N5991MM5A MIPI M-PHY® Test Automation Software Platform

KEYSIGHT

USER GUIDE

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1 Introduction

Overview

This guide provides a detailed description of the Keysight N5991MM5A MIPI M-PHY Test Automation Software Platform.

The BitifEye “ValiFrame” Test Automation software is globally marketed and supported by Keysight Technologies as N5991 and N5992. This document describes the calibrations and test procedures conducted by N5991 ValiFrame for MIPI M-PHY in detail.

The N5991 software calibrates the stress conditions and controls all test electronic equipment for automated receiver tolerance tests. The receiver tests described in this document are implemented according to the requirements of the *Conformance Test Suite (CTS) for M-PHY v5.0, Version 1.0* and also offer some custom characterization tests to provide more details about DUT behavior beyond the limits of conformance testing.

The N5991 MIPI M-PHY receiver tests support Keysight Technologies’ M8040A and M8020A BERTs, which allow multi-lane testing. A Keysight Infiniium oscilloscope is always required.

NOTE **The definitions of the acronyms and abbreviations used throughout this User Guide are given in Appendix D, "Acronyms and Abbreviations".**

Document History

First Edition (November 2022)

The first edition of this user guide describes the functionality of software version N5991 ValiFrame MIPI M-PHY_1.0.0 based on the *MIPI Alliance Specification for M-PHY, Version 5.0*.

Second Edition (April 2025)

The second edition of this user guide describes the functionality of software version N5991 ValiFrame MIPI M-PHY_1.3.1 based on the *MIPI Alliance Specification for M-PHY, Version 5.0*.

Support and Troubleshooting

If you encounter problems when running the software, check the log list at the bottom of the main window. The log file can be viewed by right-clicking within the log list section and selecting “Show Log File” (see red frame in Figure 1-1).

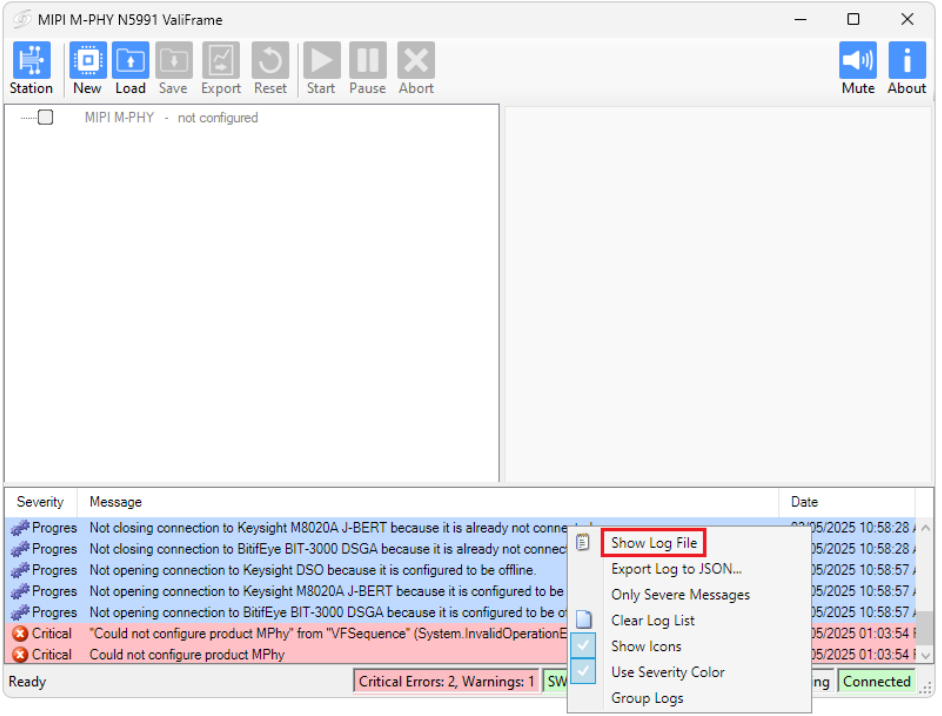

Figure 1-1 Accessing the log file

If a problem with the application persists, send the log file with the problem to Keysight support.

The Keysight support team is also happy to help you should you require further information about a particular application.

For support options, visit www.keysight.com/find/contactus.

2 Preparing to Take Measurements

The test instruments that are together used for Test Automation are referred to as a Test Station. This chapter describes how to configure and start the N5991MM5A MIPI M-PHY ValiFrame Test Station.

Overview

The set of test instruments that are used for N5991MM5A MIPI M-PHY test automation are referred to in the following as the “Test Station” or simply “Station”. The test station is controlled by a suitable PC and the N5991MM5A MIPI M-PHY Test Automation Software Platform.

Downloading and Installing the ValiFrame Software

First download and install the N5991MM5A MIPI M-PHY ValiFrame software. Further details about this and the licenses required can be found in the ValiFrame Getting Started Guide.

Normal Workflow

After the ValiFrame software has been installed, the normal procedure when testing a DUT is as listed below. More details about each step are provided in the following sections.

- **Start N5991 MIPI M-PHY app**

  (see Starting the ValiFrame Software on page 22)

- **Configure the Station**

  (see Configuring the Test Station on page 23)

  - Station configuration
  - Instrument configuration

- **Configure the DUT**

  (see Configuring the DUT and Test Parameters on page 28)

- **Calibrate the system**

  - Select calibration procedure(s) (see Selecting Procedures on page 51)
  - Modify parameters (see Modifying Parameters on page 52).
    Note: Modifying parameters might break the Compliance status.
  - View connection diagram and connect setup (see Connection Diagrams on page 54)
  - Run calibration procedure(s) (see Running Procedures on page 53)
  - Save/export calibration results (see Exporting Results on page 59)

- **Run test procedures**

  - Select test procedures (see Selecting Procedures on page 51)
  - Modify parameters (see Modifying Parameters on page 52)
  - View connection diagram and connect setup (see Connection Diagrams on page 54)
  - Run test procedure(s) (see Running Procedures on page 53)
  - Save/export test results (see Exporting Results on page 59)

Starting the ValiFrame Software

Double-click the MIPI M-PHY ValiFrame (N5991) icon on the desktop (see Figure 2-1) to launch the app. Alternatively, to access the MIPI M-PHY ValiFrame app on a Windows 10-based PC, click

Start > **BitifEye N5991** > **MIPI M-PHY ValiFrame (N5991)**.

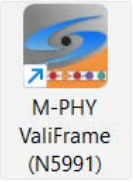

Figure 2-1 MIPI M-PHY ValiFrame (N5991) desktop icon

Configuring the Test Station

When MIPI M-PHY ValiFrame is launched, the corresponding ValiFrame main window appears, as shown in Figure 2-2.

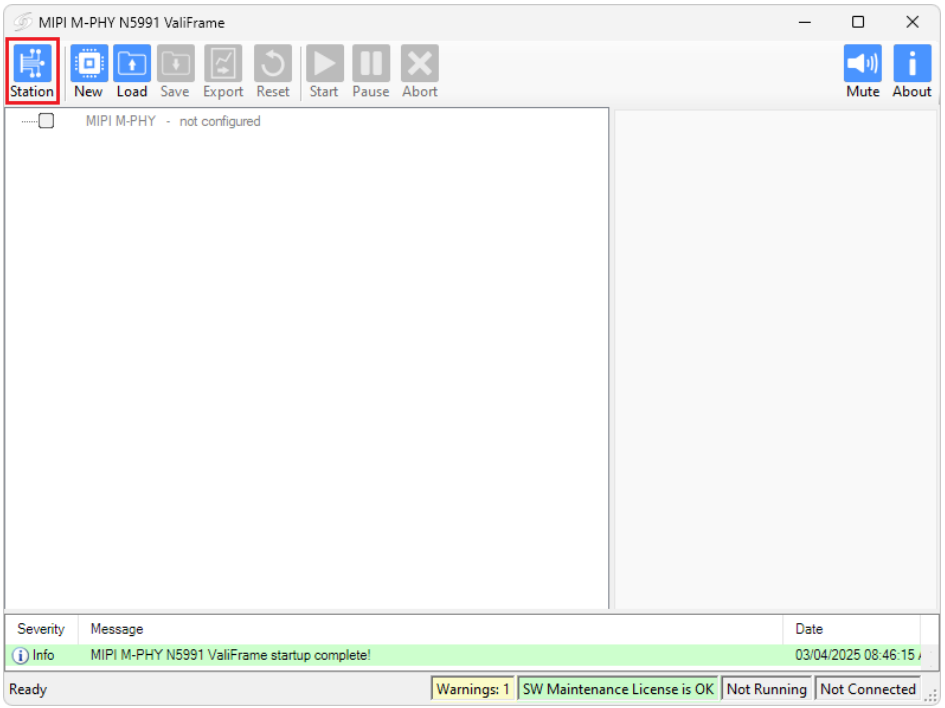

Figure 2-2 MIPI M-PHY N5991 ValiFrame user interface main window

Click **Station** (red frame in the figure) to open the Station Configuration window (Figure 2-3).

