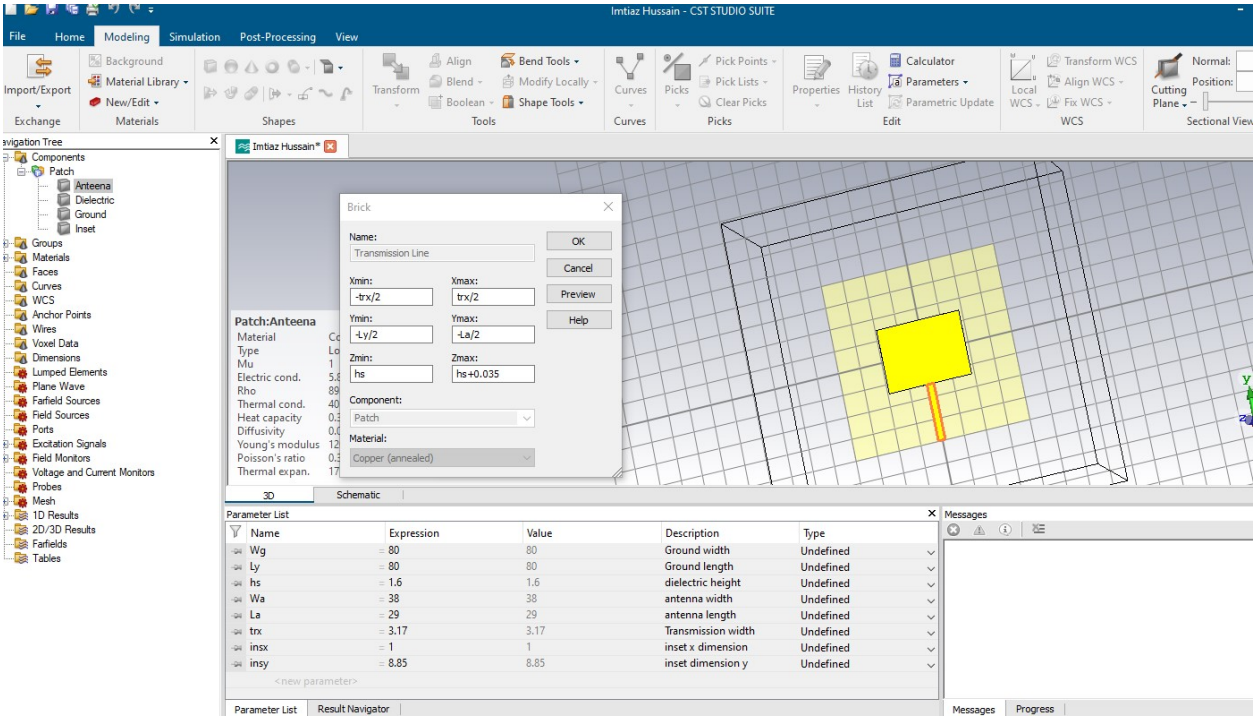
Step 7: Antenna Patch, Copper(annealed)



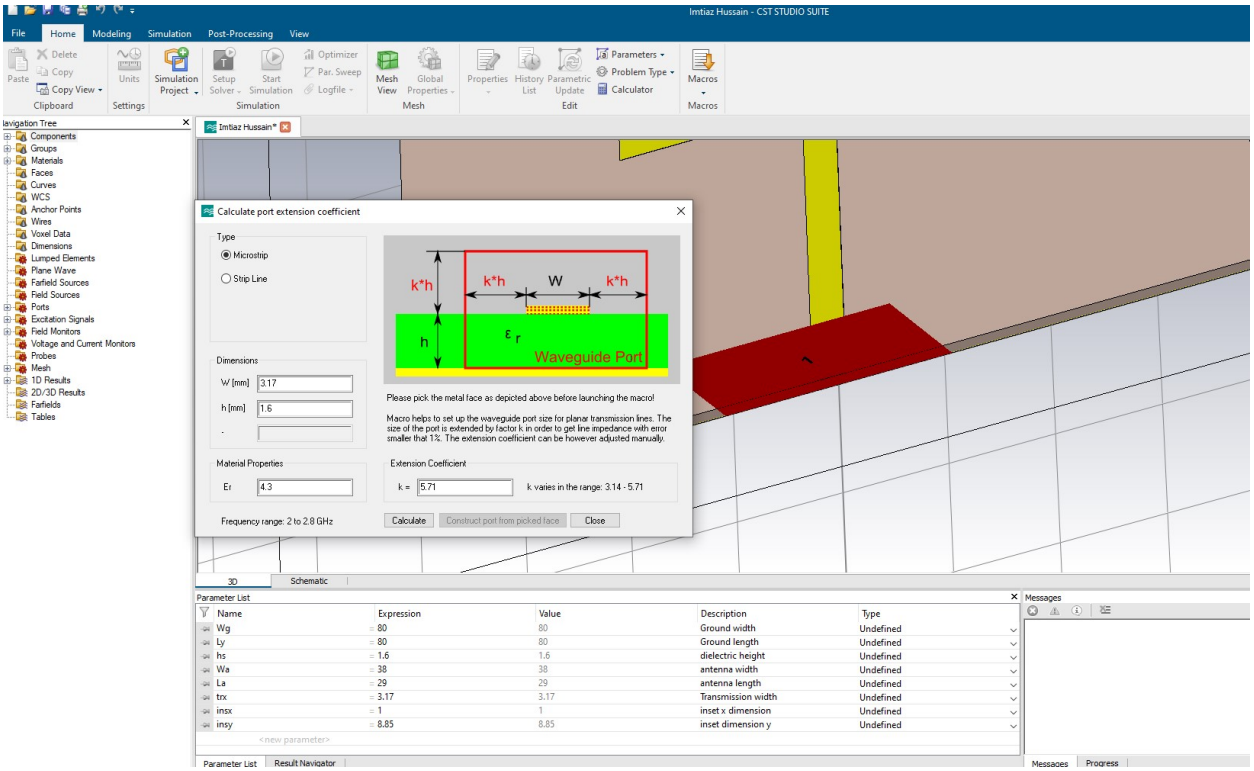
Step 8: Inset, Copper(annealed)



