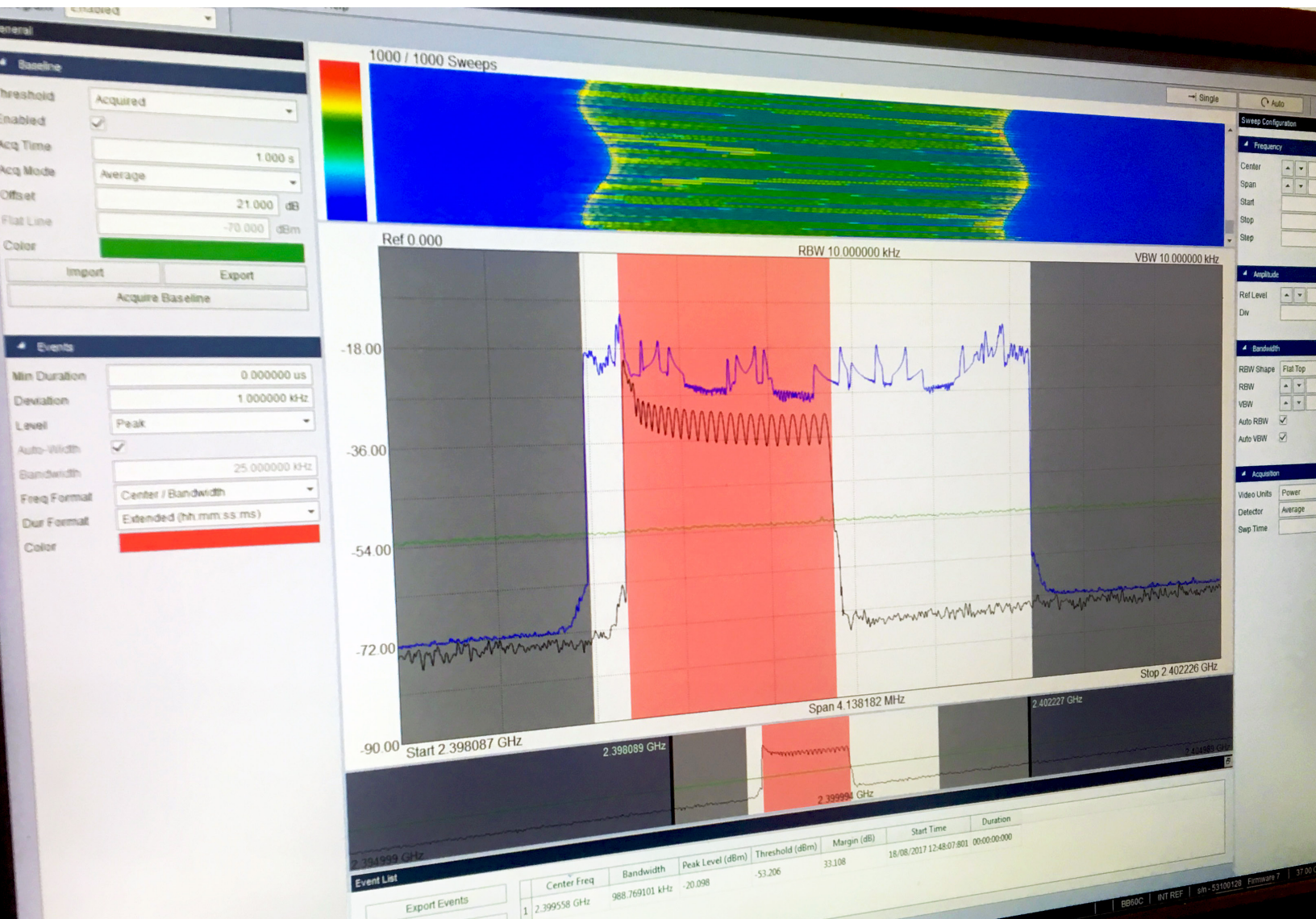


Introduction to Interference Hunting with Spike™

Signal Hound — August 18th, 2017



Introduction

Wireless technology powers the modern world. From Wi-Fi to Bluetooth, satellites to smart phones, and automobiles to homes, every year it becomes more vital and ubiquitous. All this convenience is easily taken for granted, because wireless transmission is invisible—but peer outside (or inside) with a spectrum analyzer, and you will see the real story.

