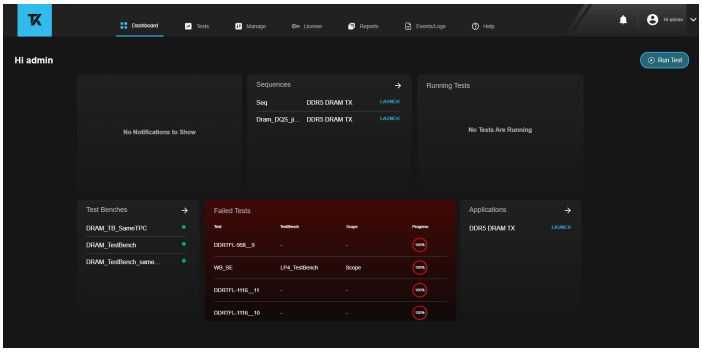
Clarius DDR5 DRAM Tx Compliance and Debug Solution

Datasheet



The DDR (Dual Data Rate) is a dominant and fast-growing memory technology. It offers high data transfer rates required for virtual computing applications, from consumer products to the most powerful servers. The high speed of these signals requires high-performance measurement tools. The Tektronix Clarius Compliance DDR5 DRAM Transmitter solution is an automated test application used to validate and debug the DDR5 designs of the DUT as per the JEDEC specifications. The solution enables you to achieve new levels of productivity, efficiency, and measurement reliability.

The Clarius compliance is a new-generation compliance test automation software platform that offers a range of features and benefits as follows:

- High asset utilization and faster test times - Disaggregated architecture to offload analysis from the oscilloscope.
- Easy workflow integration – Leverage REST API's and SDK for faster automation.
- Unified user interface for all technology standards across Transmitter and Receiver.
- Integrated data management for results, reports, and waveforms in UI along with dashboard view.

Key features

- Supports 37 measurements of DDR5 DRAM Tx Tests as per DDR5 JEDEC specification:
  - Supports 12 Tx DQS Jitter Tests
  - Supports 13 Tx DQ Jitter Tests
  - Supports 12 Tx DQ Stressed Eye Tests
- The user-defined acquisition mode enables users to conduct application measurements by adjusting the oscilloscope settings, such as sample rate, record length, bandwidth, and other parameters according to their preferences and requirements mode for all scenarios.
- Retain Vertical Scale setting supported during acquisition for all scenarios.
- Customize Number of UIs for Tx DQ Stressed Eye test.
- Custom BER support for Tx DQ Stressed Eye tests.
- Custom Limit support for all tests.
- Supports multi-run feature for all measurements.
- Supports all the data rate as per JEDEC.
- Custom Data Rate support up to 15000 MT/s.
- Signal Validation support for all measurements.
- De-embedding support for all measurements.
- DUT automation support using batch file
- Automatic and manual support of Scope Noise Compensation for Tx DQS and Tx DQ Jitter tests.
- Automatic and manual support of DCA Training.
- Variable DUT Termination voltage support.
- Vref-DQ Mode support for Tx DQ Jitter and Stressed Eye tests using different methods.
  - Widest Eye Opening
  - Peak to Peak
  - Amplitude
  - User Defined
- DUT Power Cycle Utility: Manage power states (ON/OFF) and adjust voltage/current across all channels of a Keithley Power Supply via direct address connectivity.
- Import sequence feature allows for recalling test setups, so users don't have to manually configure each time.
- Single and Dual Rank DUT support.
- For the Stressed Eye test, two distinct analysis methods are available.
  - Use one edge of the UI
  - Use both edges of the UI
- Pause before acquisition feature is supported.

Applications

The Tektronix provides industry leading DDR5 solution that empowers engineers designing cutting-edge servers, computers, and embedded applications to confidently navigate both DDR5 memory design and validation. It provides a comprehensive suite of tools to tackle design challenges and ensure compliance with the latest DDR5 DRAM JEDEC specifications.