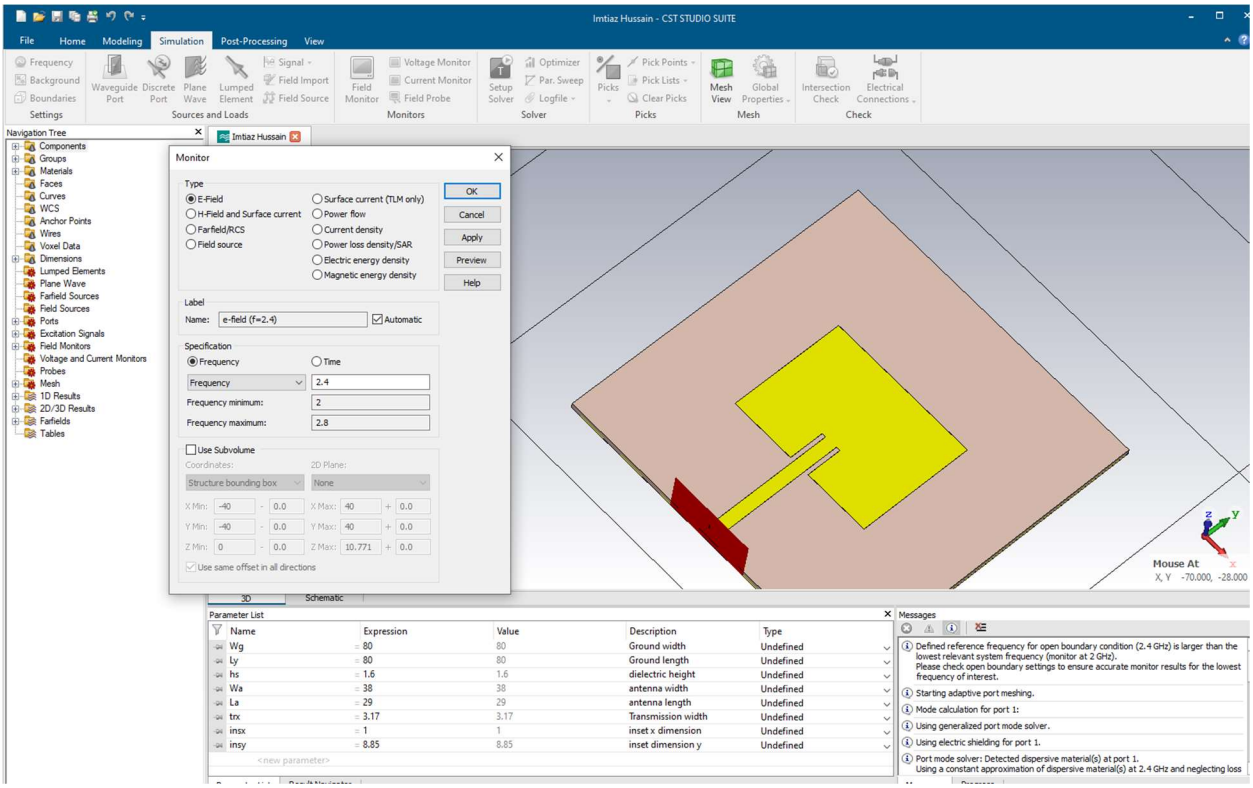
Step 9: Transmission Line, Copper(annealed)



