Signal Hound®

Signal Hound Real-time Spectrum Analyzers:

Revolutionizing Aerospace and Avionics Work Flows

By Signal Hound — October 20, 2023

Application
NOTE

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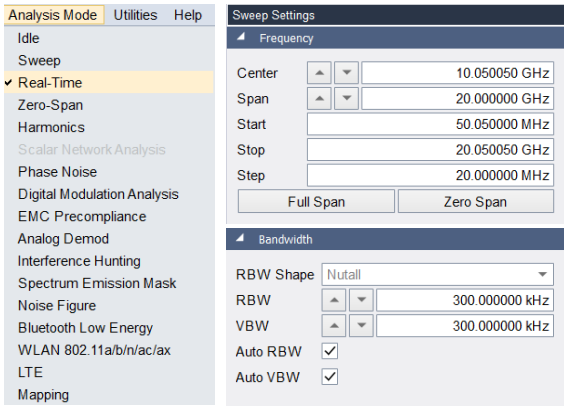
The Spectrum Analyzer – an Essential Avionics Testing Tool

A thorough understanding of spectrum analysis is a necessity when working with avionics in an aerospace environment. Avionics equipment must operate within performance specifications and must not radiate unwanted RF interference. This requirement isn't left until the last minute. Engineers are constantly simulating, evaluating and bench testing designs throughout the process. High-performance real-time spectrum analyzers (RTSAs) are a critical component of this design effort.

The ability to "see" RF signal emissions and comprehend how devices may be generating unwanted radio frequency interference (RFI) is essential. A spectrum analyzer – with ultra-fast sweep speeds, real time capability, and the ability to display both time and frequency domain measurements – is the perfect tool for successfully finding, measuring and characterizing RFI.

Finding Interferers with Ultra-Fast Sweep Speeds

Figure 1

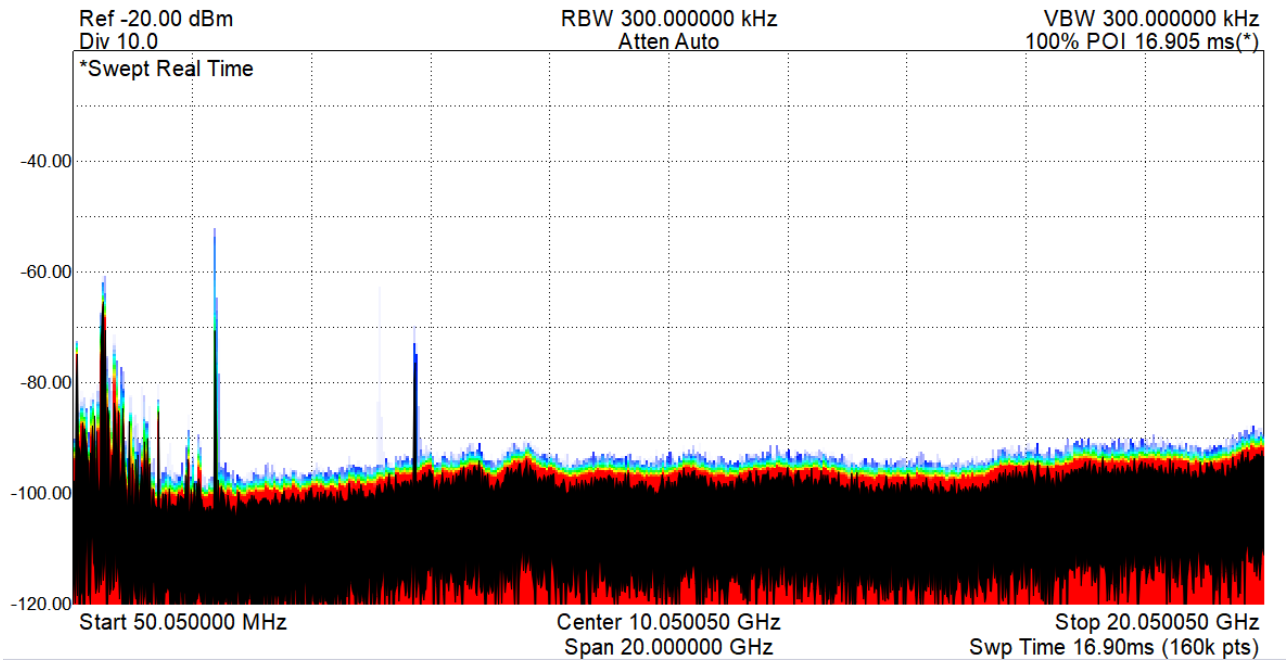


Swept analysis allows you to view wide bands of spectrum by piecing together smaller sweeps. However, that comes at the cost of potentially missing short duration pulses. Real-time modes, on the other hand, restrict you to the instruments real-time bandwidth, which is always less than the bandwidth of the swept span. The Signal Hound SM family of Terahertz sweep speed spectrum analyzers allow you to combine ultra-fast sweep speeds and real time mode, significantly increasing the viewable spectrum with extremely high probability of intercept (POI).

