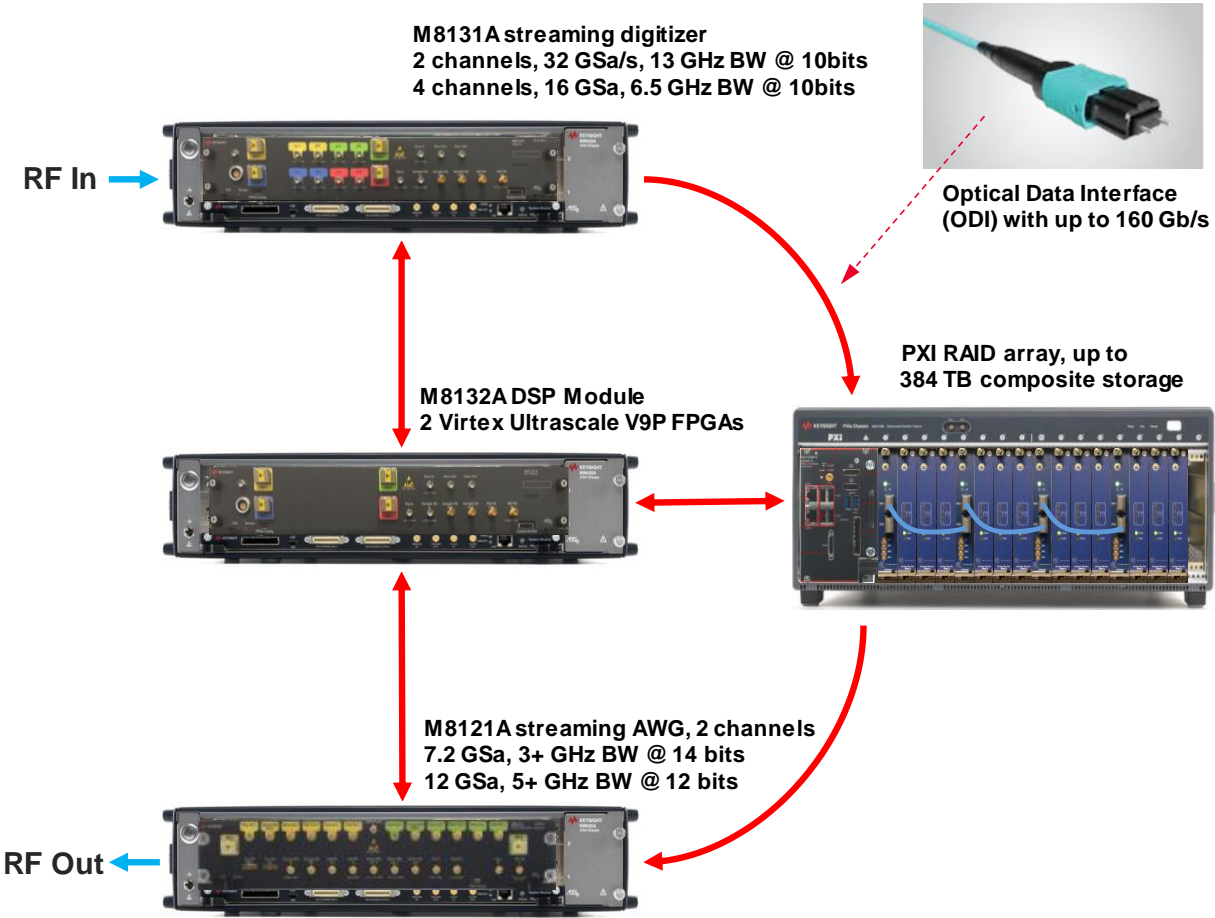


Modular Wideband Solution Platform

In many application areas, including radar/electronic warfare, satellite as well as wireless communication, the modulation bandwidth requirements keep increasing into the range of up to 4 GHz and beyond. At the same time, elaborate scenarios with multiple transmitters and receivers must be emulated to verify correct functionality of transmission systems with complex functionality such as beam steering in wireless comms or target identification in radar. Some applications even require real-time signal processing because they need to react immediately upon an incoming signal.

Existing test solutions typically offer *either* wide bandwidth *or* streaming and real-time processing capabilities, but not both. Keysight's new **Wideband Solution Platform** combines those strengths and adds scalability in terms of the number of synchronous channels and streaming throughput.