Our environment is swarming with signals, and like cars in traffic, two cannot occupy the same position in time and space without repercussions. However, unlike on your morning commute, those repercussions are not necessarily obvious, and neither are their causes.

When signals interfere with one another data rates plummet, connections drop, errors multiply, range decreases, pathways become noisy, and information exchange slows. The consequences can range from annoying to catastrophic. To keep from bumping into one another, signals ideally stay in their designated frequency lanes, do not exceed their allowed amplitudes, and conform to other relevant protocols. However, in practice, the sheer number of high-powered broadcast services overwhelms such tidy ideals; add to that illegal transmissions, unlicensed spectrum usage, leakage from all manner of devices, equipment performance degradation and failure, and the situation gets tricky.

The world turns on the strength of its communication networks—clearly, we need the best tools we can get to manage the technology of these networks.

Spike's Interference Hunting analysis mode aims to help with the management of these cluttered communications environments.

Contents

Introduction.....3

A Quick Introduction to the Interference Hunting Process6

 Equipment Required to Use Spike’s Interference Hunting Analysis Mode.....6

 Interference Hunting Setup.....7

 Define Exclusion Zones.....8

 Baseline Acquisition and Tuning.....9

 Viewing and logging interfering signal details.....10

Example Scenario.....12

Conclusion.....13

A Quick Introduction to the Interference Hunting Process

In the Interference Hunting analysis mode one can quickly track down pesky sources of interference and capture detailed information about suspicious RF activity in the area. Best of all, this can be done automatically, with no operator present, over long periods of time. Simply define a baseline and any signals that violate it will be logged to a CSV file in real-time. This maximizes both efficiency and security, as data is preserved in the event that the computer shuts down.

Equipment Required to Use Spike's Interference Hunting Analysis Mode



A Signal Hound Spectrum Analyzer

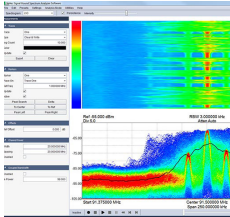
Any of the spectrum analyzers from Signal Hound will work with the Interference Hunting analysis mode.

See our spectrum analyzers at <https://signalhound.com/products>.



An Antenna

An antenna for receiving local wireless transmissions is required. Directional antennas (like the one pictured on the left) are optimal for interference hunting as they can better indicate the direction from which a signal is originating.



Spike Spectrum Analyzer Software (from Signal Hound)

Spike Software requires a PC equipped with Windows 7, 8, or 10 operating system either 32 or 64-bit. For Signal Hound's BB-series real-time spectrum analyzers, an Intel Desktop quad-core i5/i7 processor model number 3000 series or later is required. Additionally, a minimum of 4 GB of RAM are required, with 8 GB of RAM being the recommended hardware. Spike Software typically requires less than 1 GB of available hard disk space.

Download for free at <https://signalhound.com/spike>.

Interference Hunting Setup

When interference is suspected due to a noisy receive channel, a first step to tracking it down is to determine the bandwidth of the receiver, since the interfering signal must appear within this span.

To set up Interference Hunting analysis mode:

1. Connect the spectrum analyzer to your computer via USB cable, connect the antenna to the analyzer, and open the Spike software.
2. Click **Analysis Mode** and select **Interference Hunting**.
3. In the **Sweep Configuration** pane, in the **Frequency** panel, set the center frequency and span to align with the frequency and bandwidth of the receiver suffering from interference.
4. Examine the plot in the main window.

Quick, detailed visual inspection of the sweep without changing spans is enabled by the Regional Zoom Controller (Figure 1), the horizontal strip plot beneath the main plot. It determines the main plot's frequency range—the unshaded region represents what is being displayed. Quickly scan and zoom in and out on the sweep by dragging the left and right vertical black boundary markers and the unshaded region itself.

