Technical Reference

MOST Essentials - Electrical Compliance and Debug Test Solution for MOST50 and MOST150

Measurements and Setup Library Methods of Implementation (MOI)

Version 1.0

P/N: 077069900

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Revision History			
Version	**Issue Date**	**Pages**	**Nature of Change**
0.1	**24 May 2012**	**All**	**Initial draft version**
0.2	**1 Jun 2012**	**All**	**Incorporated with review comments**
0.3	**11 Jun 2012**	**Section 3.2 Pg.13-17 Section 5 Pg.33-37**	**Added schematic diagram for the test points and test methodologies**
1.0	**19 Jun 2012**	**All**	**Final version**

Contents

1. Introduction to the DPOJET MOST Essentials Setup Library

This document provides the Methods of Implementation (MOI) for making MOST measurements with Tektronix MSO/DPO5000, DPO7000C MSO/DPO/DSA70000C/D oscilloscope enabled with option DJA (DPOJET Advanced Jitter and Eye Analysis Tool), Option MOST.

Instrument Setup files using DPOJET measurements are used to perform MOST50 and MOST150 specific measurements. DPOJET along with its associated setup files provides transmitter path measurements (amplitude, timing, and jitter), waveform mask testing and limit testing described in the MOST50 and MOST150 specifications at respective test points.

MOST Specification Title	**Table 1 – Supported Specifications Spec Revision**	**MOI Test Points Defined**
MOST Electrical Physical layer Compliance Specification	Rev1.0	MOST50 - SP1E,SP2E, SP3E and SP4E
MOST Electrical Physical Layer Specification	Rev1.1	MOST50 - SP1E,SP2E, SP3E and SP4E
MOST150 oPhy Automotive Physical Layer Sub-Specification	Rev1.1	MOST150-SP1, SP2,SP3 and SP4
MOST150 oPhy Compliance Measurement Guideline	Rev1.1	MOST150-SP1, SP2,SP3 and SP4

In the subsequent sections, step-by-step procedures are described to help you perform MOST measurements. Each measurement is described as a Method of Implementation (MOI).

For the latest version of this document and the latest MOST Setup Library refer to www.tek.com/software, (keyword 'MOST Essentials').

For further details on MOST test specifications and compliance testing requirements, you can refer to specification documents available on MOST Cooperation website.

2. MOST Physical Layer - Transmitter Specifications

2.1 MOST Essentials Setup Library

IMPORTANT: Each Setup file is defined embedding the absolute file paths of the Filter, Masks and Limit files used for the respective tests. All Setup files must be in the proper file path locations for correct operation.

The MOST Setup Library consists of the following software file types.

MOST50 and MOST150 Setup Files

Setup File Library File Path: C:\TekApplications\DPOJET\Setups\MOST

Description: The MOST folder contains setup files for MOST50 and MOST150 standards. According to the test points (SP1E, SP2E, SP3E, SP4E for MOST50 and SP1, SP2, SP3, SP4 for MOST150) setup files are created. Refer to Table 1 of this document for further description.

Saved Setups have been created by using the Save > Setup function of the supported oscilloscopes. If any changes are made to the Setup file it is recommended you re-save the modified setup file as a different name so not to change the parameters in the factory default distribution files.

MOST50 and MOST150 Filters

Filter Library File Path: C:\TekApplications\DPOJET\Filters\MOST

Description: The MOST Math Arbitrary Filters library provides a pre-defined filter for MOST50 SP1E test point.

MOST50 and MOST150 Waveform Masks

Mask Library File Path: C:\TekApplications\DPOJET\Masks\MOST

Description: The MOST Mask library contains the waveform mask files used by various MOST 50 and MOST 150 setup files. Waveform masks are used to perform Pass/Fail eye diagram template testing on the waveform. Refer to Section 3.5 for a full listing and description of the masks available in the distribution.

MOST150 Limits Files

Limit Library File Path: C:\TekApplications\DPOJET\Limits\MOST

Description: The MOST Limits library contains the measurement limit files used by the various MOST 150 setup files. Measurement limits are used to provide Pass/Fail indication for each measurement.

MOST50 specification does not define limits, so limit files are not available in Option MOST.

2.2 Transmitter Specifications

Test Point Definitions:

MOST50

SP1E: Electrical test point at the MOST50 transmitter

SP2E: Electrical test point after the signal is passed through a filtering component

SP3E: Electrical test point at the Receiver end

SP4E: Electrical test point after the signal is passed through a filtering component

All above MOST50 electrical test points are probed using a Tektronix P6248 Differential probe.

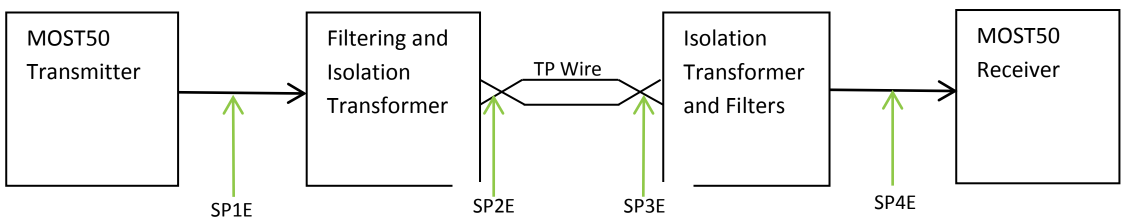

Figure 1: Location of MOST50 Specification Points

MOST150

SP1: Electrical test point at the MOST150 transmitter

SP2: Optical test point after the signal passes through the Fiber Optic Transmitter

SP3: Optical test point on the other side of the Optical Pigtail

SP4: Electrical Point after the signal passes through the Fiber Optic Receiver

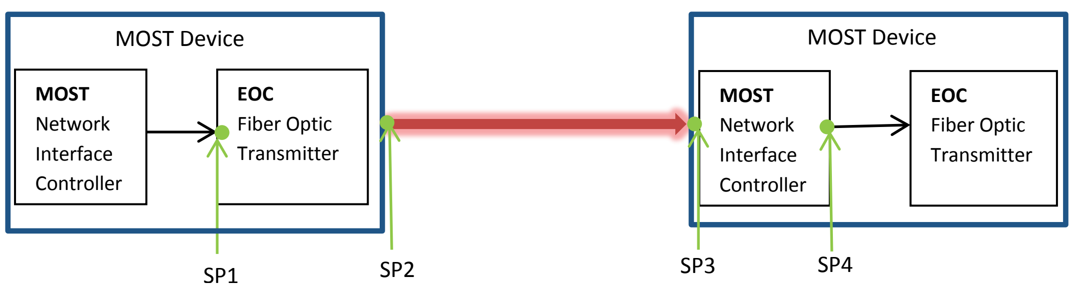

Figure 2: Location of MOST150 Specification Points

SP1 and SP2 are probed using a Tektronix P6248 Differential probe.

SP3 and SP4 electrical test points above are probed using a Graviton O/E Probe with optical 80/20 POF 1mm Splitter. More details of Graviton probe are available at:

http://www.graviton.co.jp/english/products/optical/oe_products/spd-2/spd-2_e.html

The following table describes the setup file names, supported MOST test names, corresponding DPOJET base measurements and test limits as defined at each test point in the Specification.

Option MOST-Setup file Name or Test Point on DUT	MOST Specification – Reference Section	MOST Specification - Symbol(s)	MOST Specification – Parameter/Test name	Option MOST – DPOJET Base Measurement Method	Option MOST - Measurements Methodology in brief	Option MOST – Additional methodology details in this document
MOST50-SP1E	Table 2.1	Clock Recovery			1st Order PLL Loop BW:125 KHz Bit Rate:98.3Mb/s	
	Table 2.2		Transferred Jitter	TIE		Section 4.6
	Section 3.1.1.1		Transmission Quality	Unit Interval		
				Bit Rate		
				Rise Time		
				Fall Time		
				High		
				Low		
				DDJ		
				TJ@BER		
	Table 3.1		Eye-Mask	Mask Hits		
MOST50-SP2E	Table 2.1	Clock Recovery			1st Order PLL Loop BW:125 KHz Bit Rate:98.3Mb/s	
	Table 2.2		Transferred Jitter	TIE		Section 4.6
	Section 3.1.2.1		Transmission Quality	Unit Interval		
				Bit Rate		
				Rise Time		
				Fall Time		
				High		
				Low		
				DDJ		
				TJ@BER		
	Table 3.2		Eye-Mask	Mask Hits		

MOST50-SP3E	Table 2.1	Clock Recovery			1st Order PLL Loop BW:125 KHz Bit Rate:98.3Mb/s	
	Table 2.2		Transferred Jitter	TIE		Section 4.6
			Transmission Quality	Unit Interval		
				Bit Rate		
				Rise Time		
				Fall Time		
				High		
				Low		
				DDJ		
				TJ@BER		
	Table 3.3		Eye-Mask	Mask Hits		
MOST50-SP4E	Table 2.1	Clock Recovery			1st Order PLL Loop BW:125 KHz Bit Rate:98.3Mb/s	
	Table 2.2		Transferred Jitter	TIE		Section 4.6
			Transmission Quality	Unit Interval		
				Bit Rate		
				Rise Time		
				Fall Time		
				High		
				Low		
				DDJ		
				TJ@BER		
	Table 3.4		Eye-Mask	Mask Hits		
MOST150-SP1	Table 5.1	Clock Recovery			1st Order PLL Loop BW:125 KHz Bit Rate:294.91Mb/s	
	Table 5.2	Jtr1	Transferred Jitter	TIE	50 ps RMS(Max)	Section 4.6
	Table 6.1	A_1 to H_1	Eye-Mask	Mask Hits		
				Unit Interval		
				Bit Rate		
				Rise Time		

				Fall Time		
MOST150-SP2	Table 5.1	Clock Recovery			1st Order PLL Loop BW:125 KHz Bit Rate:294.91Mb/s	
	Table 6.2	Jtr2	Transferred Jitter	TIE	112ps RMS(Max)	Section 4.6
		t_{tr2}	Transition Times	Rise Time	1.699ns(Max)	
				Fall Time	1.699ns(Max)	
		r_{e2}	Extinction ratio	Extinction Ratio	10dB(Min)	Section 4.4
		A_2 to H_2	Eye-Mask	Mask Hits		
			Alignment Jitter	TIE		Section 4.5
				Width@BER		
				Unit Interval		
				Bit Rate		
				High		
				Low		
				Tj@BER		
				DDJ		
	Section 3.5	b0	Low Ref	B0 Ref		Section 4.3
		b1	High Ref	B1 Ref		Section 4.3
	Table 6.3		Overshoot	Overshoot	Separate exe for this measurement	Section 4.7
	Table 6.4		Undershoot	Undershoot	Separate exe for this measurement	Section 4.7
MOST150-SP2_Atten	Table 5.1	Clock Recovery			1st Order PLL Loop BW:125 KHz Bit Rate:294.91Mb/s	
	Table 6.2	Jtr2	Transferred Jitter	TIE	112ps RMS(Max)	Section 4.6
		t_{tr2}	Transition Times	Rise Time	1.699ns(Max)	
				Fall Time	1.699ns(Max)	
		r_{e2}	Extinction ratio	Extinction Ratio	10dB(Min)	Section 4.4
		A_2 to H_2	Eye-Mask	Mask Hits		

