Design Of T Junction:

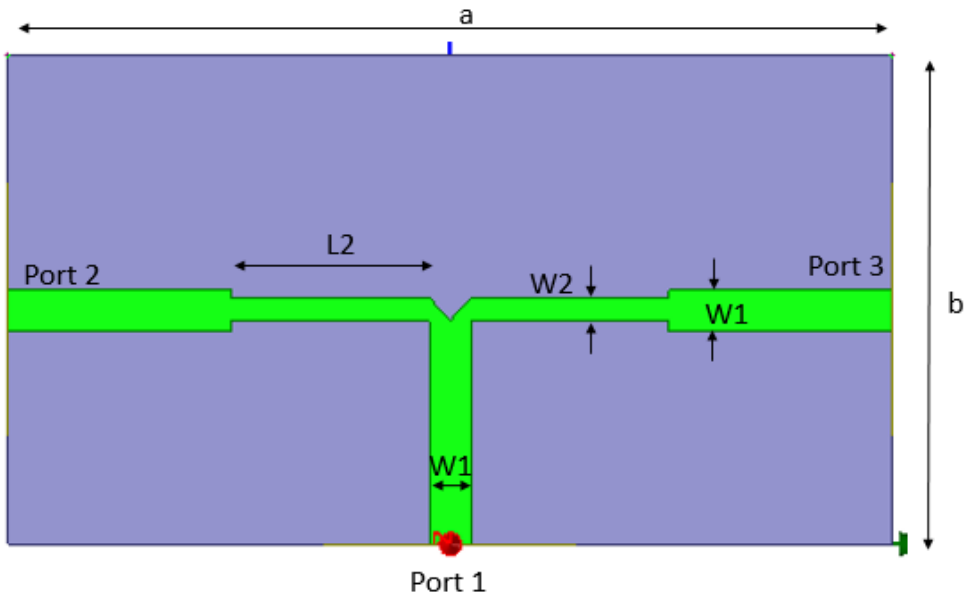

Fig. 8: Layout of T Junction

- **Components:**
  - Metal: **Copper**
    - Conductivity: 58000000 Siemens/m
    - Relative Permittivity (εr): 1
  - Substrate: **Rogers RO4003**
    - Relative Permittivity **(**εr): 3.55
    - Dielectric Loss Tangent ($tan\delta$): 0.0027
- **Design Specifications:**
  - a = 23.785mm
  - b = 13.136mm
  - h = 0.508mm (Substrate thickness)
  - t = 0.017mm (Metal thickness)
  - W_1 = 1.1363mm
  - W_2 = 0.6199mm
  - L_2 = 5.8929mm
- **Design Criteria:**
  - Operating Frequency: 7.8 GHz

Results:

Magnitude Plot of S parameters of the T junction:

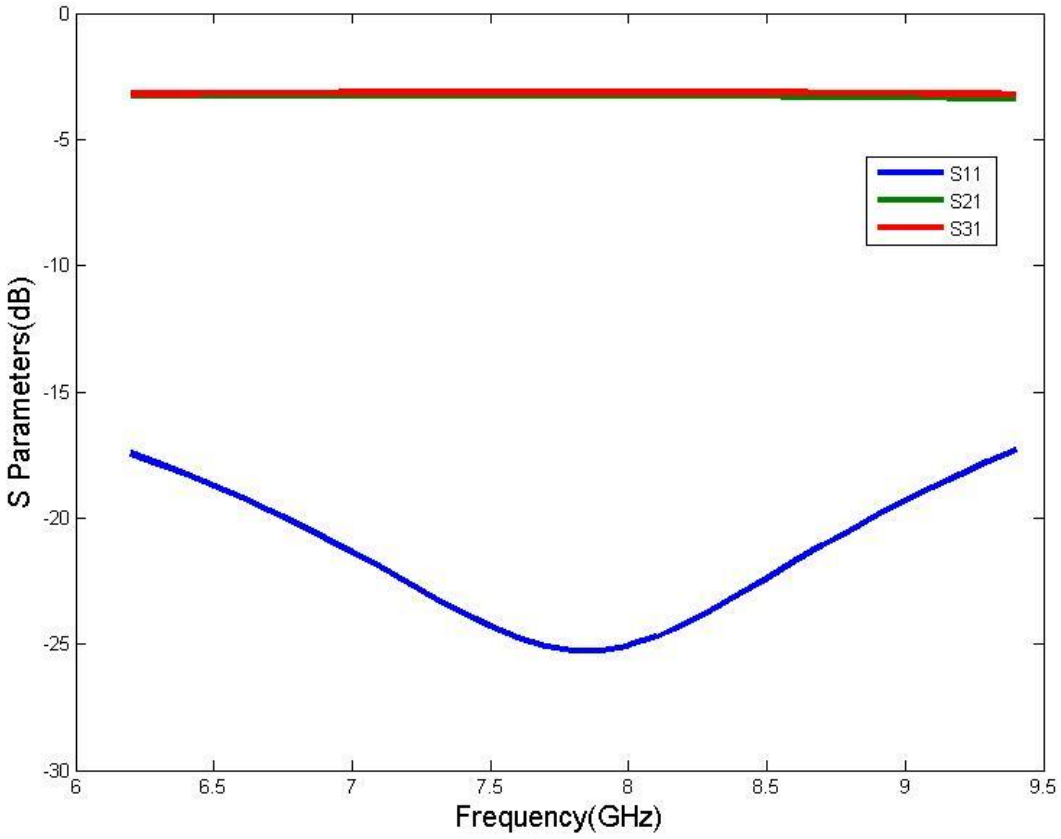

Fig. 9. Magnitude plot for the simulated S parameters of the T junction

Calculations

Design:

- Length of the quarter-wave transformer $L2 \approx \lambda g/4$
- Characteristics impedance of the quarter-wave transformer is 70.71 Ω

The microstrip lines at all three ports are 50Ω line. The 50Ω line of the input port is divided equally to 100Ω line at the junction. To match these lines to 50Ω line of port 2 or port 3, we have used a quarter-wave transformer of length λ/4 and line impedance

$$Z_{quarter} = \sqrt{50 \times 100} = 70.71\Omega$$

Conclusion

- A T junction is designed on a Rogers RO4003C substrate having dielectric constant 3.55 and dielectric loss tangent 0.0027 using HFSS as shown in Fig. 8 and its characteristics are studied through Fig. 9. Fig.9 shows the magnitude of reflection and transmission coefficients of the T junction over 6-9.5 GHz band.

- The reflection curve remains below -25 dB indicating good matching throughout the band and the transmission coefficients remain nearly at -3 dB mark.

- Ideally, the transmission through the T junction is supposed to be at -3 dB as the power transmitted through the junction should be equally divided in the two arms of the junction.

- Due to a low value of the loss tangent of Rogers RO4003C substrate, the Loss seems to be less enough at the port 2 and port 3. However, the transmission coefficients at both of these ports give nearly -3dB as expected theoretically.