To enter into Signal Hound's "swept real-time" mode, (Figure 1) from the menu bar, select Analysis Mode/Real-Time and set up a span **greater than** your instruments real-time bandwidth (RTBW):

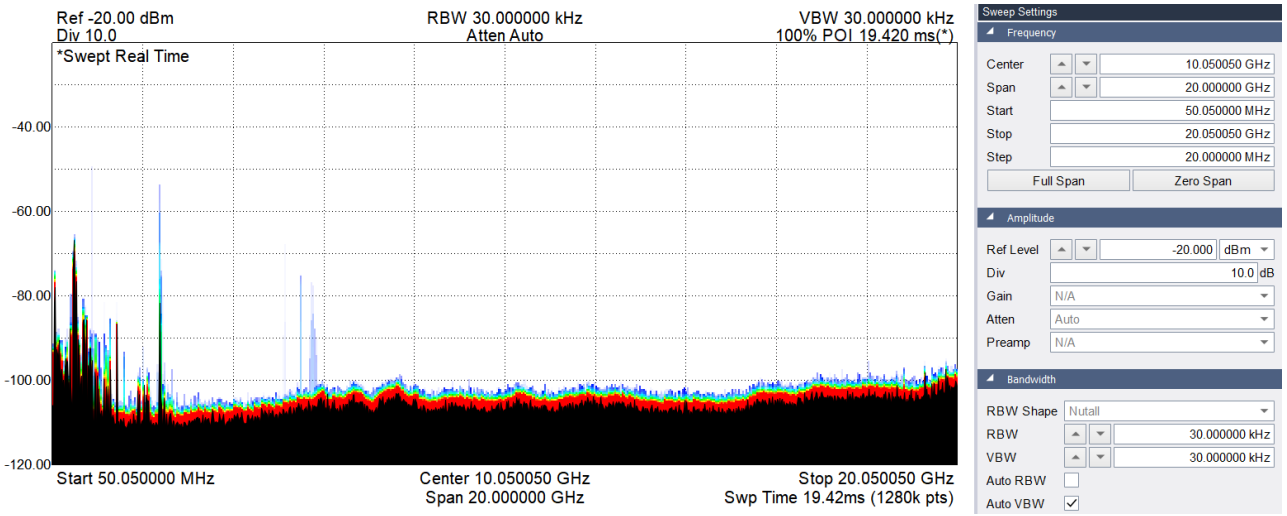
For the SM200/435C with 160 MHz RTBW, selecting anything greater than 160 MHz in real-time mode, Spike automatically enters "swept real-time" mode, displaying the 100% POI signal duration, sweep time, and 3D spectrum view. Figure 2 below shows the full span of an SM200C in Swept Real-Time mode, indicating a 100% POI of any signal with a pulse duration of 16.905 ms.

Figure 2



Adjusting the RBW filter is the key to capturing short duration pulses in swept analysis modes. As is true of all swept mode analysis, adjusting the real-time bandwidth filter (RBW) will increase the number of FFT points, increasing the sensitivity of the measurement, at the expense of sweep time. In swept real-time mode, (Figure 3) Spike will limit the lowest possible RBW setting to ensure the highest possible POI (note in standard swept analysis mode, those limits are off).