Station Configuration

The Station Configuration window (Figure 2-3) displays various options for MIPI M-PHY testing.

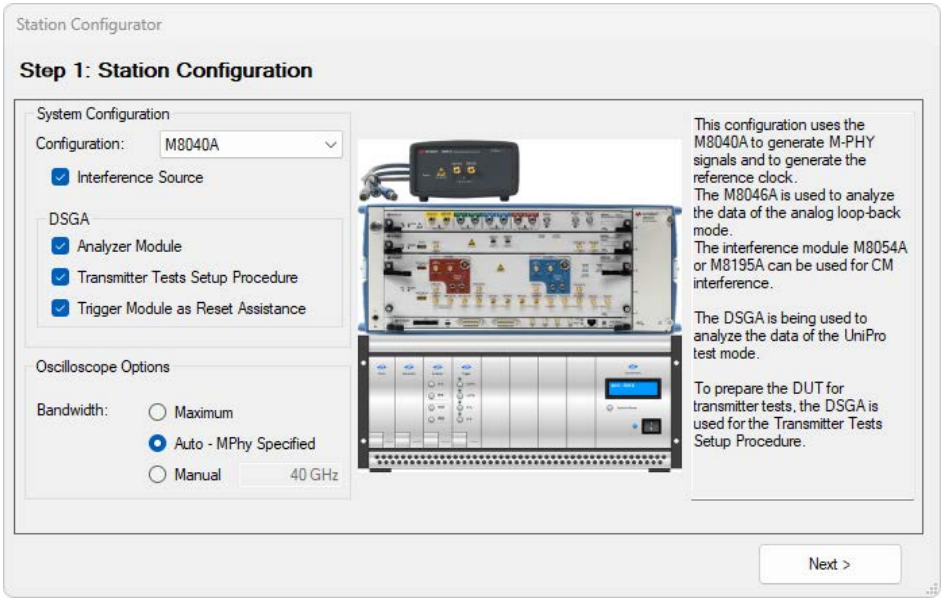

Figure 2-3 MIPI M-PHY Station Configuration window

System Configuration

Select the instruments to be used for signal generation and analysis. The image and the text will vary according to your selection. The text on the right describes which instruments are used for which tasks with the selection made on the left. The image in the center shows the required instruments.

Configuration: Choose the signal generator: M8020A BERT or M8040A BERT.

Depending on your choice, various options become available.

Interference Source: Only M8040A. Check this box to use M8054A or M8195A for CM interference.

DSGA

Here you can select what the DSGA should be used for.

Analyzer Module: Check to use the BIT-3000 DSGA to analyze the data of the UniPro test mode.

Transmitter Tests Setup Procedure: Check to use the Transmitter Tests Setup Procedure to prepare the DUT for transmitter tests.

Trigger Module as Reset Assistance: Only if one of the above options is enabled. Check to use the BIT-3000 DSGA as the trigger generator.

Oscilloscope Options

Bandwidth: Select the bandwidth of the oscilloscope. Options are

- Maximum
- Auto – MPhy Specified
- Manual

NOTE Use of the Maximum option may generate non-monotonic results in jitter calibrations.

Instrument Configuration

Once the N5991MM5A MIPI M-PHY station is configured, the instrument addresses must be set. An example of instrument configuration is shown in Figure 2-4.

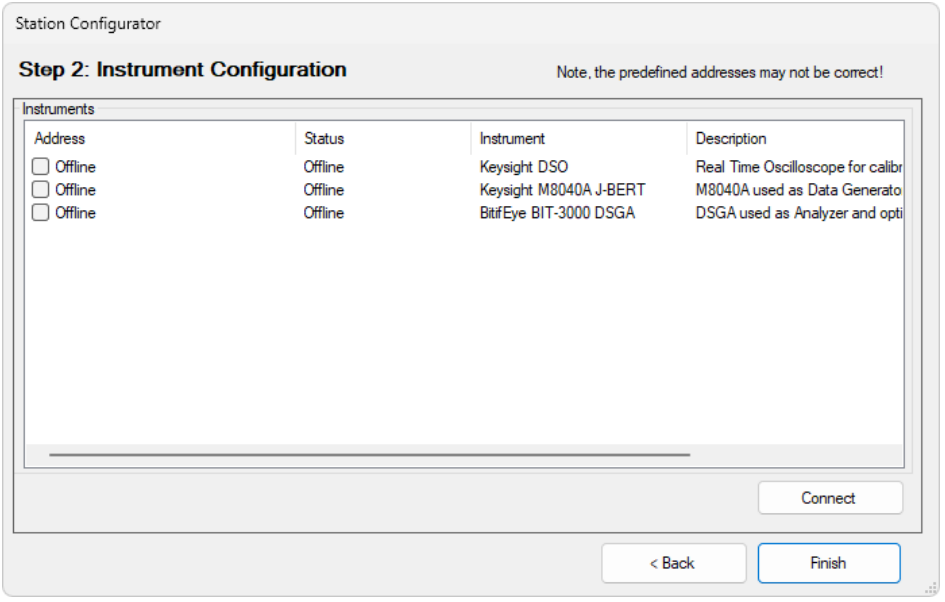

Figure 2-4 Instrument configuration window

NOTE **Make sure that all the selected instruments for the test station are connected to the test station PC controller by remote control interfaces such as LAN or USB.**

After the installation process, all instruments are configured by default in Offline mode. In this simulation mode, hardware does not need to be physically connected to the test controller PC. The ValiFrame software cannot connect to any instrument in this mode. In order to control the instruments that are connected to the PC, the instrument address must be entered. The address depends on the bus type used for the connection, for example, LAN or USB.

Most of the instruments listed in the Instrument Configuration window require a VISA connection. To determine the VISA address, run the “Keysight Connection Expert”, which is part of the Keysight IO Libraries Suite. For each instrument, copy the address string from the Connection Expert entries and paste it as the instrument address in the ValiFrame Instrument Configuration window.

For further details about how to use the Keysight Connection Expert, see the ValiFrame Getting Started Guide.

Some applications running on the oscilloscope use a different technology to provide remote access to ValiFrame, called ‘.NET Remoting’. Remote access is only possible using a LAN connection to the oscilloscope; therefore, an IP address is used to connect to such an instrument.

After the address strings have been entered in the Instrument Configuration window of ValiFrame, click **Connect** to verify that the connections for the instruments are established properly. The software checks for the best kind of connection, and displays a message if you have entered one that is not optimal. For the data generator and the real-time oscilloscope, the use of a HiSLIP connection string is recommended.

Click **Finish** to save the selected instruments and connections.

NOTE

When starting a specific test station configuration for the first time, all instruments are set to the “Offline” mode. In this mode the test automation software does not connect to any instrument. This mode can be used for demonstrations or checks only. No valid data is produced.

You will need to repeat the station and instrument configuration whenever you change the instruments you are using or their connections.

Configuring the DUT and Test Parameters

Once the Test Station has been configured, the next step is to configure the DUT and test parameters.

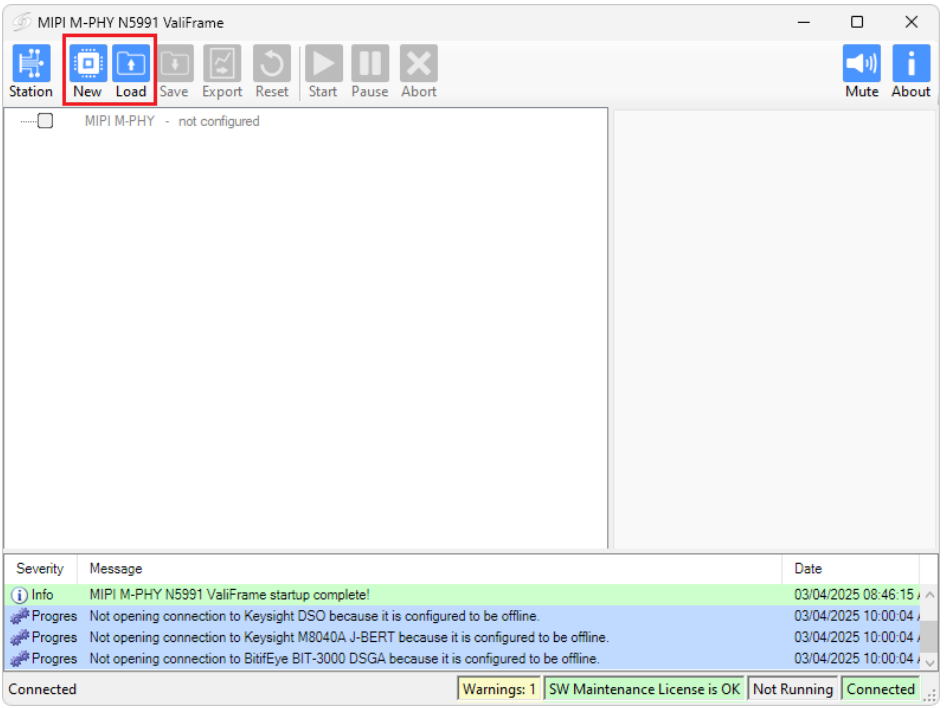

Figure 2-5 New and Load buttons in the main window

Opening a Previously Saved Project

If you have already configured the N5991MM5A MIPI M-PHY ValiFrame software and saved the settings as a configuration or project file, you can click **Load** (Figure 2-5) to use the same station, product and test parameters again, which can save time.

