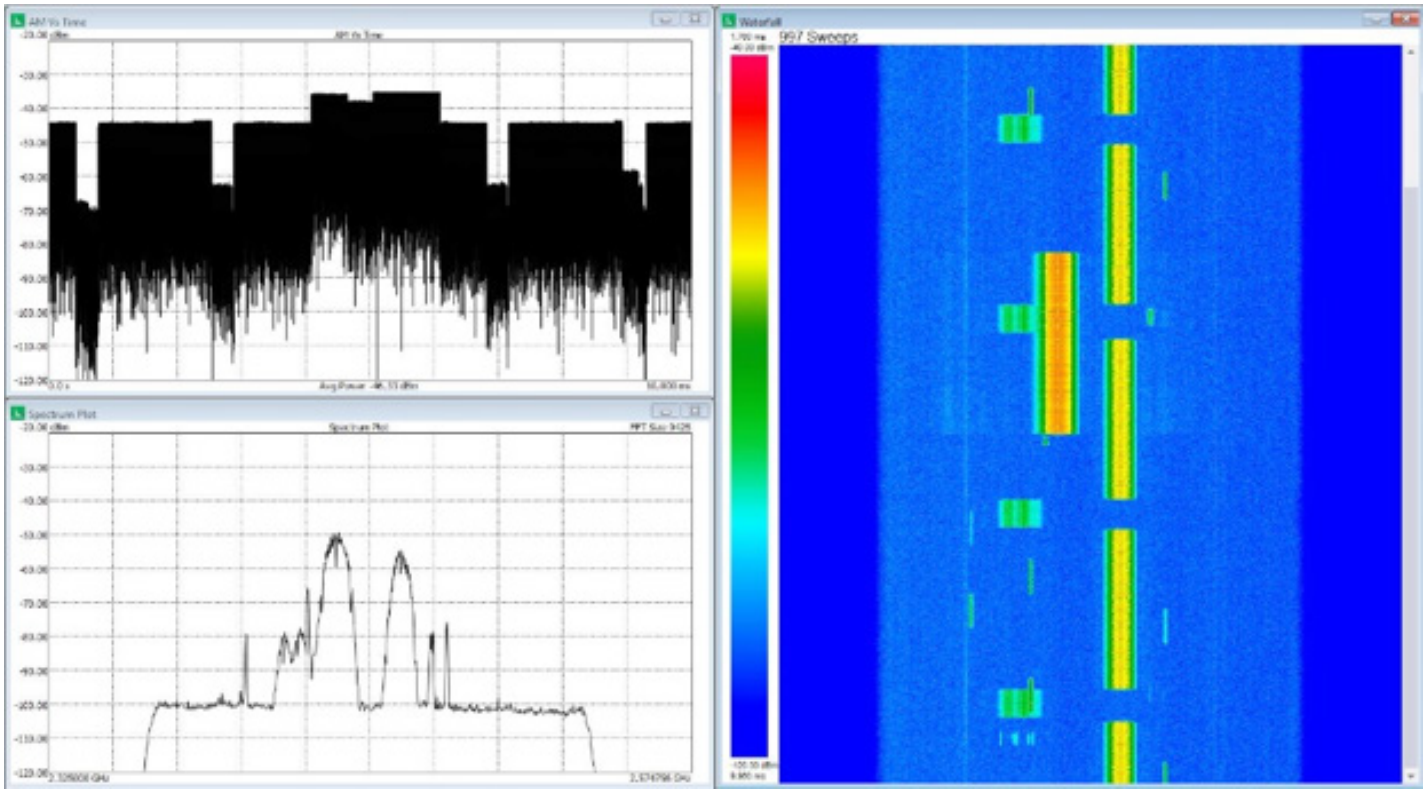
Signal Hound®

Feature Overview—

160 MHz Segmented I/Q Capture with the SM200B



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Overview

With the introduction of Signal Hound's SM200B, we now offer 160 MHz instantaneous bandwidth (IBW) I/Q capture. The SM200B still has the dynamic range, phase noise, 1 THz/s sweep speed, and 100 kHz to 20 GHz tuning range that made the SM200A so popular, but now features 2-seconds of segmented I/Q capture memory with advanced triggering options such as frequency mask triggering (FMT) to satisfy the ever-increasing analysis bandwidth demands of the wireless industry.

