DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE NAME : 19EC602 – Microwave and Optical Engineering

III YEAR / VI SEMESTER

Unit III- MICROWAVE MEASUREMENTS

Topic : Spectrum Analyzer

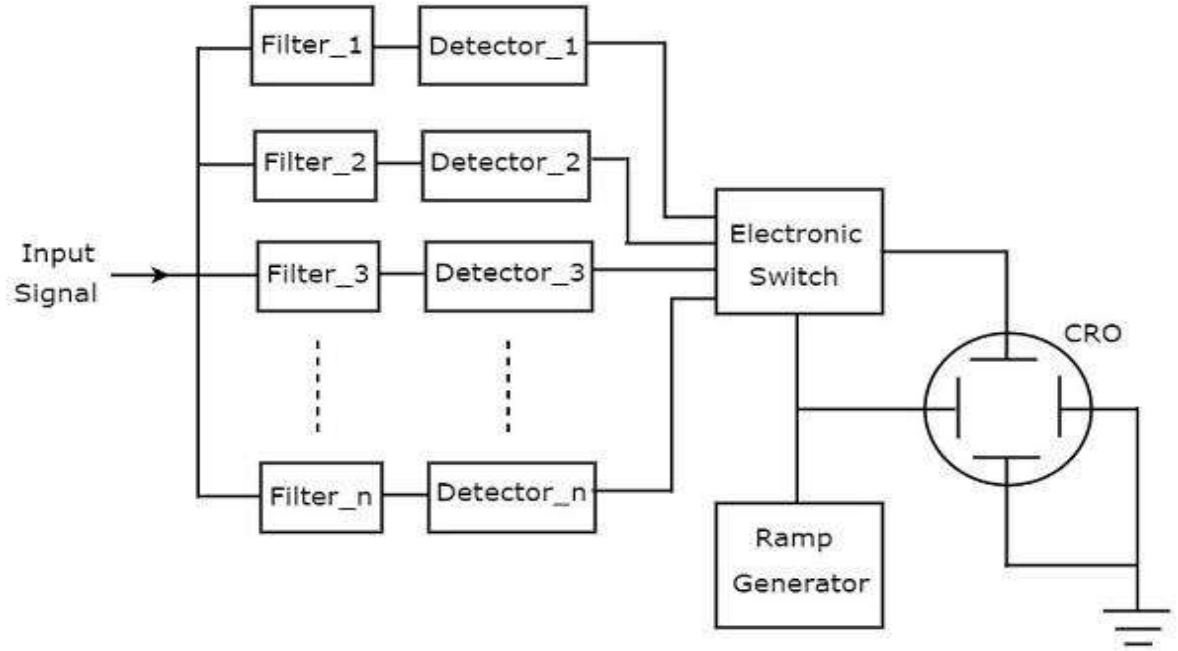
INTRODUCTION

- The electronic instrument, used for analyzing waves in frequency domain is called **spectrum analyzer**. Basically, it displays the energy distribution of a signal on its CRT screen. Here, x-axis represents frequency and y-axis represents the amplitude.

  - Filter Bank Spectrum Analyzer
  - Superheterodyne Spectrum Analyzer

Filter Bank Spectrum Analyzer

The spectrum analyzer, used for analyzing the signals are of AF range is called filter bank spectrum analyzer, or **real time spectrum analyzer** because it shows (displays) any variations in all input frequencies.