Beginning a New Project

To begin a new project, click **New** (Figure 2-5), which opens the MIPI M-PHY Configure DUT window (Figure 2-6).

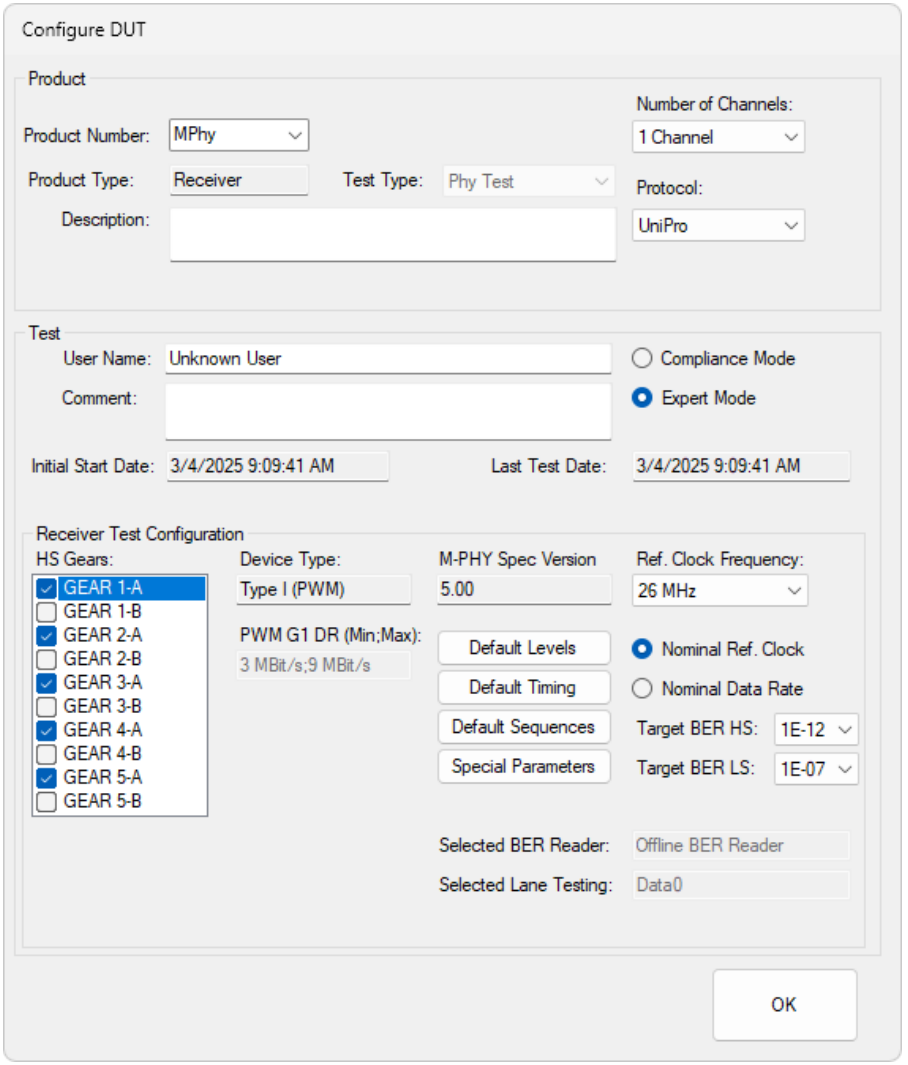

Figure 2-6 MIPI M-PHY Configure DUT window

The MIPI M-PHY Configure DUT window allows you to select product and test parameters (Table 2-1).

Table 2-1 Configuration Parameters

Parameter Name	Description
Product Parameters	
Product Number	Preselected as MIPI M-PHY. Used to identify the application (standard).
Product Type	Receiver (read only).
Test Type	Phy Test (read only).
Description	Text field for a description of the product (DUT).
Number of Channels	Select the number of channels to be tested.
Protocol	Select from – UniPro (for more details see Appendix B: Using the UniPro Test Mode) – UFS – None
Test Parameters	
User Name	User name text field.
Comment	Text field for user comments.
Initial Start Date	Time stamp of the start of the current session.
Last Test Date	Time stamp of the last test conducted in the current session.
Compliance Mode	Tests are conducted as mandated by the CTS. The parameters that are shown in the calibrations and test procedures cannot be modified by the user.
Expert Mode	Calibration and tests can be conducted beyond the limits and constraints of the CTS in order to identify the limits of the DUT. The parameters that are shown in the calibrations and test procedures can be modified by the user.
HS Gears	Select gears for the tests.
Device Type	Type I (PWM) (read only).
M-PHY Spec Version	5.00 (read only). The supported specification version.
Ref. Clock Frequency	Choose from – 19.2 MHz – 26 MHz – 38.4 MHz – 52 MHz

Table 2-1 Configuration Parameters (cont.)

Parameter Name	Description
PWM G1 DR (Min;Max)	The minimum and maximum values of the PWM Gear 1 data rate.
Default Levels	This button opens the 'Set M-PHY Default Levels' dialog (Figure 2-7). The parameters are listed under the headings – Data Levels – De-emphasis Level – Ref. Clock Levels The parameters are listed and described in Appendix C.
Default Timing	This button opens the 'Set M-PHY Default Timings' dialog (Figure 2-8). The parameters are listed under the headings – High Speed Timing Settings – Low Speed Timing Settings – Other Timing Settings The parameters are listed and described in Appendix C.
Default Sequences	This button opens the 'Select M-PHY Sequences' dialog. See Figure 2-9 and the text below that figure.
Special Parameters	This button opens the 'Special Parameters' dialog. See Figure 2-10 and the text below that figure.
Nominal Ref. Clock	If this is selected, the generated data rate is calculated as a multiple of the reference clock.
Nominal Data Rate	In this case, the reference clock frequency is set to achieve the nominal Gear x-B data rate value given in the specification.
Target BER HS	Target BER for the HS mode.
Target BER LS	Target BER for the LS mode.
Selected BER Reader	The BER reader that was selected in the Special Parameters dialog (see Figure 2-10).
Selected Lane Testing	The Lane Test Mode that was selected in the Special Parameters dialog (see Figure 2-10).

Default Value Dialogs

Default Levels

Click Default Levels to open the 'Set M-PHY Default Levels' dialog (Figure 2-7). Use this dialog to set default levels (Amplitude and Offset) for the Data and Reference Clock channels. The De-emphasis Level can also be set.

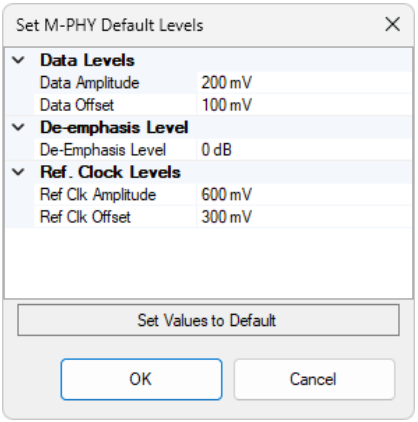

Figure 2-7 Set M-PHY Default Levels dialog

Default Timings

Click Default Timings to open the 'Set M-PHY Default Timings' dialog (Figure 2-8). Use this dialog to set default timing settings. This dialog lists all the M-PHY timing parameters, which are described in Table C-5 on page 226. Each parameter value can be selected and modified. Click 'Set Values to Default' to reset all the modifications and set all the timing parameters to their default values.

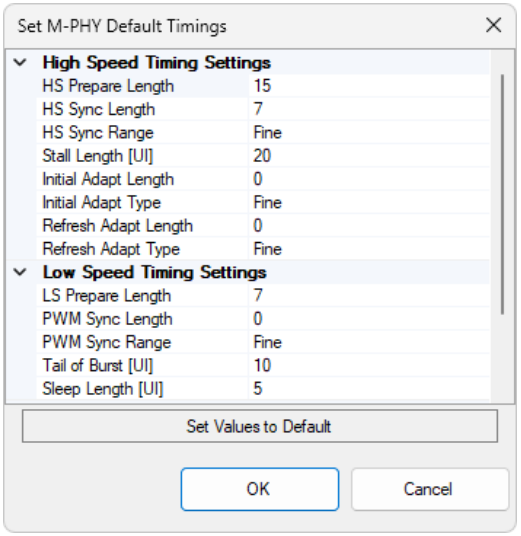

Figure 2-8 Set M-PHY Default Timings dialog

Default Sequences

Click Default Sequences to open the 'Select M-PHY Sequences' dialog (Figure 2-9) and set default sequences as described below the figure.

