DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE NAME : 19EC602 – Microwave and Optical Engineering

III YEAR / VI SEMESTER

Unit III- MICROWAVE MEASUREMENTS

Topic : Phase shift measurement

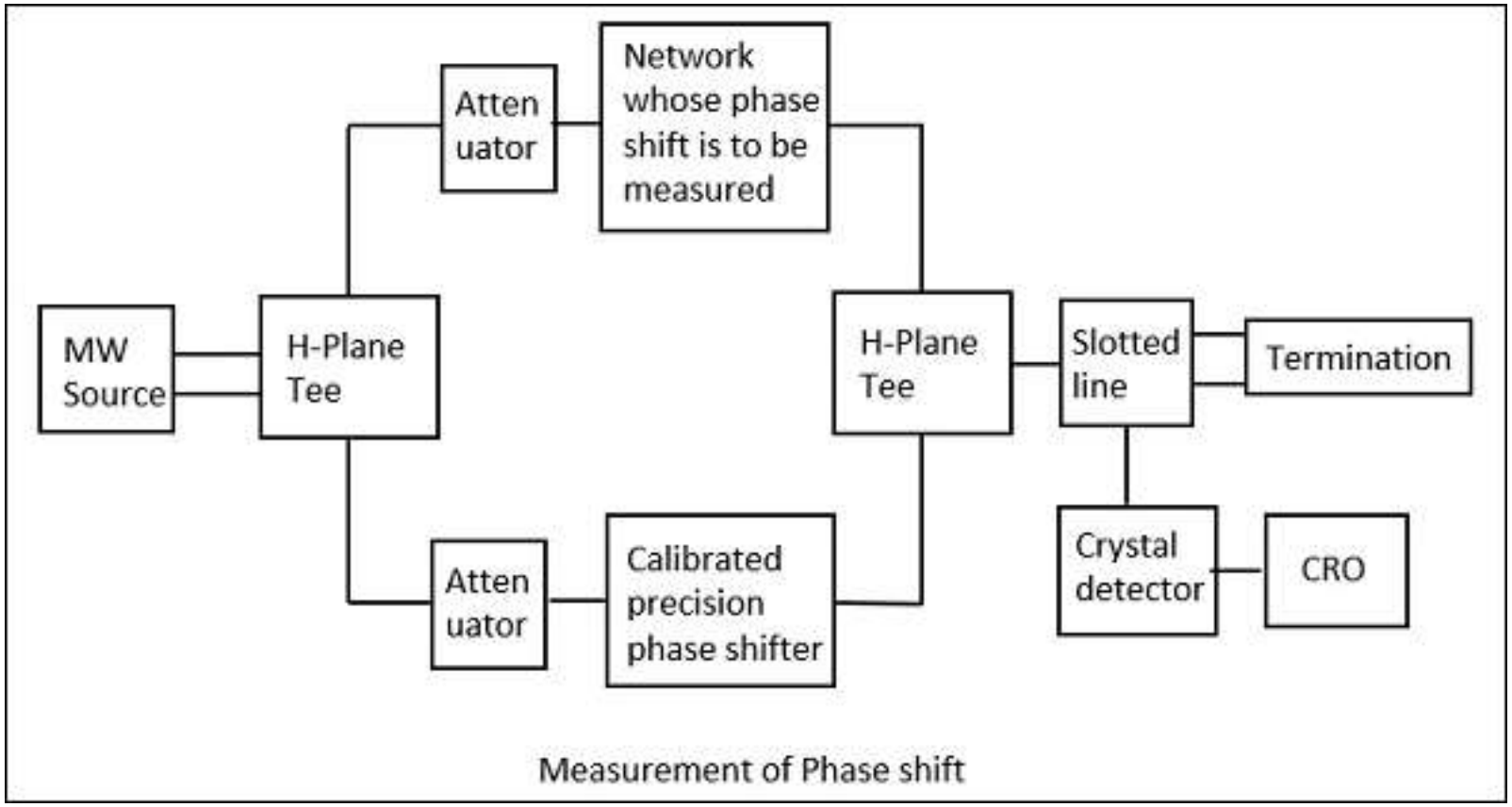
INTRODUCTION

- In microwave measurements, phase shift, the angular difference between two signals, is typically measured using a comparison technique, often involving a precision phase shifter and a dual-mode oscilloscope to observe the demodulated output.

Comparison Technique:

To measure phase shift, a common method is to compare the phase of the signal under test with a reference signal using a microwave bridge or similar setup.