			Alignment Jitter	TIE		Section 4.5
				Width@BER		
				Unit Interval		
				Bit Rate		
				High		
				Low		
				Tj@BER		
				DDJ		
	Section 3.5	b0	Low Ref	B0 Ref		Section 4.3
		b1	High Ref	B1 Ref		Section 4.3
	Table 6.3		Overshoot	Overshoot	Separate exe for this measurement	Section 4.7
	Table 6.4		Undershoot	Undershoot	Separate exe for this measurement	Section 4.7
MOST150-TransJitter			Transferred Jitter	TIE	112ps RMS(Max)	Section 4.6
MOST150-SP3			Transferred Jitter	TIE		Section 4.6
				Unit Interval		
				Bit Rate		
				Rise Time		
				Fall Time		
				TJ@BER		
MOST150-SP4	Table 5.1	Clock Recovery			1st Order PLL Loop BW:125 KHz Bit Rate:294.91Mb/s	
	Table 6.7		Transferred Jitter	TIE	230 ps RMS(Max)	Section 4.6
		A_4 to H_4	Eye Mask	Mask Hits		
				Unit Interval		
				Bit Rate		
				Rise Time		
				Fall Time		
	Table 8.1	A_{4T} to H_{4T}	Receiver Tolerance	Mask Hits Rx Tolerance		

Table 1: List of measurements supported in Option MOST Essentials

3. Preparing to Take Measurements

3.1 Required Equipment

The following equipment is required to take the measurements:

- Oscilloscope: Tektronix MSO/DPO5000, DPO7000C, MSO/DPO/DSA70000C/D Oscilloscope.
- Oscilloscope firmware: TekScope firmware version 6.4.0 or later.
- Application Framework: Option DJA: DPOJET Advanced Jitter and Eye Analysis Tool application version 3.6.0 build 25 or later.
- Application Software: Option MOST Essentials – Electrical Compliance and Debug Test Solution for MOST-50 and MOST-150.
- Electrical Probes – P6248 Differential probe (1 ea).
- O/E Probe – Graviton O/E-Probe with Optical 80/20 POF 1mm Splitter (1 ea.). More details, http://www.graviton.co.jp/english/products/optical/oe_products/spd-2/spd-2_e.html
- No Test Fixtures are required.

3.2 Initial Oscilloscope Setup

After connecting the DUT by the proper probing configuration for the test, press the DEFAULT SETUP button on the oscilloscope front panel, and turn on Ch1 on oscilloscope to view the incoming signal on the oscilloscope screen.