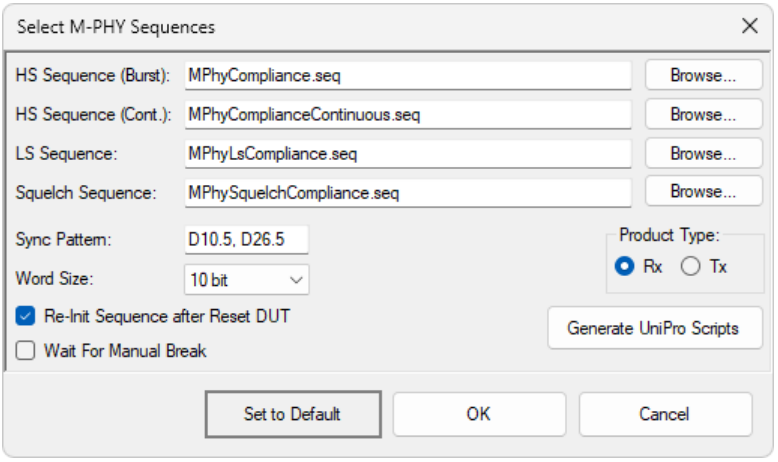

Figure 2-9 Select M-PHY Sequences dialog

Either click the Set to Default button at the bottom or click the corresponding Browse... button to select

- the **HS sequence file for burst mode** communication tests
- the **HS sequence file for continuous mode** communication tests
- the **LS sequence file** for tests
- the **Squelch sequence file** for tests

Sync Pattern: The D10.5 and D26.5 symbols are used as the default sync pattern.

Word Size: Choose the word size as 8, 10, 16 or 20 bit.

Re-Init Sequence after Reset DUT: If you select this check box, the pattern generator sequencer will restart for every test step. It will bring up the link while the signal impairments are being applied, which can be harder on the DUT. If you do not select this check box, the sequencer will bring up the link only once during the initialization.

Wait for Manual Break: This option is available when you select the Re-Init Sequence check box provided you have enabled "Manual Break at Sequence Start" in the Special Parameters Dialog (see Figure 2-10 on page 36). A dialog to

manually restart the DUT is displayed for every test step. This is useful for DUTs that come out of test mode when loopback is being used.

Product Type: Select either Rx or Tx.

Generate UniPro Scripts: This button appears if you select the Protocol as UFS or UniPro. Click to generate the scripts required for the UniPro Test Mode (see Appendix B: Using the UniPro Test Mode for more details).

Special Parameters

Click the Special Parameters button in the Configure Product window (Figure 2-6) to open the Special Parameters dialog (Figure 2-10 on page 36). The settings are explained in the order

- BER Settings
- Calibration Files Directory
- BERT Analyzer Settings
- Oscilloscope Channel Configuration (UXR only)
- Infiniium Settings
- Other Settings
- Equalization Settings

BER Settings

Select BER Reader: For automated receiver testing, it is necessary to determine whether the DUT is receiving the data properly. This can be achieved by reading pass/fail information from the device. The Bit Error Ratio (BER) is measured and read. N5991 MIPI M-PHY supports the following BER Reader implementations.

- *BERT Analyzer*

  The DUT is configured in Loopback Mode, so it will loop back the received test pattern. The Error Detector (ED) then compares the pattern returned by the DUT with the generated pattern to detect bit errors and compute the BER.

  The pattern must match and be in phase. This is ensured by a common reference clock. The same pattern is loaded to the generators and the ED. When the received bits are not synchronized with the pattern of the ED, the computed BER will be very high. In this case, the synchronization algorithm in the ED is restarted.

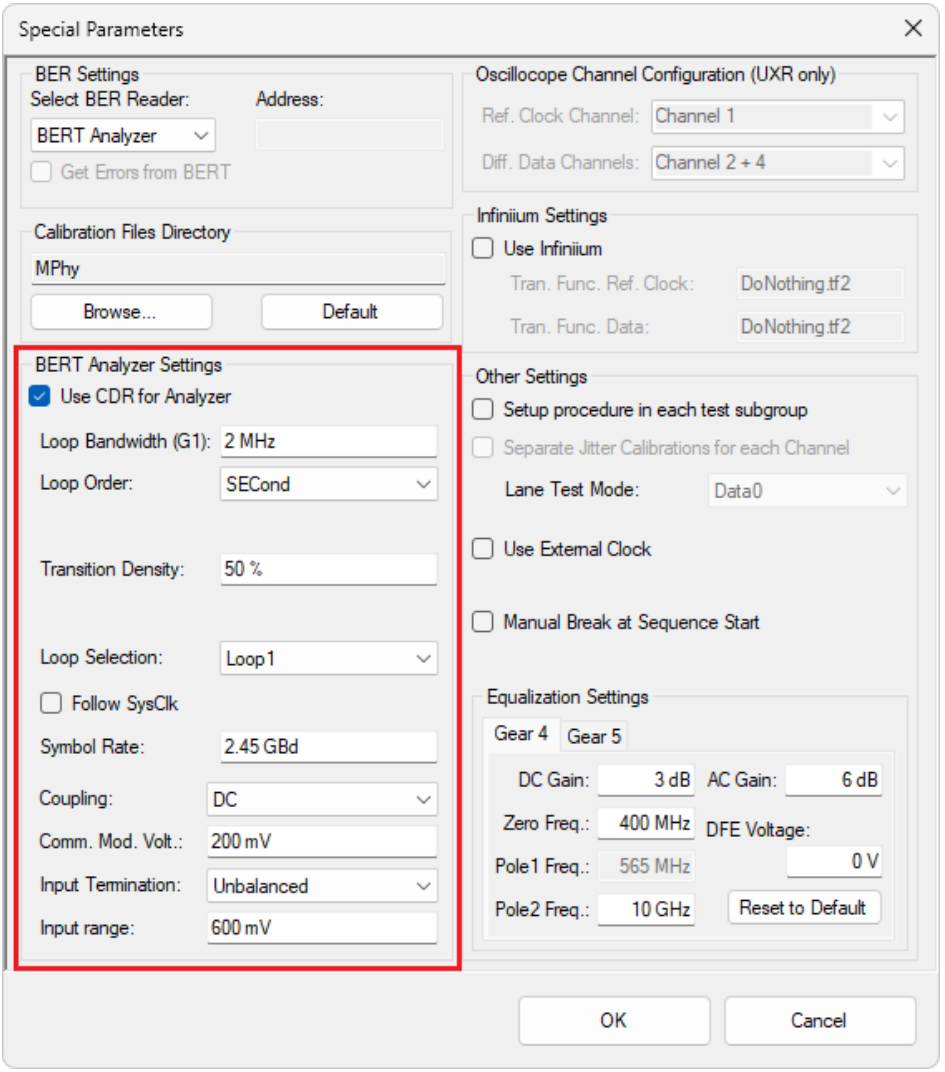

Figure 2-10 Special Parameters dialog

It is important to note that the ED of the BERT compares the whole pattern, including the Sleep, Stall and Prepare states. This makes Loopback Mode testing not an ideal solution for burst pattern tests. For example, if the Prepare Length that the DUT sends back is different to that coming from the BERT generator, the computed BER will be high and the test will fail, even if the returned test pattern matches the original pattern.

– *UniPro BER Reader*

  If this is selected, a Settings button becomes visible, which leads to the DSGA Analyzer Settings dialog. Select the analyzer (M8020A - if available - or DSGA), the PWM Data Rate and the Compare Mode (differential or single-ended).

  The DUT is configured to Test Mode, and Frame and Error Counter requests are interleaved with the test pattern. N5991 ValiFrame decodes the responses captured with the test equipment and calculates the BER.

  For more details about the UniPro Test Mode, refer to Appendix B: Using the UniPro Test Mode.

– *Custom BER Reader*

  This option is available if an MPhyCustomBerReader.dll file is copied to C:\Program Files\BitifEye\ValiFrameK1\MPhy\TestAutomation.

  The use of a Custom BER Reader enables fully automated testing for all transmission modes (HS and LS) without the need for a BER ED or Unipro BER Reader support. This method requires you to implement a class supporting the IBerReader interface, providing access to the DUT's pass/fail information, for example, by reading the DUT's internal error counter registers. You can obtain the definition of the IBerReader interface via your Keysight representative.

NOTE **Use of the Custom BER Reader requires a separate license. Please contact your Keysight representative.**

CAUTION **Do not attach a debugging tool to the MPhyCustomBerReader.dll file as this will cause the ValiFrame license container to be locked, and you will no longer be able to use ValiFrame.**

– *Offline BER Reader*

  For each step of the test procedure, N5991 MIPI M-PHY shows pop-up dialogs asking you to reset and initialize the DUT and decide whether the DUT is working properly. This method is applicable to devices that allow a visual check, for example, a DSI device connected to a display. It is also possible to connect the DUT to the oscilloscope and verify if the output data is valid with the help of the oscilloscope's serial decoder. Using an offline BER reader will result in a semi-automated test, because at each test point you have to enter the pass/fail information.