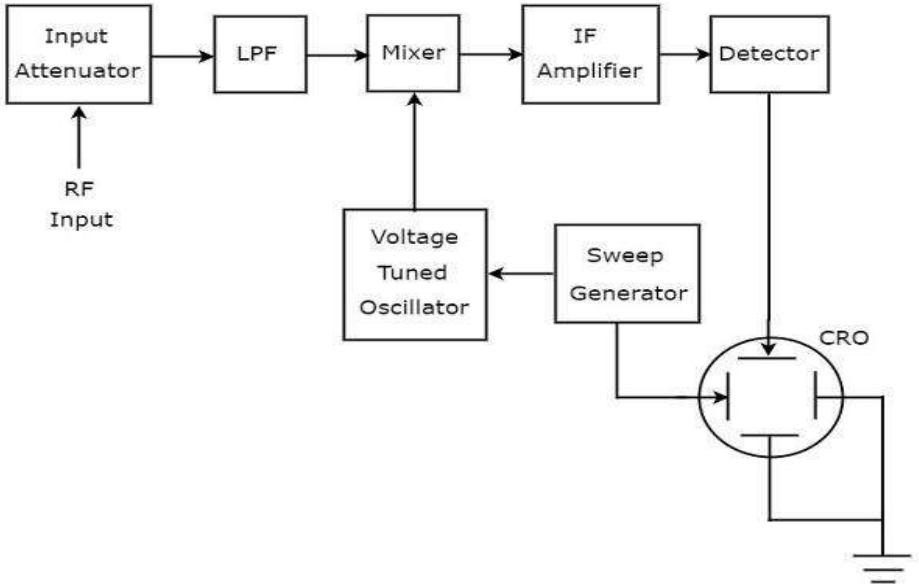
Working of FBSA

•It has a set of band pass filters and each one is designed for allowing a specific band of frequencies. The output of each band pass filter is given to a corresponding detector.

•All the detector outputs are connected to Electronic switch. This switch allows the detector outputs sequentially to the vertical deflection plate of CRO. So, CRO displays the frequency **spectrum of AF signal** on its CRT screen.

Superheterodyne Spectrum Analyzer

- The spectrum analyzer, used for analyzing the signals are of RF range is called **superheterodyne spectrum analyzer**. Its **block diagram** is shown in below figure.



Working of SSA

•The RF signal, which is to be analyzed is applied to input attenuator. If the signal amplitude is too large, then it can be attenuated by an **input attenuator**.

•**Low Pass Filter** (LPF) allows only the frequency components that are less than the cut-off frequency.

•**Mixer** gets the inputs from Low pass filter and voltage tuned oscillator. It produces an output, which is the difference of frequencies of the two signals that are applied to it.

•**IF amplifier** amplifies the Intermediate Frequency (IF) signal, i.e. the output of mixer. The amplified IF signal is applied to detector.

The output of detector is given to vertical deflection plate of CRO. So, CRO displays the frequency **spectrum of RF signal** on its CRT screen.

ADVANTAGES

•**Wide Frequency Range (Swept Analyzers):** Swept spectrum analyzers are capable of operating at frequencies extending into the GHz range. This broad coverage makes them suitable for a wide variety of RF and microwave applications.

•**Fast Analysis & Phase Information (FFT Analyzers):** FFT spectrum analyzers can analyze signals very quickly, processing data sample by sample. This speed enables them to capture and analyze phase information of signals, a critical feature in many signal analysis scenarios.

DISADVANTAGES

•**Limited Signal Detection (Swept Analyzers):** Swept-type analyzers are primarily designed to detect continuous wave (CW) signals and typically do not provide phase information. This limits their use for more complex signal analysis tasks that require phase measurements.

•**High-Frequency Limitations (FFT Analyzers):** FFT analyzers are constrained by the sampling rate of their ADC (Analog to Digital Converter). This limitation hinders their ability to operate effectively at higher RF frequencies. Additionally, they face restrictions on the bandwidth they can handle.

APPLICATIONS

- **Frequency Domain Analysis:** Spectrum analyzers work in the frequency domain, displaying the amplitude of a signal as a function of frequency.
- **Signal Characterization:** They help characterize signals spread across a wide range of frequencies, like those generated by RF transmitters.
- **Distortion Measurement:** They can measure different types of distortion, including harmonic distortion and intermodulation distortion.
- **Interference Identification:** Spectrum analyzers can identify and locate in-band and out-of-band interference.

Any Query????

Thank you……