BLOCKDIAGRAM

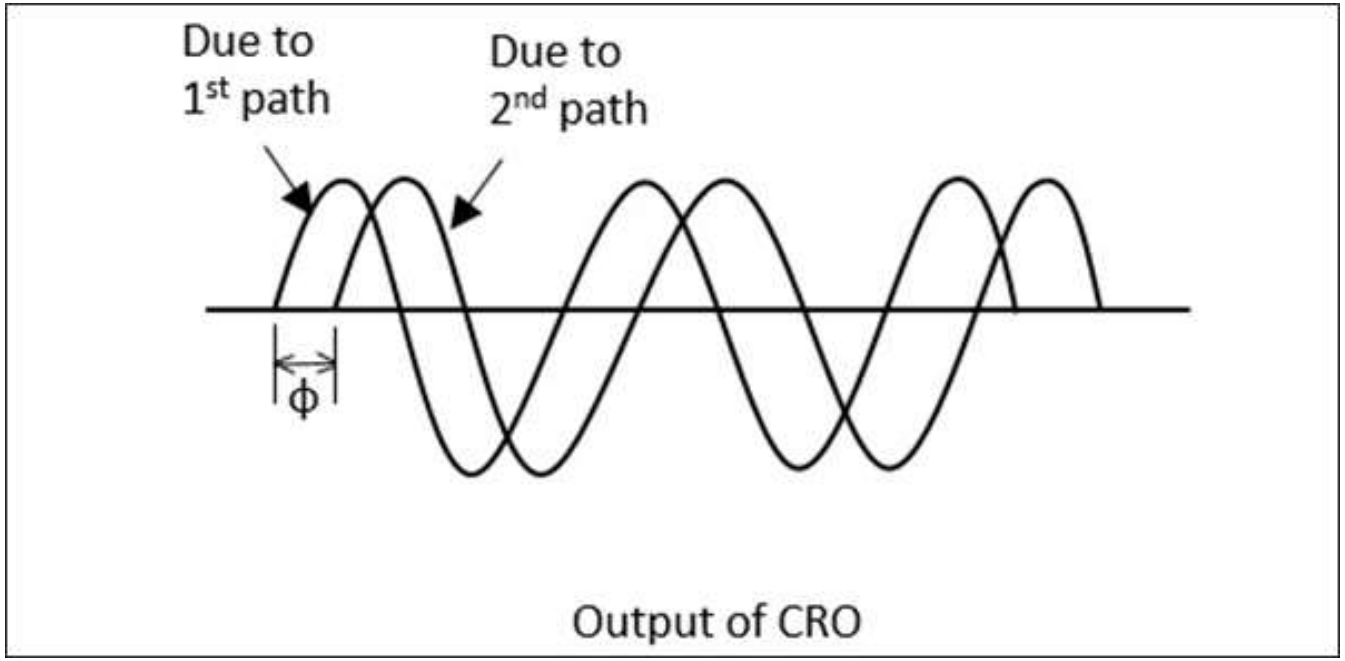


Measurement of Phase shift

Working of Phase shift measurement

- To measure such phase shift, we use a comparison technique, by which we can calibrate the phase shift.
- Here, after the microwave source generates the signal, it is passed through an H-plane Tee junction from which one port is connected to the network whose phase shift is to be measured and the other port is connected to an adjustable precision phase shifter.
- The demodulated output is a 1 KHz sine wave, which is observed in the CRO connected. This phase shifter is adjusted such that its output of 1 KHz sine wave also matches the above. After the matching is done by observing in the dual mode CRO, this precision phase shifter gives us the reading of phase shift.

Output of CRO



ADVANTAGES

•**Precise Timing Control:** Microwave phase shifters allow for fine-grained control of signal timing, crucial for applications like radar, phased array antennas, and high-speed data transmission.

•**Beam Steering:** In phased array antennas, phase shifters enable electronic beam steering, allowing the antenna to focus its radiation in different directions without physical movement.

•**Signal Processing:** They are essential for various signal processing techniques, including frequency diversity, beamforming, and interference cancellation.

•**Non-Intrusive Measurement:** Microwave systems can often perform measurements from a distance without interfering with the process, making them suitable for various applications.

ADVANTAGES

- **Penetration and Volume Measurement:** Microwaves can penetrate many materials (except metals), enabling measurements of volume rather than just the surface.
- **Immunity to Noise:** Some phase shifter technologies, like digital phase shifters, offer immunity to noise on control lines.
- **Uniform Performance:** Certain phase shifter designs, like digital phase shifters, exhibit more uniform performance unit-to-unit.
- **Wide Bandwidth:** Some phase shifters can achieve flat phase performance over a wide bandwidth.

DISADVANTAGES

- **High Cost:** Some microwave phase shifters, particularly those with high performance requirements, can be expensive.
- **Complexity:** Implementing and controlling microwave phase shifters can be complex, requiring specialized knowledge and equipment.
- **Insertion and Reflection Losses:**Phase shifters can introduce insertion losses (signal attenuation) and reflection losses (mismatched impedance).
- **Size and Weight:** Some microwave phase shifters can be bulky and heavy, limiting their applicability in certain applications.
- **Power Consumption:** Some phase shifters, especially those based on active components, can consume significant power.

Any Query????

Thank you……