Address: The BER Reader's address. It can be an IP address or a file directory.

Get Errors from BERT: This button is enabled when Custom BER Reader is selected.

Settings: This button is visible when UniPro BER Reader is chosen. Clicking it opens the DSGA Analyzer Settings dialog (Figure 2-11).

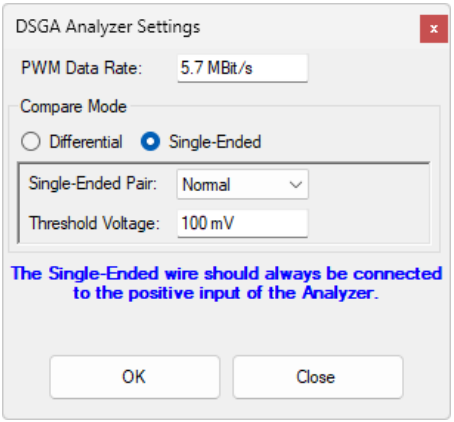

Figure 2-11 DSGA Analyzer Settings dialog for single-ended connections

Select the PWM Data Rate and the Compare Mode (differential or single-ended).

The Single-Ended mode allows you to connect one of the TX single-ended pairs to the DSGA and the other one to the oscilloscope to monitor the DUT responses through the oscilloscope decoder. Select which single-ended pair is connected to the DSGA, either the Normal line or the Complement line. Finally, enter the threshold voltage.

Calibration Files Directory

Click **Browse** to select a directory to which calibrations will be saved and from which they will be loaded.

Click **Default** to set the calibration files directory to the default one (C:\ProgramData\BitifEye\ValiFrameK1\MPhy\Calibrations).

Note: For offline calibrations, which are intended for demonstration purposes only, “Calibrations” is replaced by “CalibrationsOffline”.

BERT Analyzer Settings

The BERT Analyzer Settings become visible only if ‘BERT Analyzer’ is chosen as the BER Reader in the Special Parameters dialog. Those for M8040A are outlined in red in Figure 2-10 on page 36. Those for M8020A are shown in Figure 2-12.

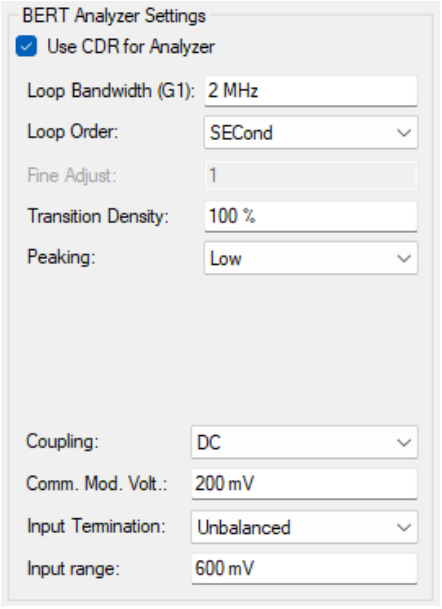

Figure 2-12 BERT Analyzer Settings (for M8020A)

Use CDR for Analyzer: Check this box to use the CDR for the analyzer. This enables further selections, as follows.

Loop Bandwidth (G1): This allows you to configure the loop bandwidth of the analyzer CDR. Note that the value entered here will be used for HS-G1 tests. For

other gears, the bandwidth is automatically calculated as a multiple (×2 for G2, ×3 for G3, etc.). To directly modify the CDR Loop BW value for each gear, use the "CDR Loop Bandwidth – Top Level" parameter, which is accessible in the parameter grid of the main window when the required Terminated Mode group (e.g., Terminated Mode 1.248 GBit/s) is selected in the test procedure tree.

Loop Order: Choose either First or Second order.

Fine Adjust: Only for M8020A. This allows manual adjustment, from –1.0 to +1.0, of CDR settings to minimize CDR output jitter.

Transition Density: The transition density of the CDR can be set from 0% to 100%.

Peaking: Only for M8020A and only when Loop Order is selected as Second. Choose Low, Medium or High. It defines the second-order CDR characteristics by defining a peaking value that is valid for the jitter transfer function.

Loop Selection: Only for M8040A. Choose from the available loops.

Follow SysClk: Only for M8040A. If this is not checked, enter the **Symbol Rate**.

The following settings are available even if "Use CDR for Analyzer" is not checked.

Coupling: Select either DC or AC.

Comm. Mod. Volt.: Only for DC coupling. Enter the Common Mode Voltage.

Input Termination: Select either Balanced or Unbalanced.

Input Range: Enter the maximum input supported by the DUT.

Oscilloscope Channel Configuration (UXR only)

If you are using a Keysight UXR oscilloscope, configure the channels at the top-right corner of the Special Parameters dialog. Select the Reference Clock Channel and the Differential Data Channels.

Infiniium Settings

Check the 'Use Infiniium' box to specify transfer functions for the reference-clock and data channels of the Infiniium Real-Time Oscilloscope.

Other Settings

Setup Procedure in each Test Subgroup: Check this box to make the "Setup Procedure Full" available for each test subgroup in the procedure tree of the N5991 MIPI M-PHY GUI, which allows you to configure the DUT before tests are started.

Separate Jitter Calibrations for each Channel: When more than one channel is selected for testing, check this box to perform a jitter calibration for each channel.

Lane Test Mode: The Lane Test Modes available depend on the protocol selected in the Configure DUT dialog (see Figure 2-6 on page 29) and on how many lanes are to be tested. Note: You must enable 'Separate Jitter Calibrations for each Channel' in order for the chosen Lane Test Mode to be applied.

- *Protocol: None*

  Multiple lanes can be tested either individually or simultaneously.

  - For 1 Lane: The only available option is "Individually" and procedures are performed for Data0.
  - For 2 Lanes:
    - "Individually": Procedures are available for Data0 and Data1 (Figure 2-13).
    - "Simultaneously": The procedure tree does not show separate test procedures for each lane. Instead, each test procedure is shown a single time and is referenced as Data All (Figure 2-14).

- *Protocol: UniPro or UFS*

  There are two Lane Test Mode options: "Data0" and "Data0+Data1".

  - For 1 Lane: The only available option is "Data0" and procedures are shown for Data0.
  - For 2 Lanes:
    - "Data0": Procedures are available for Data0.
    - "Data0+Data1": Each test procedure is shown a single time and is referenced as Data All, similarly to Figure 2-14.

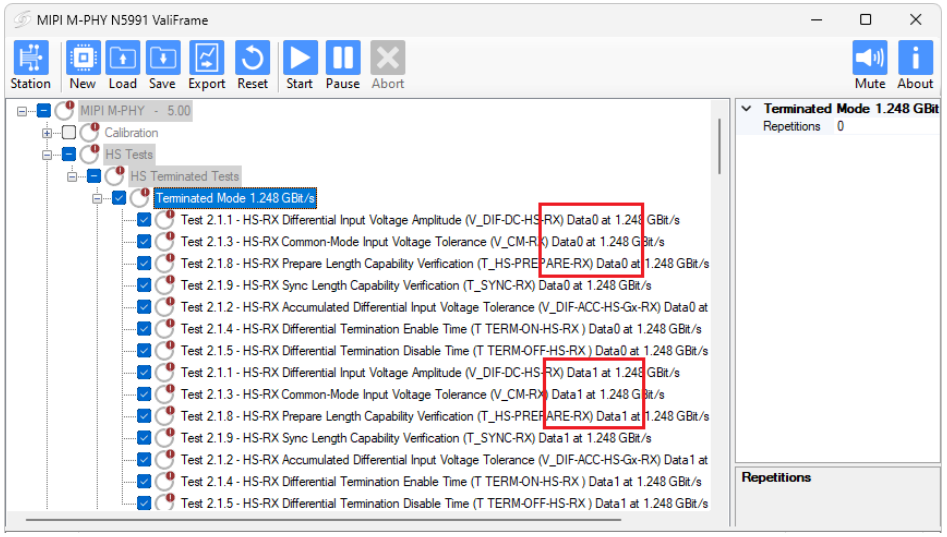

Figure 2-13 Lane Test Mode ‘Individually’

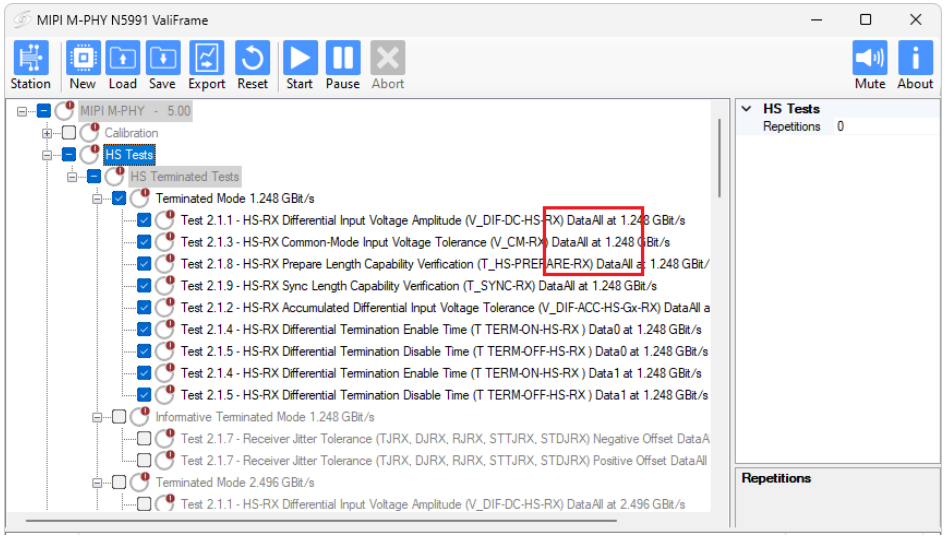

Figure 2-14 Lane Test Mode ‘Simultaneously’

Use External Clock: If you wish to use an external clock, check this box and the HS data rate will be generated using the Clock Multiplier source.