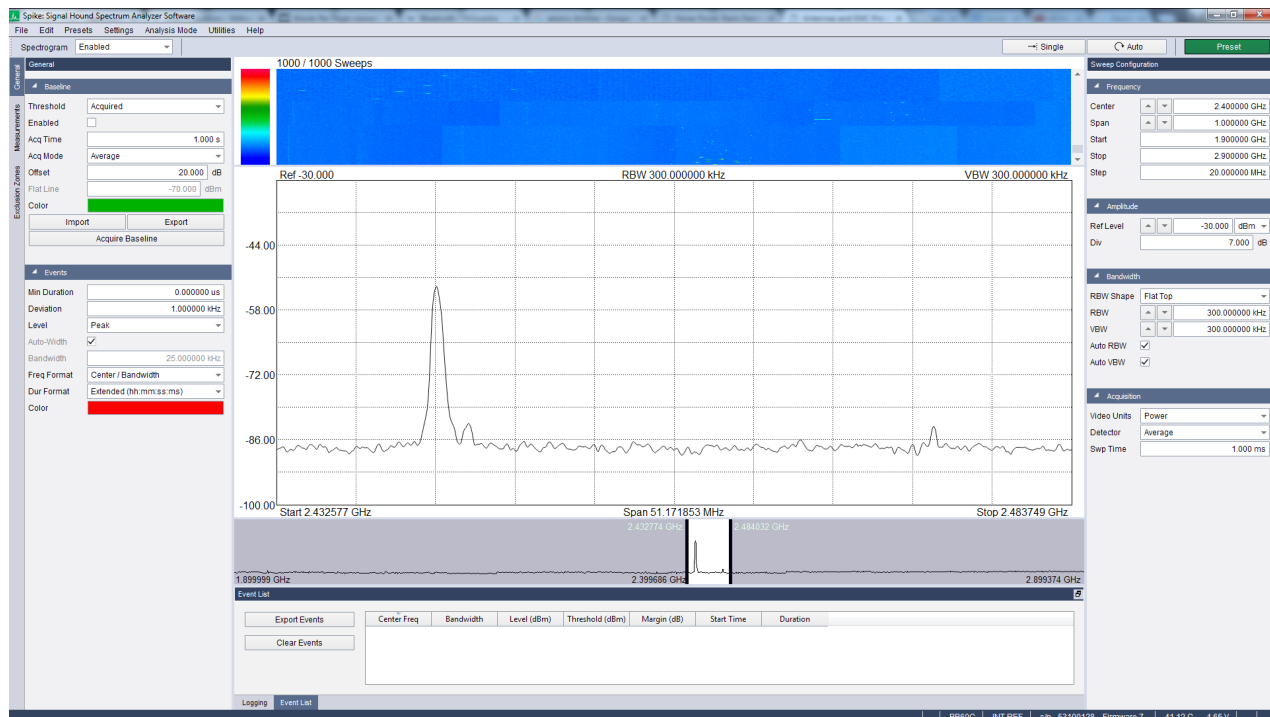


Figure 1—Using the Regional Zoom Controller to closely inspect a sweep without changing span.

Define Exclusion Zones

In the visible chunk of spectrum there may be some known signals present that are not candidates for interference, or areas that are not of interest. These should be excluded from the search by defining exclusion zones (Figure 2).

Any RF activity occurring within an exclusion zone will be ignored by the mode's processing, but will still be visible on the plots.