Figure 3



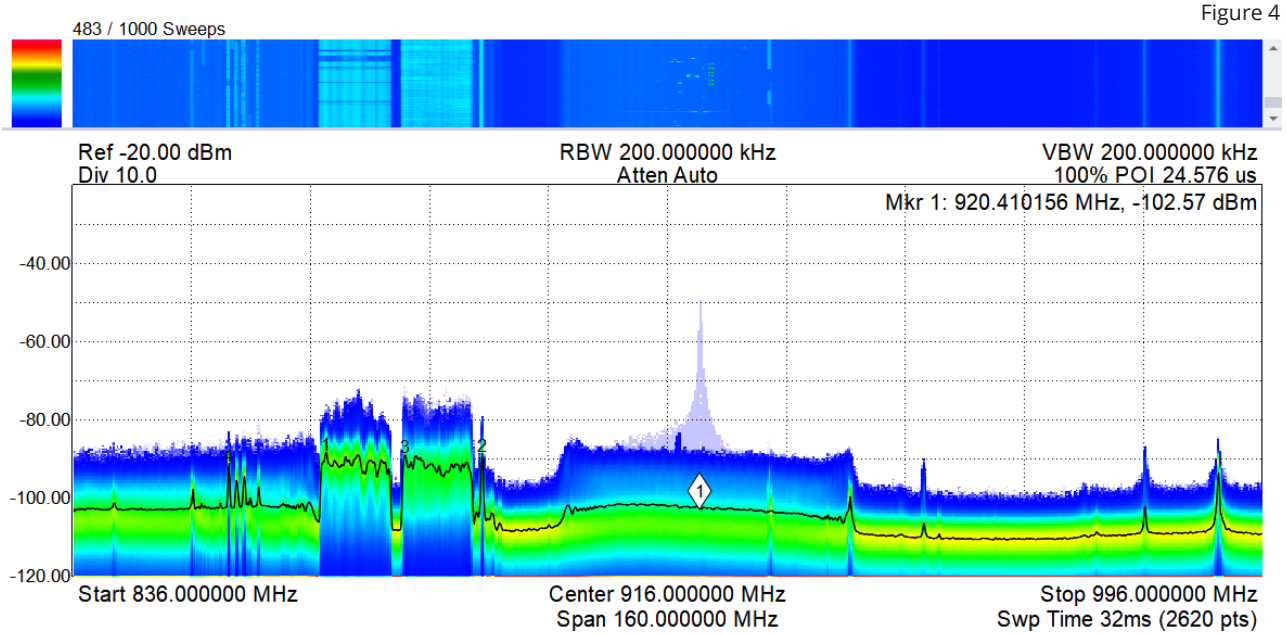
This wideband view is particularly important when fast spectrum survey is key. Historically seen only in the most expensive real time spectrum analyzers, this view is now available on the engineering benchtop.

Enhanced Measurements with Zero Span Mode

Another valuable tool is the ability to display both time domain and frequency domain measurements side by side. Zero span measurements have been in use for decades – well before the creation of real-time analyzers. Zero span mode can capture signal energy at time-slices on a single frequency and display this over time, providing valuable insight.

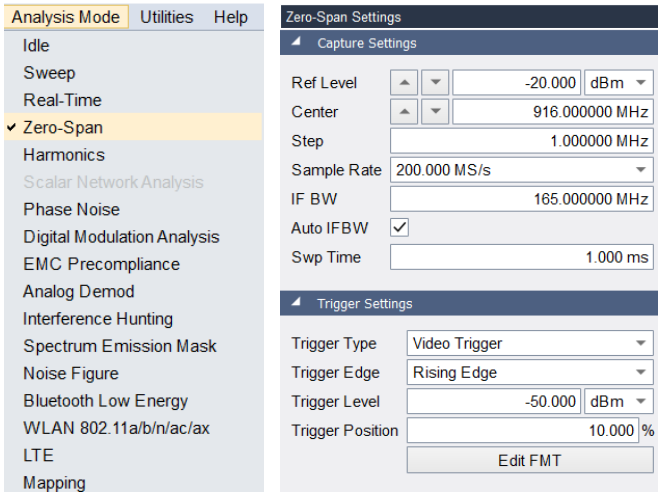
For example (Figure 4), in swept real-time mode we noted periodic spikes at around 916 MHz.