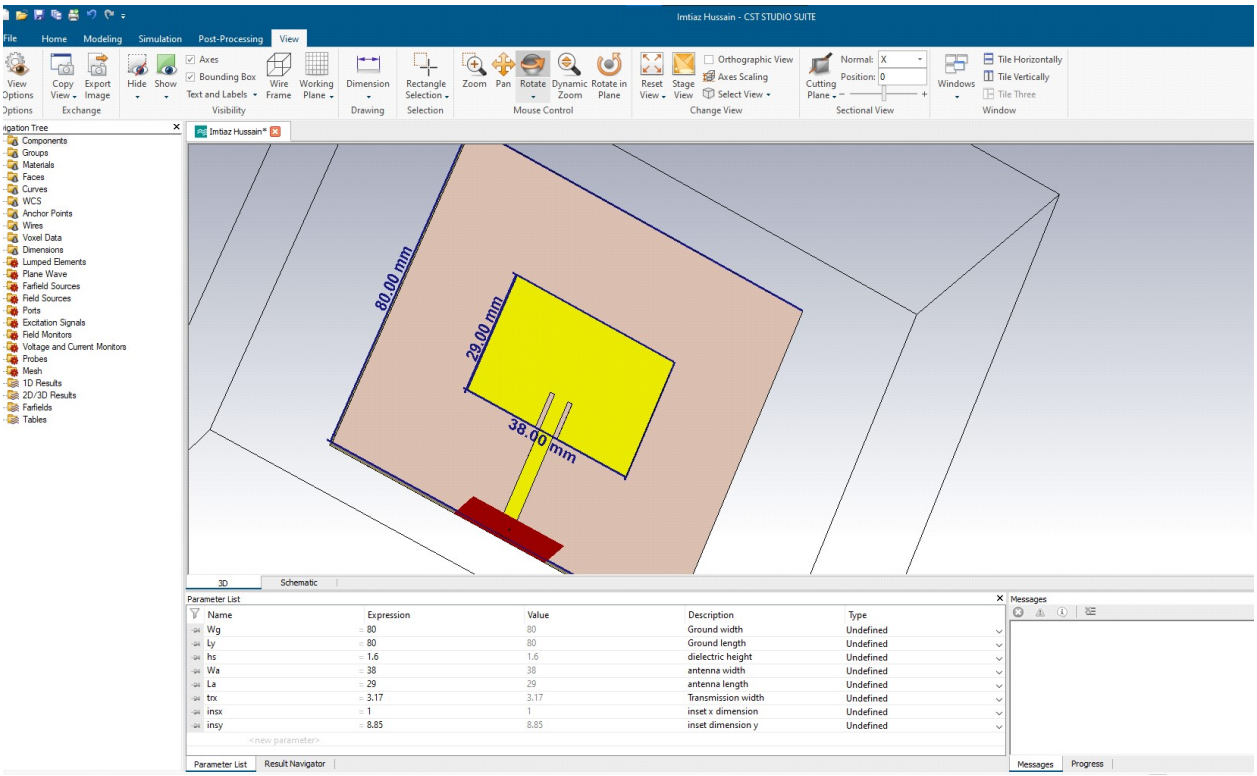
Step 10: Antenna Port



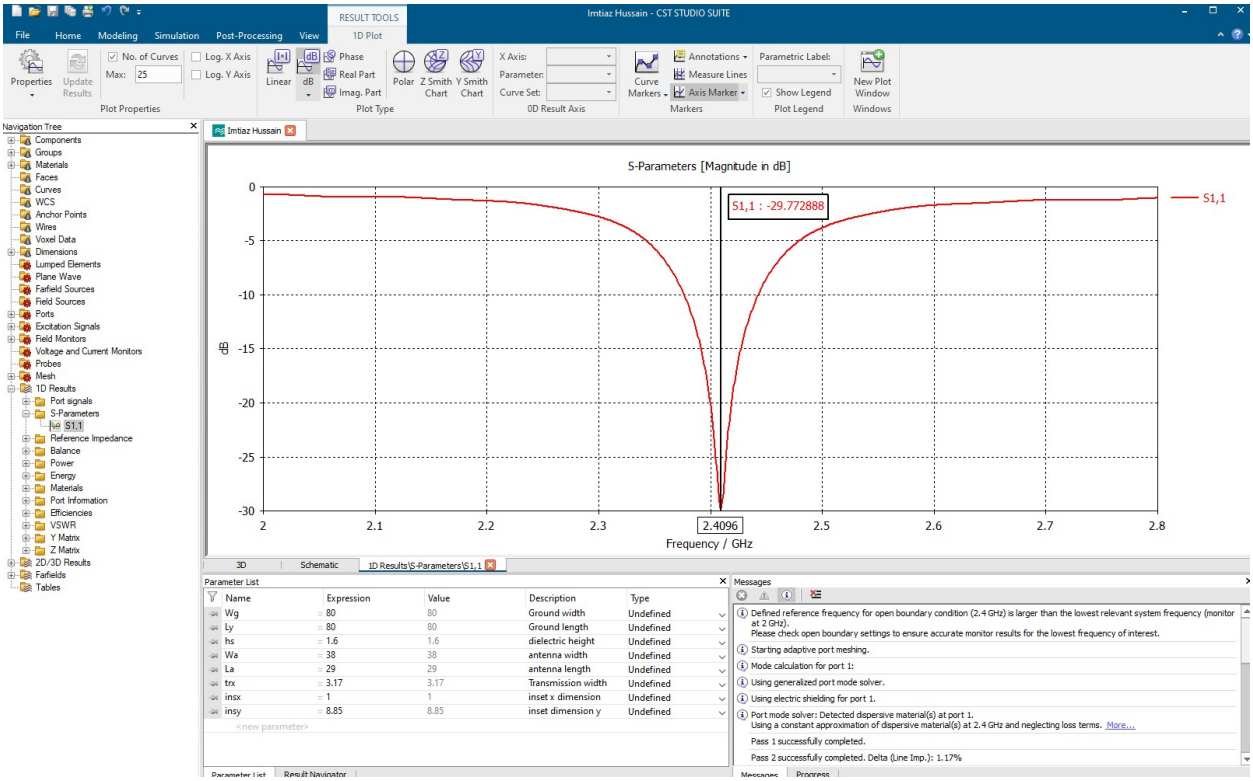
Step 5: Antenna Port, Copper(annealed)



