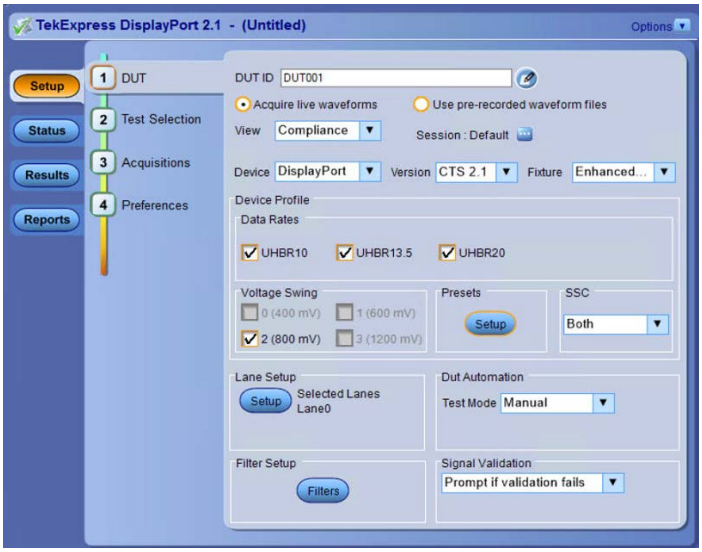
DisplayPort 2.1 Compliance and Debug Solution

Opt. DP20 Application Datasheet



Tektronix provides the most comprehensive solution to serve the need of engineers designing DisplayPort silicon for computer systems and embedded systems, as well as for those who are validating the physical-layer compliance of DisplayPort devices as per the DisplayPort 2.1 Compliance Test Specification. Tektronix TekExpress DisplayPort 2.1 Compliance/debug solution help the customers to test their DP2.1 DUTs. The Tektronix Opt. DP20 application is compatible with Tektronix DPO/MSO 70000 DX/SX Series oscilloscopes that are designed to meet the challenges of the next generation of display standards such as HDMI and DisplayPort.

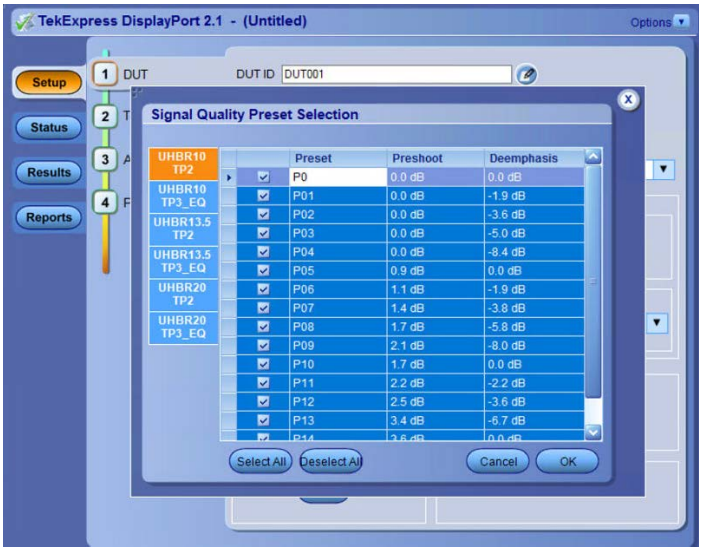
key features

- Complete compliance testing of data rates UHBR10, UHBR13.5, and UHBR20 for DP2.1 Source devices (Enhanced DP, mDP, and Type-C connectors)
- Supports preset optimization feature to find out separate optimal presets for TP2 and TP3_EQ Test points for individual data rates
- Supports TX Preset Equalization Tests for all data rates
- Supports normative and informative measurements that are mentioned in DisplayPort 2.1 CTS
- Optimized algorithms to execute tests with improved accuracy
- Analyze multiple data rates and multiple presets at TP2 and TP3 EQ test points for multiple lanes on one go
- Supports DUT toggle automation using Unigraf UCD-323 device
- Support P7625 and P7633 differential probes
- Fixture De-embedding in differential and single-ended mode by creating a custom filter file using SDLA software to leverage the channel modelling and receiver equalization functionality
- Support DP2.1 Compliance test execution on Best Preset as well as all selected Preset
- Supports signal validation option to detect anomalies in the signal before analysis
- Supports offline analysis of the saved waveforms in Pre-recorded mode
- Provides a consolidated report for all tests in .mht, .pdf, and .csv formats.