Manual Break at Sequence Start: If this is selected, the sequence will start with a manual break.

Equalization Settings: The parameters to be used for equalization should be entered here. There are separate tabs for Gear 4 and Gear 5 (see Figure 2-15).

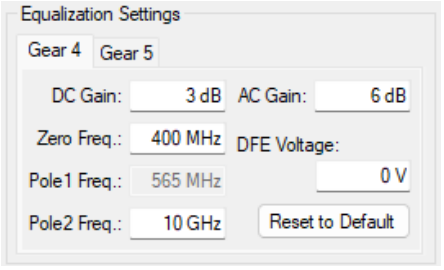

Figure 2-15 Equalization Settings part of the Special Parameters dialog

M8020 ISI Setting

When an M8020A configuration is used, the M8020A ISI Setting button appears just below the Special Parameters button in the Configure DUT dialog (Figure 2-6 on page 29). It is enabled if you are working in Expert Mode. Then, clicking this button opens the dialog shown in Figure 2-16. If the Preset is chosen as “Physical Trace,” none of the other settings are visible.

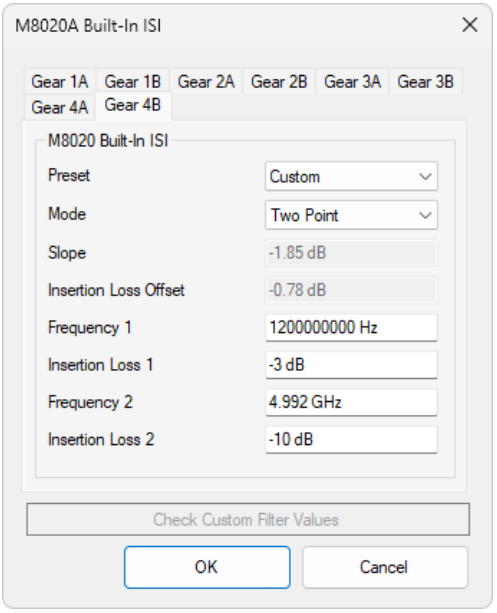

Figure 2-16 M8020A Built-in ISI dialog

Preset: For the relevant Gears, select the Preset from the following:

- Physical Trace: In this case the ISI is not generated internally with the M8020A but by including physical traces in the setup.
- Automatic (only Gear 3A, Gear 3B, Gear 4A, Gear 4B): The embedded ISI fixture is calibrated to a target value, discounting the loss of the cables. Using the Automatic mode will result in a new calibration, named Embedded Fixture ISI Calibration, being added to the procedure tree.
- Custom: The preset is defined by selecting the properties shown in Figure 2-16 and described below.

- MPHY G3A Ch1 (only Gear 3A, Gear 4A): A predefined preset of the M8020A.
- MPHY G3A Ch2 (only Gear 3A, Gear 4A): A predefined preset of the M8020A.
- MPHY G3B Ch1 (only Gear 3B, Gear 4B): A predefined preset of the M8020A.
- MPHY G3B Ch2 (only Gear 3B, Gear 4B): A predefined preset of the M8020A.
- MIPI Short: A predefined preset of the M8020A.
- MIPI Standard: A predefined preset of the M8020A.
- MIPI Long: A predefined preset of the M8020A.

Mode: Chose Two Point or One Point.

- Two Point: The two frequency/insertion loss points can be defined.
- One Point: The first point is predefined as 0 Hz/0 dB.

Slope: This depends on the points defined. The allowed values depend on the chosen Gear.

Insertion Loss Offset: The insertion loss at 0 Hz. The allowed values depend on the chosen Gear.

Frequency 1, Frequency 2: First and second frequency points.

Insertion Loss 1, Insertion Loss 2: Insertion losses applied to the first and second frequency points, respectively.

Check Custom Filter Values: Click this button to check the filter values that you have set. If they lie within the allowed limits, the OK button will be enabled.

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3 Using the Software

This chapter describes how to select the calibrations and test procedures that are to be run and how you can modify the parameters – in expert mode – if you need to go beyond the tests specified by the CTS.

Introduction to Using the Software

Once the DUT has been configured, click ‘OK’ in the MIPI M-PHY Configure DUT panel. The MIPI M-PHY ValiFrame main window will appear (Figure 3-1).

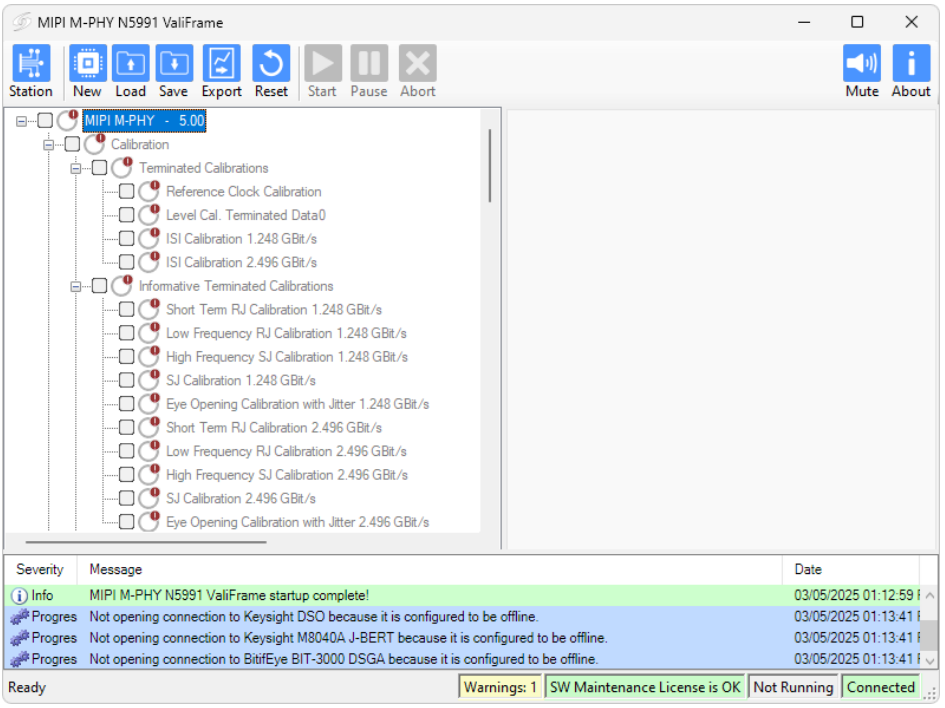


Figure 3-1 MIPI M-PHY ValiFrame main window with procedure tree

ValiFrame Toolbar

Use the **Station** button to configure the Test Station. See Configuring the Test Station.

Use **New** to open the MIPI M-PHY Configure DUT window. This allows you to configure a new DUT or change the DUT and test parameters. See Configuring the DUT and Test Parameters.

If you have already configured the N5991MM5A MIPI M-PHY ValiFrame software for a particular product and saved the settings as a configuration file, you can

click **Load** to use the same station, product and test parameters again, which can save time.

The **Save** button is used to save settings for a particular project. You can save the settings as either a ValiFrame configuration file (.vfc; this contains the changed parameters and the selected procedures) or a ValiFrame project file (.vfp; contains the same as the configuration file and in addition the results of the current run). See the ValiFrame Getting Started Guide for more details.

Use the **Export** button to save results of measurements. See Exporting Results for details.

Reset sets ALL parameters to their default values.

To start one or more procedures, select the corresponding check box(es). Then, the **Start** button is enabled and turns blue. Click Start to run the selected procedure(s).

Pause interrupts the current run at the end of the current step. When the test is paused, the Start button is relabeled **Step**.

You have two options when a procedure is paused.