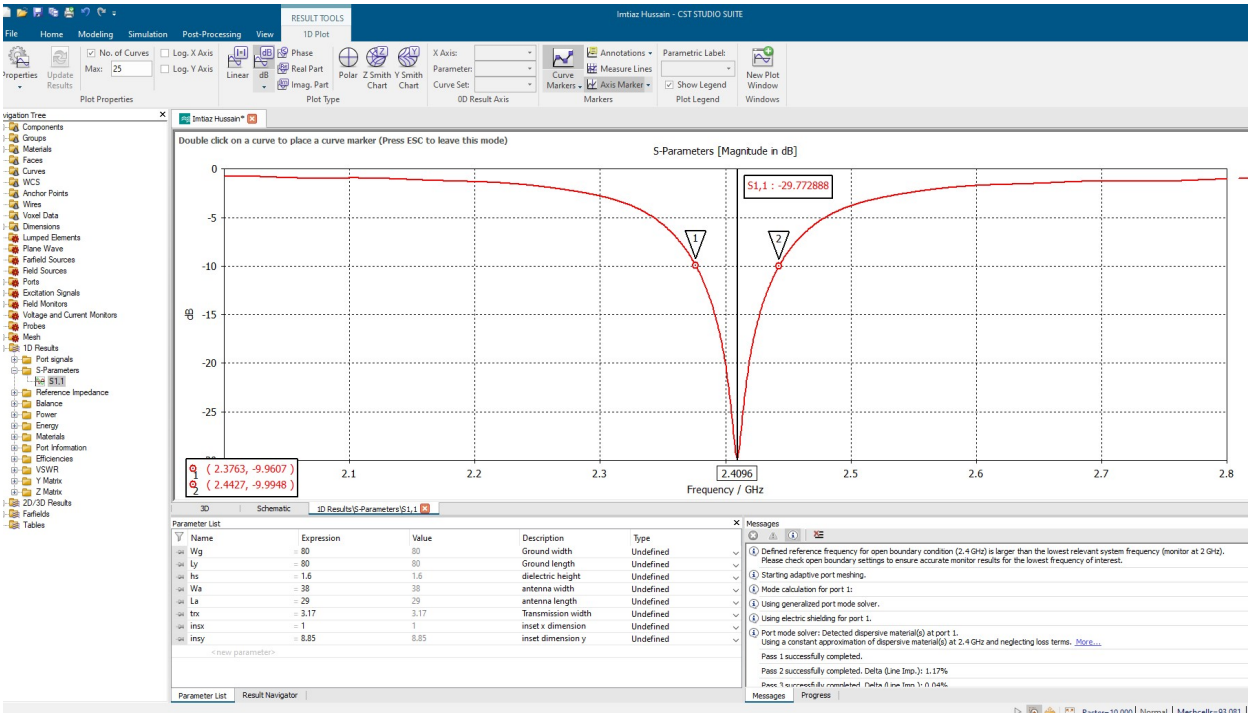
Step 12: Antenna Dimension: Patch, Dielectric, Ground