Solution overview

TekExpress DisplayPort 2.1 supports 16 presets for UHBR data rates. It allows you to choose the optimal Preset and run the Signal Quality test on it. The DisplayPort 2.1 solution provides flexibility to select different Presets for different test points for available data rates. If optimal preset is not known then the DisplayPort solution allows you to select multiple Presets to find the optimal Preset among selected Preset and run the Signal Quality test on the optimal Preset.

The DisplayPort solution provide Signal Quality run on all Presets. It allows you to run a subset of Signal Quality measurements. By default DisplayPort cables (DP40 and DP80) are configured for testing but different cable models can be selected in Advanced mode.



Preset selection panel for signal quality measurements

DisplayPort 2.1 transmitter test overview

DisplayPort sources (transmitters) have state control requirements in order to transmit the data patterns and signal properties required to demonstrate conformance as per the compliance test specification. The following properties and patterns need to be transmitted for full measurement coverage:

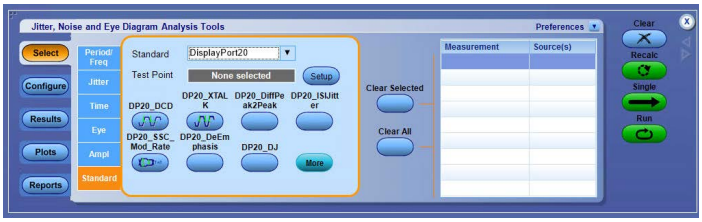
- Bit rates: UHBR10, UHBR135, and UHBR20
- Data patterns: PRBS15, PRBS31, and SQ128
- Preset: 16 presets as defined
- Output levels: 800 mV
- SSC (spread spectrum): On/Off

Compliance to characterization support

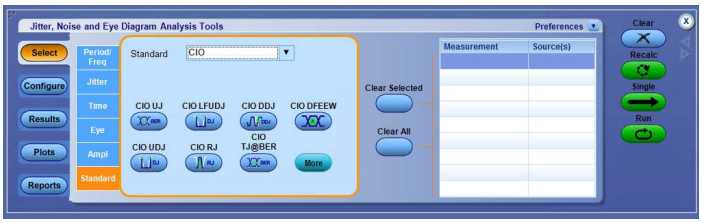
Tektronix offers DisplayPort 2.0 DPOJET essentials package which comes bundled with TekExpress DisplayPort 2.1 Compliance and Debug solution that can be used to characterize a DUT and analyzing its finer behavior. It serves as an analysis tool when the DUT fails any portion of the compliance tests or you want to take a deeper look into the failures. All the compliance tests which are supported in the application and requires a single acquisition are supported in this package. You can build automation scripts around these measurements to setup a custom test environment. The DisplayPort 2.0 DPOJET solution also supports all measurement for lower data rates e.g., RBR, HBR, HBR2, and HBR3.

You can enable this package by running DisplayPort 2.0 from the **Oscilloscope → Analyze** menu. The DisplayPort 2.0 DPOJET measurement library helps in characterizing the silicon. Other advantage of this library is the ability to debug the measurement in case of failures. If any of the tests fail during compliance testing, you can tap into the DPOJET DisplayPort measurement library for a deeper dive into the failures such as eye diagram mask hit failures and look at relation between pre-emphasis level vs voltage swing tests to perform root cause analysis. The solution also gives users the flexibility to configure measurements with different settings, make configuration changes in existing measurements on the fly, and run tests in single-shot or free-run repetitive modes.

DisplayPort 2.0 DPOJET solution comes with setup files. All measurements corresponding to a data rate and a particular pattern are clubbed in a single setup file. Setup files for lower data rates e.g. RBR, HBR, HBR2, and HBR3 are also included. Setup file helps to avoid any manual mistakes while configuring a measurement. This ensures that a non-expert user can also use the debug solution and validate the results.



