Rapid Design Validation and Testing in Just 2 Weeks

How signal integrity solutions accelerated the design validation process of a new genomic sequencer.
Whole genome sequencing (WGS) provides a complete map of an organism’s genome. A genome is a complete set of genes and DNA that can provide valuable insights about any organism of interest. WGS is used to improve disease detection and test for genetic disorders.

Companies that produce genome sequencers analyze the DNA of an organism and sequence the entire genome of the organism. To analyze a genome or sequence the DNA, the sequencers extract DNA from tissue or a specimen such as saliva, blood, or plant tissue.

A genome sequencer can simultaneously sequence multiple human, plant, or animal genomes in just one to two days.

The company was at work on a large-scale population study of diseases relevant to a specific ethnic group. The study involved sequencing and analyzing the genomes of 100,000 participants. The project required collecting and processing high-quality genomic data quickly. The company needed a next-generation genomic sequencing machine capable of taking on this massive task.
The Challenge: Capture and Display Data at High Speed for Effective Analysis

Obtaining rapid WGS results and interpreting them would determine the success of this project. The R&D team for the genomic sequencer needed to ensure its high-speed digital design considered signal integrity to minimize crosstalk and other sources of noise for the accuracy of data transmission.

However, early in the project, the R&D engineers discovered that their system was unable to accommodate the high sequencing throughput and massive amount of genome data that required processing. In fact, the imaging on their genomic sequencing machine kept flickering. The engineers suspected the flickering was caused by an issue with the display port, but they did not have the tools to verify their hypothesis.

In addition, the sequencing platform used a lot of high-speed digital interfaces, which are required to crunch huge amounts of data and perform complex data processing. The R&D team needed to ensure their design met the high-speed digital compliance requirements.

Solution: Use Signal Integrity Measurement Tools for the Design Validation Analysis

After an investigation, Keysight found that the customer was using a longer-than-recommended cable with a repeater for the display port.

To demonstrate the correlation between cable length and outcome on the display, Keysight recommended using the DSOV164A Infiniium V-Series oscilloscope with the D9040DPPC Display Port compliance application’s eye diagram test feature. The feature provided information on the bit error rate of the data transmission before the repeater and after the repeater.

Using the information provided by the eye diagram, the customer was able to verify its specifications and successfully identify the source of the problem.

Figure 1. The D9040DPPC’s setup screen.
During troubleshooting, Keysight recommended using the D9120ASIA Advanced Signal Integrity Software paired with the DSOV164A oscilloscope to complement the signal integrity compliance test.

Figure 2. The D9120ASIA Advanced Signal Integrity Software (Crosstalk)

Using the Infiniium Serial Data Equalization (SDE) feature, the clock recovery algorithm combines with equalization software to accurately depict DFE, CTLE, and FFE. The designer can then make use of this information to check the margin of the eye-opening.
Results: Reduction in Design Validation And Test Time, Faster Time-to-Market

The R&D team was able to quickly identify the design flaws and signal integrity issues by using the D9020ASIA software. Without these tools, the team would have to manually write software code to recover the clock and manually check on the signals. A process that used to take up to six months of design validation and test time now takes a mere two weeks.

The customer was able to use the self-guided DisplayPort compliance application to troubleshoot all future systems to ensure its designs comply with voltage and data requirements. The shorter design validation and testing cycle enabled the customer to release the newly designed genomic sequencing machine into the market faster and with greater confidence.

Looking Ahead: Expand Future Capabilities to Meet Advanced Requirements

Keysight signal integrity solutions are now part of the company’s R&D test tools. As the customer’s products evolve, new designs will incorporate more capabilities and advanced requirements. The customer is looking to Keysight as a trusted partner for test solutions to address these new capabilities and advanced requirements.

Learn more about the Keysight signal integrity solutions mentioned in this case study:

- **DSOV164A Infiniium V-Series Oscilloscope**: 16 GHz, 4 Analog Channels
- **D9040DPPC DisplayPort 1.4 Compliance and Validation Test Software**
- **D9120ASIA Advanced Signal Integrity Software (Crosstalk)**
- **MX0024A and MX0021A InfiniiMax Ultra Probe Amplifier**