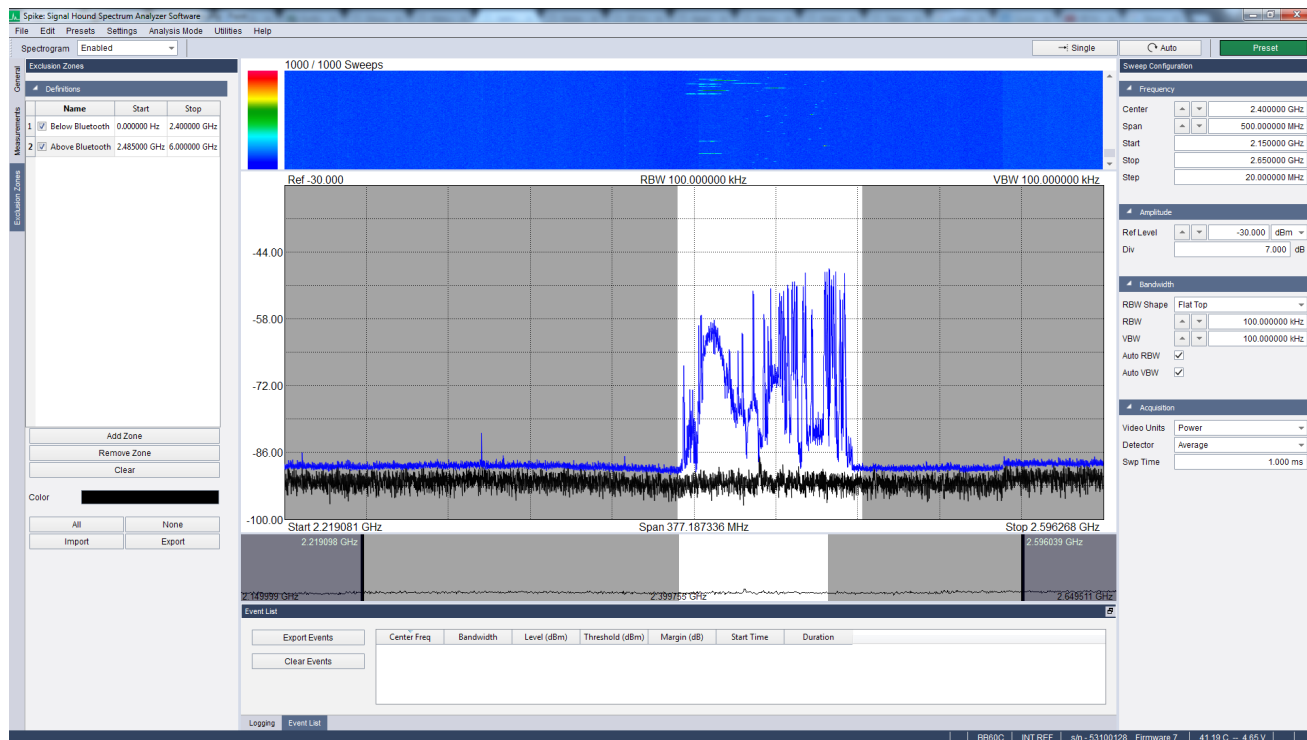


Figure 2—Using exclusion zones to isolate signals in the Bluetooth range. Areas of spectrum falling within an exclusion zone are grayed out.

To define exclusion zones:

1. In Spike, on the left-hand control panel, select the **Exclusion Zones** tab.
2. Click **Add Zone**. A new exclusion zone definition appears in the list with the default name *New Zone*.

Note—The name *New Zone* only appears when the first exclusion zone is created. Subsequent exclusion zones take the name of the last exclusion zone in the list.

3. Double-click the default name and type a new name into the field.
4. In the **Start** column, double-click the **frequency** field. This opens the Edit Zone window.

5. In the **Edit Zone** window, in the **Start** field, type the frequency at which you want your exclusion zone to start.
6. In the **Stop** field, type the frequency at which you want your exclusion zone to end. This will be a higher frequency than the value in the start field.
7. Close the window to set the values in for the exclusion zone.

The shaded area in the main sweep plot now reflects this newly-defined exclusion zone.

To create additional exclusion zones, repeat steps 1-7.

Baseline Acquisition and Tuning

A baseline (Figure 3) is required in order to define a limit under which frequency activity is considered normal. Let's acquire a baseline so we can start watching for interference events.

To define a baseline:

1. When the sweep appears stable in Spike, select the **General** tab on the left-hand control panel.
2. In the **Baseline** panel, click **Acquire Baseline**.

After one second a green image of the sweep will appear on the plot, just above the running sweep. This is a baseline. It represents the normal state against which RF events are measured to determine if they are potentially trouble. As we watch the sweep, if a signal appears on the spectrum that violates the baseline, it will be denoted by a red bar on the plot, and will be listed in the Event List in the bottom control panel.