Figures 3-6 below detail the connections at the various MOST50 test points

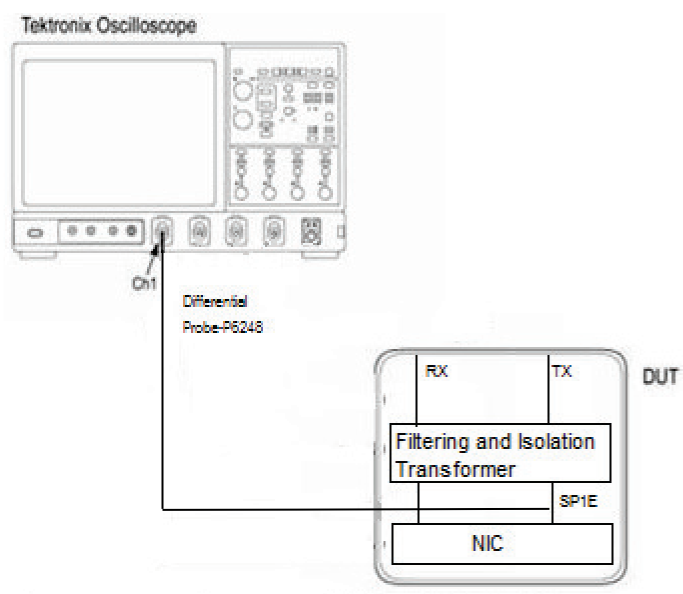

Figure 3: Schematic Diagram for MOST50-SP1E

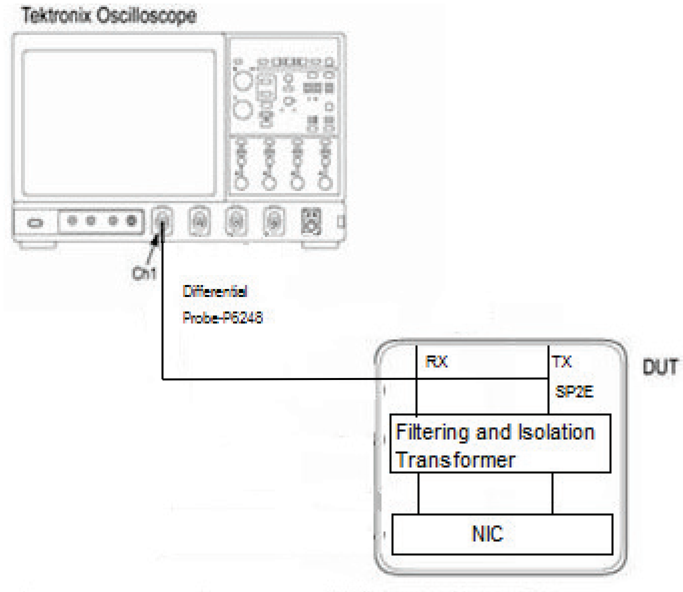

Figure 4: Schematic Diagram for MOST50-SP2E

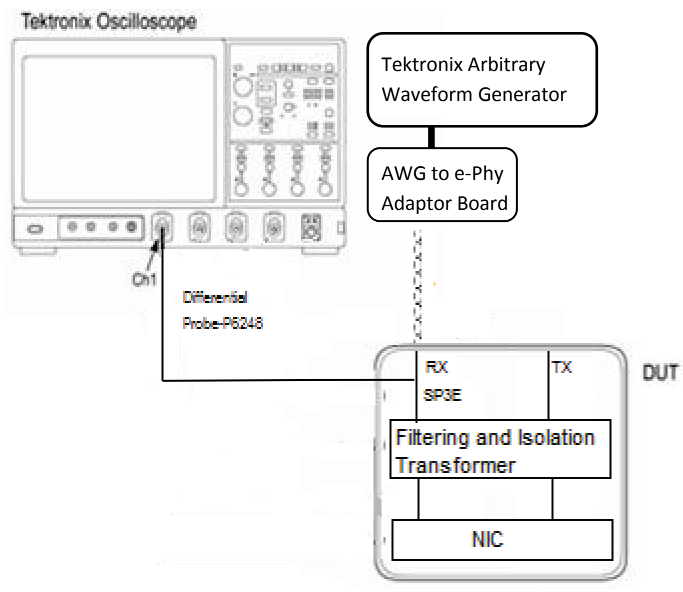

Figure 5: Schematic Diagram for MOST50-SP3E

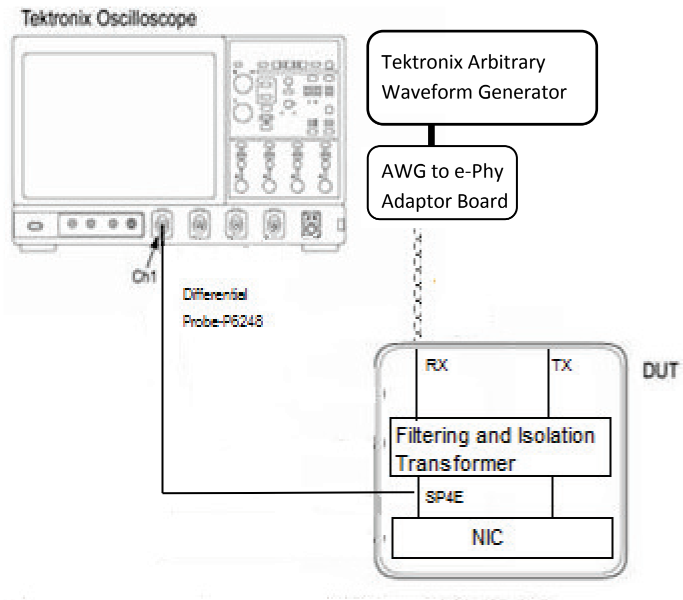

Figure 6: Schematic Diagram for MOST50-SP4E

Figures 7-10 below detail the connections at the various MOST150 test points

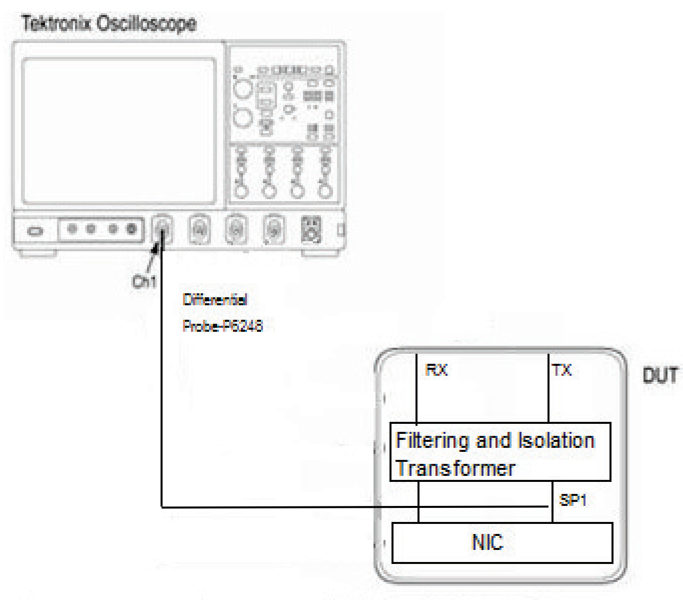

Figure 7: Schematic Diagram for MOST150-SP1

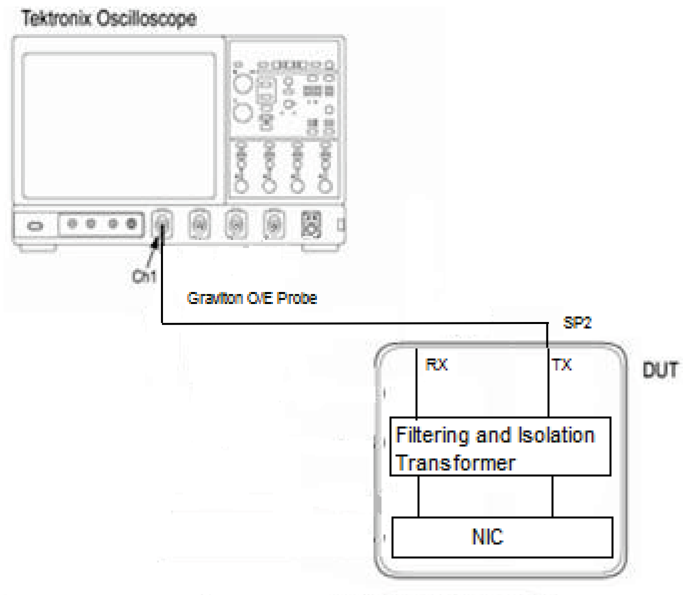

Figure 8: Schematic Diagram for MOST150-SP2

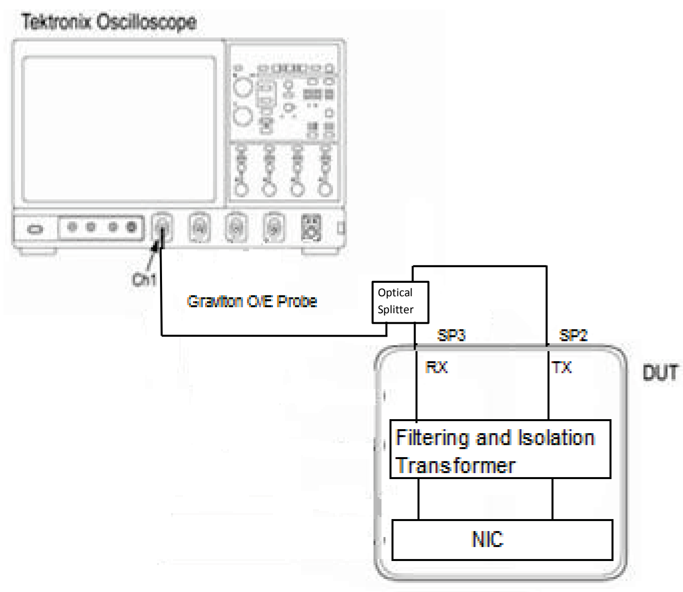

Figure 9: Schematic Diagram for MOST150-SP3 (Informative Tests Only)

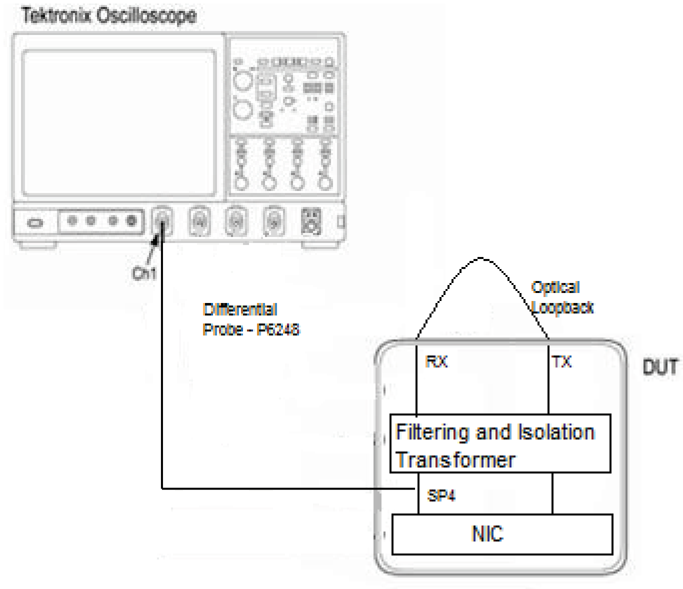

Figure 10: Schematic Diagram for MOST150-SP4

3.3 Installation

Ensure the following software is installed before installing the Option MOST Essentials application

- TekScope firmware version 6.4.0 or later on a Win7 oscilloscope.
- Tektronix Option DJA DPOJET Advanced Jitter and Eye Diagram tool Version 3.6.0.25 or later.

For installation, click on the setup.exe present in the Option MOST installer distribution. After installation, launch TekScope and the MOST Essentials package is ready to use.

3.4 Accessing the DPOJET MOST Essentials Measurement Menu

On the oscilloscope TekScope menu, go to Analyze > MOST Essentials, and click on it to invoke the MOST setup library in DPOJET standards tab.

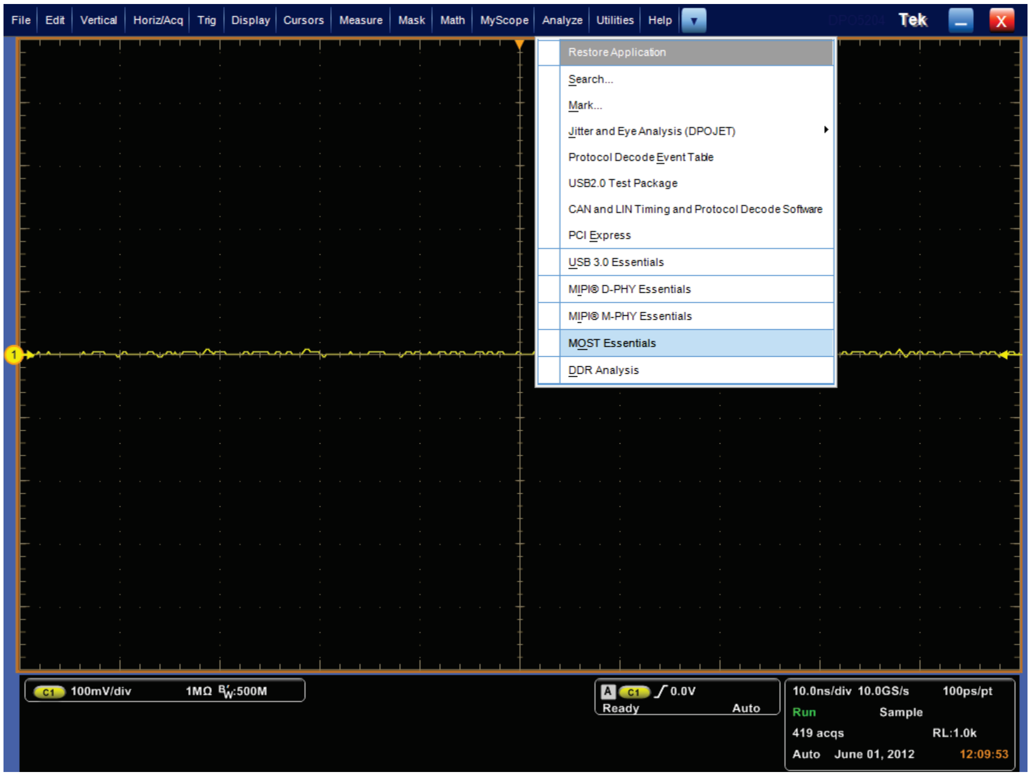

Figure 11: shows the oscilloscope Tekscope Analyze with MOST Essentials

3.5 Configuring the Software to take various measurements

Selecting Measurements

In the DPOJET standards tab MOST menu, select the desired measurements or load pre-defined set files by clicking the Test point > Setup button. You select either a single measurement or recall a setup file to run multiple measurements at a time. Recalling a pre-defined setup file will load all the required setup configurations for each test/measurements supported for the setup file.

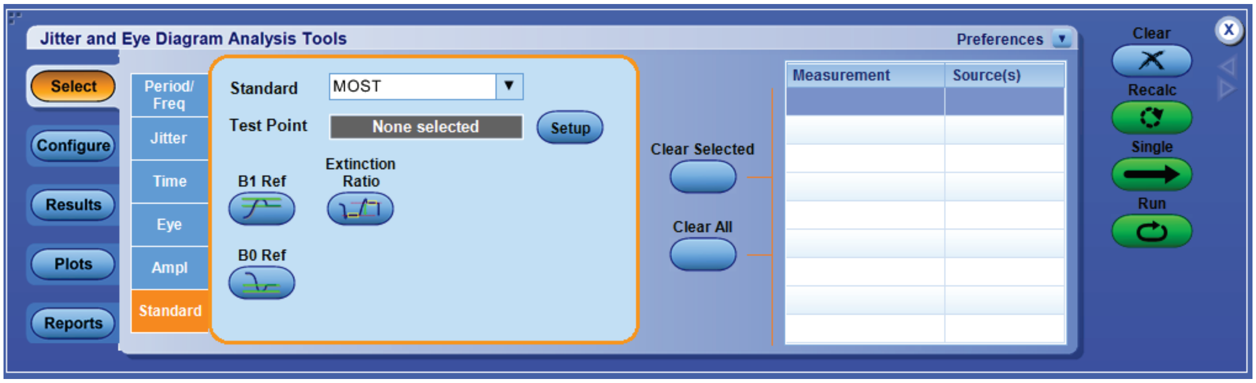

Figure 12: MOST Standard option in DPOJET standard menu

Selecting Limit Files

If a measurement has a pass/fail limit associated with it in the test point file, go to Analyze > Jitter and Eye Analysis > Limits to select the limit file from the folder where the limit files are saved. Measurements with pass/fail limits will show up in the Results Summary panel when the compliance test is run.

Configure Mask file:

1. In the DPOJET application go to 'Plots' if you want to enable the Mask file.
2. Select measurement from the measurement column.
3. Click 'Configure' to change the default setup for that measurement. The mask selection window opens as shown:
4. In the Mask file selection window, press the 'Off' button first and then click 'Browse' to select the Mask file.