The Tektronix Clarius DDR5 DRAM TX compliance solution is compatible with the following Tektronix oscilloscope models:

- DPO72304SX, DPO72504SX, and DPO73304SX.
- Non-ATI channels of DPO75002SX, DPO75902SX, DPO77002SX, DPS75004SX, DPS75904SX, and DPS77004SX.

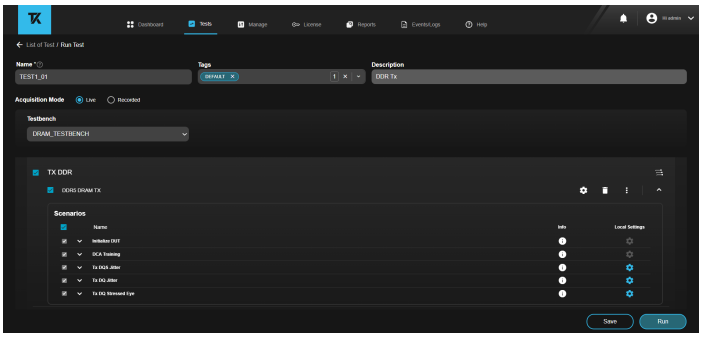
The above-mentioned Tektronix oscilloscopes are designed to meet the challenges of the next generation memory standards and provide the industry's leading vertical noise performance with the highest number of effective bits (ENOB) and flattest frequency response for oscilloscopes in their class.

Specifications

DDR5 DRAM Tx tests

The Clarius DDR5 DRAM Tx solution streamlines the compliance testing process for DDR5 systems and devices, empowering you to achieve faster time-to-market with several innovative features.

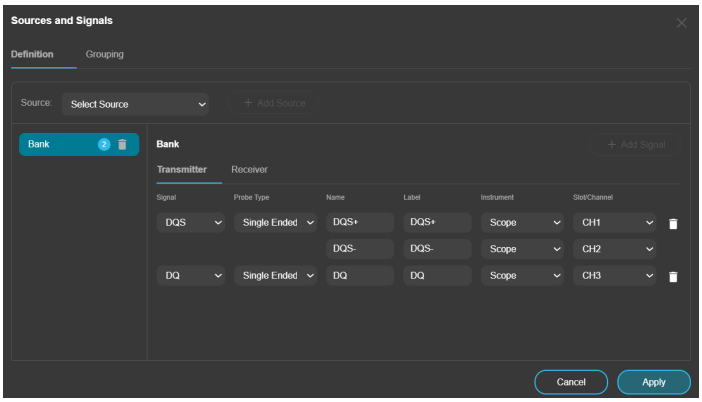
Experience a user-friendly, step-by-step interface that accelerates test setup. Effortlessly configure key settings like data rate, acquisition parameters, and test limits within a single, intuitive global configuration window. The interface groups tests logically by category (e.g., Tx DQS Jitter, Tx DQ Jitter, Tx DQ Stressed Eye) and allows for individual measurement selection within each group.



Clarius DDR5 DRAM Tx – application launch screen

Sources and signals

The Clarius DDR5 DRAM Tx application comes with a unique feature to select or deselect the signal. Once the signal is selected in the sources and signals panel, the user can select the signal source connected to the oscilloscope.



Sources and Signals panel – signal source selection

User defined acquisition mode

The Clarius DDR5 DRAM Tx application empowers users with granular control over oscilloscope settings through User Defined Acquisition (UDA) mode. This allows customization of scope acquisition parameters like sample rate, bandwidth, record length etc directly within the automation framework. UDA facilitates tailored test setups for specific JEDEC DDR5 compliance needs, streamlining workflows and reducing errors.