- Click 'Step' to continue the procedure and pause at the next step.
- Click 'Pause' again to toggle the state of the Start/Step button. Then click 'Start' to continue running the test until the end of the procedure.

The Step feature is useful for debugging purposes, for example to analyze the signal on the oscilloscope at each step. When a procedure is paused, a message in the bottom-left corner of the main window indicates which step has been reached.

Abort stops the current run and closes the procedure window.

ValiFrame produces a sound to indicate when a different state of the program has been reached. You can turn this off (and on again) using the **Mute** button.

The **About** button opens a window that provides details of the software, such as the version of ValiFrame that is being run, the Container ID of the computer and when the software maintenance will expire. The window can also be used to send a report to Support if you encounter persistent problems. For more details see the ValiFrame Getting Started Guide.

Parts of the Main Window

All the relevant calibration and test procedures are listed in groups in a **procedure tree** (left side of the MIPI M-PHY ValiFrame main window, Figure 3-1), similarly to how they are organized in the CTS.

The **parameter grid** in the right pane of the window shows the parameters that are related to the individual procedure or group of procedures selected on the left.

The **log list** in the bottom pane of the window shows calibration and test status messages (regular progress updates as well as information, warnings and error messages).

The **status bar** at the very bottom provides information about how many critical errors have occurred, how many warnings have been sent, the status of the software maintenance license, whether a procedure is running, which step has been reached and whether the instruments were successfully connected.

CAUTION Before executing the calibration or test procedures, ensure that the MIPI M-PHY Station Configuration is conducted properly with all necessary instruments, such as the oscilloscope, set to “online”. All calibrations can be run in offline mode, that is, without any instrument connected. The offline mode is intended for product demonstrations with simulated data. CALIBRATIONS RUN IN OFFLINE MODE DO NOT GENERATE VALID CALIBRATION DATA.

Selecting, Modifying and Running Procedures

Selecting Procedures

The calibration and test procedure groups can be globally selected to run by clicking the check box next to the group name. Alternatively, one or more individual procedures can be selected by clicking the check boxes next to the individual procedure names. Click 'Start' (Figure 3-2) to run the selected procedures.

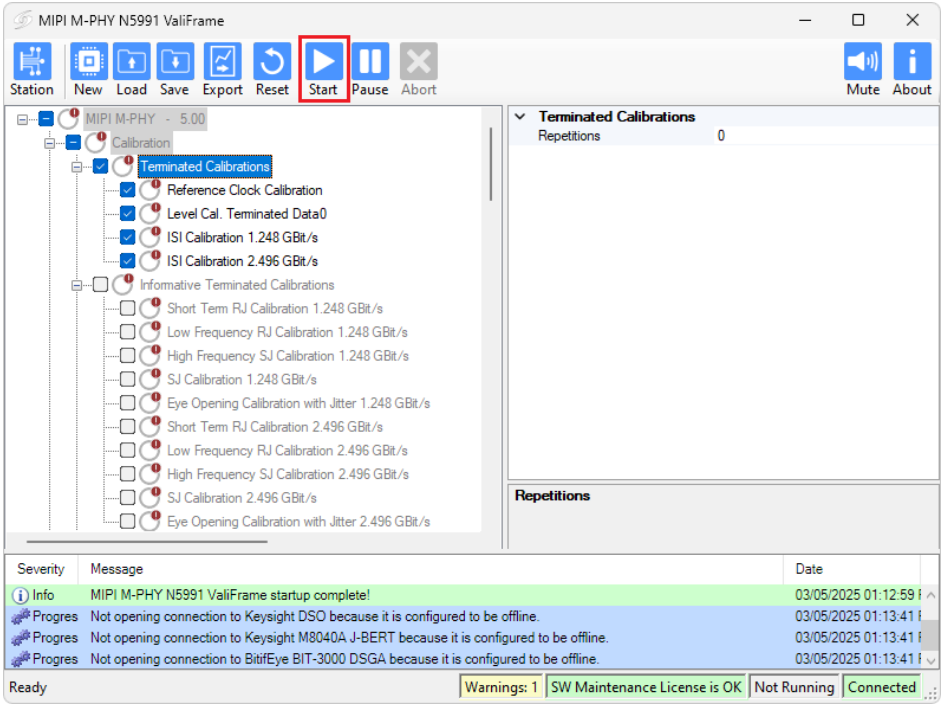


Figure 3-2 Selecting and starting procedures

Modifying Parameters

Most calibration and test procedures, as well as the groups containing them, have parameters that control the details of how the procedures are run. In compliance mode, most of these parameters are read-only. In expert mode, most of the parameters can be modified. To modify a parameter, first select a specific calibration or test procedure in the procedure tree, as shown in the left half of Figure 3-3. The corresponding parameters are displayed in a property list (parameter grid) in the right pane. These parameters can be configured only before the selected procedure is started. All of the selected test parameters are listed in the test results.

For more details about parameters, see MIPI M-PHY ValiFrame Parameters on page 63.

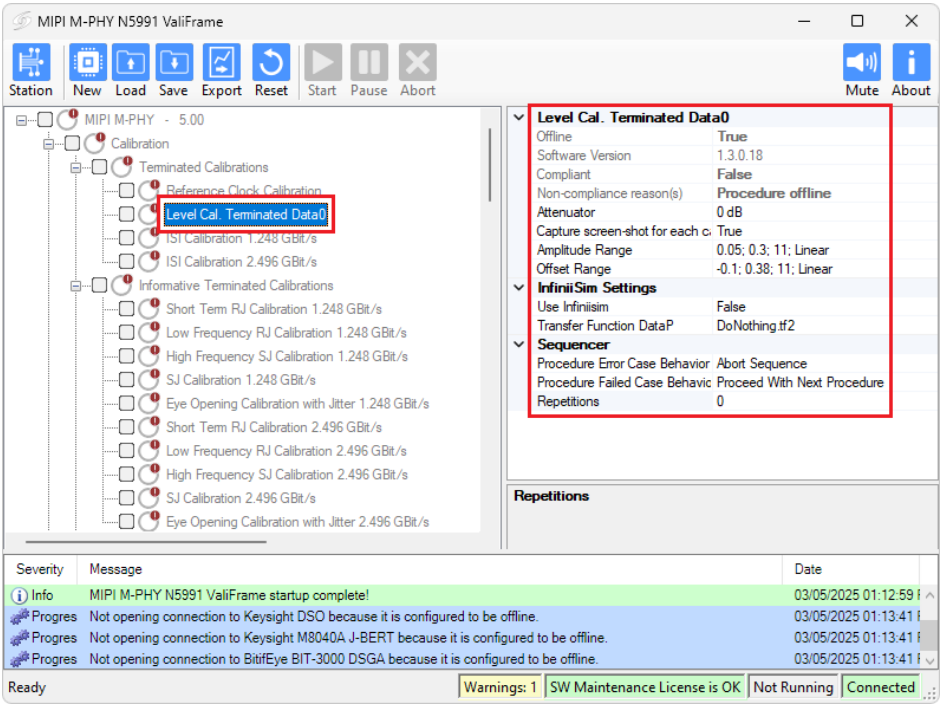


Figure 3-3 Modifying parameters

Running Procedures

To run the selected procedure, click the Start icon on the toolbar (see Figure 3-2). The procedures are run sequentially in the order shown in the procedure selection tree. Some procedures may require user intervention, such as changing cable connections or entering DUT parameters. The required action is prompted in pop-up dialog boxes.

To view the appropriate connection diagram, right-click the desired test or calibration and select 'Show Connection...'. See also Connection Diagrams on page 54.

State Icons

Once the selected procedures have been run, the state icon next to a group or an individual procedure indicates the result (pass / fail / incomplete) and provides further information. For an explanation of the icon beside a particular procedure, right-click the procedure name and select 'Show State Details...' (Figure 3-4). For more information about all state icons, refer to the ValiFrame Getting Started Guide.

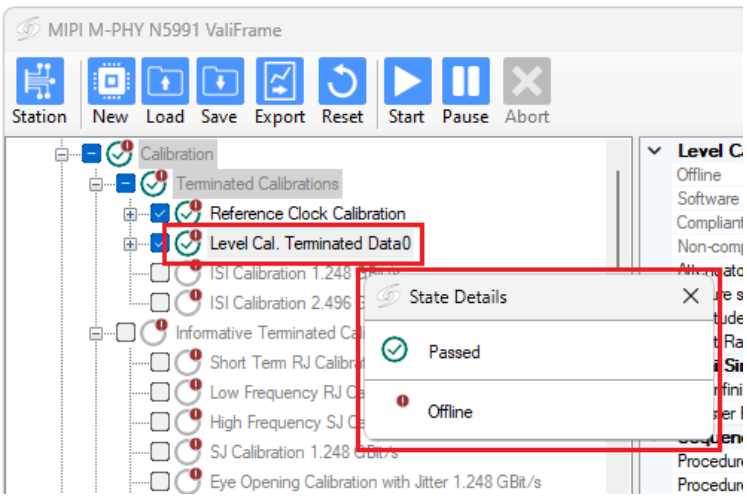


Figure 3-4 Icon representation

Connection Diagrams

To view the connection diagram for a particular set of instruments and procedure, right-click the desired test or calibration in the procedure tree. From the context menu select ‘Show Connection...’.