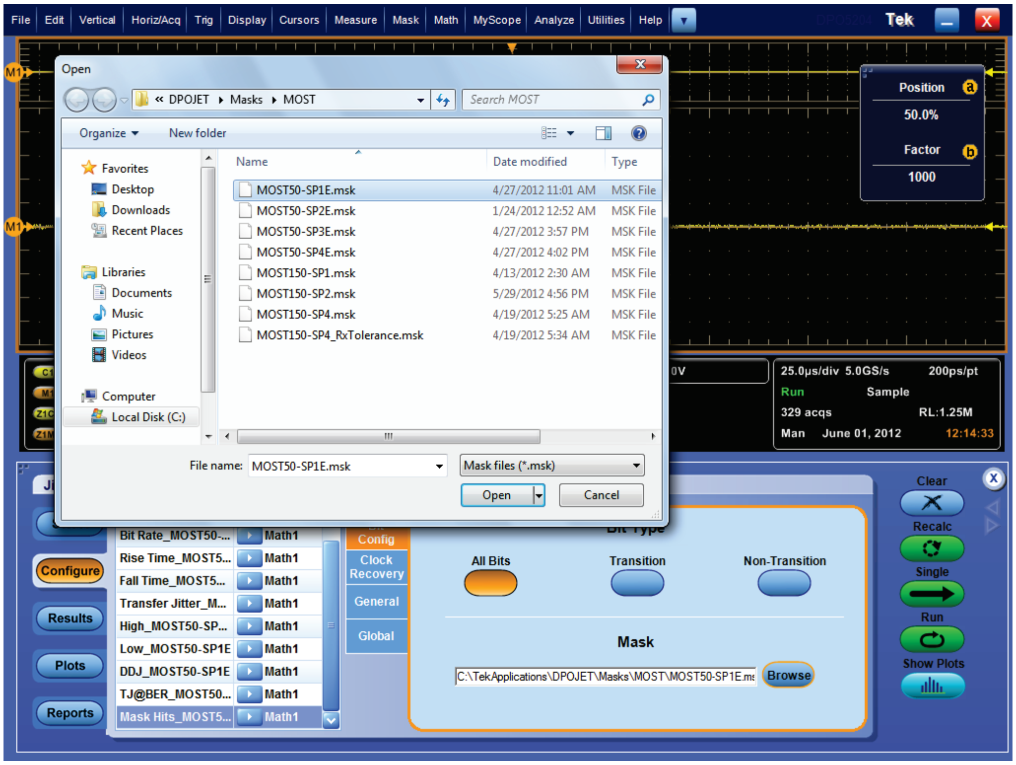

Figure 13: Selecting a Mask File

5. Select the relevant mask file (For example, MOST50-SP1.msk) and click ‘Open’.
6. Enable the file by selecting the ‘On’ button, and click OK.

Configuring Source of Waveforms

Source selections are dependent on which probe type is selected. The selection options are:

- Live/Ref/Math source selection (uses single differential signal as data source)
- Live channel selections–Ch1, Ch2, Ch3, Ch4
- Reference waveform selections–Ref1, Ref2, Ref3, Ref4

Configure Clock Recovery

In the Configure menu, select Clock Recovery and select the type of clock recovery to be used.

From the Figure 2.2 in *MOST Electrical Physical Layer Specification Rev 1.1* and Figure 5.1 in *MOST150 oPHY Automotive Physical Layer Sub-Specification Rev. 1.1*, Clock recovery configuration is given below. This configuration is used for the Transition Times (rise and fall), Alignment Jitter and Eye Mask measurements.

1. Select **Method >PLL-Custom Bandwidth**.
2. Select PLL **Model > Type I**
3. Select **Bandwidth 125 kHz**. Select Advanced button and configure **Bit Rate to 98.3Mb/s for MOST50 and 294.91Mb/s for MOST150.**

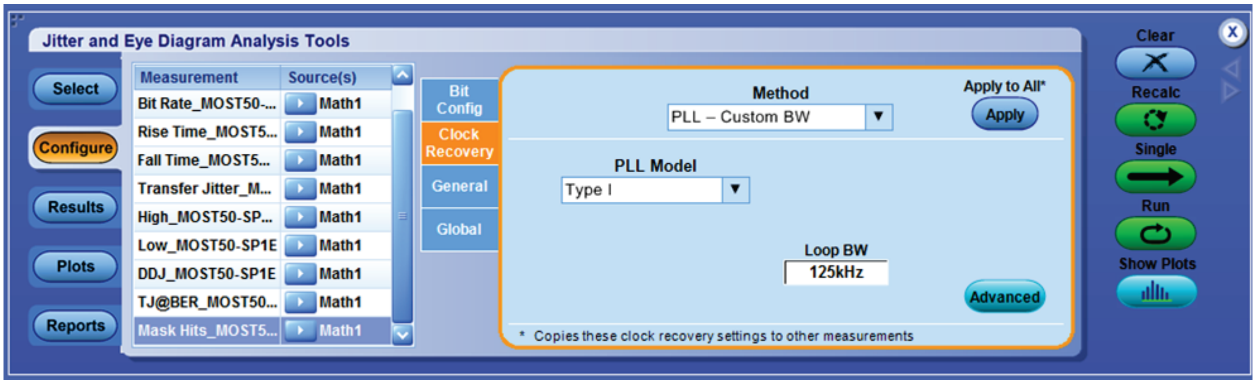

Figure 14: Clock recovery settings for Option MOST

For Transfer Jitter measurement, the clock recovery is set differently as follows:

1. Select **Method >Constant Clock-Mean.**
2. Select **Bandwidth 125 kHz**. Select Advanced button and configure **Bit Rate to 98.3Mb/s for MOST50 and 294.91Mb/s for MOST150.**
3. In the Filter tab, select Low Pass Filter Spec > 1st Order.
4. Set Frequency > 200 kHz.
5. If more than one measurement is selected at a time, then click Apply to All buttons.

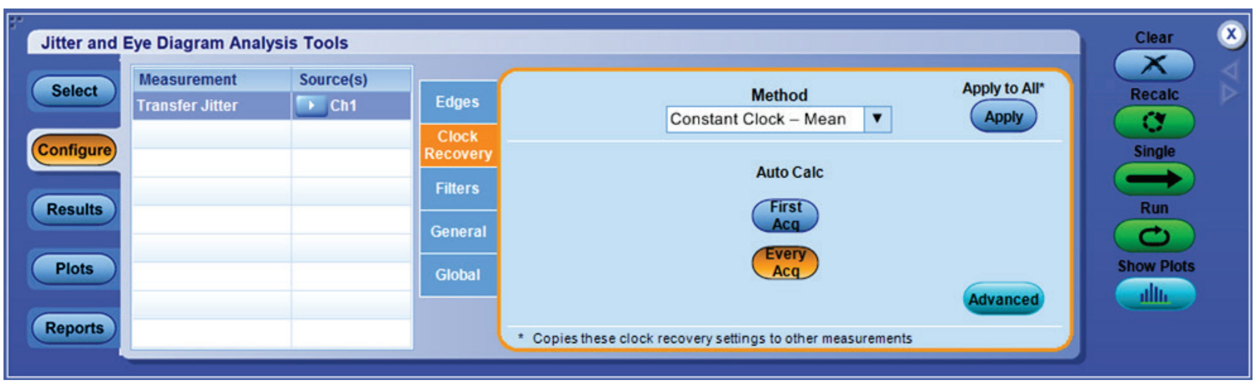

Figure 15: Clock recovery settings for Transfer Jitter DPOJET

Source and Reference Level Autoset

Following steps are applicable only if you have modified any of the “MOST150-SP2” setup files. However, these steps are not required if you are using the pre-defined factory default setup files distributed with the Option MOST installer without any modifications.

Step1:

1. Select the **'Source Configuration'** window
2. Select **'Advanced'** under **'Reference Levels'**
3. Select **20%-80%**
4. Select **MOST Standard** as the **‘Base top method’**

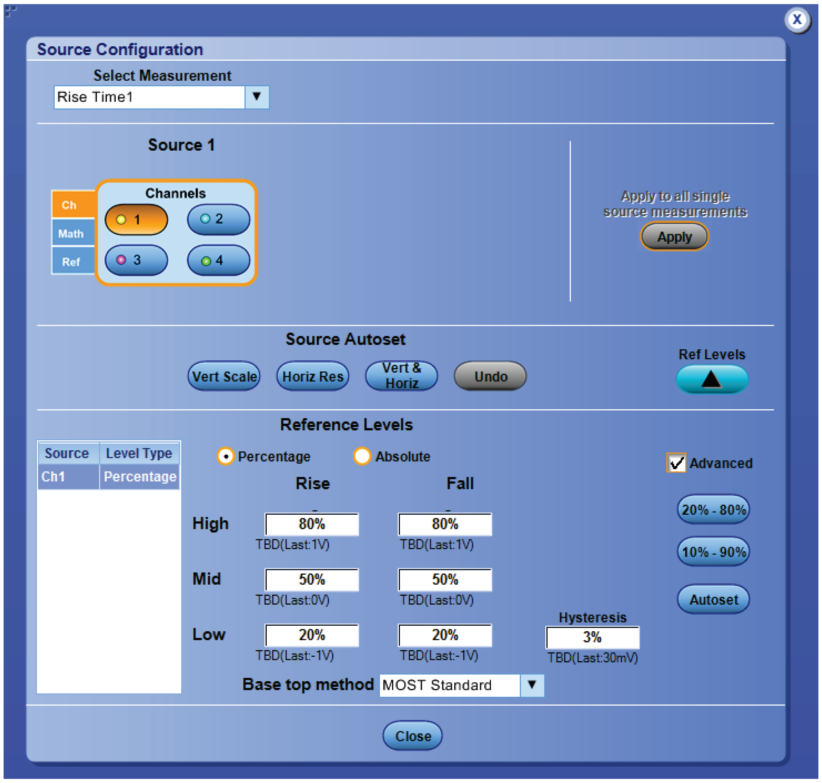

Figure 16: Reference Levels Autoset required for MOST150-SP2, if pre-defined setup files are modified.

5. Press 'Autoset' under 'Reference Levels Source Configuration'

Step2: Horizontal Setup

6. Now go to the 'Horiz/Acq'-> 'Horizontal /Acquisition Setup' and Change the 'Record Length' to the required value.

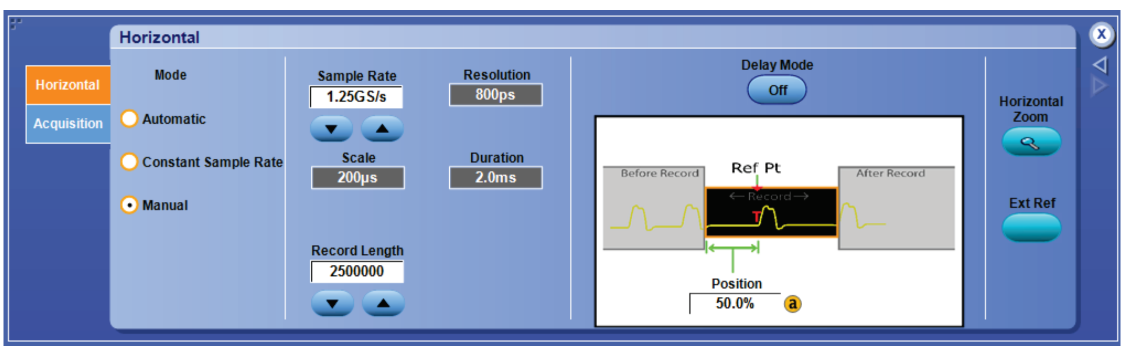

Figure 17: Horizontal/Acquisition Setup

For all the MOST 50 test points 1.25M record length (at 1.25GS/s sample rate) is required to meet the specification. MOST50-SP1 needs 1.25M Record length (at 5GS/s sample rate).