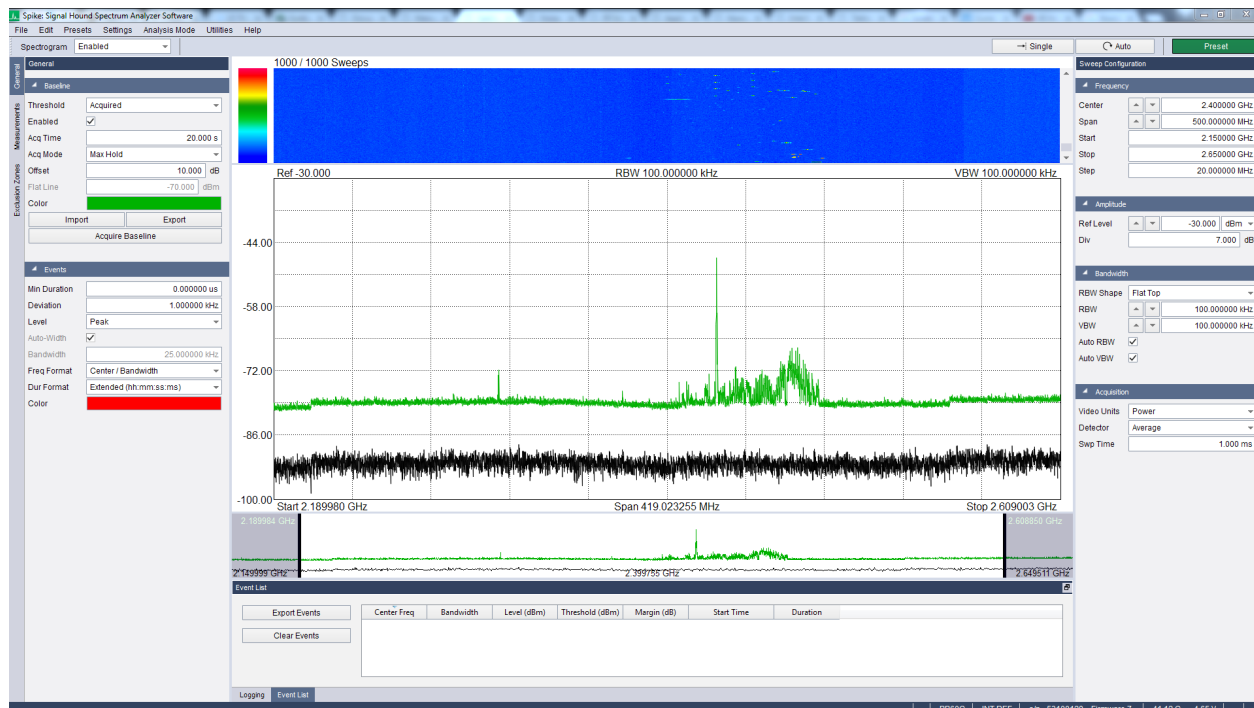


Figure 3—A baseline acquired over twenty seconds in Max Hold acquisition mode. The black waveform is the current sweep, the green waveform is the baseline.

Viewing and logging interfering signal details

To further investigate the interfering events (Figure 4), we can quickly capture a snapshot of these events at any given moment on the currently active main sweep plot.