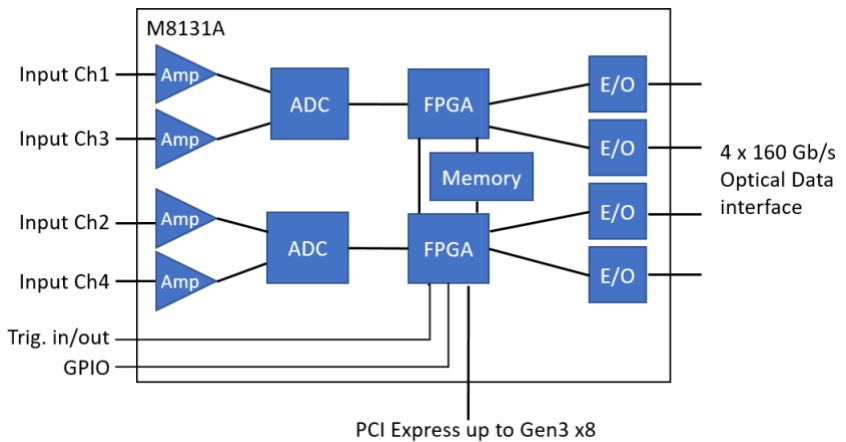
This Wideband Solution Platform consists of a portfolio of compatible instruments, including digitizer, arbitrary waveform generator, digital signal processor and mass storage modules that can be combined in a flexible way, depending on application needs. The interconnect between these products is based on the optical data interface (ODI) that is standardized by the AXIe consortium.



Elements of the Wideband Solution Platform

Digitizer

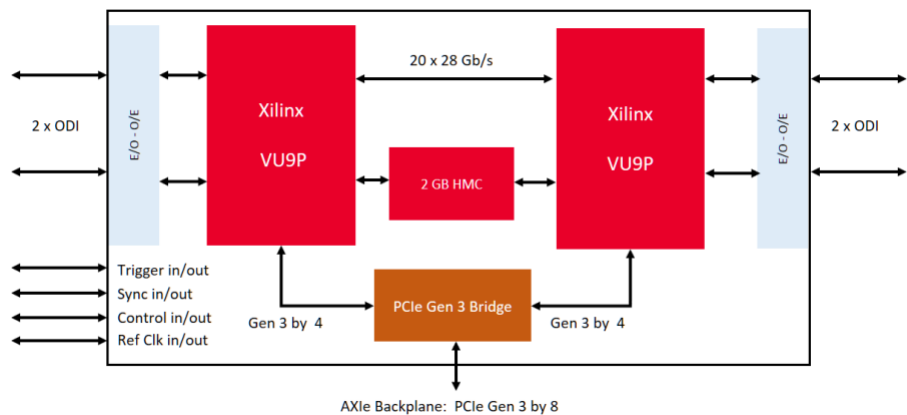
The M8131A is a 16/32 GSa/s, 10-bit digitizer with 4 channels at 6.5 GHz bandwidth or 2 channels at 12.5 GHz bandwidth per module. The M8131A offers – in addition to its build-in acquisition memory – an optical streaming interface (ODI), that allows gapless capture for an unlimited amount of time. Depending on the configuration, the M8131A can either stream the “raw” digitized samples or down-converted I/Q samples over the optical data interface.



In digital down-conversion mode, each channel can operate on a different intermediate frequency and with increasing decimation factor (4...256), the analysis bandwidth and thus the data rate on the streaming interface is reduced, but at the same time SNR and ENOB are improved by as much as 24 dB (or 4 ENOB) when decimating by 256.

Digital Signal Processing Module

The M8132A is a powerful digital signal processing engine consisting of two Xilinx Ultrascale+ VU9P FPGAs, 2 GByte of HMC memory¹ that can be accessed from both FPGAs, four ODI interfaces running at up to 160 Gb/s in+out each, a 560 Gb/s inter-FPGA link¹ and a PCIe Gen3 x8 link to the AXIe backplane. In addition, the module provides a trigger input and output, synchronization input and outputs for deterministic latency between compatible digitizers and AWG modules as well as a 10-general purpose I/Os.

