❖ Implementation of Bias Tee:

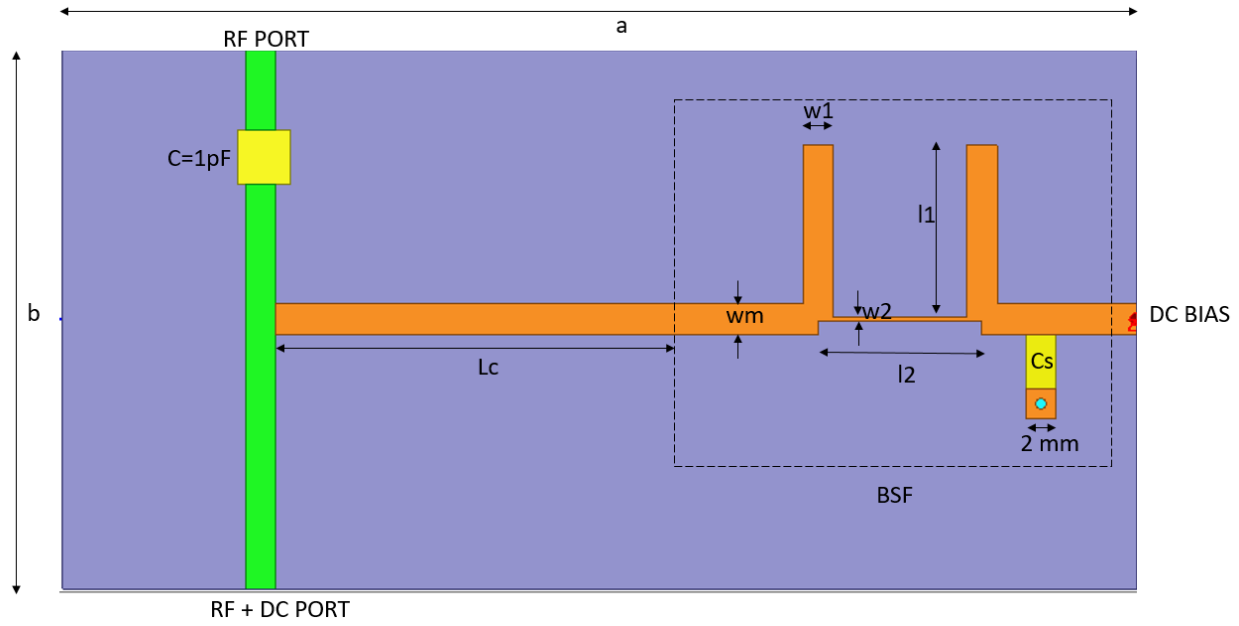

Fig. 31. The layout of Complete Bias Tee integrated with BSF.

➢ Components:

- Metal: **Copper**
  - Conductivity: 58000000 Siemens/m
  - Relative Permittivity (εr): 1

- Substrate: **Rogers RO4003C**
  - Relative Permittivity (εr): 3.55
  - Dielectric Loss Tangent ($tan\delta$): 0.0027

➢ Design Specifications:

- a = 20mm
- b = 30mm
- h = 0.508mm (Substrate thickness)
- t = 0.017mm (Metal thickness)
- w_m = 1.136mm
- w_2 = 0.172mm
- l_1 = 5.766mm
- w_1 = 1.136mm
- l_2 = 6.097mm

