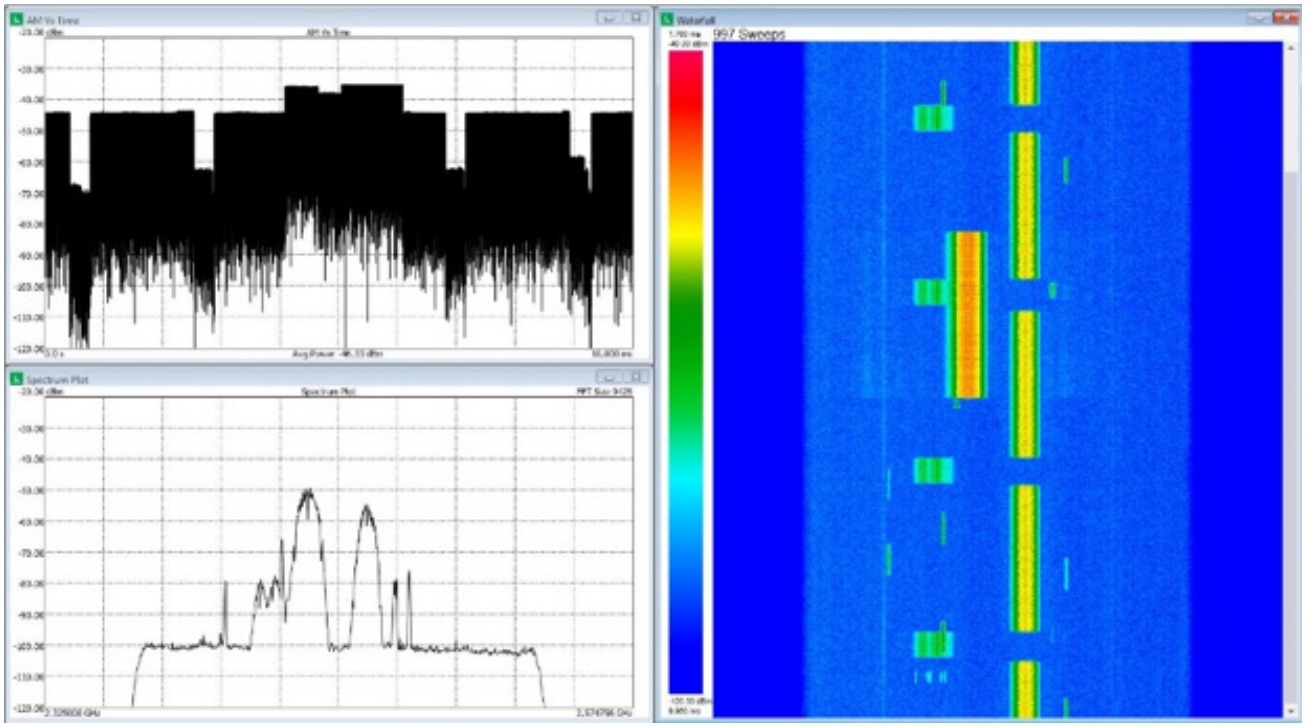
Feature Overview-

160 MHz Segmented I/Q Capture with the SM200B and SM435B



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Overview

Signal Hound's SM200B and SM435B spectrum analyzers offer segmented I/Q streaming. This feature allows the devices to capture data at a full 160 MHz IBW (in 2-second segments) then stream the data to the PC via USB 3.0 for analysis, overcoming the throughput limitations of the USB 3.0 interface. Combining the SM200B/SM435B's innovative receiver capabilities with advanced triggering options – such as frequency mask triggering (FMT) – creates an powerful, yet cost-effective, RF measurement system, satisfying the ever-increasing analysis bandwidth demands of the wireless industry.

Introducing the SM200B and SM435B

Signal Hound's SM200B and SM435B spectrum analyzers offer 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. Our SM200B and SM435B analyzers have a built-in memory buffer, capable of capturing 2 seconds of I/Q data.

While this buffer does not overcome the limitations of USB data transfer rates, it does allow the SM200B and SM435B 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 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).