For all the MOST 150 test points 2.5M record length (at 10GS/s sample rate) is required to meet the specification.

4. MOST Test Procedure

This section provides the Methods of Implementation (MOIs) for Transmitter tests using Tektronix real-time oscilloscope, probes, and Option MOST software on DPOJET.

4.1 Step-by-Step MOST50 testing

The following procedure describes how to use Option MOST to test the MOST50 test points.

Initializing Scope Setup

1. Configure the DUT to transmit the MOST50 signal.
2. Connect differential probe to **Ch1.**
3. Press the **DEFAULT SETUP** button on oscilloscope front panel.
4. Turn on **Ch1** to view the incoming signal from the DUT.
5. Confirm that the desired signal is transmitted from the DUT.

Recalling the Setup file

6. Start DPOJET Application. Go to Analyze> MOST Essentials.

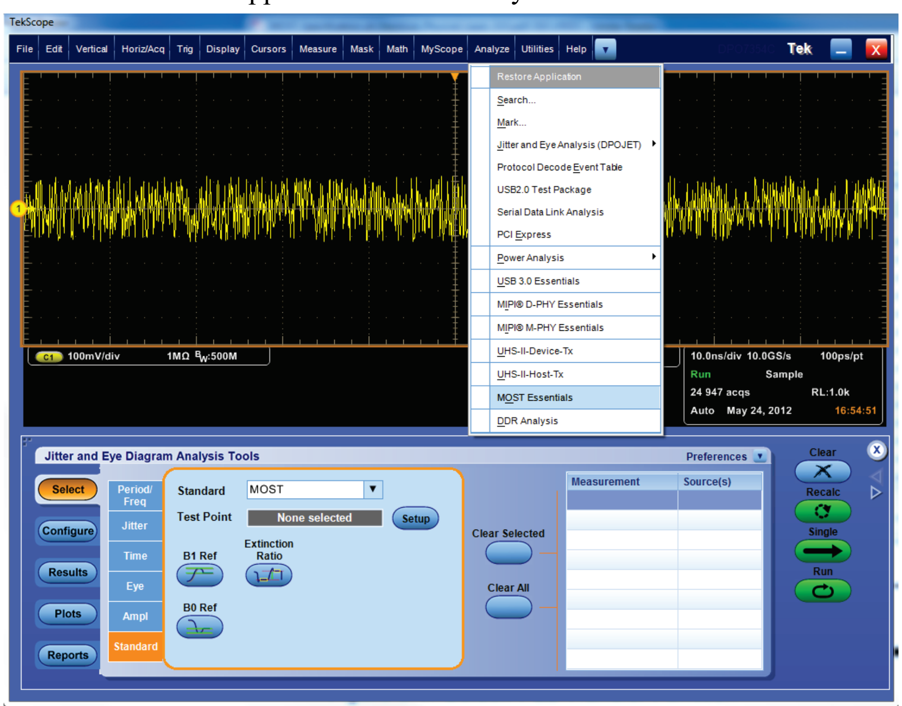

Figure 18: Selecting DPOJET

7. From the test point, click setup and recall the setup from MOST setup library.

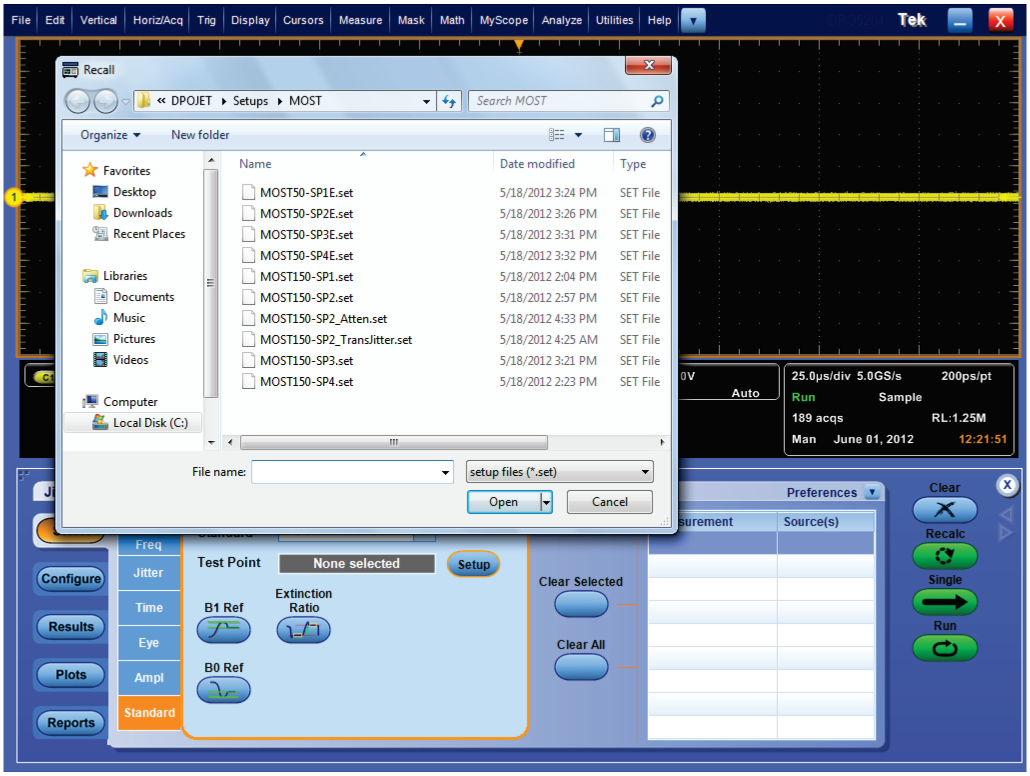

Figure 19: Recalling Setup File

8. Select the appropriate setup file from the MOST setups folder. Example: Select MOST50-SP1E.set to test for Compliance at MOST 50 SP1 of the specification.
9. Select ‘Recall’ and open the setup file.
10. MOST50-SP1E is configured for Math1. A filter MOST50-SP1.flt is applied to the acquired signal.

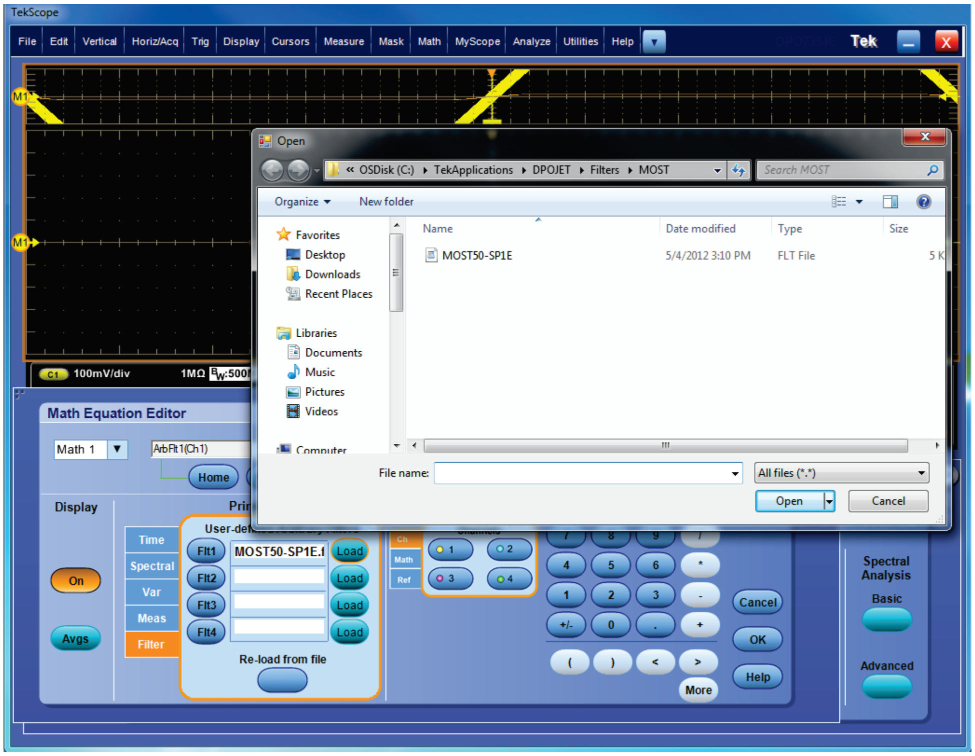

Figure 20: Filter applied on MATH1

11. Continue the remaining test setup files for other test points on the DUT. The remaining MOST50 setup files do not required filtering and are configured for Ch1.

Running the MOST50 setup files

12. After configuring the Acquisition Channel, return to Analyze>Jitter and Eye Analysis>Select.
13. Select ‘Single’ to run the setup.
14. After running the application, the results are shown:

Figure 21: Results

Saving the Test Report:

15. Select the Reports button in the DPOJET menu.
16. Press the 'Save As' button and enter the report name.
17. The Report is as shown:

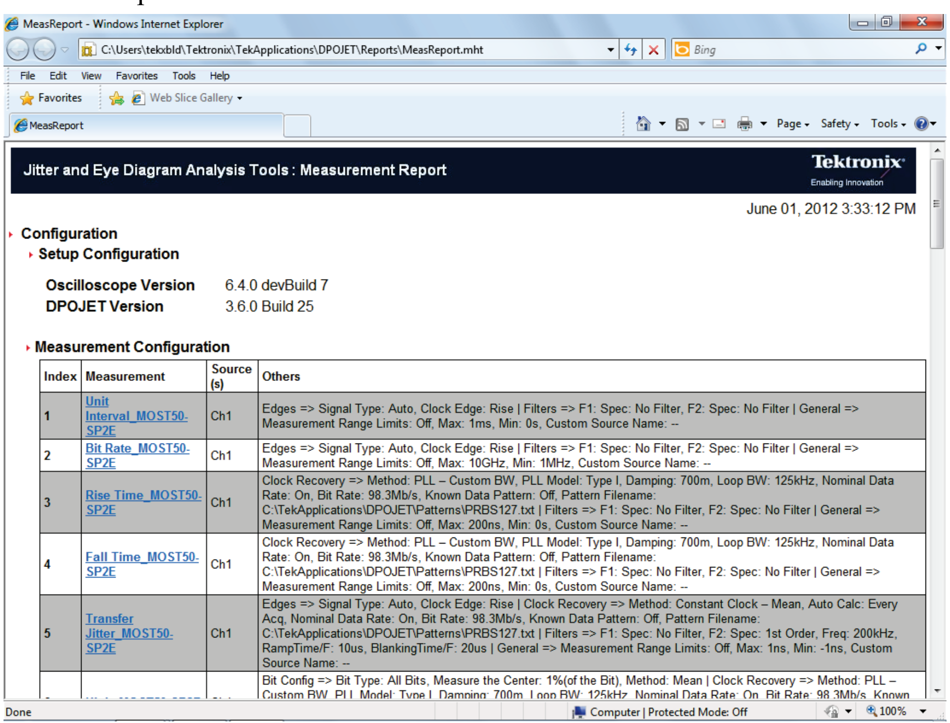

Figure 22: Test Report Giving Pass/Fail Status

4.2 Step-by-Step MOST150 testing

The following procedure discusses how to use Option MOST to test the MOST150 test points. Differences in the procedure for testing the test points are discussed but not in detail.