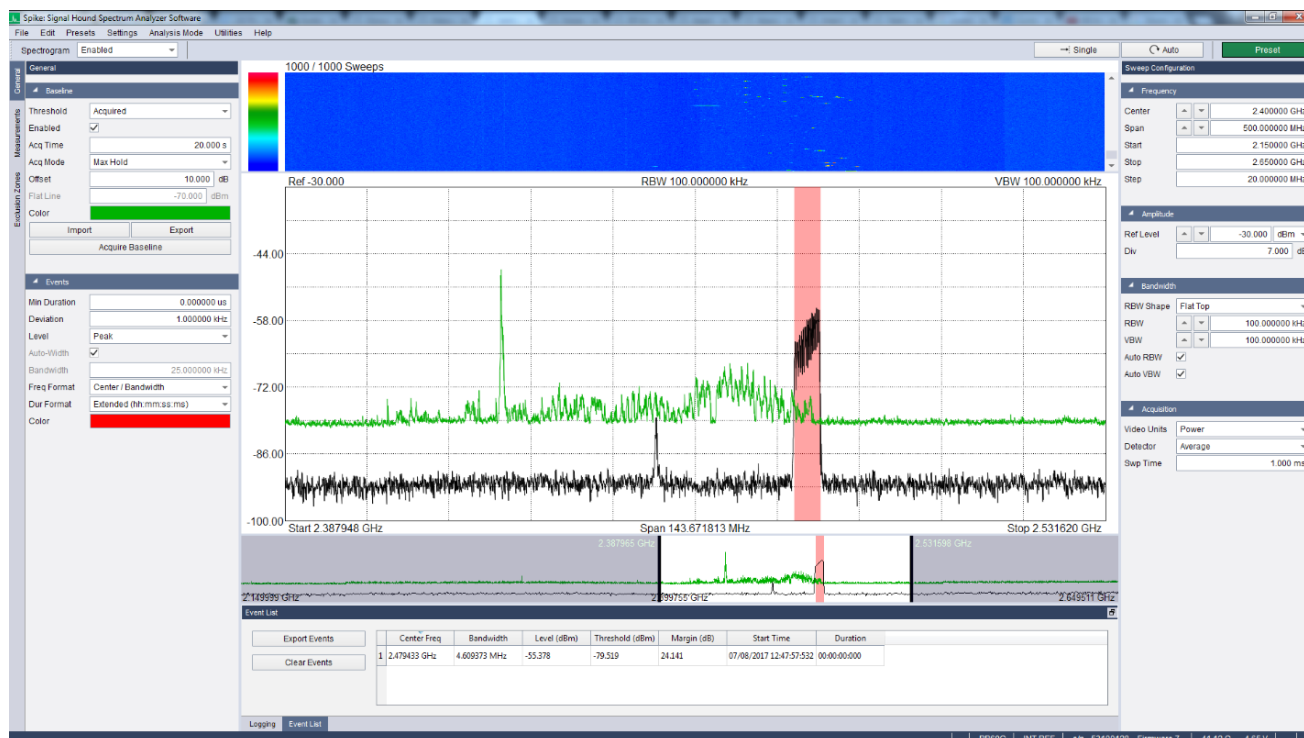


Figure 4—A Bluetooth signal violating the baseline and being interpreted as an event. The red bar marks the bandwidth of the event.

To view the details of interfering signals:

1. In Spike, at the bottom of the application window, select the **Event List** tab.
2. While an interfering signal is present in the Main Sweep Plot (indicated by a red bar present in the plot), in the **Event List** panel at the bottom of the window, click **Export Events**.
3. In the **Export Events** window, type a file name and select a location to save the log file, and click **Save**. A CSV file is saved to the selected directory.
4. Navigate to the selected directory and open the CSV file to view the list of interfering signals and detail

The ability to view the details of interfering signals is valuable, but these signals often occur intermittently at unknown or unpredictable intervals, and can be short or long in duration. It may not be practical to manually monitor the sweep over an extended period of time. For this, Spike provides the option of logging (Figure 5) these signals while unattended.

Figure 5—Configuring baseline logging in the Logging panel.

To log interfering signals while unattended:

1. In Spike, at the bottom of the application window, select the **Logging** tab.
2. In the **Capture Size** field, type in the amount of time you want the unattended logging session to run.

Note—Enter times in numerical format, followed by *s* (seconds), *m* (minutes), *h* (hours) or *d* (days).

3. To limit the number of logged events, do one of the following:
 - a. To capture an unlimited number of events during the logging session, select **Unlimited Events**.
 - b. To capture a specific number of events during the logging session, deselect **Unlimited Events**, then click in the **Max Events** field and type the number of events you want to log.
4. In the **Max File Size (GB)** field, type the maximum size of the log file (in gigabytes) that you want to record.

Note—the capture will stop logging as soon as one of the above criteria are met. For example, if you set a Capture Size of 2 days but set Max Events at 20 and Spike logs 20 events in the first minutes of capturing, the capture will stop, logging the 20 events.

5. Press **Select** to specify a directory in which to save the file. The path for the saved file displays in a field below the button.
6. In the **File Prefix** field, type the name you want to save the log file as.
7. Press **Start**.

When the capture is finished, Spike stores the log as a CSV file with the specified file prefix in the selected directory.

The entries in the CSV file display all data pertaining to an event including its frequency, bandwidth, peak level, threshold (the value of baseline at frequency of peak), margin (decibels above threshold of peak), start time, and duration.

Example Scenario

Using the steps in the procedures above for reference, use the following process to work through an interference hunting scenario:

1. Connect the Signal Hound spectrum analyzer to the antenna and PC, and launch Spike.
2. Within range of the antenna, configure a hardware setup comprised of emitting/receiving Bluetooth devices in order to create wireless activity around the 2.4 GHz range. Do not turn the Bluetooth functionality on at this point.
3. In Spike, enter the **Interference Hunting** analysis mode.
4. In the **Sweep Configuration** pane, in the **Frequency** panel, set the center frequency to 2.4 GHz, and the span to 500 MHz.
5. Define two new **Exclusion Zones** — one named *Before Bluetooth* from 0 to 2.4 GHz, the other name *After Bluetooth* from 2.485 GHz to the upper frequency limit of your spectrum analyzer.