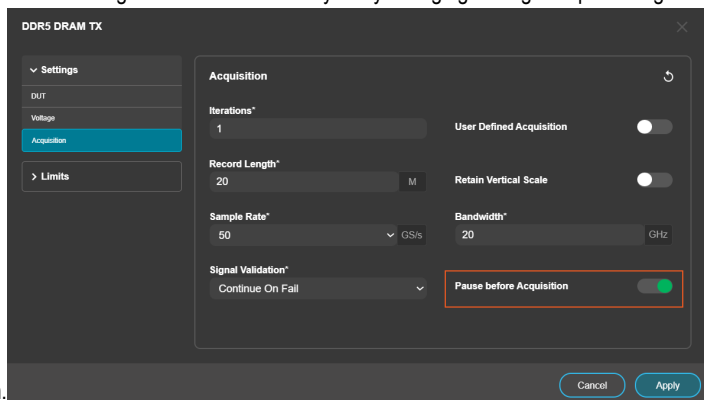
UDA's control extends beyond compliance testing. By adjusting acquisition settings on-the-fly during test execution, engineers can gain deeper insights into signal behavior, enabling faster debug and issue resolution.

DCA Training

The Duty Cycle Adjuster (DCA) Training algorithm uses period and duty cycle measurements on the ODD and EVEN cycle of the DRAM clock to determine the DCA optimal mode register settings. This presents a significant advancement in addressing the industry's critical need to improve signal reliability and performance by reducing duty cycle error and phase mismatch translated jitter.

Pause before acquisition

Gain more control on signal validation and analysis by changing settings/scripts during the test run using Pause before acquisiton.



De-embed filters

Easily de-embed the fixture and cable effects by applying suitable de-embed filters within the DDR5 standard. Apply filter is applicable for all measurements and setting is present in test level setting.

De-embed filters

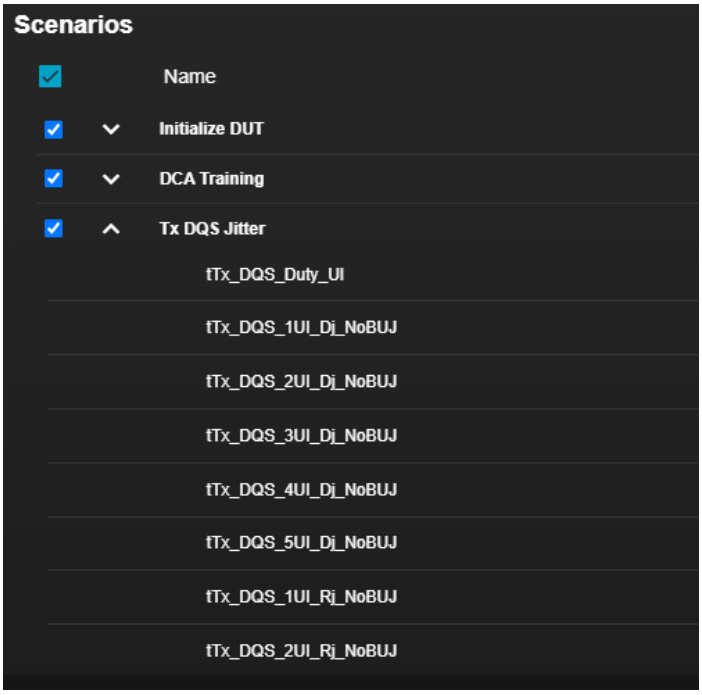
Comprehensive measurements

The Clarius DDR5 DRAM Tx compliance solution adds a long list of JEDEC specific measurements for DDR5 memory standards. It covers Jitter and Stressed Eye measurements as per the JEDEC standards.

Test selection

The Clarius DDR5 DRAM Tx compliance solution test selection panel allows the user to select the various measurements supported by the application.

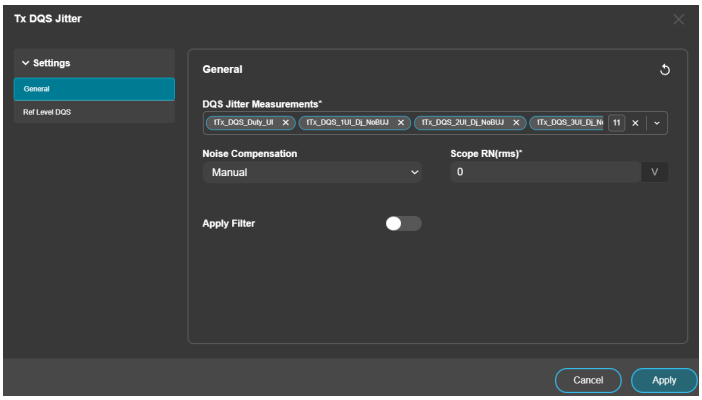
- Supports 37 measurements of DDR5 DRAM Tx Tests as per DDR5 JEDEC specification:
  - Supports 12 Tx DQS Jitter Tests
  - Supports 13 Tx DQ Jitter Tests
  - Supports 12 Tx DQ Stressed Eye Tests