Running MOST150SP2 setup file

1. For MOST150-SP2 tests, execute the **MOST OS and US measurement.exe** to perform MOST150 Overshoot and Undershoot measurements at SP2 test point. The executable file is located at C:\Program Files\TekApplications\MOST file path, and a shortcut is made available on the desktop for this location.
2. Before launching the executable, ensure that the TekScope is running. Acquire the signal and ensure that it fits at least 4-6 divisions in the scope graticule. Click the **MOST OS and US Measurement.exe.**
3. Click on Run. (If required to save reports in a different path, modify the file path before clicking Run).

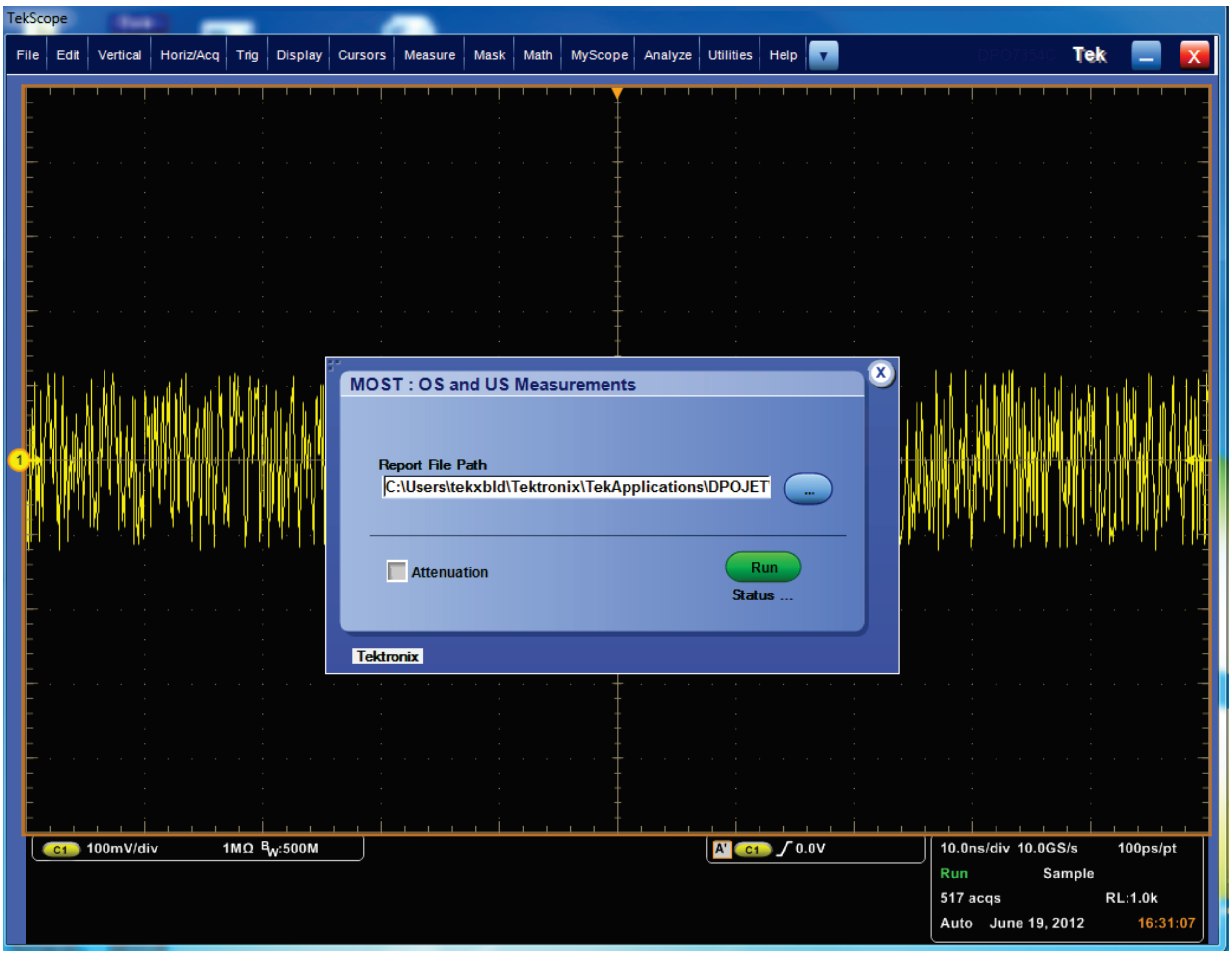

Figure 23: MOST150-SP2 OS and US measurement

4. The button toggles to Stop and the analysis begins. The application can be stopped anytime during the analysis.

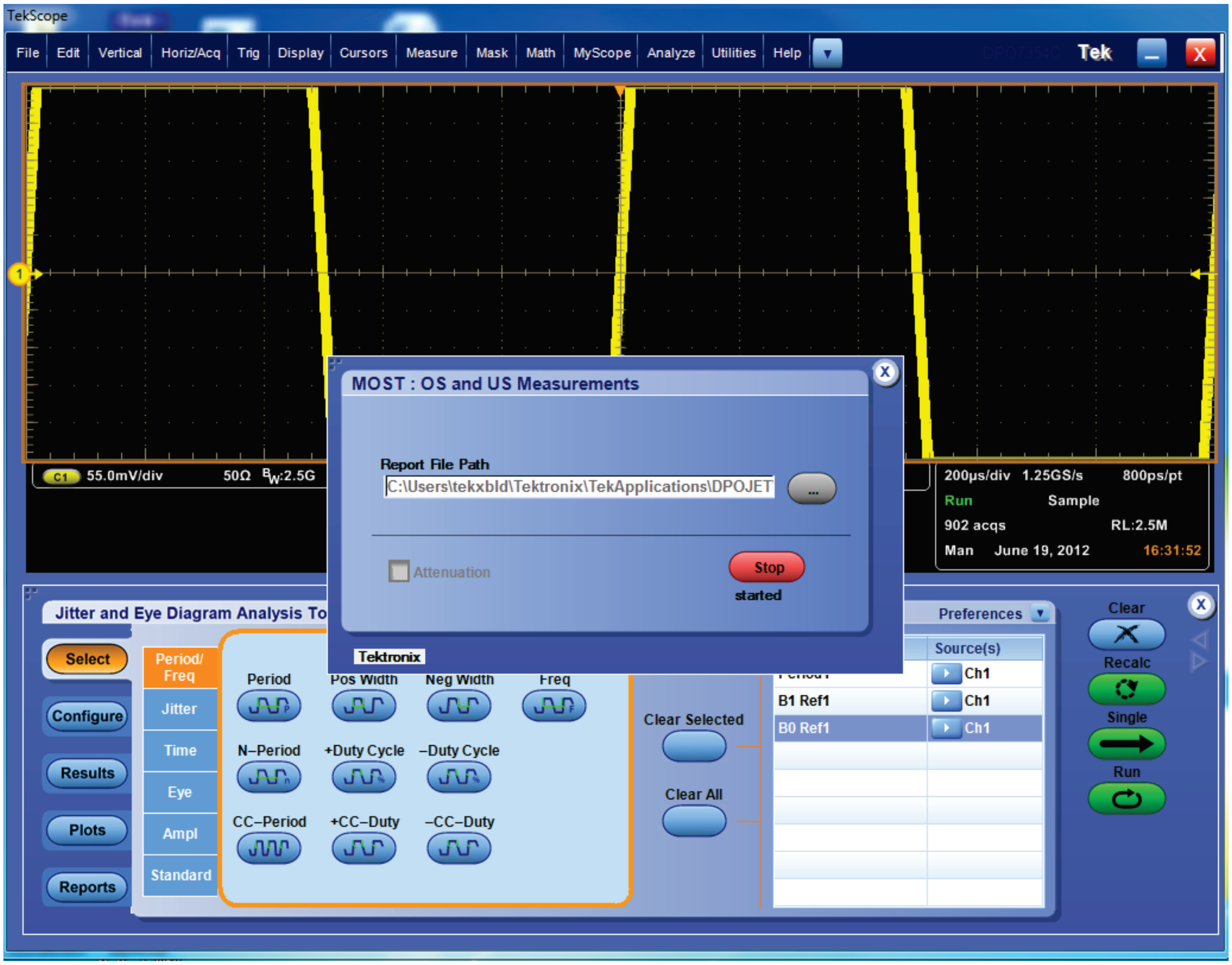

Figure 24: MOST150-SP2 OS and US analysis after clicking Run

5. A report is generated at the end of the analysis. It is located at: C:\Users\tekxbld\Tektronix\TekApplication\DPOJET\Reports\OS_US.mht. The report can be saved at any other desired location.