Figure 4



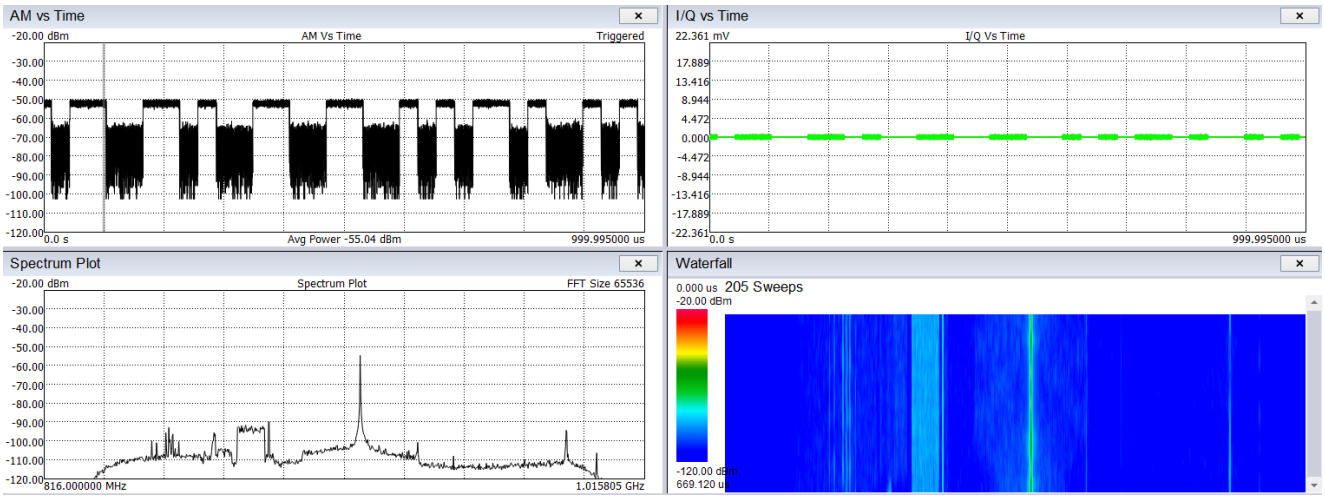
With the center frequency set at 916 MHz, select Analysis Mode / Zero Span to enable Zero Span mode in Spike (Figure 5). Then enable a Video Trigger, Rising Edge, with a trigger level of -50 dBm.

Figure 5



With the trigger enabled, in Zero Span Mode we can see the amplitude vs time, spectrum plot, I/Q vs time plots (Figure 6) and waterfall each time the signal pulse of interest reaches the trigger level. This allows us to take specific measurements of the highly intermittent interferer.

Figure 6



This intermittent interferer can now be analyzed, isolated, and either removed or corrected, all made possible by triggering on the time domain amplitude to isolate just a single transmitter.

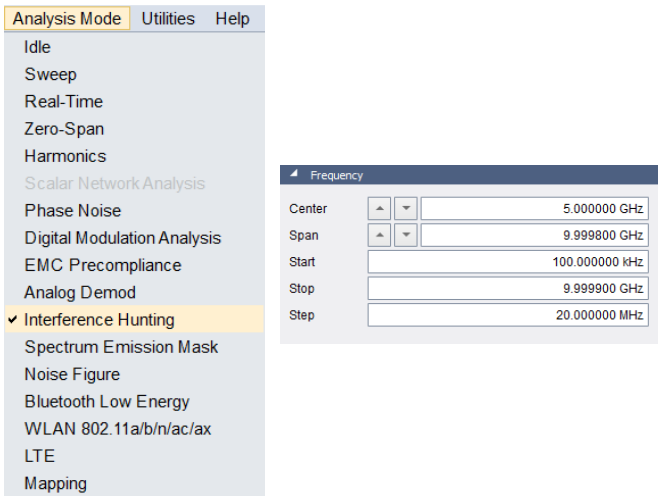
Combining Elements of Analysis Modes for Improved Workflow

As you just saw, it is easy to switch between analysis modes and capture specific signals out of a congested spectrum. In Spike, we also provide workflows that combine elements of swept analysis, real-time analysis and zero span analysis, presenting the information in a workflow that best represents the task. Let's look at the Interference Hunting workflow.

For this example, we have created a very short interferer pulse that is 20us in duration centered at 3 GHz.

