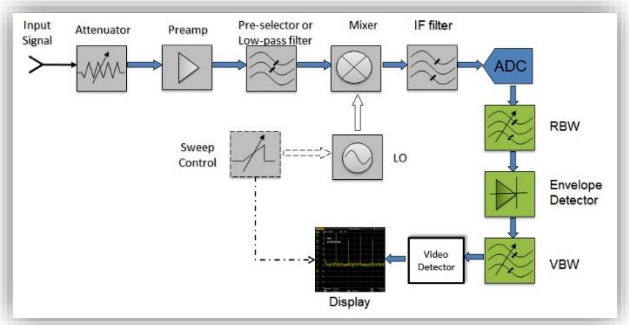
Introduction to Swept Spectrum Analyzer



Spectrum analyzers based on swept super heterodyne designs are very popular. This is due, in part, to their low noise, ease of use, and ability to differentiate between signals that have very close frequencies.

First, a little history. The full name of super-heterodyne is supersonic heterodyne. The basic design was created by US Engineer Edwin Armstrong in 1918, near the end of World War I. Supersonic refers to waves with frequencies that are higher than those within the range of human hearing (31Hz to 21kHz). Heterodyne is a contraction of the Greek words hetero- which means "different" and -dyne which means "power".

A basic design for a modern super-heterodyne receiver used in a spectrum analyzer is shown as the diagram on the left.

In basic terms, the swept super-heterodyne is almost identical to a radio receiver. Both can be set to a particular frequency range and filter out other frequencies (like tuning to particular radio station) and then observe the incoming signal. The major differences are that a radio is tuned to a particular frequency and the signal is fed to a speaker. An analyzer is not set to a fixed frequency. Instead, the analyzer sweeps across frequencies in steps, like moving the radio to a new channel, and draws the signal amplitude on a display.

In simple terms, this design takes an unknown signal (input, or RF_{in} signal) and mixes (combines) it with a sweeping signal, or swept Local Oscillator (LO) to create a signal that is a combination of the unknown and the LO signal. The LO is swept from a start to a stop frequency in discrete steps. Each step in the sweep defines a frequency "bin" on the spectrum analyzer display. At each bin, the power is measured. If the unknown signal has a frequency component within the bin, the display will place a data point at the equivalent amplitude of the unknown signal.

After the sweep has completed, the resultant display will represent one scan across the span defined by the start and stop values of the instrument. In the following articles, we will look at how each circuit element is used to create this output.