Experiment 5(a) : E-Plane Tee

Aim

To study the characteristics of an E-plane tee junction and determine its isolation.

Apparatus required

1. Klystron Power Supply
2. Klystron tube with Klystron mounts
3. Isolator
4. Variable attenuator
5. Frequency meter
6. Detector mount
7. DSO
8. E-plane tee junction
9. Matched load
10. BNC cable

Theory

An E-plane tee is a T-shaped waveguide junction in which the side arm is parallel to the electric field (E-field) of the main waveguide.

- When power is fed into the side arm, it divides equally between the two collinear arms with 180° phase difference.
- When equal and opposite waves are applied to the collinear arms, the resultant field at the side arm is zero.
- Hence, the side arm acts as a difference port.

Insertion loss is the reduction in signal power caused by inserting a device (such as a filter, attenuator, or waveguide junction) into a transmission line or microwave system. When a component is introduced between a source and a load, part of the input power is

- Absorbed,
- Reflected, or
- Dissipated as heat

This results in a decrease in the output power, which is termed insertion loss.

$$\text{Insersion Loss(dB)} = 10\log_{10}\left(\frac{P_{\text{in}}}{P_{\text{out}}}\right)$$

Since power is proportional to the square of voltage:

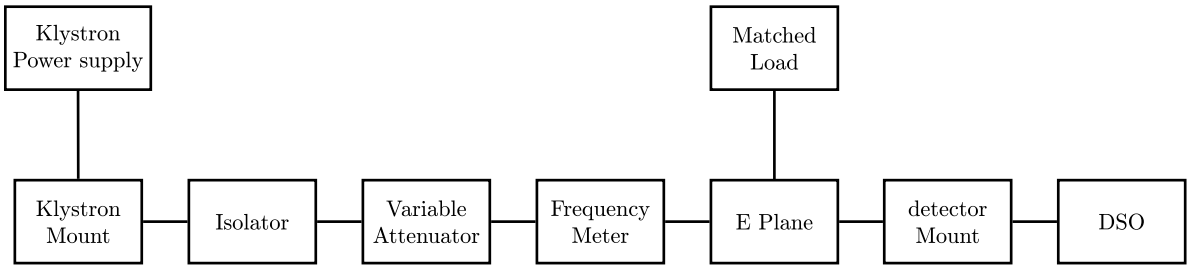
$$\text{Insersion Loss(dB)} = 20\log_{10}\left(\frac{V_1}{V_2}\right)$$

Where:

- V_1 = Input voltage
- V_2 = Output voltage

Procedure

1. Set up the components and equipments as shown in figure.



2. Set Mode selector switch to AM-Mode position with AM amplitude and AM frequency knob at mid position. Keep beam voltage control knob fully anticlockwise (minimum) and reflector voltage knob to fully clockwise (maximum).
3. Place the cooling fan in front of the klystron tube and switch ON the fan to avoid overheating
4. Switch 'On' the klystron power supply and oscilloscope. Adjust the repeller voltage until a square wave on a DSO
5. Measure the input voltage by disconnecting the E plane tee and Connect the detector mount directly to the output of the microwave bench. Note the voltage indicated on the DSO. This voltage is taken as the **input reference voltage** V_1
6. Connect the E-plane tee to the setup.
7. Connect the detector mount to one port and terminate the other port with a matched load.
8. Measure the output voltage on the DSO . This voltage is the output voltage V_2.and calculate the isolation in dB using

$$\text{Isolation (dB)} = 20\log_{10}\left(\frac{V_1}{V_2}\right)$$

9. Interchange the position of the matched load and detector mount. Note the change in DSO reading and determine isolation.

Result

The characteristics of the E-plane tee were studied and its isolation was determined