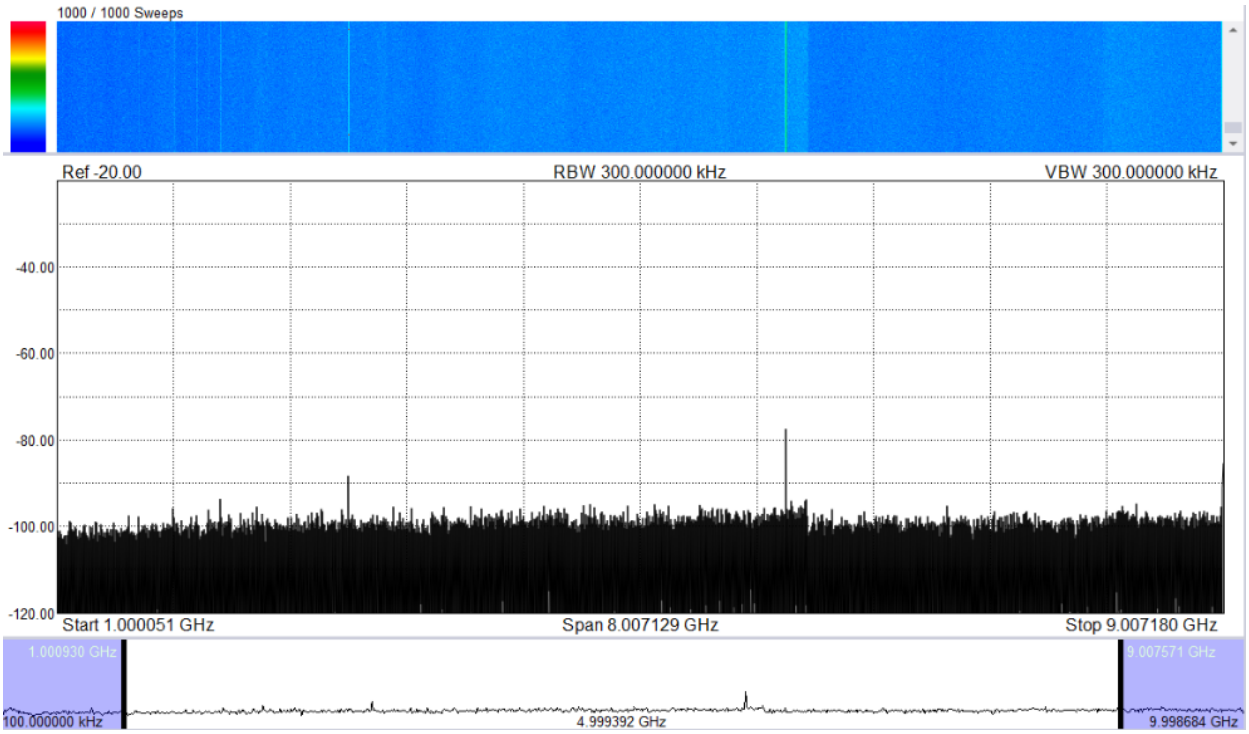
In Analysis Mode (Figure 7), select the Interference Hunting workflow and this time set the center frequency to 5 GHz.:

Figure 7



Now you will see the Interference Hunting work flow, which pulls together the FFT plot of the span, a waterfall display, and a regional zoom control that will allow you to zoom in to an area of interest without changing the span (Figure 8).

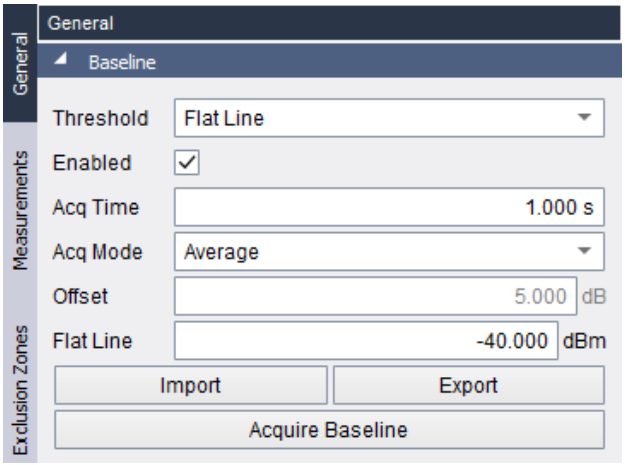
Figure 8



As you can see in the Figure 8 above, the intermittent interferer is not seen in the FFT plot or waterfall display. (Recall from above that the 100% POI for full span was about 19ms and this intermittent pulse is only 20us wide). We should capture the event periodically.