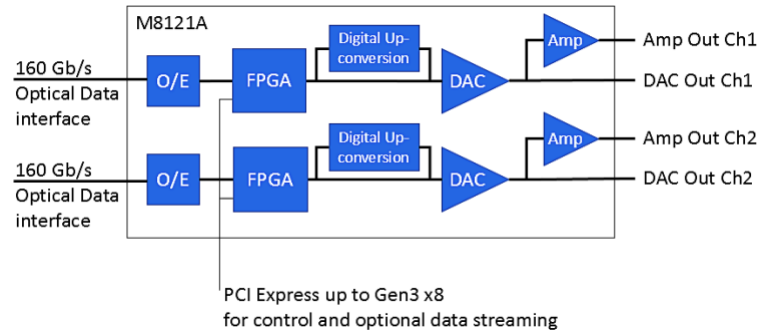


¹ Access to HMC memory and the inter-FPGA link is not supported in the initial release. Contact Keysight for further details

Arbitrary Waveform Generator

Instead of the built-in memory of a conventional AWG, the M8121A offers a full rate optical data interface (ODI) to stream the samples to the DAC at up to 12 GSa/s, which enables infinitely long scenarios to be generated with up to approximately 5 GHz of modulation bandwidth.

In addition to a “direct mode”, where DAC samples are transmitted over the streaming interface, it is possible to use the built-in “digital up-conversion” functionality. In this mode, in-phase and quadrature (I/Q) baseband samples are supplied over the streaming interface at a much slower rate than the DAC’s sample rate. The signal is interpolated to the DAC sample rate, multiplied with the desired carrier frequency before it is sent to the DAC.



Mass Storage System

The mass storage system is a key element of the Wideband Solution Platform. It consists of a combination of ODI interface cards and memory cards in PXI formfactor. Depending on the required data bandwidth, up to 4 ODI interface cards can be cascaded to support a sustained data rate of up to 160 Gb/s (or 20 GByte/s) per channel. Each ODI interface card can support up to three memory cards with a storage capacity of up to 32 TByte per storage card for a total capacity of 384 TB per PXI chassis.

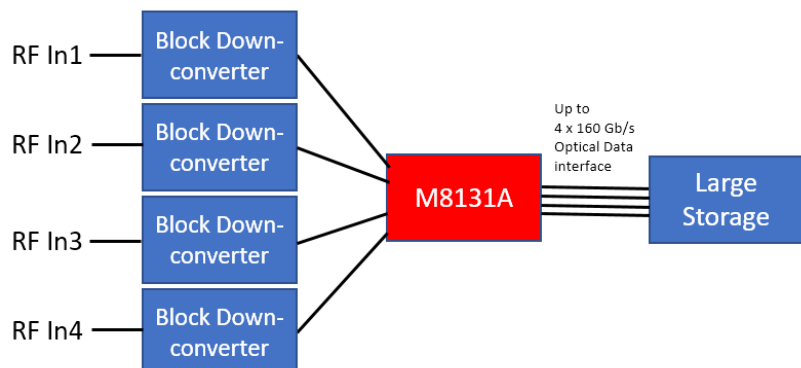
The read/write bandwidth of the storage system is sufficient for capturing data from the M8131A digitizer or playback on the M8121A AWG at full rate without any gaps.

Variety of system configurations

Due to its modular structure, the Wideband Solution Platform can be configured in many ways. Here is an overview of some typical configurations. In each of the configurations, only a single digitizer or AWG module is shown, but the systems can be scaled to a larger number of coherent channels by using multiple modules.

Wideband Gapless Capture

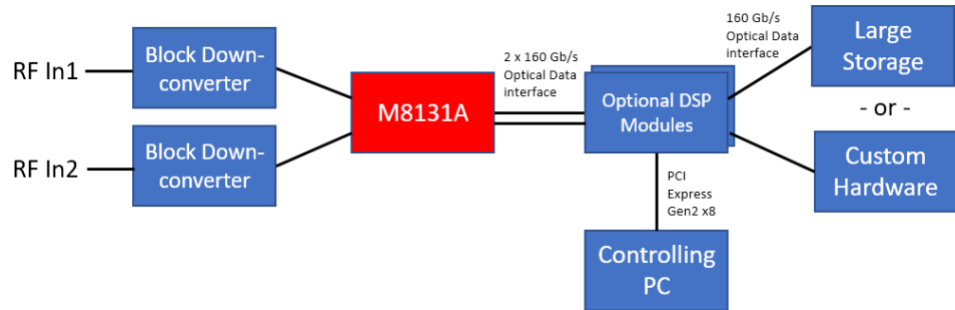
The combination of M8131A digitizer together with a compatible mass storage device offers the unique capability to capture wideband scenarios without any gaps for minutes to hours to days – only limited by the capacity of the storage device. Up to 4 channels at 6.5 GHz bandwidth or 2 channels with up to 12.5 GHz bandwidth can be



captured simultaneously using a single M8131A module. Combined with a compatible block down-converter, frequencies up to 44 GHz with modulation bandwidths up to 4 GHz can be captured.