Test selection – tree view of measurement

Configurations

Ease of use measurement configuration to configure measurements by group instead of running through all the 34 measurements.

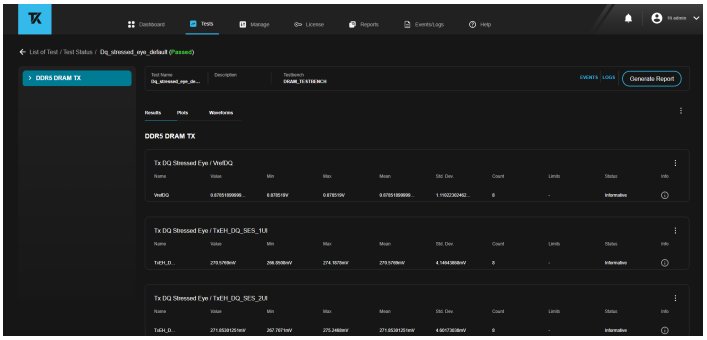


Configurations

Results and reporting

The measurement configurations and JEDEC pass/fail limits are automatically applied for the selected measurements based on the memory specification and the selected speed grade. The results report includes DDR measurements statistical data, measurement plots, and the screenshot of the waveforms with the cursors.

When test execution is complete, the application automatically opens the Results panel and displays the summary of test results.



Measurement results

Clarius DDR5 DRAM TX Test Report

Setup Information

Test Name	DQ_stressed_Eye_Default	**Scope Model Number**	DPO73304SX
DUT ID	DUT001	**Scope Serial Number**	KR200033C
Date and Time	2024-12-02 11:33:52.452	**SPC; Factory Calibration**	PASS,
Overall Test Result	PASSED	**Scope F/W version**	CF:91.1CT FV:10.14.1 Build 15
Overall Execution Time	00:10:58	**Clarius Version**	2.0.0-master.864
Execution Mode	LIVE	**App Version**	2.0.0-master.484
Data Rate	3200 MT/s	**Jedec Specification**	JESD79-5C.01_v1.31
Iterations	1	**Record Length**	20 M
User Define Acquisition	Disabled	**Sample Rate**	50 GS/s
Retain Vertical Scale	Disabled	**Bandwidth**	20 GHz
DIMM Type	RDIMM	**DUT Type**	DRAM
DDR5 Module Rank	Dual Rank	**DUT Automation**	Enabled
Signal Validation	Continue On Fail		
Additional Comments	None		

Probe and De-Skew Information

Source	Probe Type	Probe Serial Number	De-Skew Value
CH1	N/A	N/A	0.000000 s
CH2	TCA292D	None	0.000000 s
CH3	TCA292D	N/A	0.000000 s
CH4	TCA292D	N/A	0.000000 s

Test Summary

Test Name	Test Group Name	Status
VrefDQ	Tx DQ Stressed Eye	PASSED
TxEH_DQ_SES_1UI	Tx DQ Stressed Eye	PASSED
TxEH_DQ_SES_2UI	Tx DQ Stressed Eye	PASSED
TxEH_DQ_SES_3UI	Tx DQ Stressed Eye	PASSED
TxEH_DQ_SES_4UI	Tx DQ Stressed Eye	PASSED
TxEH_DQ_SES_5UI	Tx DQ Stressed Eye	PASSED
TxEW_DQ_SES_1UI	Tx DQ Stressed Eye	PASSED
TxEW_DQ_SES_2UI	Tx DQ Stressed Eye	PASSED

Measurement report

Verification versus debug

The Clarius DDR5 DRAM Tx compliance solution offers a one-stop shop for both ensuring your designs meet DDR5 specifications and efficiently debugging any issues that may arise.