DPOJET DisplayPort 2.0 standard dropdown

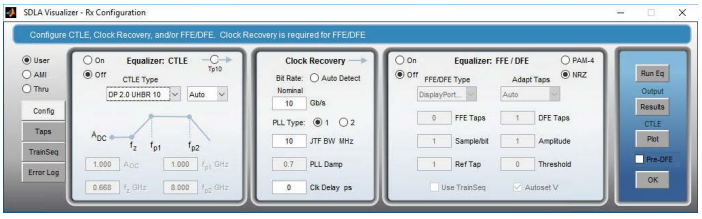


DPOJET CIO standard dropdown

SDLA features

SDLA enables the user to probe and visualize data at the required location (de-embed / embed) using virtual probing through test points. It can remove (de-embed) the effects of the cables, probes, and fixtures to get more accurate measurement results. It can embed user defined channel models to simulate the signal at the end of the link. It can also be used to open a closed eye using receiver equalization, Continuous Time Linear Equalizer (CTLE), Decision Feedback (DFE), or Feed Forward Equalization (FFE). SDLA also has advanced analysis and modeling capabilities. One can view and measure multiple test points using DPOJET Jitter and Eye analysis comprehensive frequency and time domain plots, enable quick verification of S-parameters and test point transfer functions.

For DisplayPort 2.1, SDLA has been enhanced to provide the flexibility of choosing the optimal CTLE. To calculate optimal CTLE based on Eye Area, SDLA selects the appropriate DisplayPort standard from the CTLE dropdown menu and runs the configuration from 0 dB to -9 dB. Optimal CTLE waveforms gets loaded on the oscilloscope and can be configured.



RX setup in SDLA

Proposed measurements

List of supported measurements

Measurement	UHBR10		UHBR135		UHBR20	
	TP2	TP3_EQ	TP2	TP3_EQ	TP2	TP3_EQ
Preset Optimization	Yes	Yes	Yes	Yes	Yes	Yes
Eye Height	Yes	Yes	Yes	Yes	Yes	Yes
Eye Width	Yes	Yes	Yes	Yes	Yes	Yes
Total Jitter	Yes	Yes	Yes	Yes	Yes	Yes
Random Jitter	Yes	Yes	Yes	Yes	Yes	Yes
Uncorrelated Deterministic Jitter (UDJ)	Yes	Yes	Yes	Yes	Yes	Yes
Low Frequency UDJ (LFUDJ)	Yes	Yes	Yes	Yes	Yes	Yes
Data Dependent Jitter (DDJ)	Yes	No	Yes	No	Yes	No
Uncorrelated Jitter (UJ)	Yes	No	Yes	No	Yes	No
SSC Phase Deviation	Yes	No	Yes	No	Yes	No
SSC Down Spread Rate	Yes	No	Yes	No	Yes	No
SSC Down Spread Range	Yes	No	Yes	No	Yes	No
SSC Slew Rate	Yes	No	Yes	No	Yes	No
Unit Interval	Yes	No	Yes	No	Yes	No
Bit Rate	Yes	No	Yes	No	Yes	No
Electrical Idle	Yes	No	Yes	No	Yes	No
AC Common mode	Yes	No	Yes	No	Yes	No
Transmitter Equalization	Yes	No	Yes	No	Yes	No

General characteristics

Physical characteristics

Configuration	Description
Oscilloscope	• DPO/MSO 70000 DX/SX or above • Oscilloscopes with Opt. DJA, 5XL, and SDLA64 • Bandwidth ≥16 GHz recommended for UHBR10 • Bandwidth ≥21 GHz recommended for UHBR13.5 and UHBR20

Table continued…

Configuration	Description
Probe	• Trimode probe P7625, P7633 with P76CA-292C probe tip • Direct SMA

Ordering information

Nomenclature	Description
DPOFL-DP20	License; TekExpress DisplayPort 2.1 Tx Compliance/Debug Solution (Requires Opt. CIO, DJA, SDLA); Floating
DPOFT-DP20	License; TekExpress DisplayPort 2.1 Tx Compliance/Debug Solution (Requires Opt. CIO, DJA, SDLA); Floating Trial
DPO-UP DP20	TekExpress DP21 Compliance and DPOJET: DP20 TX Plugin Solution (Requires Opt. CIO, DJA, and SDLA64)
DPO/MSO70000SX/DX Opt. DP20	TekExpress DP21 Compliance and DPOJET: DP20 TX Plugin Solution (Requires Opt. CIO, DJA, and SDLA64)

Oscilloscope and software prerequisite

Operating system DPO/MSO 70000 SX/DX with Microsoft Windows 10 OS

Recommended accessories

Item	Vendor	Quantity
PMCABLE1M Phase Matched SMA cable set	Tektronix	Min 1- Max 4
P7625 or P7633 Probes [Optional]	Tektronix	4
P76CA-292 or P76CA-292C or P76CA-SMP or P76TA [Optional]	Tektronix	4

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

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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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