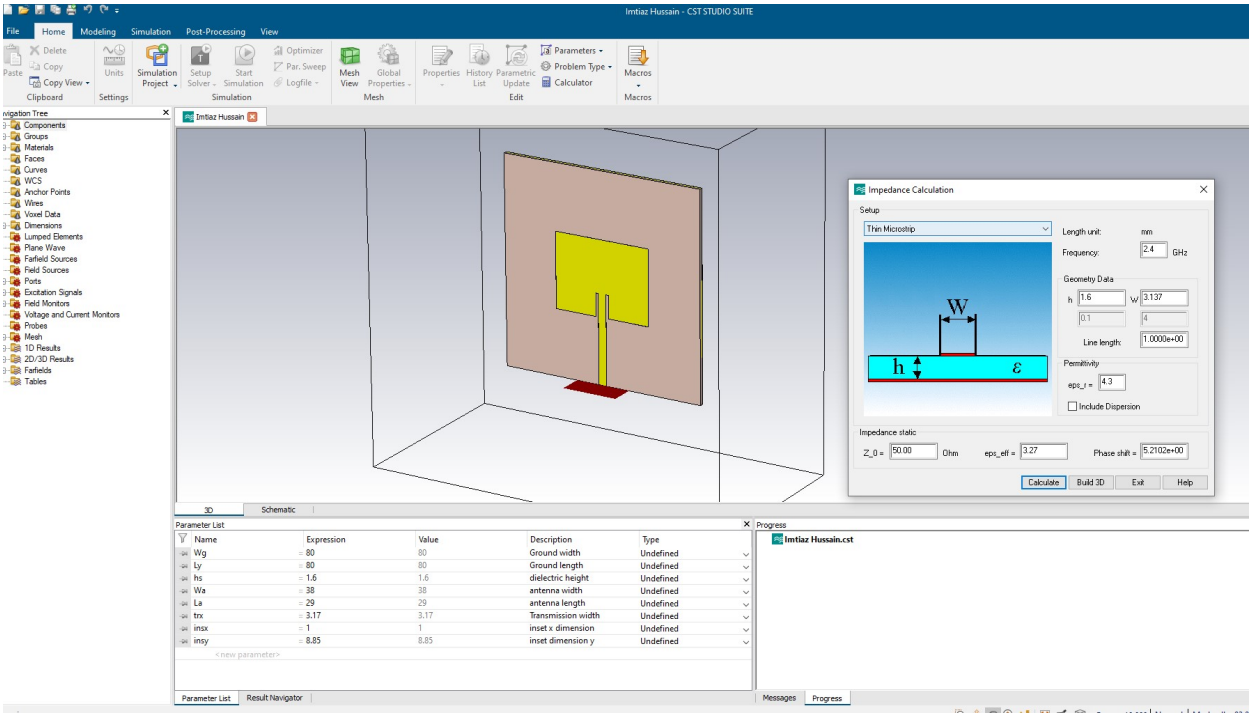
Step 13: S Parameters



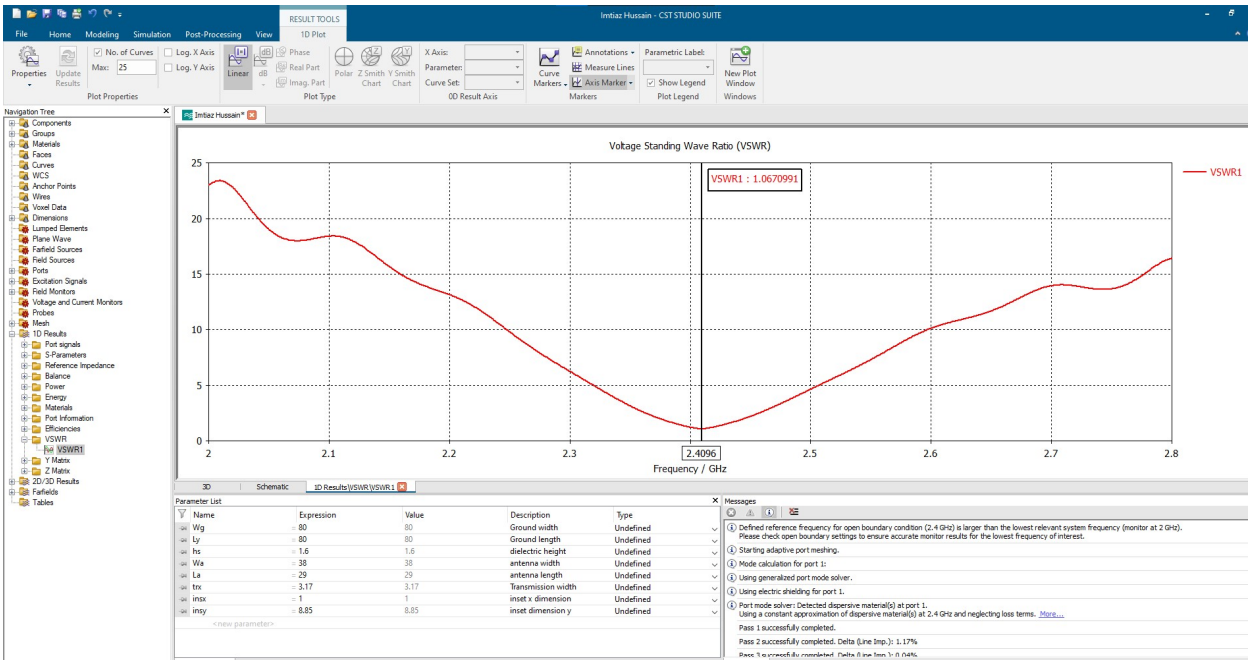
Step 14: S Parameters, Frequency Difference



