

Common Component Test

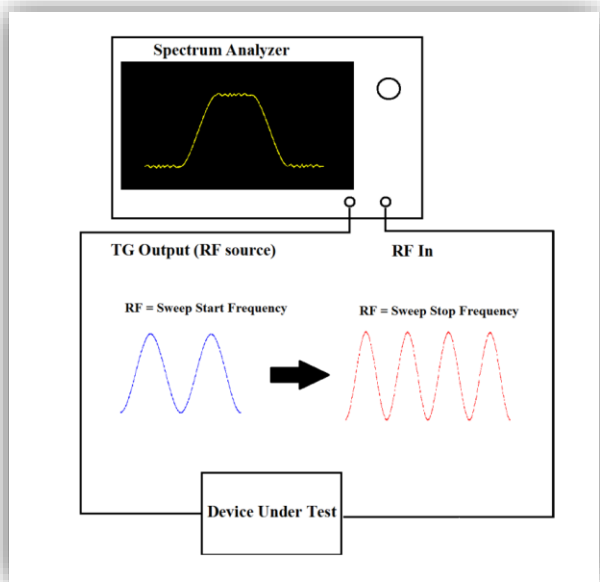
Now that we have a basic understanding of the instrumentation used for measuring RF, let's take a closer look at measuring the performance of some common RF components using a spectrum analyzer.

The Tracking Generator

Many component level tests require an RF source to deliver a signal to the device-under-test (DUT) with a known amplitude and frequency. When testing an RF filter, for example, you would want to deliver a series of known amplitudes at specific frequencies to see where the filter is most effective. You could use an external RF source and synchronize it with the sweep of a spectrum analyzer to perform this test, but many spectrum analyzers are available with a tracking generator that can make this type of testing quite a bit easier.

A tracking generator is an extension of the sweep circuit. It is a programmable RF source with the ability to synchronize the output frequency with the sweep steps of the spectrum analyzer. In this way, the source and measurement frequencies are locked. If you are measuring from 1MHz to 100MHz on the spectrum analyzer, the tracking generator output a continuous sine wave with a frequency that will sweep from 1MHz to 100MHz in full synchronization with the measurement.

Figure 1: Example of a spectrum analyzer with tracking generator sweeping a DUT.



Testing Filters

A filter is a useful component in many designs. The primary goals of a filter are to remove unwanted frequencies and to enhance desired frequencies from an input signal.

Here are some common filters and their descriptions:

Low pass - Allow frequencies below a certain value to pass through, and reject higher frequencies. This can be used to remove high frequency noise from a signal.

High pass - Allow frequencies above a certain value to pass through, and reject lower frequencies. This can be used to remove low frequency components from the input signal.

Band pass - Allow a certain frequency range, or band, to

pass through the filter and reject those frequencies that are outside of the operating frequency band. This type of filter will allow a band of frequencies to pass through the filter with little to no changes while drastically lessening the amplitude of signals having frequencies outside of the operating band.

Notch - Reject those frequencies that are inside of the operating frequency band and reject those within the operating band of the filter. This type of filter will allow all frequencies outside of the operating band to pass through the filter with little to no changes while drastically lessening the amplitude of signals having frequencies inside of the operating band. The exact opposite of a bandpass filter. In all cases, testing a filter provides information about the quality of a filter. How well does it decrease unwanted signals and how well does it allow wanted signals through.

Here are some common steps for testing a filter using a spectrum analyzer:

Required Hardware:

- Spectrum analyzer with tracking generator
- Cabling and adapters to connect to the filter
- Filter to test

Test Steps:

Normalize the trace (Optional)

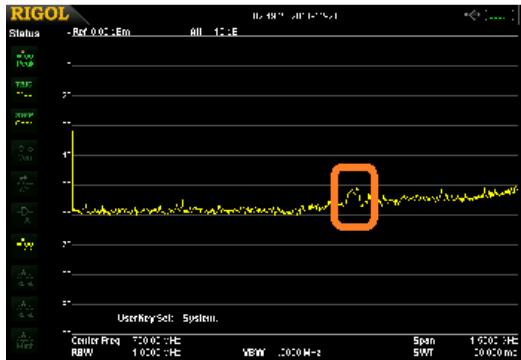
Many elements in an RF signal path can have nonlinear characteristics. In many cases, these nonlinear effects on your base measurements can be minimized by normalizing the instrument. Normalization is the process of mathematically removing the effects of cabling, adapters, and connections that could add unnecessary error to the characterization of the filter.

1. Connect tracking generator output to RF input using the same cabling that you will be using to test your device. Any element, like an adapter, used during normalization should also be used during device measurement as any changes to the RF signal path could effect the accuracy of the measurement.

NOTE: Clean the surfaces of the adapters and input with a lint free cloth to prevent damage and ensure repeatability.



2. Enable the tracking generator
3. Store the reference trace
4. Enable the normalization. Now, the displayed trace will more accurately represent your filter by removing cable and adapter losses.



Measure the filter

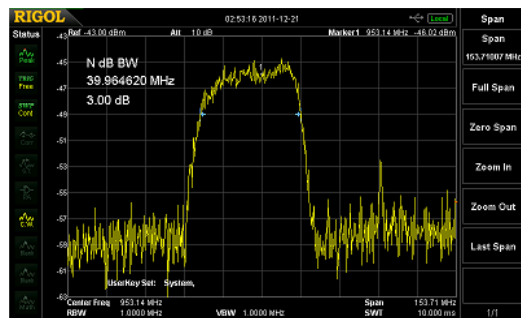
1. Connect the tracking generator output to the filter input using the appropriate cabling and connectors.
2. Connect the filter output to the instrument RF input.

NOTE: Clean the surfaces of the adapters and input with a lint free cloth to prevent damage and ensure repeatability.

3. Configure the stop, start frequency for the span of interest.
4. Set the tracking generator amplitude.

NOTE: If your instrument is equipped with a Preamplifier, you can enable it to lower the displayed noise floor.

5. Enable the Tracking generator .You can see the small bump in the figure below.
6. Adjust the amplitude, start, and stop frequency to zoom in on the trace.



Some analyzers have a convenient Auto scale feature that can automatically configure the analyzer to display a full view of the area of interest on the trace.

NOTE: Some analyzers also have markers. These are cursors that can show the frequency and amplitude of specific points on the trace as well as the ability to measure bandwidth at a particular dB level.