SNS COLLEGE OF ENGINEERING

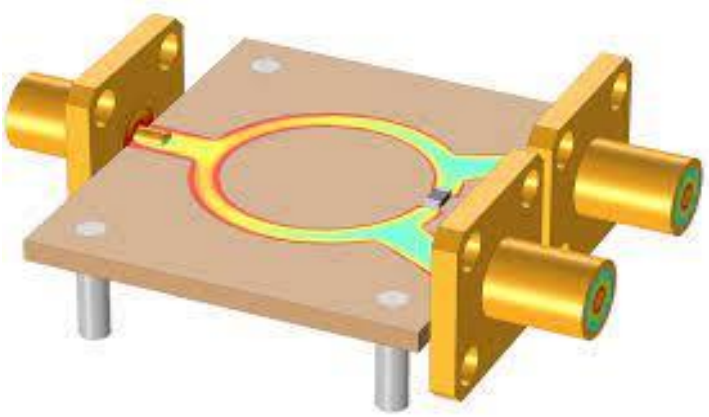
(Autonomous)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

19EC602- MICROWAVE AND OPTICAL ENGINEERING

UNIT-3

MEASUREMENT OF INSERTION LOSS



INSERTION LOSS

- When a device or network is inserted in The transmission line, part P_r of the input signal power P_i is reflected from the input terminal and the remaining part P_i-P_r which actually enters the network is attenuated due to the non-zero loss of the network. The output signal power P_o is therefore less than P_i.

- Therefore, insertion loss is defined by The difference in the power arriving at the terminating load with and without the network in the circuit.

INSERTION LOSS

Since ,

$$\frac{P_0}{P_i} = \frac{P_i - P_r}{P_i} * \frac{P_0}{P_i - P_r} \quad ..(1)$$

or

$$10 \log \frac{P_0}{P_i} = 10 \log \left(1 - \frac{P_r}{P_i}\right) + 10 \log \left(\frac{P_0}{P_i - P_r}\right) \quad ..(2)$$

Insertion loss = reflection loss + attenuation loss

INSERTION LOSS

Where, by definition

$$\text{Insertion loss (dB)} = 10 \log (P_0/P_i) \quad ..(3)$$

$$\text{Reflection loss (dB)} = 10 \log \left(1 - \frac{P_r}{P_i}\right) = 10 \log (1 - |\Gamma|^2)$$

$$= 10 \log \frac{4S}{(1+S)^2}; S = \frac{1-|\Gamma|}{1+|\Gamma|} \quad ..(4)$$

INSERTION LOSS

$$\text{Attenuation loss (dB)} = 10 \log \left(\frac{P_0}{P_i - P_r} \right) \quad ..(5)$$

$$\text{Return loss (dB)} = 10 \log P_r/P_i = 20 \log |\Gamma| \quad ..(6)$$

For perfect matching , Pr =0 and the insertion loss and the attenuation loss become the same. The experimental setup for insertion and attenuation loss measurements are shown below in figure 1 . The relative power levels are measured by using detectors and a VSWR meter. DC_1 and DC_2 are two identical directional couplers .

INSERTION LOSS

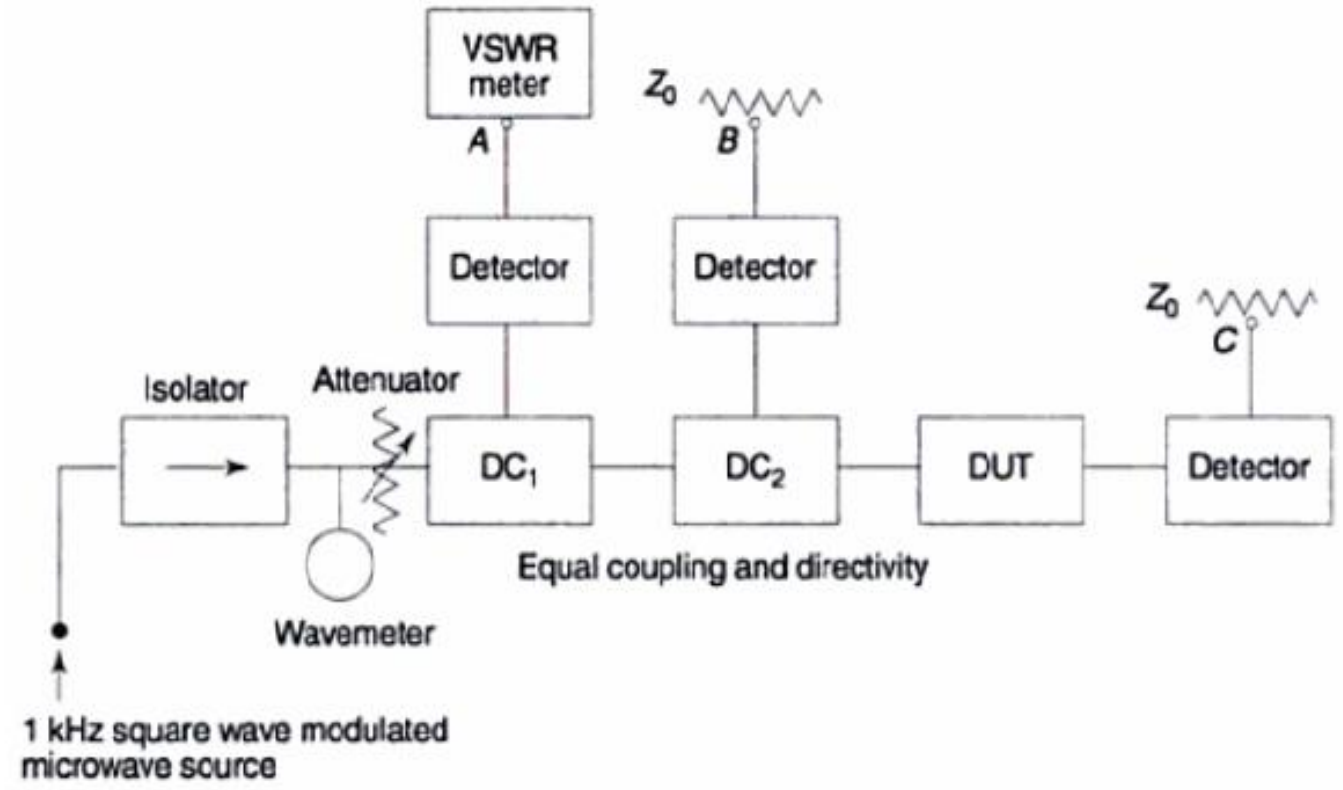


Figure 1 : Insertion loss and attenuation loss measurement setup


Thank
you