Capture and process in real-time

In many cases, the captured samples need to be post-processed in real-time. This can be accomplished in one of the two FPGA's inside the M8131A that is available for custom DSP functionality or in one or more

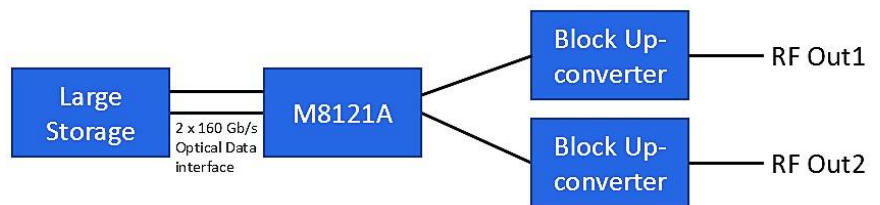


compatible digital signal processing modules. Possible applications include:

- Demodulation of communications signals
- Pulse-descriptor-word extraction from a received radar signal
- Real-time spectrum analysis
- Determination of the angle-of-arrival in a phased array antenna
- Custom digital signal processing

Wideband Streaming Playback

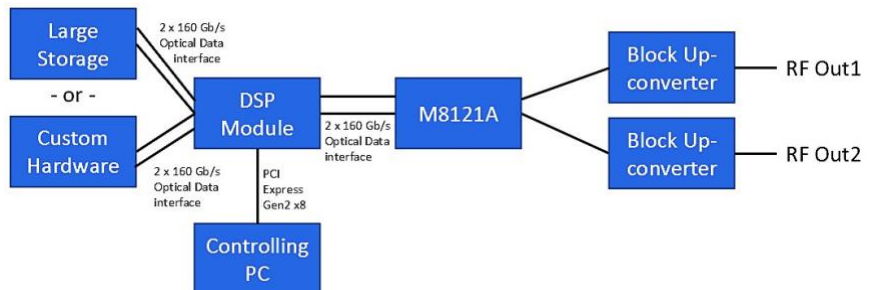
The M8121A together with a mass storage device offers the unique capability to generate non-repeating, wideband scenarios for minutes to hours – only limited by the capacity of the storage device.



Combined with a compatible block up-converter, frequencies up to 44 GHz with modulation bandwidths up to 4 GHz can be generated.

Dynamic signal generation

In many cases, the scenario that needs to be generated is not static, but it must be modified at runtime. In conjunction with a digital signal processing module, the digital waveform that is transmitted to the AWG can be altered or even

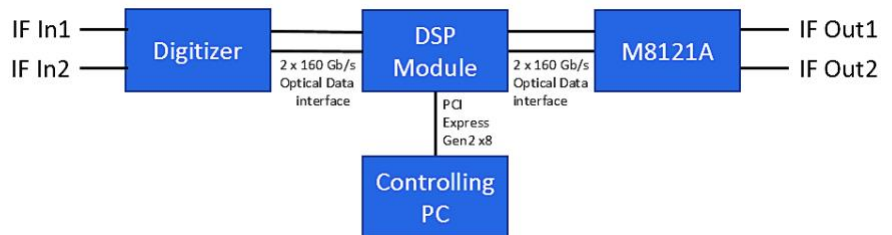


generated in real-time. Possible applications that can be realized include:

- Scenario playback with real-time modifications, such as adding noise or clutter
- Electromagnetic spectrum simulation
- Translation from pulse descriptor words into I/Q signals for radar simulations
- Adjusting the pulse delay in a radar target simulation

Record and playback

Finally, with the combination of the digitizer and the AWG in a single system, it is possible to put together a very wideband coherent record-and-playback system. Depending on the amount of processing required, one or more digital signal processing modules can be inserted in the path.



Conclusion

The Keysight Wideband Solution Platform is a very flexible system that can be configured for a variety of applications that require wide bandwidth, gap-free signal analysis, processing, generation over a long period of time.