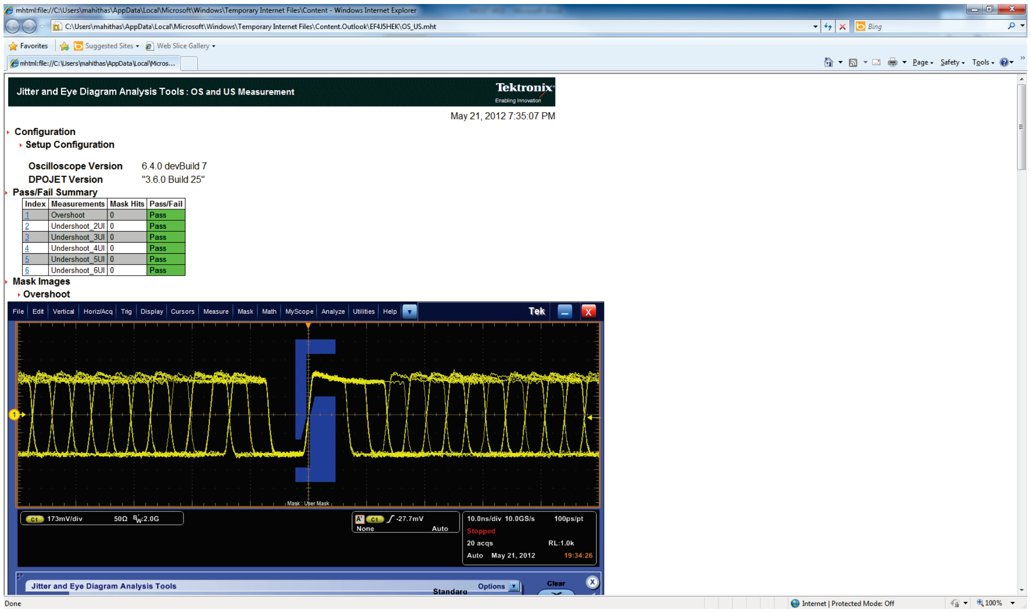

Figure 25: Report for Overshoot and Undershoot measurement.

6. After the Overshoot and Undershoot measurements are completed, click on Autoset and acquire the signal. Ensure that it fits at least 4-6 divisions in the scope graticule.
7. For continuation of other tests, load the MOST150-SP2.set (for signals greater than 100mV amplitude) and MOST150-SP2_Atten.set (for signals less than 100mV amplitude) setup file appropriately through DPOJET standards tab MOST selection.
8. After loading the setup file, click on Single.
9. Results will be populated after the analysis is complete.

Note: A separate setup file is created for Transfer Jitter measurement at MOST150 SP2 test point. The Record Length is set to 100M. But record length may vary depending on the oscilloscope used. Some models do not support such a high record length, and in such cases the record length will be set to the maximum possible. Load MOST150-Sp2_TransJitter.set to measure Transfer Jitter at SP2.

5. Measurement Methodologies

MOST150- High Ref and Low Ref Measurement(B0 and B1)

Definition:

The b1 (i.e. MOST150 High Ref) level is measured during a high 5 or 6 UI pulse while the b0 (i.e. MOST150 Low Ref) level is measured during a low 5 or 6 UI pulse. The transient regions are the areas of the pulse where the signal is not settled enough to yield a repeatable measurement for b1 or b0. The b1 and b0 values are the statistical mean of the high and low signal amplitude respectively during the interval defined in Figure 3.

Measurement Region	Value	Unit
t_{OSLS}	2.5	UI
t_{OSLE}	4.0	UI

Figure 18: Optical Signal Level measurement Interval

Pseudo code of "MOST150 High Ref" and "MOST150 Low Ref" measurement is given below:

Pre-requisites:

The "Signal Type" and "Clock Edge" model parameters should be set to "Auto" and "Rise" respectively in a measurement. These parameters are used by Clock recovery module.
For MOST technology, perform clock recovery using PLL filter given in Figure 3.8 in the MOST150_oPhy_Measurement Guideline 1V1 spec.

In DPOJET, the above PLL clock recovery can be obtained by doing configurations in clock recovery.
Refer Section 5.1 of MOST150_oPhy_Sub_Spec_1V1 spec

Algorithm:
Acquire MOST 150 differential waveform.
Obtain clock recovered bits.
Ignore the clock recovered bits that fall under blanking time.
In "B1" measurement, collect all sample values that fall under 2.5UI to 4.5UI of high bits.
In "B0" measurement, collect all sample values that fall under 2.5UI to 4.5UI of Low bits.

MOST150 - Extinction Ratio

Definition:

Extinction Ratio re2 is calculated based on the measured optical levels for b1 and b0 as described in Section 4.2.1.2 of the spec by using a high precision DC coupled O/E-converter.

Extinction Ratio is calculated using the following equation.

$r_{e2} = 10 .\log(b1/b0)$

Where,
b1 = OpticalHighLevel
b0 = OpticalLowLevel

Pseudo code of "Extinction ratio" measurement is given below:

Pre-requisites:

The "Signal Type" and "Clock Edge" model parameters should be set to "Auto" and "Rise" respectively in a measurement. These parameters are used by Clock recovery module.
For MOST technology, perform clock recovery using PLL filter given in Figure 3.8 in the MOST150_oPhy_Measurement Guideline 1V1 spec.

In DPOJET, the above PLL clock recovery can be obtained by doing configurations in clock recovery. Refer Section 5.1 of MOST150_oPhy_Sub_Spec_1V1 spec

Algorithm:
Acquire MOST 150 differential waveform.
Obtain clock recovered bits.
Ignore the clock recovered bits that fall under blanking time.
Compute b0 and b1 values using "B0" and "B1" measurements
Compute Extinction Ratio using the given equation.

MOST150 - Alignment Jitter

Definition:
Alignment Jitter is the phase deviation between any edge of the waveform and the correlating transition of the recovered UI-clock. Calculating the misalignment between clock and data for each data transition and drawing the successive phase deviations over run-time in a graph result in an "AJ-Track" which is the base for further evaluations.

Specification followed:
MOST150_oPhy_Measurement_Guideline 1V1[1].pdf
Page 25 to 29. Section 4.1 and 4.2

Signal Type:
MOST signal where the clock is embedded on the data. The rise transition of data is considered for the clock recovery. Data Rate is 300Mb/s.

Algorithm:
Acquire MOST 150 Data waveform which has embedded clock.
Recover the UI clock from the data only for rising edge of the data.
Apply the Low pass Filter (Golden PLL) on the positive edge of the data stream.
Calculate the misalignment between clock and data.
Plot the Eye Diagram on recovered UI clock only w.r.t. BER 10E-9. PLL is not required to draw the Eye Diagram.

DPOJET procedure:

For the Alignment Jitter calculations use the configuration as follows:
Measurement name: TIE (Peak to Peak)
Edges: Signal Type→ Auto, Clock Edge → Rise
Clock Recovery: Method→ PLL Custom BW, PLL Model → Type I, Loop BW → 125 KHz, Nominal Data Rate → 294.91Mb/s
Filter: No Filter
General: Off
Global: Off

For the Eye Diagram plot:

Measurement name: Width@BER
Edges: Signal Type→ Auto, Clock Edge → Rise
Clock Recovery: Method→ Constant Clock Mean, Nominal Data Rate → 294.91Mb/s
RjDj: Pattern Type→ Repeating(Default), Pattern Length→2UI(Default), Jitter Target BER→ 1E-9
Filter: No Filter
General: Off

Global: Off

MOST150 - Transferred Jitter

Definition:
Jitter is the phase deviation between an edge of the waveform and the correlating transition of the recovered UI-clock. For transferred jitter, only phase variations coming with rising edges of the waveform are relevant, because only these deviations are tracked by the PLL and impact the recovered clock's phase.

Std Dev = $\sqrt{1/N\sum(v_i - mean)^2}$

where i= 1 to N

Specification followed:
MOST150_oPhy_Measurement_Guideline 1V1[1].pdf
Page 30 to 31. Section 4.3

DPOJET procedure:
For the Transferred Jitter calculations use the configuration as follows:
Measurement name: TIE(Standard Deviation)
Edges: Signal Type→ Auto, Clock Edge → Rise
Clock Recovery: Method→ Constant Clock Mean, Nominal Data Rate → 294.91Mb/s
TIE Filter: Low Pass → 1st Order, 200 KHz, Blanking Time →4/F and Ramp Time → 2/F
General: Off
Global: Off

Pre-requisites:
The "Signal Type" and "Clock Edge" model parameters should be set to "Auto" and "Rise" respectively in a measurement. These parameters are used by Clock recovery module.

Algorithm:
Acquire MOST 150 Data waveform which has embedded clock.
Recover the UI clock from the data only for rising edge of the data.
Apply the Low pass Filter (Golden PLL) on the positive edge of the data stream.
On the filtered data, apply Low Pass Filter w.r.t. focused spectral range up to 200 KHz.
Calculate the misalignment between clock and data only on rising edge.
Plot the Eye Diagram on recovered UI clock only. PLL is not required to draw the Eye Diagram.

MOST150 - Overshoot and Undershoot measurement

Definition:
Measurement of the optical overshoot and undershoot is required to ensure proper operation of the optical receiver. The optical pulse shape is tested with a parameterized mask. The mask parameters are based on the measured optical logic levels b0 and b1. Optical transmitting devices must produce an optical signal complying with the defined mask, when driven with a compliant electrical signal.

Mask amplitude parameters are normalized and are calculated based on the measured b1 and b0 levels. Time parameters are specified in units of UI and the origin is defined from the midpoint of the rising or falling edge of the signal, as per the MOST150 oPhy Automotive Physical Layer Sub-Specification spec. The signal must not touch the "Keep Out" areas of the masks.