With the Exclusion Zones configured, a baseline now needs to be defined to set a standard for normal, non-interfering activity.

6. Now, select the **General** tab on the left-hand control panel, and in the **Baseline** panel, click **Acquire Baseline**.

After one second a green image of the sweep will appear on the plot, just above the running sweep. This is a baseline.

7. Change the amplitude offset of the baseline (to make it more inclusive) in the **Baseline** panel, by clicking in the **Offset** field and pressing the Up arrow key until the number 10.000 displays in the field.

With the Exclusion Zones configured and the baseline set, you are ready to view the Bluetooth signals within the defined frequency range in Spike.

8. Power on the Bluetooth devices and pair them in order to create a continuous wireless connection between the devices.

Observe the activity in the main sweep plot. Red bars should be intermittently displaying as the new Bluetooth signal violates the baseline configured in step 7.

9. At the bottom of the Spike application window, select the **Logging** tab, specify a suitable output directory for the log file or use the default, change the **Capture Size** to ten minutes, and click **Start**. Spike will now record all events to the log file for the next ten minutes.

	A	B	C	D	E	F	G	H
1	centerFreq(Hz)	bandwidth(Hz)	level(dBm)	threshold(dBm)	margin(dB)	time	duration	IFOverload
2	5.00E+09	9765.62	-79.2395	-82.4859	3.24634	15/08/2017 10:01:47:803	00:00:00:000	0
3	5.00E+09	4882.81	-79.6668	-82.4859	2.81907	15/08/2017 10:01:49:985	00:00:00:000	0
4	5.00E+09	9765.62	-79.1976	-82.4859	3.28828	15/08/2017 10:01:53:257	00:00:03:273	0
5	5.00E+09	9765.62	-79.3617	-82.4859	3.12412	15/08/2017 10:02:00:893	00:00:01:091	0
6	2.50E+09	7324.22	-79.0832	-83.6541	4.57091	15/08/2017 10:01:53:257	00:00:14:181	0
7	5.00E+09	9765.62	-79.2636	-82.4859	3.22224	15/08/2017 10:02:05:256	00:00:03:273	0
8	5.00E+09	9765.62	-79.2493	-82.4859	3.2366	15/08/2017 10:02:10:710	00:00:00:000	0

Figure 6—Example log file containing one long event at 2.5 GHz, lasting 14.181 seconds, and a handful of brief events occurring sporadically at the steady signal's second harmonic (5 GHz).

Conclusion

Signal Hound's new Interference Hunting software makes it easy to visualize and capture critical data about intrusive signals over long periods of unattended monitoring. With baseline acquisition, fine-tuned event definition, automatic capture, and real-time logging, Spike's new analysis mode can help to quickly locate hard-to-find signals in our increasingly crowded wireless environments.



Further Reading

Download the Spike software manual from www.SignalHound.com/spike for complete Interference Hunting details.

About Signal Hound

The Signal Hound® company started as Test Equipment Plus (TEP) in 1996 with the belief that providing quality used test equipment, at affordable prices to every customer, would drive growth and foster loyal customers. It did. Then in 2006, TEP expanded their focus by designing and manufacturing a color LCD display retrofit kit to answer the need for CRTs that were no longer available for the aging HP® 8566A, 8566B, 8568A, and 8568B spectrum analyzers. TEP also began offering a repair service for HP/Agilent® step attenuators. In 2007 TEP designed and began manufacturing another color LCD display retrofit kit to support the HP/Agilent 8560 series spectrum analyzers. At the same time, TEP also decided to play to their strengths, and began offering test equipment repair services for Agilent spectrum analyzers, network analyzers, and signal generators. The repair segment of TEP is now recognized in the RF and microwave test equipment industry as a world class operation.

The LCD kits were so well received that in 2009, TEP decided to design a compact, lightweight, and inexpensive spectrum analyzer. The goal was to provide an economical spectrum analyzer with unparalleled value compared to anything else on the market. TEP achieved that goal with the USB-SA44 spectrum analyzer which was introduced in February 2010, marking the birth of the Signal Hound line of test equipment. In April of 2014, Test Equipment Plus began officially doing business as Signal Hound. Signal Hound's latest innovation is the Signal Hound BB60C spectrum analyzer, introduced June 2014, which is an enhanced version of its well-received predecessor, the BB60A.

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