How to use high-speed digitizers to replace conventional test instrumentation?

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40 min

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Abstract

Conventional Instrumentation

DMM
Digital Oscilloscope
Frequency / Time Interval Counter
Power Meter
Spectrum Analyzer
Microwave Transition Analyzer

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Synthetic Instrumentation

Collection of hardware and software modules that emulate a standard instrument

- Signal conditioning modules, digitizers and processor
- Simple hardware elements, register based control with intelligence in processor
- Software reconfigurable “on the fly” to make measurements (you add a software module rather than add an instrument)

Examples of Synthetic Instruments

Analog

- Chassis
- Controller
- Timing & Control Module

RF

- Chassis
- Controller
- Timing & Control Module

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Benefits of Synthetic Instruments

Reduce tester obsolescence and increase tester flexibility

- Performance upgrades possible without replacing entire instrument
- Replace software elements to add or modify performance capability

Reduce Cost

Challenges for High-speed Digitizers

- Offer a broad range of digitizers to support various applications based on accuracy, resolution, and bandwidth
- Reduce size and power consumption
- Design high quality digitizers to optimize measurement fidelity and signal integrity
- Use fastest PC bus and on-board FPGA to maximize measurement throughput

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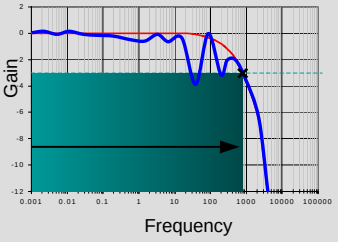
How to select your HSDC ?

- Can we compare equipment from the banner specifications ?
- What are the important factors in the product specifications ?
- How do we make the link between your requirements for a particular application and the product solution ?
- How to compare competitive solutions ?

What do banner specs REALLY tell us?

8-bit Resolution	256
10-bit Resolution	1,024
12-bit Resolution	4,096
14-bit Resolution	16,384
16-bit Resolution	65,536

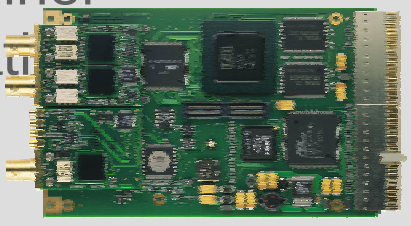
Must address the :
Clock accuracy
Clock jitter
Time-to-digital conversion



Perception → ~~Accuracy~~

Perception → ~~Temporal accuracy~~

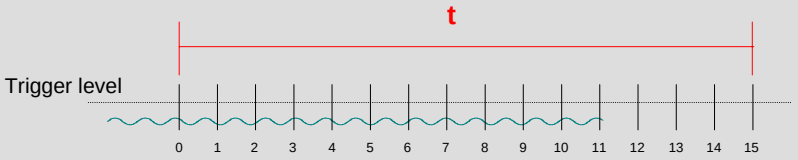
Non-banner Specificati



ENOB
Clock accuracy
Clock jitter
Time-to-Digital Conversion (TDC)
Flatness
Signal-to-Noise Ratio (SNR)
Spurious-Free Dynamic Range (SFDR)

Frequency Counter

Three differing data readouts are possible
Frequency counting over some time interval, t
Calculated period from this frequency count
Totalizing over some time interval or a user defined gate, t



$$Frequency = \frac{Number\ of\ Triggers}{t}$$

$$Period = \frac{1}{Frequency}$$

$$Total = Number\ of\ Triggers$$

Conclusions

Synthetic Instrumentation, a solution for the future

- Reduce tester obsolescence and increase tester flexibility
- Reduce Cost
- Significant downsizing

Carefully select your HSDC

- Banner specifications DO NOT give any indication of measurement fidelity or signal integrity
- ALL the specifications are important as well as how they are defined and over what ranges