Introducing the SM200B

Signal Hound's SM200B, like its predecessor the SM200A, offers calibrated streaming of I/Q data with up to 40 MHz bandwidth. The full 160 MHz IBW (250 MS/s) of I/Q data cannot be streamed to the PC in real-time due to the throughput limitations of the USB 3.0 interface. With the release of our SM200B spectrum analyzer we have added a 2-second memory buffer inside the analyzer.

While this does not overcome the limitations of USB data transfer rates, it does allow the SM200B to capture data at 160 MHz IBW and store it to memory. The captured data can then be streamed across USB at standard rates.

Triggering Choices

The segmented I/Q capture memory can be used as a single contiguous capture buffer for up to 2 seconds worth of I/Q data at 160MHz BW, or by taking advantage of our new complex triggering sequences and triggering options, you can effectively extend the capture duration by only triggering on the RF events and data you want. The capture memory can be configured for up to 250 triggerable capture segments, each with their own pre-trigger, trigger type, and capture length. Triggering options include video level, external, and frequency mask triggering.

External triggering allows aligned measurements in complex lab and production configurations. Video triggering allows precise timing and alignment on RF energy events, such as a radar pulses or the leading edge of an RF packet. FMT provides frequency and amplitude selective triggering at the cost of precision timing. FMT is useful for ignoring strong in-band signals or channel selective triggering. Combinations of these triggers can be set up based on the needs of your application (Figure 1).