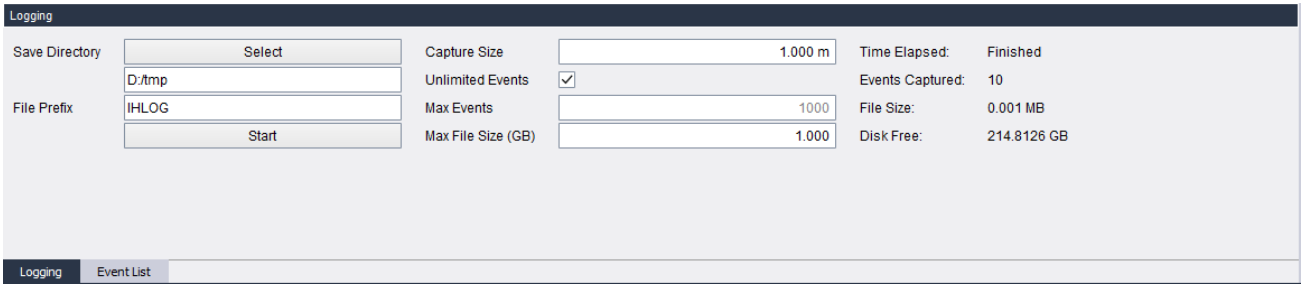
Next, set up a very simple flat line threshold by selecting the General tab (Figure 9), FlatLine Threshold, -40 dBm, and enable it:

Figure 9



This will enable a green line along the FFT spectrum plot, establishing a trigger for logging events. Let's log events by selecting the Event Logging tab at the bottom of the display (Figure 10), selecting a folder to save the log file in, and selecting a capture size (time duration) of 1.00 minute.

Figure 10



Then click Start. The Events Captured indicator will increment each time an event occurs meeting the criteria of our simple FlatLine trigger. This date is written to a comma separated values file (Figure 11).

Figure 11

centerFreq(Hz)	bandwidth(Hz)	peakLevel(dBm)	threshold(dBm)	margin(dB)	time	duration	IFOverload
3000002344	390625	-29.79	-40	10.21	06/09/2023 07:29:34:490	00:00:00:000	0
3000002344	390625	-29.8	-40	10.2	06/09/2023 07:29:46:013	00:00:00:000	0
3000002344	488281.25	-34.69	-40	5.31	06/09/2023 07:29:47:110	00:00:00:000	0
3000002344	390625	-29.8	-40	10.2	06/09/2023 07:29:50:039	00:00:00:000	0
3000002344	390625	-29.81	-40	10.19	06/09/2023 07:29:50:765	00:00:00:000	0
3000002344	390625	-29.65	-40	10.35	06/09/2023 07:29:59:508	00:00:00:000	0
3000002344	488281.25	-31.57	-40	8.43	06/09/2023 07:30:01:617	00:00:00:000	0
3000002344	390625	-29.82	-40	10.18	06/09/2023 07:30:02:555	00:00:00:000	0
3000002344	390625	-29.69	-40	10.31	06/09/2023 07:30:07:267	00:00:00:000	0
3000002344	390625	-29.83	-40	10.17	06/09/2023 07:30:22:040	00:00:00:000	0

Although this is a very simple example, it clearly demonstrates the advantages of streamlining work flows. For a complete tutorial on the Interference Hunting work flow, see:

http://signalhound.com/content/whitepapers/using-spikes-interference-hunting-mode-with-your-signal-hound-spectrum-analyzer/

Accessible Analysis Across your Entire Organization

Modern real-time spectrum analyzers have become increasingly important tools for those working in the creation of hardware for the aerospace industry, providing a unique capability to capture transient and short-duration events in both frequency and time domains. With their ability to perform zero-span measurements and display multi-domain analysis in a single instrument, RTSAs have eliminated the need for complicated and error-prone test system setups.

The costs of RTSAs capable of the advanced measurements and high input frequency ranges necessary for pre-compliance testing can be a limiting factor in engineering access as well as test bench setup. Often, a single analyzer is used, limiting the ability to synchronize and capture behavior from multiple antenna viewpoints simultaneously. Adding multiple RTSAs to the engineering bench simply hasn't been affordable. Signal Hound's high-performance line of RTSAs with ultra-fast sweep speeds, real-time and zero span modes, finally makes this a possibility.

About Signal Hound

Signal Hound designs and builds powerful, affordable spectrum analyzers and signal generators for engineers and RF professionals around the globe. Whether you're needing EMC precompliance capabilities in a small two-person shop or spectrum monitoring on a national scale, our test equipment is designed with you in mind. Accurate and powerful enough for mission-critical RF analysis, priced at a point accessible to most, and supported by a talented group of engineers committed to what they do – we truly believe that our devices offer unrivaled value in the test equipment industry.

In business since 1996 and selling our own line of Signal Hound test equipment since 2010, we've built the foundation of our company on years of test equipment repair, service, hardware and software development, and manufacturing experience. Signal Hound is a small company with big goals – and an even bigger commitment to providing our customers with an outstanding experience when purchasing and using our products.

Signal Hound®