- Lc = 14.425mm
- Cs = 1pF
- C = 1 pF

- **Design Criteria:**

  - Center Frequency: 7.8 GHz

- **Results:**

  - **Magnitude plot of S11, S21 and S31 parameters**

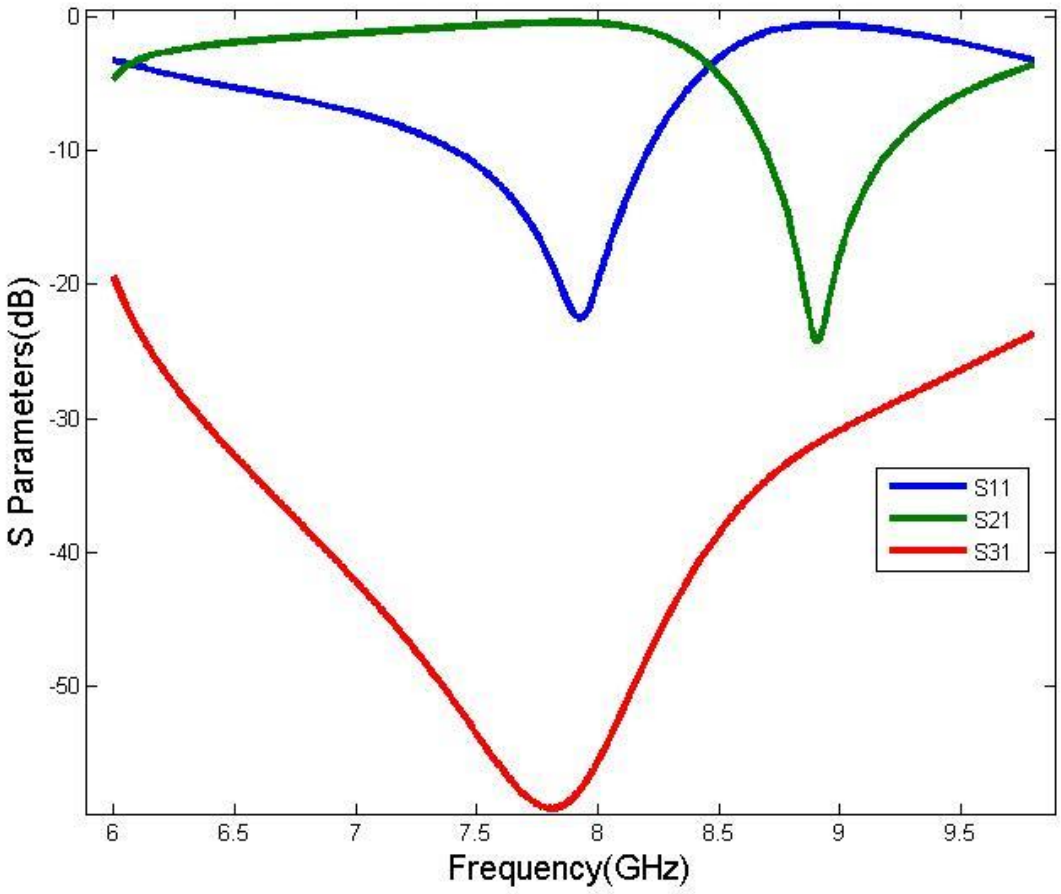

Fig. 32. Magnitude plot of S11, S21 and S31

- **Numbering of ports**
  1. **PORT 1 : RF PORT**
  2. **PORT 2: RF+DC PORT**
  3. **PORT 3: DC BIAS**

- **Magnitude plot of S22 parameters**

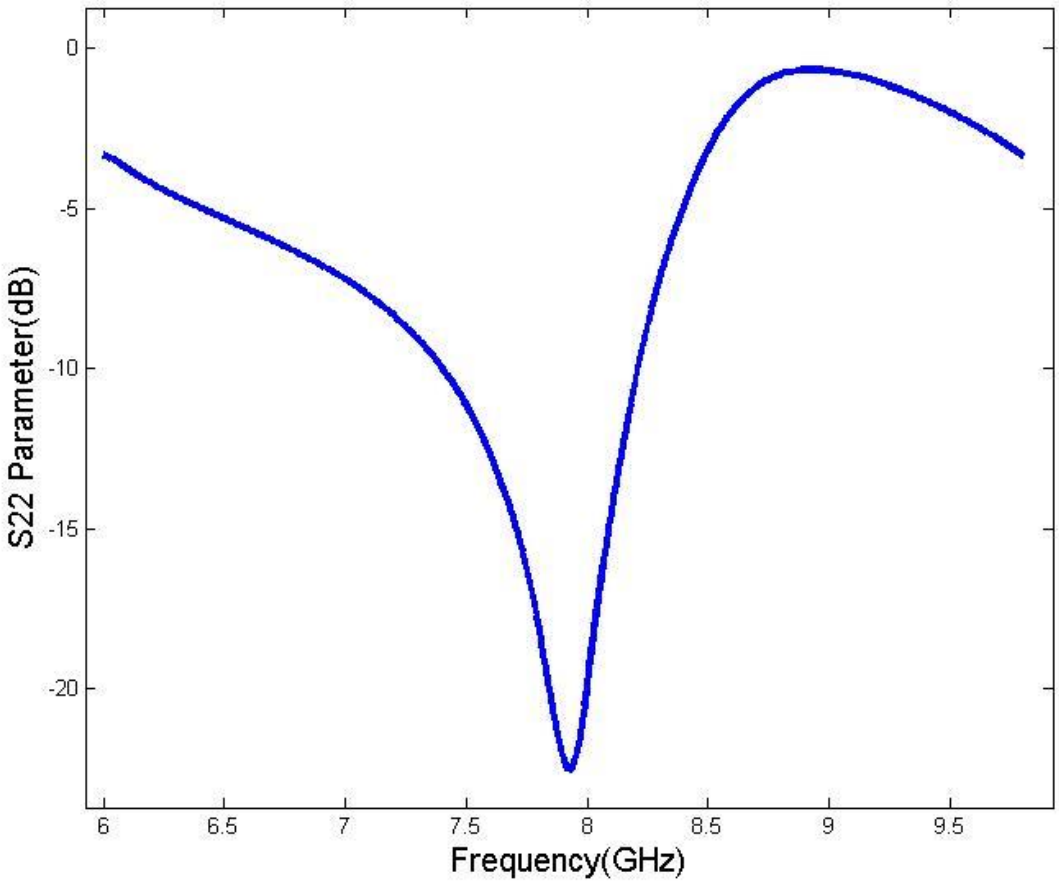

Fig. 33. Magnitude plot of S22 parameter

➢ Conclusion:

- In the design, we have considered the port 1 as RF port, port 2 as the RF and DC port and the DC bias input port as port 3. Port 2 is used to set a DC bias to the RF signal. The characteristic impedance of the bias tee is 50 ohm and the characteristic impedance of the BSF as discussed above is 50 ohm and 120 ohm for the parallel and series stub respectively.

- The BSF is used to avoid the use of inductor which acts as a capacitor at higher microwave frequency. The low shunt impedances of the open stubs along with the high series impedances increases the bandwidth as well as the level of rejection of the filter.

- The magnitude plot of S11, S21 and S31 in dB can be observed in Fig. 32. The S11 shows the isolation of nearly -20dB along with the S31 which shows around -55dB of isolation.

- The length Lc is calculated from the input port of the BSF such that the input impedance tends to infinite(i.e $Zin \rightarrow \infty$) looking at port 1. This condition provides a minimum loading effect to the microstrip line carrying RF signals.

- The capacitor of 1pF found to appropriate for the design. While designing the capacitors of 0.1 pF and 10 pF were also used. However, the best response and isolation was provided with the 1pF capacitor.

- The S22 parameter in Fig. 33 also shows good isolation which implies good response on the RF+DC port of Bias tee junction. Thus this port can be successfully used as a DC bias to another circuit such as a transistor.