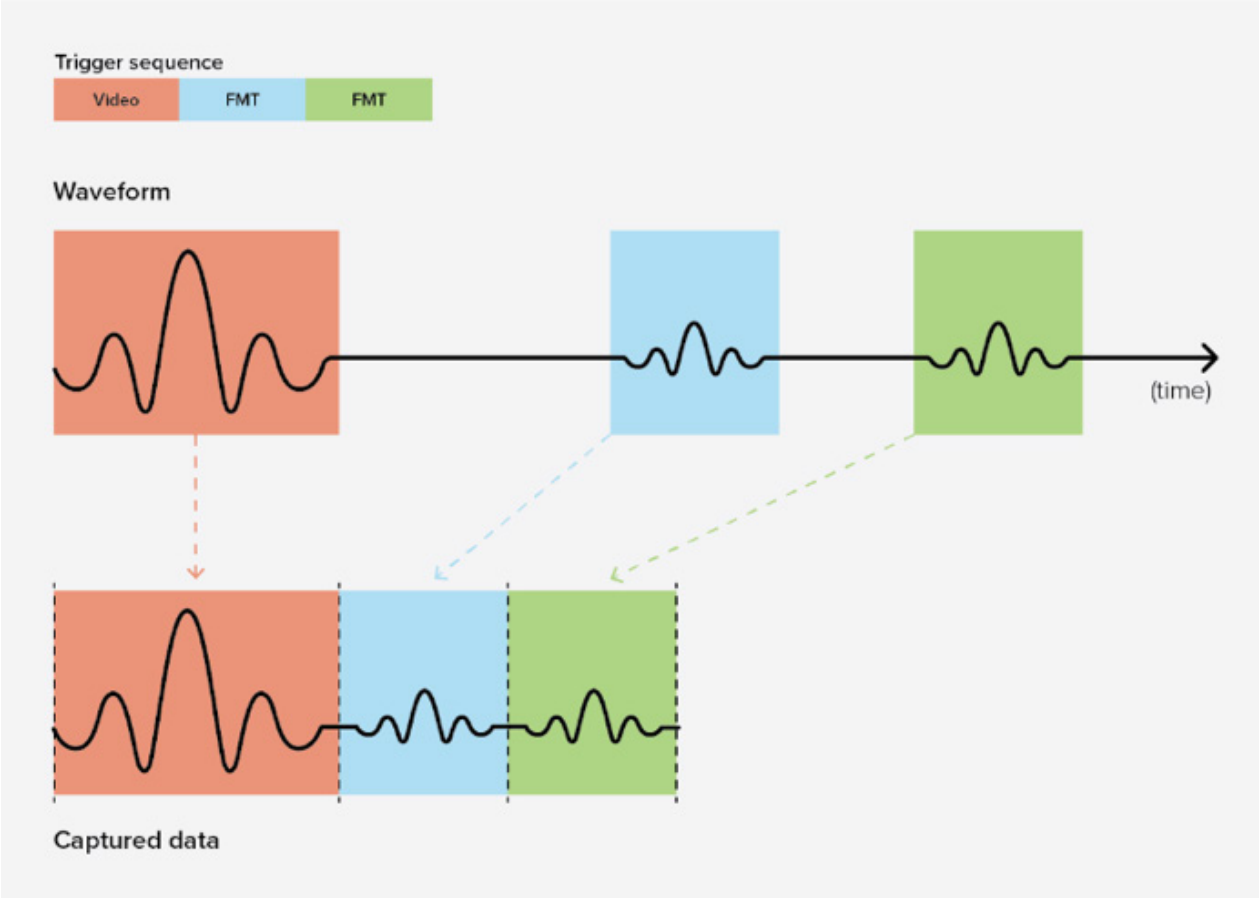

Figure 1 – The SM200B allows you to set up a variety of triggering combinations.

