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Experiment No: 10

Title: -Study the network analyzer and carry out the measurements of s-parameters

Theory: -

A directional coupler is a device with which it is possible to measure the incident and reflected power separately. It consists of two transmission lines, the main and auxiliary arm, electromagnetically coupled to each other. With reference to Figure 1, the power entering the port 1 gets divided between port 2 and port 3 and almost no power comes out in port 4.

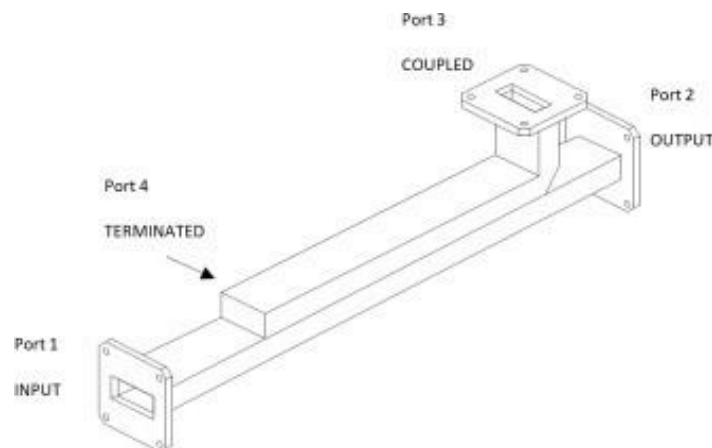


Figure 1: Directional Coupler

1. Coupling Factor:

$$\text{Coupling factor (dB)} = 10 \cdot \log_{10}(P_1/P_3)$$

When Port 2 is matched, input is applied to Port 1 and output is measured at Port 3

2. Isolation:

$$\text{Isolation (dB)} = 10 \cdot \log_{10}(P_2/P_3)$$

When Port 1 is matched, input is applied to Port 2 and output is measured at Port 3

3. Directivity:

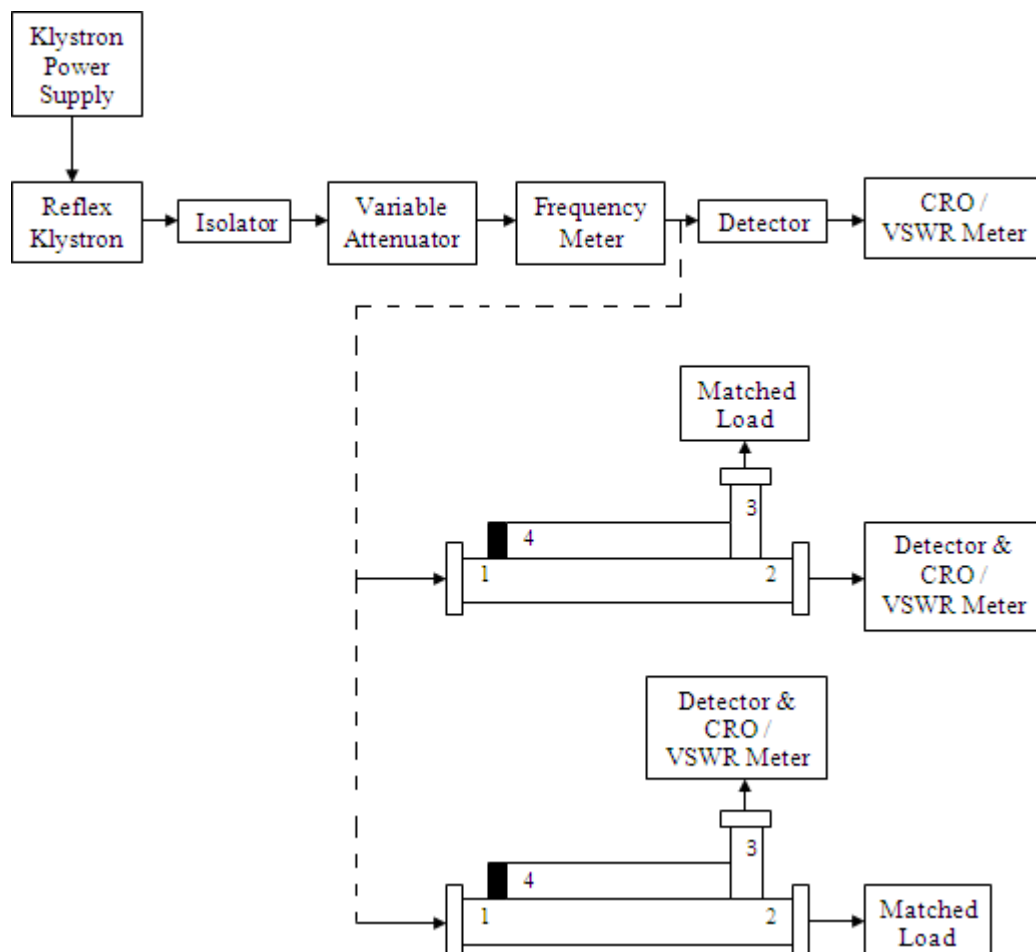
$$\text{Directivity (dB)} = 10 \cdot \log_{10}(P_1/P_2)$$

4. Insertion Loss:

$$\text{Insertion Loss (dB)} = 10 \log_{10}(P_1/P_2)$$

When Port 3 is matched, input is applied to Port 1 and output is measured at Port 2

EXPERIMENTAL SETUP:



Procedure:

1. Set up the components and equipment as shown in experimental setup.
 2. Connect tunable detector at the end of frequency meter and connect output to VSWR meter using BNC cable.
 3. Rotate plunger of frequency meter completely at any one side.
 4. Keep MOD switch of Klystron Power Supply at AM position. Keep amplitude and frequency knobs of AM at maximum position.
 5. Keep beam voltage knob fully anticlockwise and repeller voltage knob fully clockwise.
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6. Keep gain control knobs of VSWR meter at maximum position. Select NORMAL range of VSWR meter and keep its control knob at XTAL position.
 7. Turn on Klystron Power Supply and wait for few seconds so that tube will warm up.
 8. Turn on HT and increase beam voltage gradually upto 230V. The Beam current should not exceed 20mA.
 9. Maximize the output by rotating repeller voltage knob as well as amplitude and frequency knobs of AM.
 10. Adjust VSWR meter reading at 0 dB using variable attenuator.
 11. Now connect port 1 of directional coupler at the end of frequency meter. Connect detector at port 2 and matched termination at port 3. Note down the reading from VSWR meter. (This reading is insertion loss in dB.)
 12. Now connect detector at port 3 and matched termination at port 2. Note down the reading from VSWR meter. (This reading is coupling factor in dB.)
 13. Repeat the steps number 11 and 12 by connecting port 2 and port 3 at the end of frequency meter.
 14. Find insertion loss, coupling factor, isolation and directivity of directional coupler.

Observation Table:

Sr. No.	Input	Output
1	P1 =	P2 =
		P3 =
2	P2 =	P1 =
		P3 =
3	P3 =	P1 =
		P2 =

Calculations:

Insertion Loss (dB) =

Coupling Factor (dB) =

Isolation (dB) =

Directivity (dB) =

Results:

Insertion Loss =

Coupling Factor =

Isolation = Directivity =

Question: define coupling factor, insertion loss and directivity of directional coupler.

Conclusion:

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