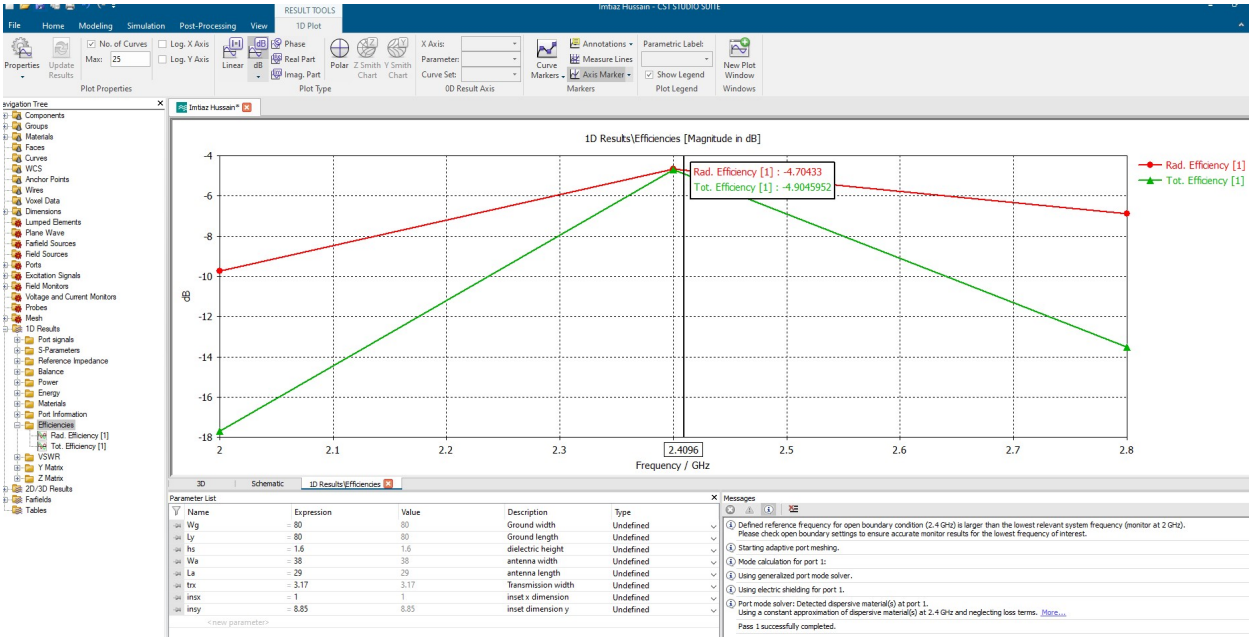
Step 15: Impedance Calculation



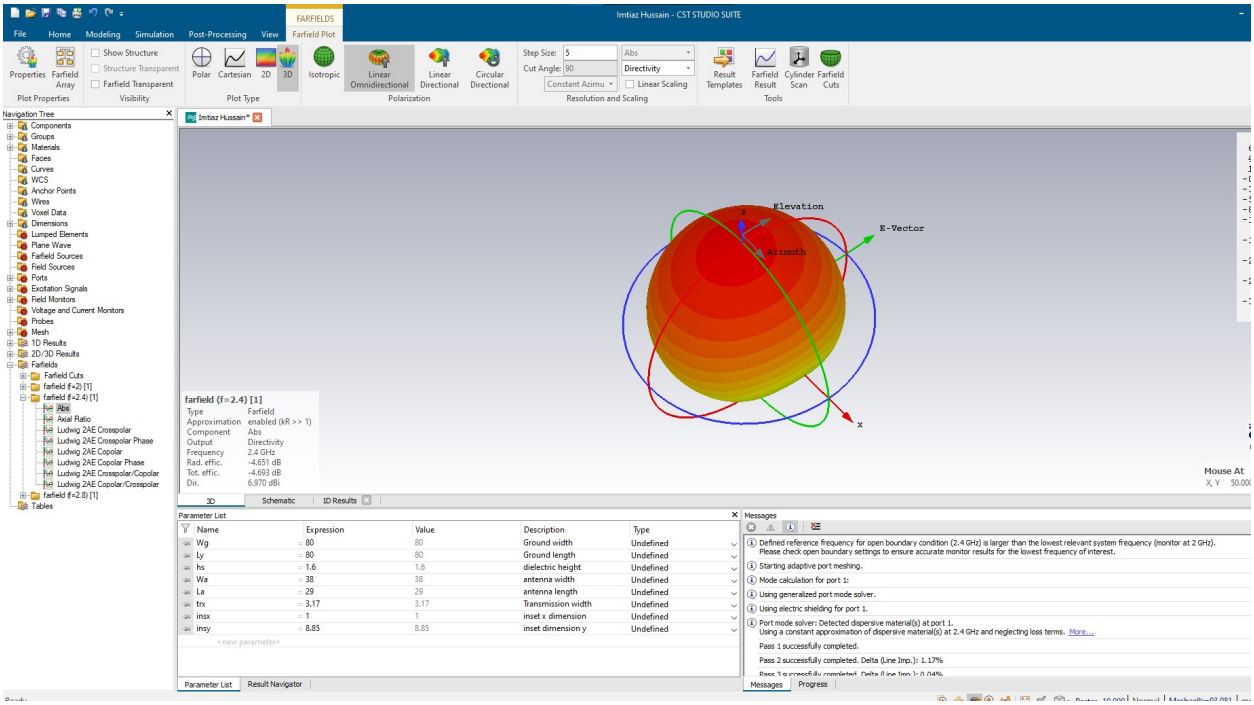
Step 16: VSWR



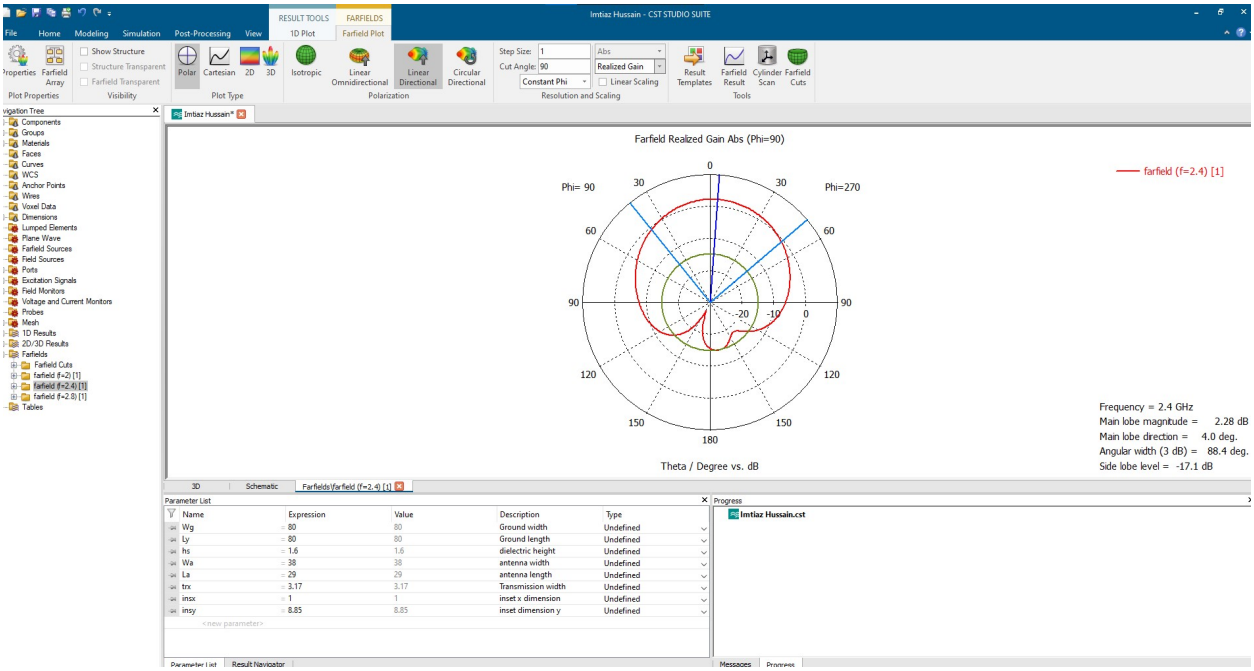
Step 17: Efficiency