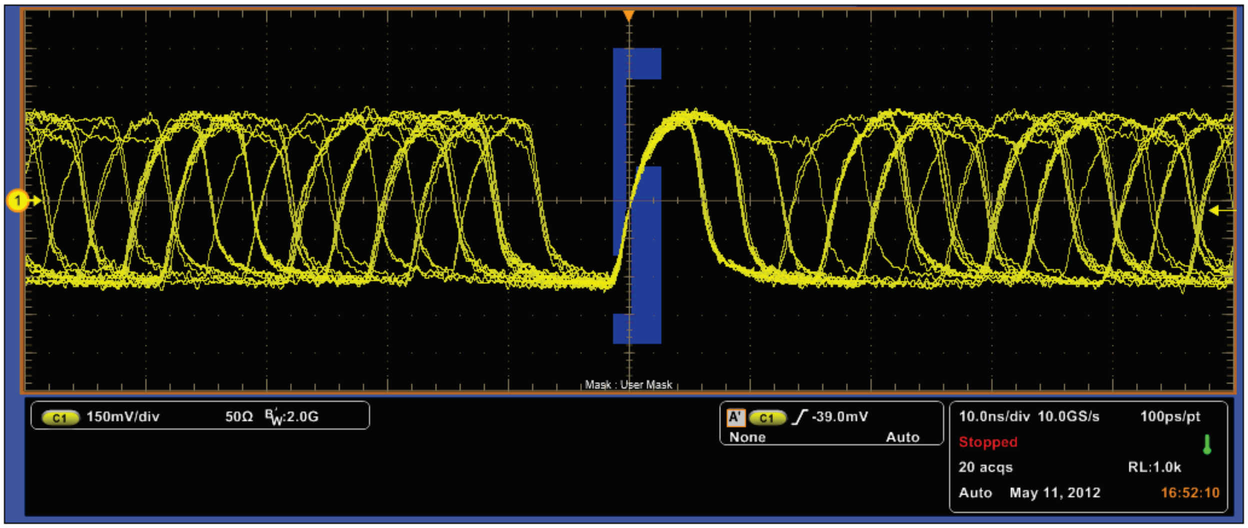

Figure 26: Overshoot mask

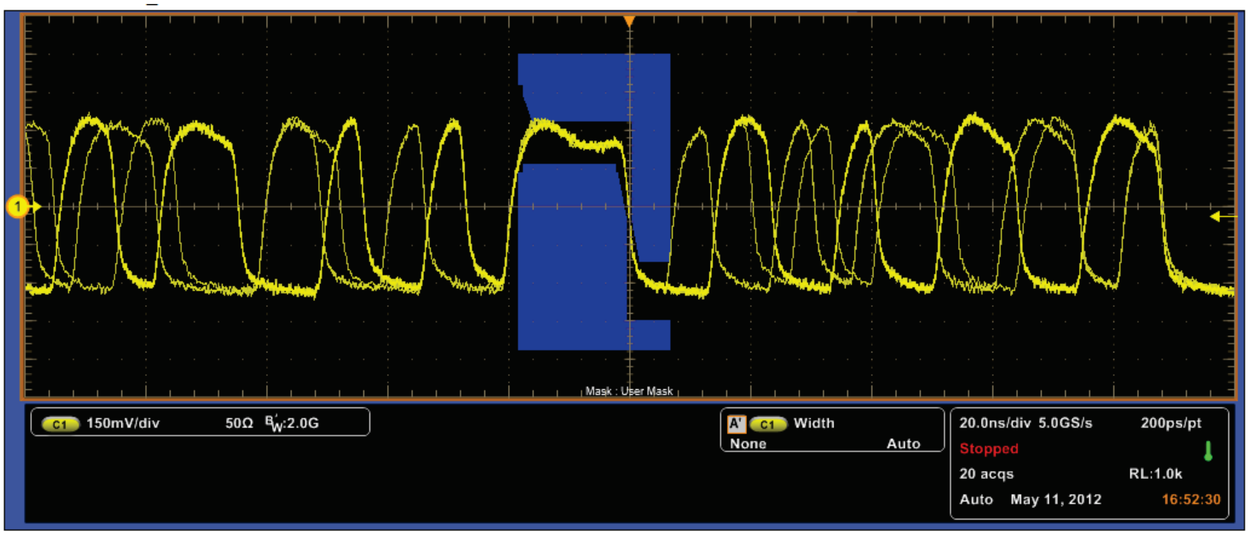

Figure 27: Undershoot mask

MOST50 and MOST150 – Unit Interval

Definition:

The Unit Interval measurement calculates the duration of a Unit Interval.
The application calculates this measurement using the following equation:

$$P_n^{Data} = (T_n^{Data} - T_{n-1}^{Data}) / K_n$$

Where:
P_{Data} is the data period.

T_{Data} is the VRefMid crossing time in either direction.
$K_n = C_n - C_{n-1}$ is the estimated number of unit intervals between two successive edges. C_n is the calculated data bit index of T_n^{Data}.
Each measurement result P_n^{Data} is repeated K_n times in the measurement result vector, so that the measurement population is equal to the number of unit intervals in the qualified waveform, rather than the number of edge pairs.

Pre-requisites:
The "Signal Type" and "Clock Edge" model parameters should be set to "Auto" and "Rise" respectively in the Unit Interval measurement.
These parameters are used by Clock recovery module.

MOST50 and MOST150 – Bit Rate

Definition:
Frequency measurement calculates the inverse of the data period for each cycle.
The application calculates data frequency measurement using the following equation:

$$F_n^{Data} = 1 / P_n^{Data}$$

Where:
F_{Data} is the data frequency.
P_{Data} is the data period measurement.

Pre-requisites:
The "Signal Type" and "Clock Edge" model parameters should be set to "Auto" and "Rise" respectively in the Unit Interval measurement.
These parameters are used by Clock recovery module.

MOST50 and MOST150 – Rise Time

Definition:
The Rise Time measurement is the time difference between when the VRefHi reference level is crossed and the VRefLo reference level is crossed on the rising edge of the waveform.

The Rise Time algorithm uses the VRef values as the reference voltage level. Each edge is defined by the slope, voltage reference level (threshold), and hysteresis. The application calculates this measurement using the following equation:

$$T_n^{Rise} = T_n^{Hi+} - T_n^{Lo+}$$

Where:
T_{Rise} is the Rise Time.
T_{Hi+} is the VRefHi crossing on the rising edge.
T_{Lo+} is the VRefLo crossing on the rising edge.

Pre-requisites:
For MOST technology, perform clock recovery using PLL filter.

Specification followed:
PLL Filter configuration is present at:

MOST Electrical Physical Layer Specification Rev 1.1, Figure 2.2
MOST150 oPHY Automotive Physical Layer Sub-Specification Rev. 1.1, Figure 5.1

MOST50 and MOST150 – Fall Time

Definition:
The Fall Time measurement is the time difference between when the VRefLo reference level is crossed and the VRefHi reference level is crossed on the falling edge of the waveform.

The Fall Time algorithm uses the VRef values as the reference voltage level. Each edge is defined by the slope, voltage reference level (threshold), and hysteresis. The application calculates this measurement using the following equation:

$$T_n^{Fall} = T_n^{Lo-} - T_n^{Hi-}$$

Where:
T_{Fall} is the Fall Time.
T_{Lo-} is the VRefLo crossing on the falling edge.
T_{Hi-} is the VRefHi crossing on the falling edge.

Pre-requisites:
For MOST technology, perform clock recovery using PLL filter.

Specification followed:
PLL Filter configuration is present at:
MOST Electrical Physical Layer Specification Rev 1.1, Figure 2.2
MOST150 oPHY Automotive Physical Layer Sub-Specification Rev. 1.1, Figure 5.1

MOST50 and MOST150 – High

Definition:
The High Amplitude measurement calculates the mean or mode of a selected portion of each unit interval corresponding to a “1” bit.

The application calculates this measurement using the following equation:

$$V_{HI}(n) = OP[v_{PERCENT}(n)]$$

Where:
V_{HI} is the high amplitude measurement result.
OP[•] is the selected Operation (either Mean or Mode).
$v_{PERCENT}$ is the set of voltage samples over the selected portion (percent) of the unit interval, ranging from 1% to 100%.
n is the index of a high bit, a high transition bit, or a high non-transition bit.

Pre-requisites:
For MOST technology, perform clock recovery using PLL filter.

Specification followed:
PLL Filter configuration is present at:

MOST Electrical Physical Layer Specification Rev 1.1, Figure 2.2
MOST150 oPHY Automotive Physical Layer Sub-Specification Rev. 1.1, Figure 5.1

MOST50 and MOST150 – Low

Definition:
The Low Amplitude measurement calculates the mean or mode of a selected portion of each unit interval corresponding to a "0" bit.

The application calculates this measurement using the following equation:

$$V_{LO}(n) = OP\left[v_{PERCENT}(n)\right]$$

Where:
V_{LOW} is the low amplitude measurement result.
OP[•] is the selected Operation (either Mean or Mode).
$v_{PERCENT}$ is the set of voltage samples over the selected portion (percent) of the unit interval, ranging from 1% to 100%.
n is the index of a low bit, a low transition bit, or a low non-transition bit.

Pre-requisites:
For MOST technology, perform clock recovery using PLL filter.

Specification followed:
PLL Filter configuration is present at:
MOST Electrical Physical Layer Specification Rev 1.1, Figure 2.2
MOST150 oPHY Automotive Physical Layer Sub-Specification Rev. 1.1, Figure 5.1

MOST50 and MOST150 – DDJ

Definition:
Data-Dependent Jitter (DDJ) is the peak-to-peak amplitude for that portion of the deterministic jitter directly correlated with the data pattern in the waveform. A single DDJ value is determined for each acquisition, by means of RJ/DJ separation analysis.

Pre-requisites:
For MOST technology, perform clock recovery using PLL filter.

Specification followed:
PLL Filter configuration is present at:
MOST Electrical Physical Layer Specification Rev 1.1, Figure 2.2
MOST150 oPHY Automotive Physical Layer Sub-Specification Rev. 1.1, Figure 5.1

MOST50 and MOST150 – TJ@BER

Definition:
Total Jitter at a specified Bit Error Rate (BER). This extrapolated value predicts a peak-to-peak jitter that

will only be exceeded with a probability equal to the BER. It is generally not equal to the total jitter actually observed in any given acquisition. A single TJ@BER value is determined for each acquisition, by means of RJ/DJ separation analysis.

Pre-requisites:
The "Signal Type" and "Clock Edge" model parameters should be set to "Auto" and "Rise" respectively in the Unit Interval measurement.
These parameters are used by Clock recovery module.

Perform clock recovery using PLL filter.

Specification followed:
PLL Filter configuration is present at:
MOST Electrical Physical Layer Specification Rev 1.1, Figure 2.2
MOST150 oPHY Automotive Physical Layer Sub-Specification Rev. 1.1, Figure 5.1

MOST50 and MOST150 – Mask Hits

Definition:
The Mask Hits measurement reports the number of unit intervals in the acquisition for which mask hits occurred, for a user-specified mask. In the Results Summary view, the Mask Hits measurement reports the total number of unit intervals for which a mask hit occurred in at least one mask zone. In the Results Details view, the number of hits in each of three segments is reported. The population field shows the total number of unit intervals measured.

The Mask Hits measurement has several unique properties:

- Unlike other measurements, it requires a Mask hits plot. Adding a Mask Hits measurement will cause the corresponding plot to be created automatically. If you delete a Mask Hits plot, the application will remove the corresponding Mask Hits measurement after verifying the action with you.
- The Mask Hits measurement does not support the Worst-Case Waveforms logging feature.
- The Mask Hits measurement does not support Measurement Range Limits.

Pre-requisites:
Perform clock recovery using PLL filter.

Specification followed:
PLL Filter configuration is present at:
MOST Electrical Physical Layer Specification Rev 1.1, Figure 2.2
MOST150 oPHY Automotive Physical Layer Sub-Specification Rev. 1.1, Figure 5.1