Automated Compliance Testing: Run comprehensive compliance tests with complete confidence. The solution automates the entire process, eliminating manual steps and ensuring consistent, reliable results.

Advanced Debug Capabilities: Should an issue surface during testing, the Clarius DDR5 DRAM Tx compliance solution solution goes beyond simply identifying the failure. It captures and stores worst-case signal waveforms for later in-depth analysis using DPOJET, our powerful advanced Jitter and Timing analysis software. DPOJET offers both generic jitter and timing analysis measurements to address a wide range of debug needs, as well as DDR5-specific measurements to ensure your design adheres to the latest memory standard. With complete control over measurement settings, you can customize each analysis to gain deeper insights into the root cause of failures, accelerating debug cycles.

Ordering information

Hardware requirements

Item	Description	Quantity	Type	Vendor	Requirement
DPO72304DX or MSO72304DX or DPO72304SX	≥ 23 GHz Oscilloscope, Windows 10 OS	1	Equipment	Tektronix	Required
MP1900A or AWG5200 or AWG70000	Bit error rate tester or waveform generator	1	Equipment	Anritsu/ Tektronix	Required
2230-30-3	3 Channel programmable power supply	1	Equipment	Keithley	Required
Host PC/Laptop	Refer to *System requirements*	-	Laptop/PC	-	Required
MS46122B	USB Vector network analyzer, 1 MHz - 8 GHz	1	Equipment	Anritsu	Recommended

Test fixtures and accessories

Item	Description	Quantity	Type	Vendor	Requirement
A9-CTC2-01	CTC2 Test fixture	1	Fixture	Astek	Required
A9-AUTO-01	Astek reset automation kit	1	Fixture	Astek	Required
PMCABLE1M	SMA-SMA, 1M, phase matched cable pair	4	Accessory	Tektronix	Required
174-6657-01	SMA-SMP adaptor, right angle (pair)	4	Accessory	Tektronix	Required

Software requirements

Compliance

Item	Description	Quantity	Type	Vendor	Requirement
DDR5 DRAM Tx	Clarius DDR5 Tx Compliance Oscilloscope Software. Refer to *License details*	1	Option	Tektronix	Required

Debug

Item	Description	Quantity	Type	Vendor	Requirement
SDLA64	Serial Data Link Analysis for Win 64-bit Scopes.	1	Option	Tektronix	Required
DJA	DPOJET Jitter Analysis.	1	Option	Tektronix	Required

System requirements

Prerequisites	Recommended requirements
Operating system	Windows 10 Enterprise and Pro (version 21H1 and above) or Windows 11 Enterprise and Pro (version 21H2 and above) **Language:** English (United States) only
CPU cores	16
RAM	64 GB
Disk space	300 GB HDD/SSD of free disk space
Internet speed	1 Gbps
Browser	Microsoft Edge (default) or Google Chrome

Table continued…

Prerequisites	Recommended requirements
Additional software	Python 3.12.x[1]

License options

Clarius DDR5 DRAM Tx Software Options

License terms	License option	Description
Subscription	AT-DDR5-Tx-NS1	Clarius DDR5 Tx Automation Test Software; Node-locked, Subscription, 1 Year
	AT- DDR5-Tx-NS3	Clarius DDR5 Tx Automation Test Software; Node-locked, Subscription, 3 Years
	AT- DDR5-Tx-FS1	Clarius DDR5 Tx Automation Test Software; Floating, Subscription, 1 Year
	AT- DDR5-Tx-FS3	Clarius DDR5 Tx Automation Test Software; Floating, Subscription, 3 Years

Tektronix is ISO 14001:2015 and ISO 9001:2015 certified by DEKRA.

Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

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1 Python installation is required for SDK and DUT control automator.

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For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit *www.tek.com*.

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