MICROWAVE ENGINEERING AND DIGITAL COMMUNICATIONS LAB

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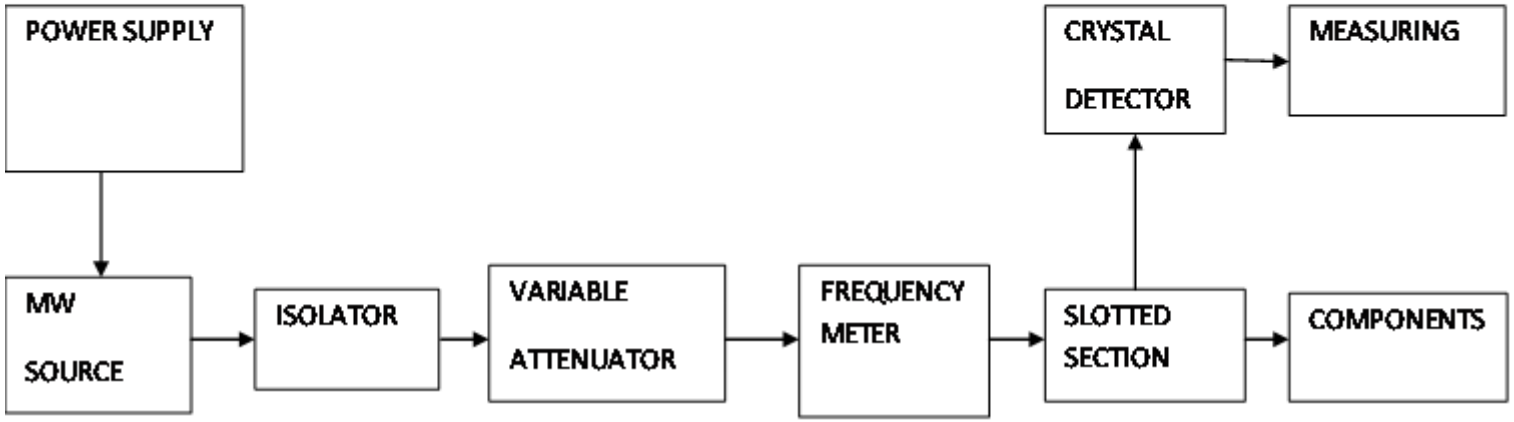
DESCRIPTION OF MICROWAVE BENCH SETUP



MEASUREMENT OF SCATTERING PARAMETERS OF A CIRCULATOR

AIM:

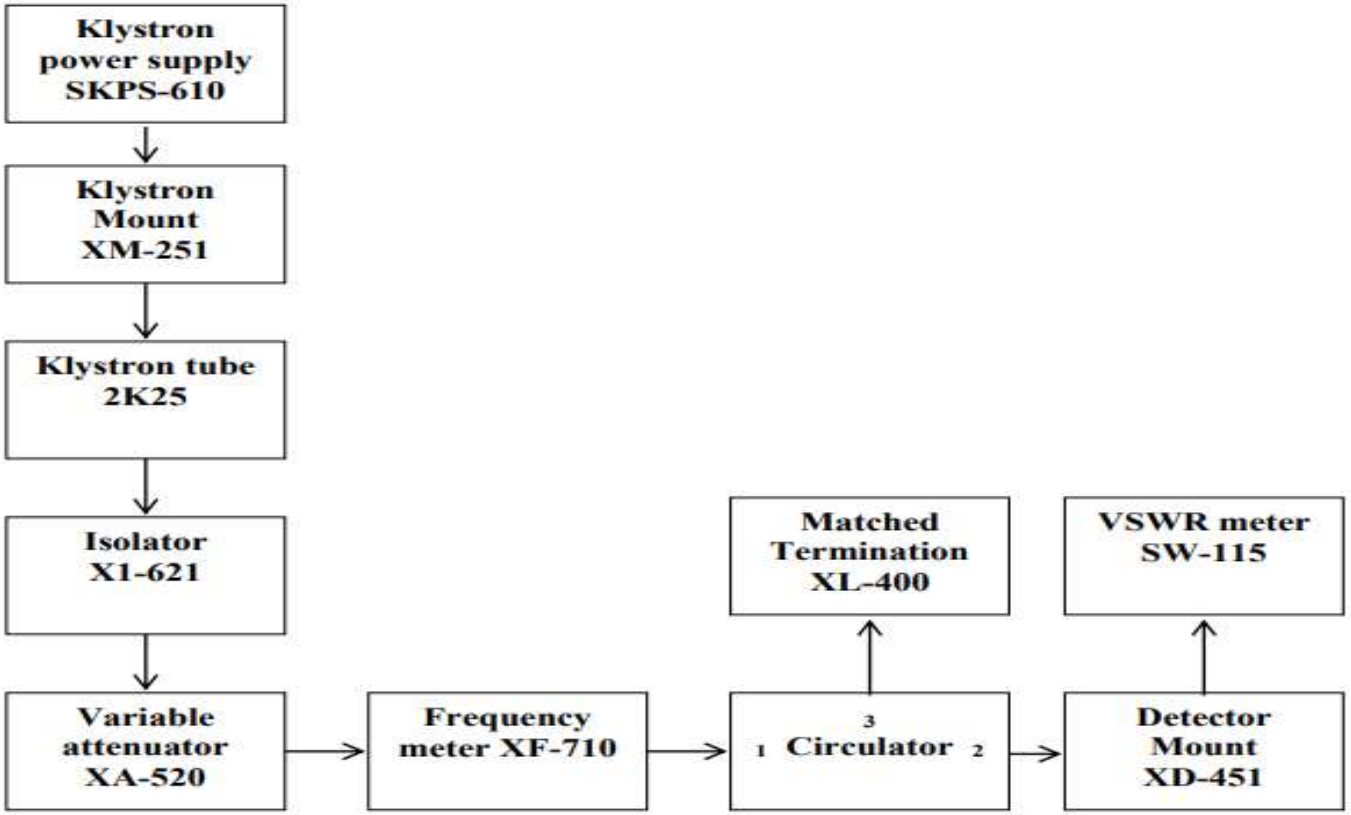
a)To calculate the Isolation and coupling coefficients .

b) To verify the scattering parameters of a Circulator.

APPARATUS

1. Regulated klystron power supply
2. Reflex klystron with mount and cooling fan
3. Isolator
4. Variable attenuator
5. Frequency meter/wave meter
6. Waveguide detector mount with detector
7. VSWR meter or micro ammeter
8. Matched Terminations
9. Circulator
10. Slotted section
11. Waveguide stands and accessories

BLOCK DIAGRAM



OPERATION

- A circulator is a passive microwave component which allows complete transmission from n to (n+ 1) port.
- Circulator can be constructed with the help of magic tees & gyrator or directional coupler with phase shifter or using ferrite material.
- A ferrite type circulator employs ferrite material at the centre of the junction.

OBSERVATIONS AND OUTPUT

1) Insertion loss:

The ratio of power input at port n to the power detected at Port n+1

$L = 10 \log_{10}(P_i / P_r)$

Where P_i = Incident power at port n

P_r = received power at port n+1

2) Isolation: The ratio of power at port n to the power detected at port n-l.

$I = 10 \log_{10}(P_i / P_3)$

The scattering matrix of a three port circulator

$$[S] = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$$

APPLICATIONS

1.Used as duplexer for a radar antenna system.

2.Two three port circulators can be used in tunnel diode or parametric amplifiers.

3.Used as low power devices as they can handle low powers only.

THANK YOU