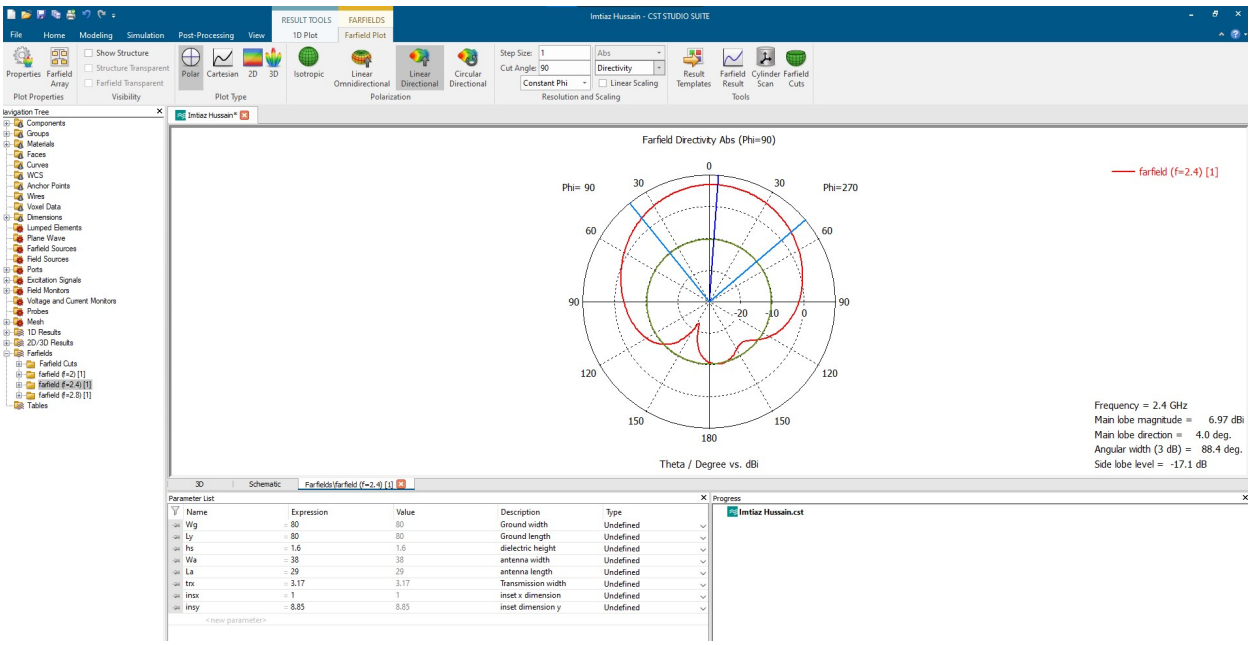
Step 18: Linear Omnidirectional, 3D Radiation Pattern



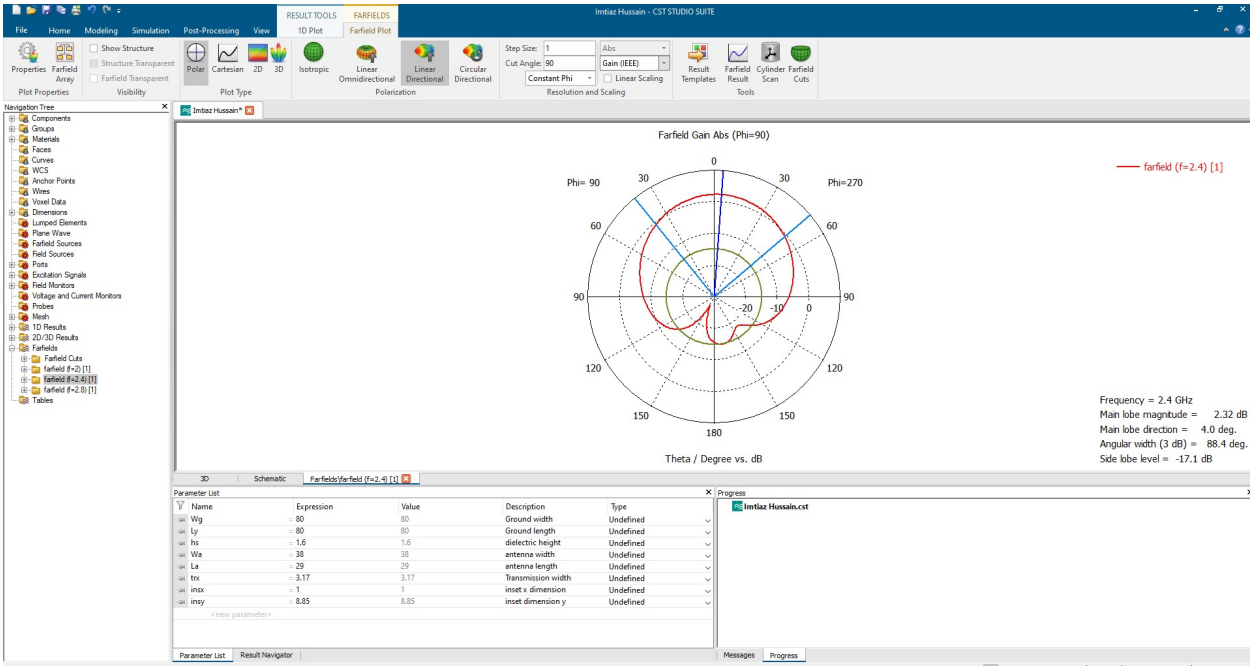
Step 19: Linear Directional Polar, Radiation Pattern, Realized Gain



