Experiment 5 : Study Of Microwave Components

Aim

To sdetermine the frequency & wavelength in a rectangular waveguide working on TE_{10} mode.

Instruments/Equipments

1. Klystron Power Supply
2. Klystron tube with Klystron mounts
3. Isolator
4. Variable attenuator
5. Frequency meter
6. Slotted section
7. Tunable probe
8. oscilloscope
9. BNC cable

Theory

Mode represents in wave guides as either TE_{mn}/ TM_{mn}, Where TE-Transverse electric, TM-Transverse magnetic. m - Number of half wave length variation in broader direction. n - Number of half wave length variation in shorter direction.

$$\frac{\lambda_g}{2} = d_1 - d_2$$

Where d_1 and d_2 are the distance between two successive minima/maxima. It is having highest cut off frequency hence dominant mode. For dominant TE_{10} mode in rectangular wave guide $\lambda_0, \lambda_g, \lambda_c$ are related as below.

$$\frac{1}{\lambda_0^2} = \frac{1}{\lambda_g^2} + \frac{1}{\lambda_c^2}$$

Where λ_0 is free space wave length,λ_g is guide wave length, λ_c is cutoff wave length. For TE_{10} mode

$$\lambda_c = \frac{2a}{m}$$

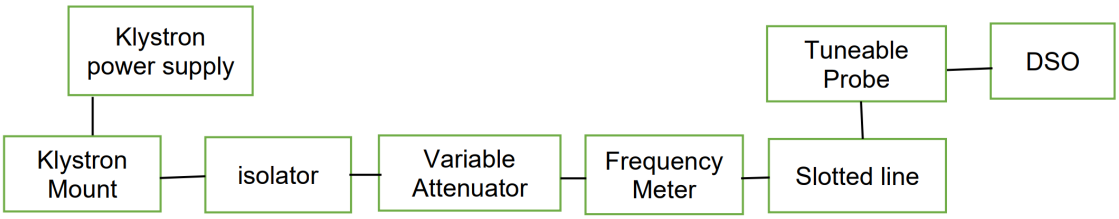
Where m = 1 in TE_{10} mode and a is inner broad dimension of waveguide. The wavelength of the signal in an unbounded medium (air or vacuum), calculated as

$$\lambda_0 = c/f$$

Where $c = 3 \times 10^8$ m/s is velocity of light and f is frequency. For propagation to occur, the operating free space wavelength must be less than the cutoff wavelength ($\lambda_0 < \lambda_c$)

Procedure

1. Set up the components and equipments as shown in figure.
2. Set Mode selector switch to FM-Mode position with FM amplitude and FM frequency knob at mid position. Keep beam voltage control knob fully anticlockwise(minimum) and reflector voltage knob to fully clockwise(Maximum).
3. Fan should be kept infront of klystron
4. Switch on Fan



5. Switch On the klystron power supply and oscilloscope. SAdjust the repeller voltage until a square wave on a DSO.Record the parameters beam voltage,beam current,repeller voltage correctly using the Mode Select switch on the Klystron Power Supply