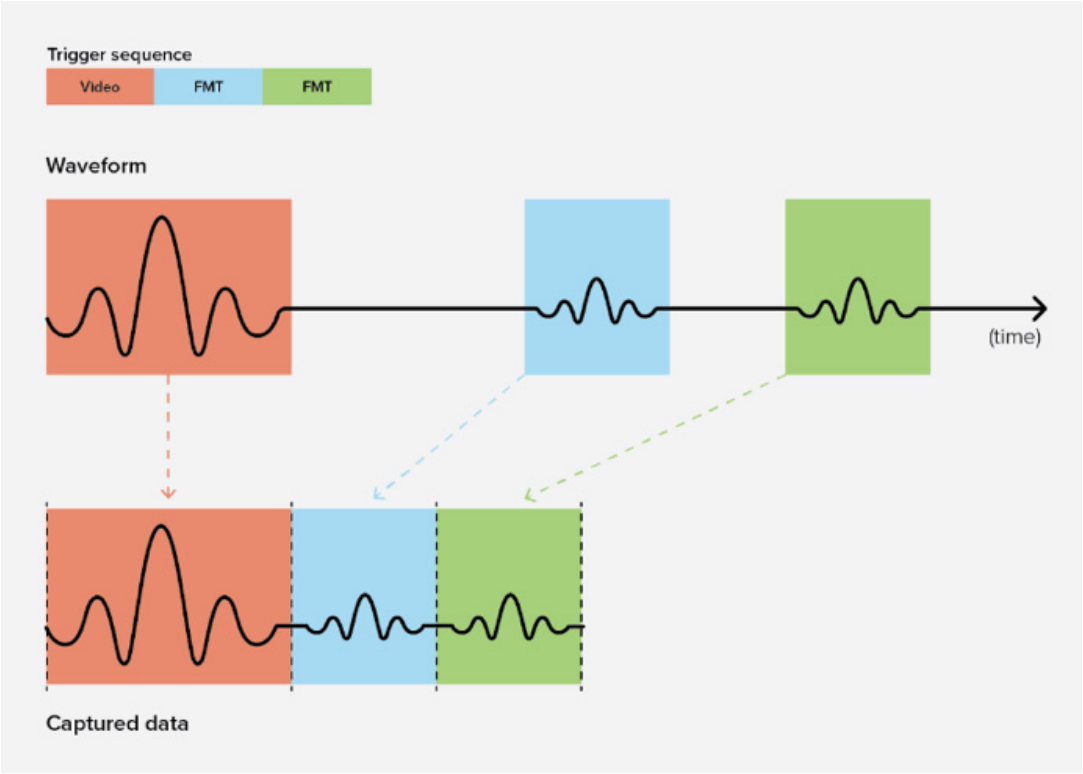

Figure 1 – The SM200B and SM435B allow you to set up a variety of triggering combinations.

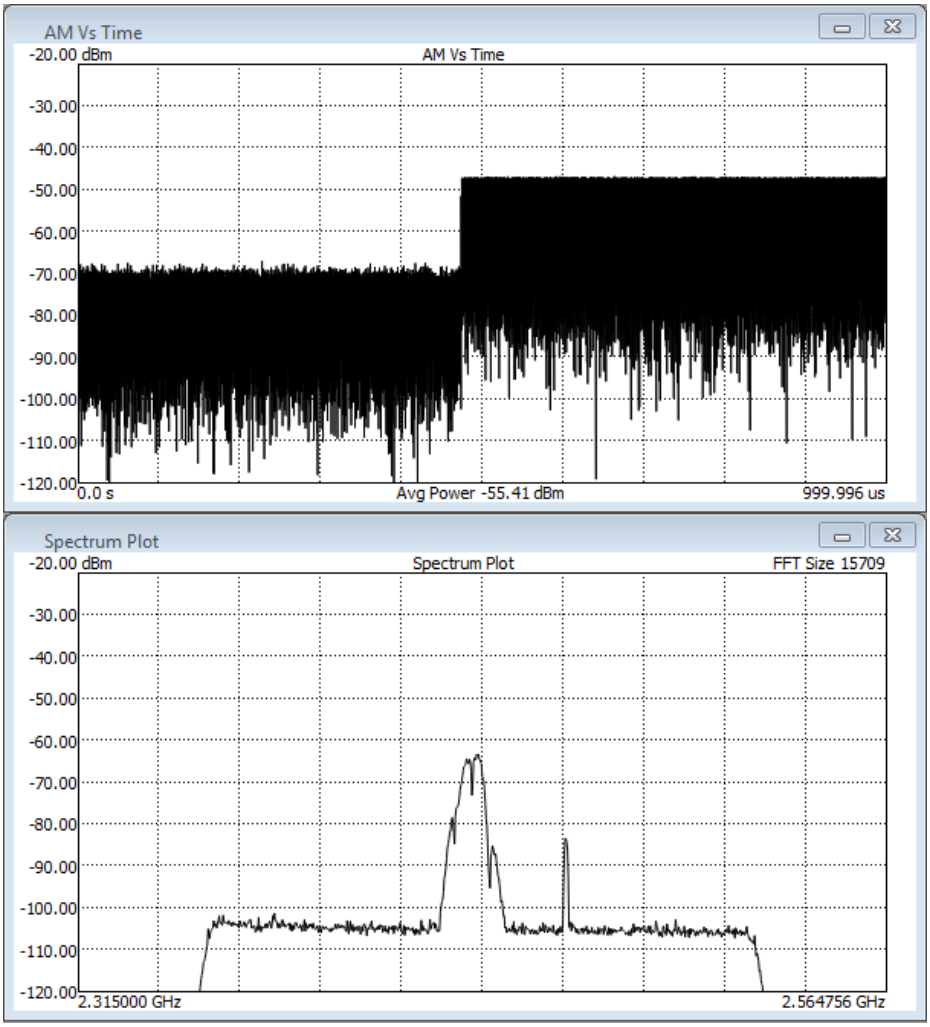

Figure 2 – Amplitude vs. time and spectrum plot of a strong Wi-Fi and weak Bluetooth signal. A video trigger could be used to trigger on the exact rising edge of the Wi-Fi packet, but the Bluetooth packet would be below the noise floor. A flat frequency mask trigger at -90 dBm would trigger on both the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

Controlling the RF Analyzer

Applications that require 160 MHz I/Q capture are typically managed with larger software solutions which perform extensive signal analysis. The SM200B/SM435B 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/SM435B 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

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®