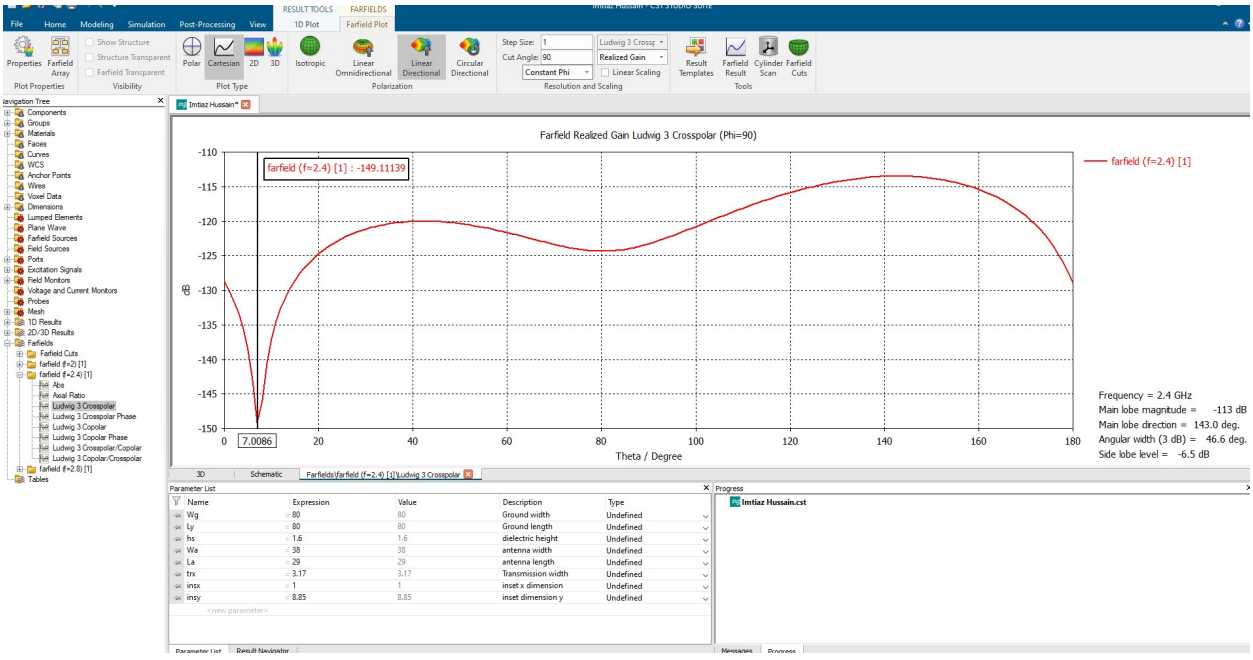
Step 20: Linear Directional, Polar Radiation Pattern, Directivity



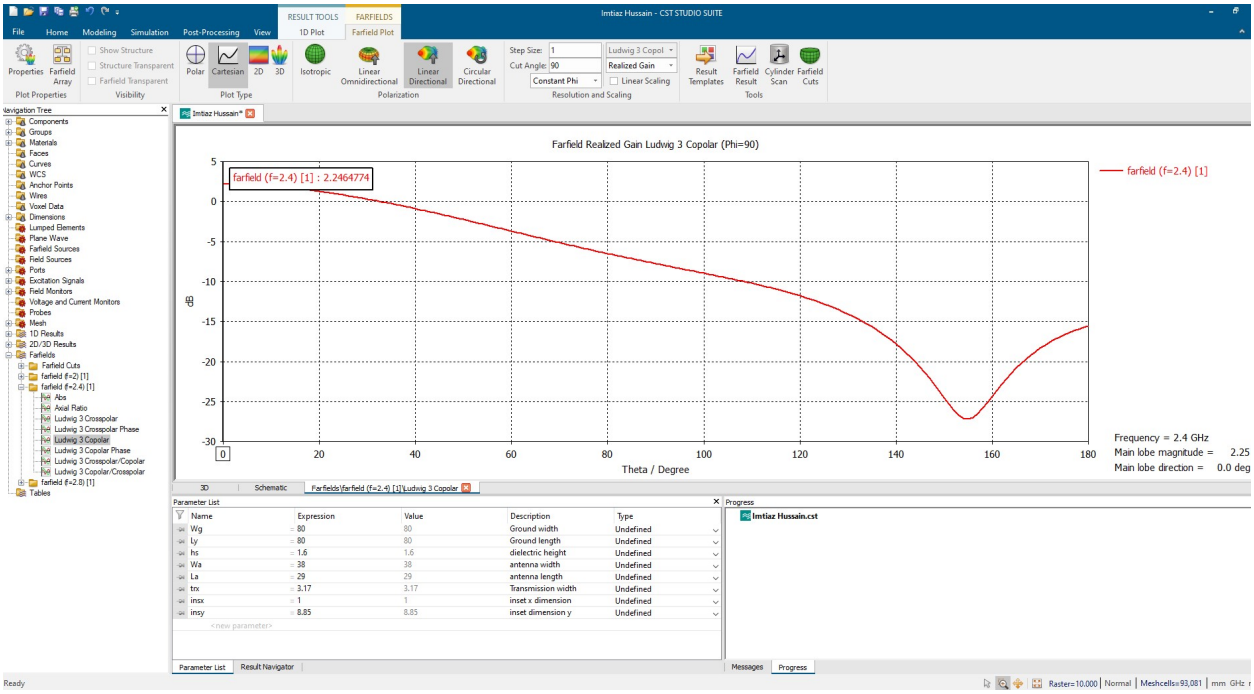
Step 21: Linear Directional Polar Radiation Pattern , Gain IEEE



Step 22: Ludwig 3 Crosspolar



Step 23: Ludwig 3 Copolar



Step 23: Overall directivity, electric field vector, magnetic field vector.