SINGLE STUB LINE MATCHING:

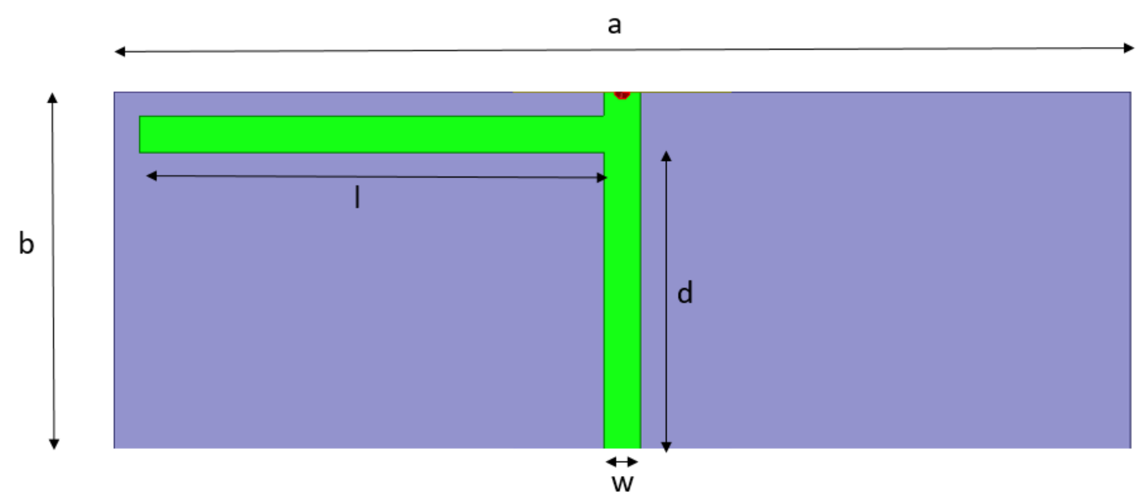

Fig. 25: Layout of Single Stub Line Matching

- **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 = 50mm
- b = 20mm
- h = 0.8mm (Substrate thickness)
- t = 0.017mm (Metal thickness)
- w = 1.789 mm
- d = 15.585 mm
- l = 22.82 mm

- **Design Criteria:**

  - Center Frequency: 2.4 GHz

- **Results:**

  - **Plot of S11 parameters from the simulation:**

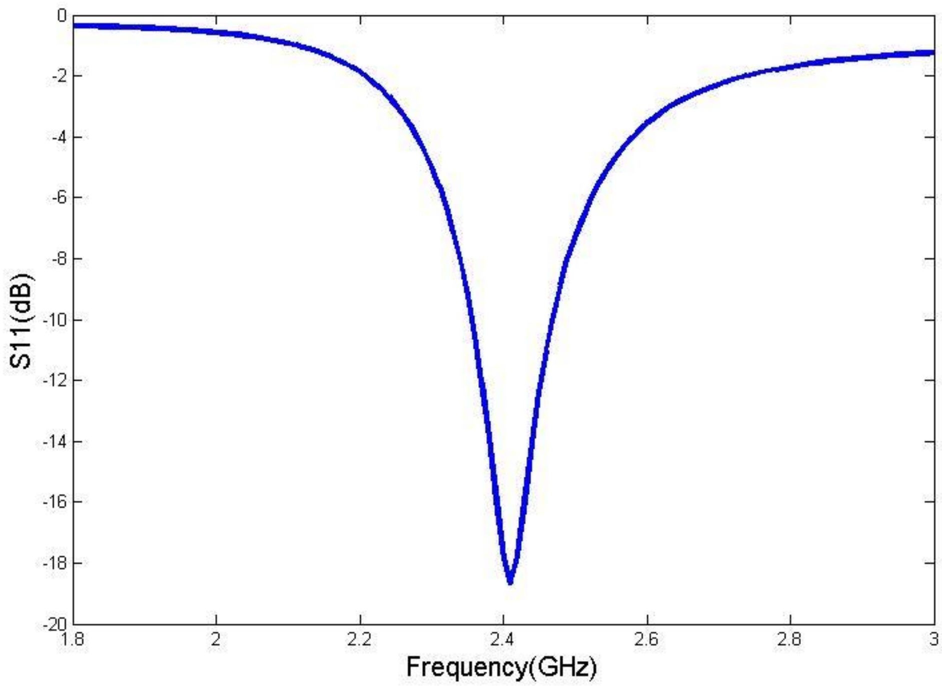

Fig. 27. Magnitude of S11(dB) in simulation.

