DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE NAME : 19EC602 – Microwave and Optical Engineering

III YEAR / VI SEMESTER

Unit III- MICROWAVE MEASUREMENTS

Topic : Network Analyzer

INTRODUCTION

- Network analyzer is an instrument that is used to measure an electrical network's network parameters.
- These instruments are normally used to measure S-parameters because transmission & reflection of electrical networks are very simple to calculate at high frequencies.
- Although there are other types of network parameter sets like Y, Z & H-parameters. These analyzers are frequently used to differentiate two-port networks like filters & amplifiers and filters.

TYPES OF NETWORK ANALYZER

- Scalar Network Analyzer
- Vector Network Analyzer
- Large Scale Network Analyzer
- S Parameters in Network Analyzer

PRINCIPLE OF NETWORK ANALYZER

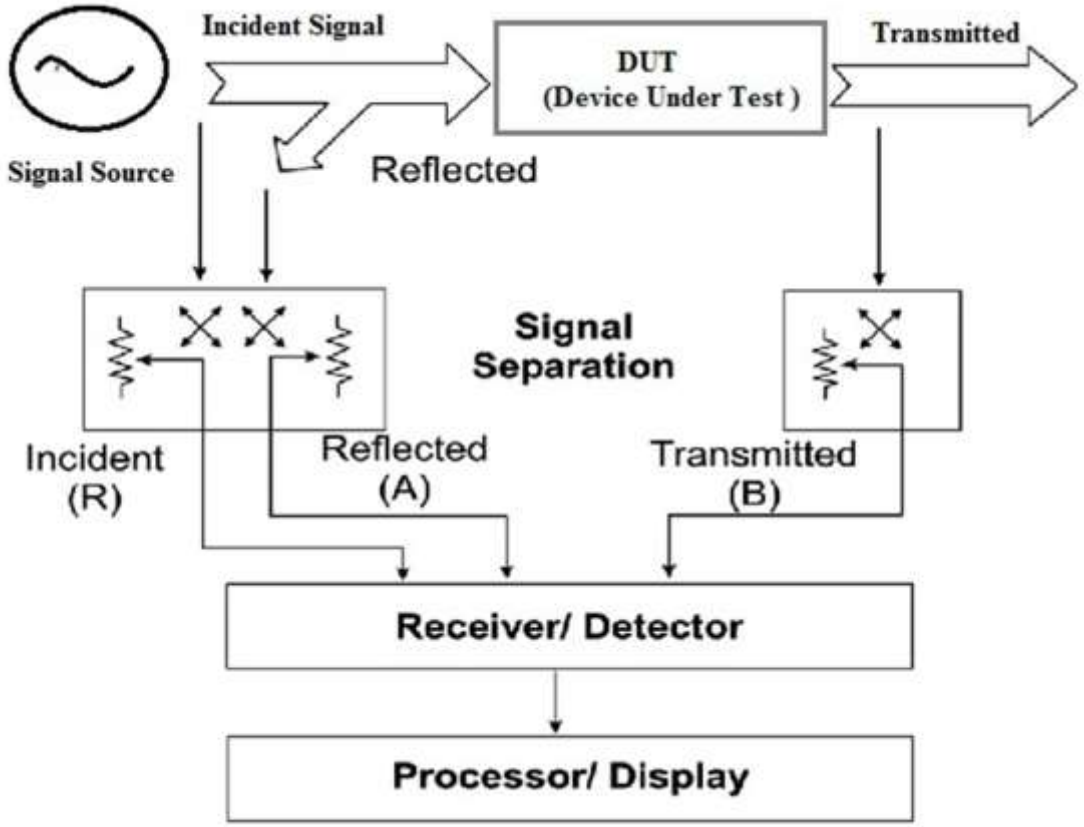
- The working principle of a network analyzer is to measure the phase & amplitude of both the waves like reflected & incident at the different ports of the Device Under Test (DUT).
- This analyzer includes both a source & set of receivers. A source is used to produce a known stimulus signal whereas receivers are used to decide changes in stimulus signal which is caused by the DUT.

MEASUREMENTS IN NETWORK ANALYZER

Network analyzer measurements are three types transmission, reflection, and scattering parameter.

- Transmission measurements are used to measure insertion loss, gain, and transmission coefficient.
- Reflection measurements are used to measure VSWR, reflection coefficient, impedance & return loss.
- Scattering parameter measurements are used to measure s-parameters like S11, S12, S21 & S22.

BLOCK DIAGRAM



WORKING

- The above network analyzer block diagram working is, fist the signal source generates an incident signal to DUT. After that, the signal separation device divides incident, reflected & transmitted signals.
- The receiver or detector changes the frequency from microwave to lower IF to make it simple for further processing. Finally, the processor or display processes the IF signal & displays the data on the CRT display.

SPECIFICATIONS

- Frequency ranges from 100 kHz to 20 GHz.
- Measured parameters are S11, S21, S2, and S22.
- The noise level is 133dB.
- The dynamic range is 1MHz to 20 GHz.
- The adjustment range of output power is -60 dBm to +10 dBm.
- Time taken for measurement for each point is <12us.
- Full CW frequency accuracy is + or – 2×10^-6.
- Setting resolution of frequency is 1Hz.

ADVANTAGES

- Scalar network analyzers are cheaper. As compared to VNA type, SNA performs sweep faster.
- In SNA, the hardware necessary for power detection & down conversion is fairly simple.
- VNA is used for phase as well as magnitude measurements not like SNA.

DISADVANTAGES

- SNA type is not applicable for phase-related measurements.
- As compared to the SNA type, VNA performs sweep slower.
- VNAs are very complex because of the full heterodyne architecture utilized within the receiver of it.
- VNAs are expensive as compared to SNAs.

APPLICATIONS

- VNAs are used to check the specifications of components & also design simulations.
- RF Network type analyzers are simply used to measure circuits, devices, components, etc.
- These are used in a range of industries to check different equipment, measure materials & observe the integrity of the signal.
- VNAs are essential for the devices & components characterization used within microwave & RF systems.
- These are used to measure the S parameters, insertion loss, reflection, transmission & return loss.
- These are mainly used do research & development purposes.

Any Query????

Thank you……