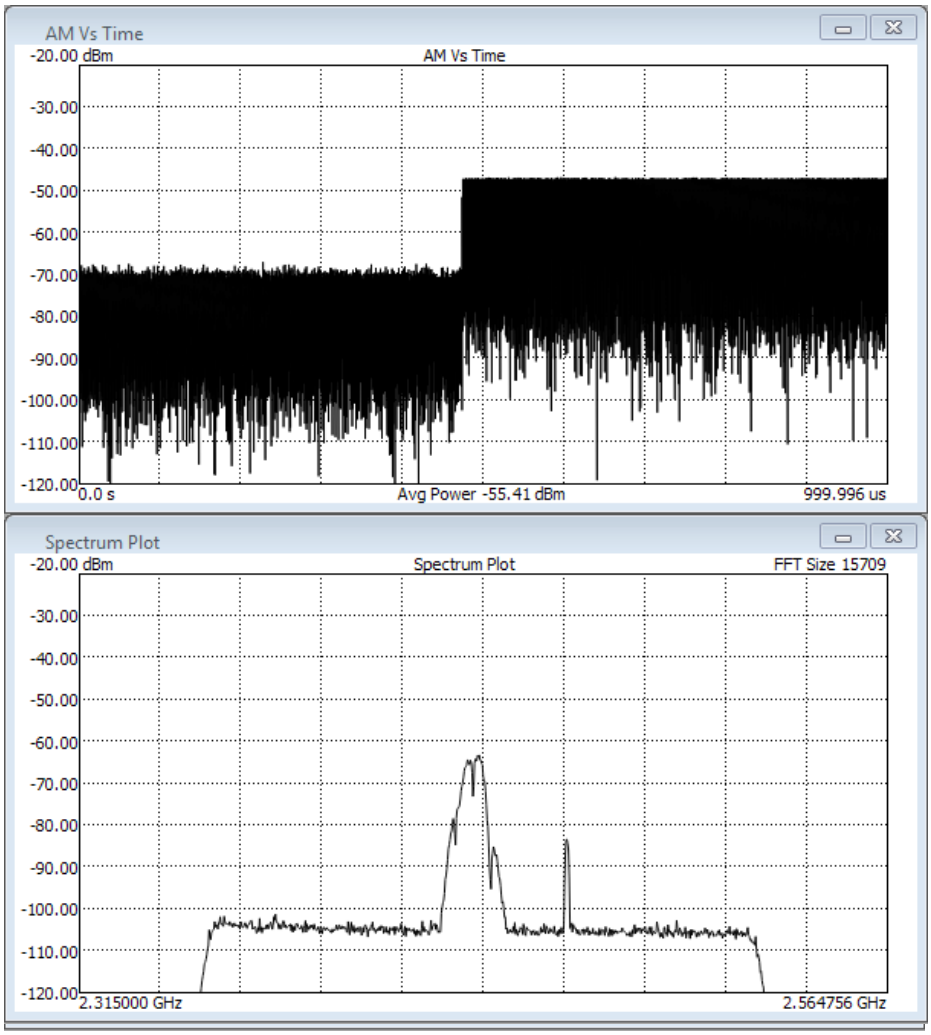

Figure 2 – Amplitude vs. time and spectrum plot of a strong Wi-Fi and weak Bluetooth signal. A video trigger could be used to trigger on the exact rising edge of the Wi-Fi packet, but the Bluetooth packet would be below the noise floor. A flat frequency mask trigger at -90 dBm would trigger on both the Bluetooth and Wi-Fi packets with less precise timing. A frequency mask trigger with a notch for the Wi-Fi band would only trigger

Controlling the SM200B

Applications that require 160 MHz I/Q capture are typically managed with larger software solutions which perform extensive signal analysis. The SM200B 160 MHz I/Q capture is designed to be easily controlled via direct device API programming. Programming using the Signal Hound-supplied device API is available for fast, direct device control. The device API uses a C interface, and the functions can be called from most modern programming languages and environments such as C/C++, C#, Python, Java, LabVIEW, and MATLAB.

160 MHz Segmented I/Q Applications—

- **5G** – Prototype development for protocol and component verification, monitor tower-cell phone interactions, verify in-band and out-of-band emissions
- **Radar** – Capture and analyze only the pulses of interest, avoid recording time between pulses, capture with GPS time stamp to better analyze pulses of interest
- **Spectrum Monitoring** – Easily capture and record infrequent fast moving signals such as FHSS, selectively pick channels of interest, use pre-triggering to never miss an event, use FMT to reconstruct 100% POI
- **Transmitter QA Monitoring** – Define a frequency mask to capture data any time your transmitter is operating outside of its specification

Optimize Triggering and Throughput

The SM200B segmented capture memory can be setup with a variety of trigger types and capture sizes which will ultimately influence overall system performance. The following tables will help you optimize your application.

Table 1. Sample Throughput[1]

Segment Size (samples)	Throughput (samples per second)
16384	20.3M
32768	28.1M
65536	35.3M
131072	36.8M
262144	39.1M
1048576	40.6M

Table 1 – highlighting the effect of segment length on overall system throughput. It shows that as the segment size increases, throughput becomes limited by the maximum data rates of the USB 3.0 bus.[1]Based on using immediate trigger and no pretrigger.

Table 2. How fast can you re-arm/trigger

Trigger Type	Time
Video/Ext	25µs plus capture length
FMT 1024 pt FFT	33µs plus capture length
FMT 2048 pt FFT	49µs plus capture length
FMT 4096	81µs plus capture length
FMT 8192	150µs plus capture length
FMT 16384	262µs plus capture length

Table 2 – showing the minimum time between triggers based on the defined trigger types. Video and external triggering offers the fastest re-arming speeds, while the frequency mask trigger (FMT) re-arming time increases with the size of the FFT.

Table 3. Trigger Throughput (Ext/Video/Imm)[2]

Segment Size (samples)	Triggers Per Second (Video/Ext/Imm)	Triggers/s (FMT 1024/2048/4096)	Triggers/s (FMT 8192 FFT)	Triggers/s (FMT 16384 FFT Size)
16384	1227	1215	931	689
32768	847	852	849	642
65536	535	529	529	535
131072	282	280	278	282
262144	152	150	150	152
1048576	41	40	40	40

Table 3 – showing how many triggered acquisitions you can do per second. For smaller segment sizes the capture size becomes more limited as you increase the FMT FFT size. As the segment size increases, it starts slowing down the triggering throughput equally regardless of trigger type due to system overhead. [2]Input to the system is an RF pulse with 40µs duration and an 80µs repetition period.

Further Reading

Learn more about Signal Hound's robust, real-time spectrum analyzers at signalhound.com/learn.

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 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 officially began doing business as Signal Hound, with Signal Hound subsequently selling Test Equipment Plus in May 2018. Signal Hound's latest innovation is the SM200B spectrum analyzer, introduced in June 2019, which is a 20 GHz high-performance spectrum analyzer with applications from spectrum monitoring to benchtop RF analysis.

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