- **Plot of S11 parameters from simulation and calculation:**

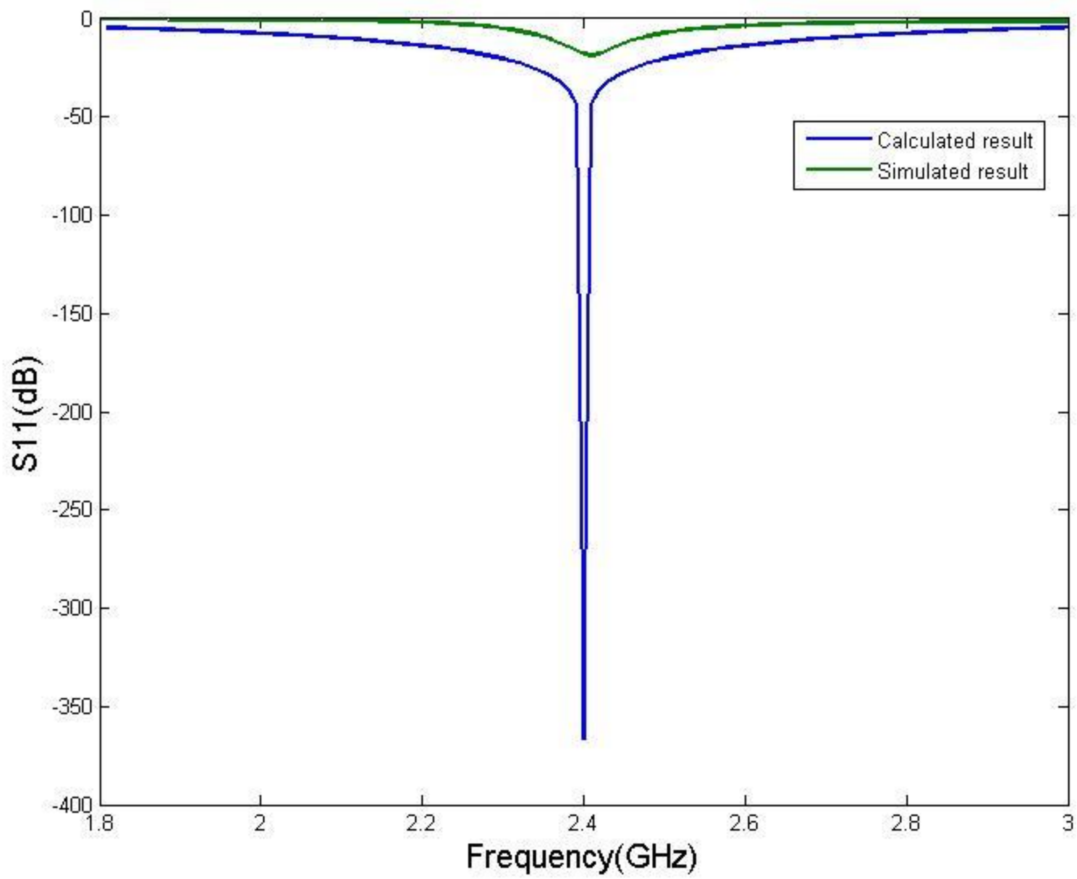

Fig. 27. Comparison of plots obtained from simulation and calculation

- **<u>Calculation:</u>**

The ABCD parameter of the single stub section can be found by using the following equation

$$\begin{bmatrix} A & B \\ C & D \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ Y & 1 \end{bmatrix} \begin{bmatrix} cos\theta_s & jZ_s sin\theta_s \\ jY_s sin\theta_s & cos\theta_s \end{bmatrix} \quad \textbf{(14)}$$

Where Y is the input susceptance of the stub, θ_s is the electrical distance of the stub from the load, Z_s is the input impedance seen from the stub joining point and Y_s is the respective stub admittance. Here

$$Z_s = \frac{1}{Y_s} = Z_0 \frac{Z_L + jZ_0 tan\theta_s}{Z_0 + jZ_L tan\theta_s} \quad \textbf{(15)}$$

where $Z_L = R_L + jX_L =$ **125+j300 Ω**

Now we can find the S (1,1) from the ABCD parameters using the following equation

$$\boldsymbol{S(1,1)} = \frac{\boldsymbol{A+\frac{B}{Z_0}-CZ_0-D}}{\boldsymbol{A+\frac{B}{Z_0}+CZ_0+D}} \qquad \textbf{(16)}$$

Using these equations in MATLAB, we can get |S (1,1) | plot and simultaneously we can simulate in the full-wave simulator.

- **Conclusion:**

- The stub matching was performed using one of the matching technique known as open shunt stub. The design and the simulation result is also verified by calculating the plot in MATLAB.

- The load impedance here used was 125+j300 Ω and the characteristic impedances for the microstrip line were 50 Ω for each. From Fig. 26 we can confirm a dip at 2.4 GHz operating frequency.

- The theoretical value suggests that the value of the magnitude of S11 must tend to zero which implies that the result must show the value as low as possible. Hence a mutual agreement is observed in both the simulated and calculated plot.

- The dip obtained in for the S11 magnitude is more in the calculated plot as compared to the simulated plot. This might explain the difference in analysis and actual implementation using microstrip technology.