The window that opens consists of a connection diagram surrounded by five buttons, which are outlined in red and numbered in Figure 3-5.

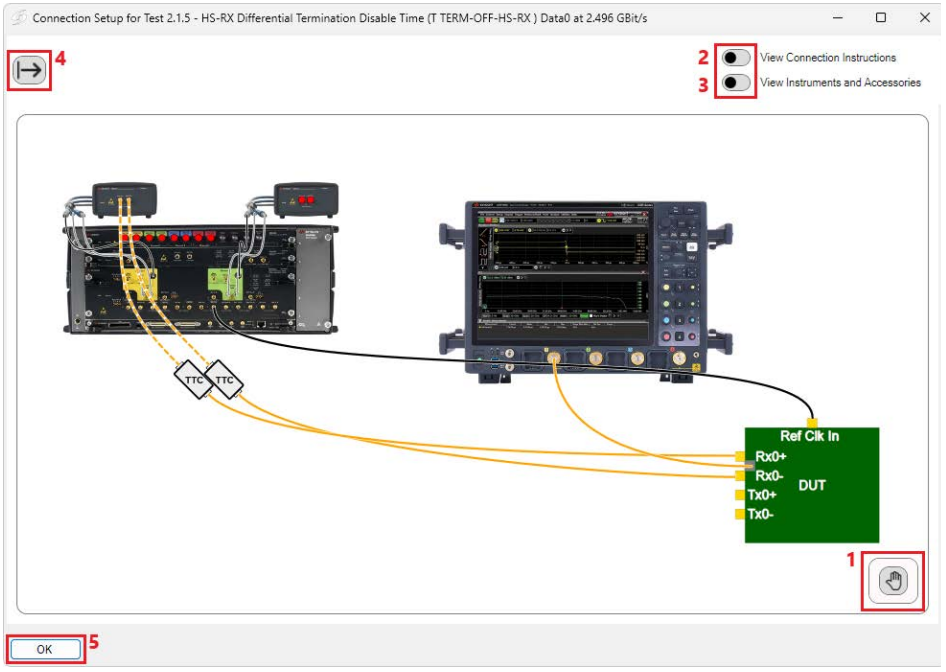


Figure 3-5 Connection diagram window – default view

1 **Export Mode**: Click here to change the positions of the individual instruments and cables in the connection diagram before exporting it. This is intended to increase the clarity of the connections.

2 **Connection Instructions**: Toggle to ‘on’ to view the connection instructions and further information. It is possible to open step-by-step instructions, where the connection currently being made is highlighted (Figure 3-6).

3 **Instruments and Accessories**: Toggle to 'on' to view the list of required instruments and accessories (Figure 3-6).

4 **Export**: Export the diagram as an HTML file. If the list of instruments and accessories is expanded, that will be included in the HTML report as well.

5 **OK**: Click here to close the connection diagram window.

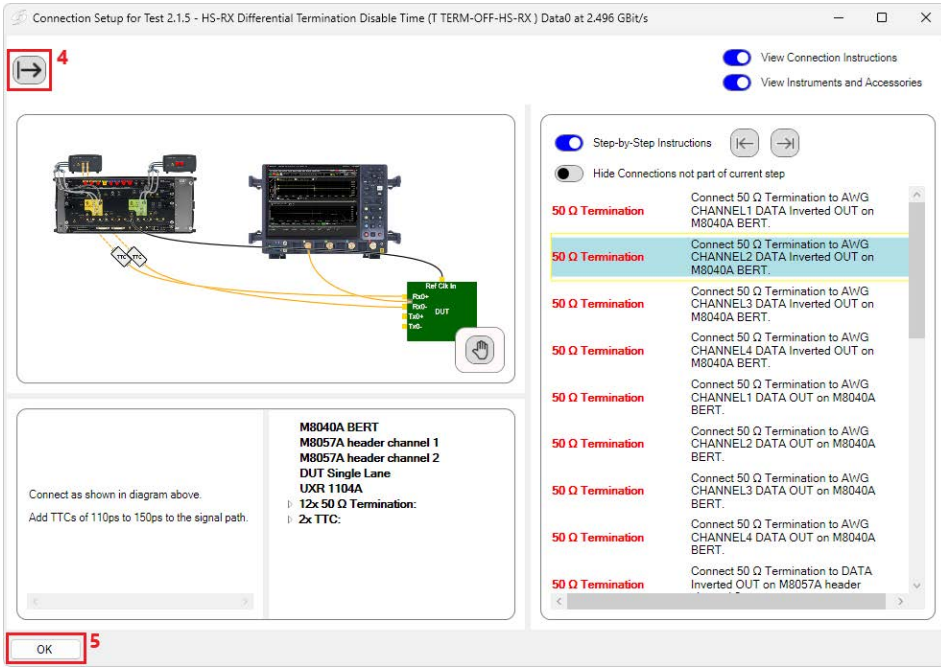


Figure 3-6 Connection diagram window with step-by-step instructions and list of instruments

For more details, see the ValiFrame Getting Started Guide.

NOTE A cable that appears as a broken line in a connection diagram is only 'virtual', that is, the two items joined by the cable are in fact directly connected, without a cable. This is the case for the TTCs and the remote head in Figure 3-5. Virtual cables are added simply to improve clarity.

Required Calibration Data

Some of the calibration procedures and most of the test procedures require calibration data that has been measured previously. You can see the calibration data required by a particular procedure by right-clicking its name in the procedure tree and selecting 'Required Calibration Data...'. A list of the prerequisite calibrations pops up (Figure 3-7).

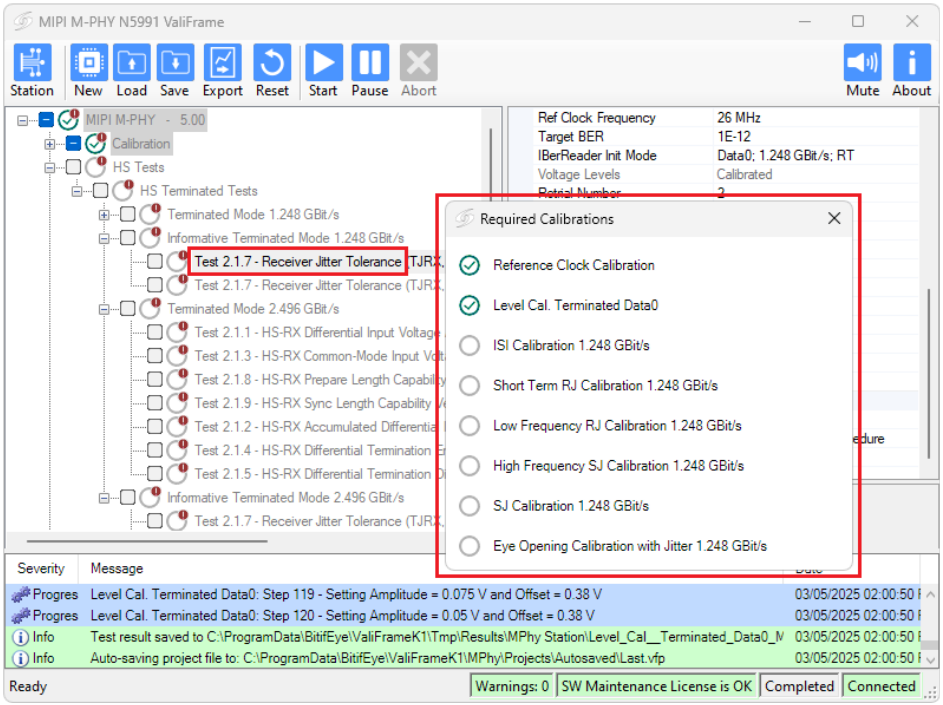


Figure 3-7 Example list of required calibrations

The icon next to the name of a calibration procedure in the list indicates whether the calibration has been run successfully (green), is incomplete (yellow), failed (red) or has not yet been run (gray).

N5991 MIPI M-PHY Data Structure

All the N5991 MIPI M-PHY internal data is saved on the PC's local disk in the application data folder ProgramData\BitifEye\ValiFrameK1\MPhy.

NOTE **Windows hides the system folders by default. To make the application data folder visible, check 'Hidden items' in the Windows file explorer > View > Show.**

The MPhy data folder contains the following folders:

- Calibrations
- CalibrationsOffline
- Data
- History
- Pattern
- Projects
- Settings
- SParameter

Calibrations

The calibration data is saved in the Calibrations folder. For each calibration procedure run, at least one calibration file is saved.

CalibrationsOffline

If the calibration was run in offline (simulation/demonstration) mode, the calibration data is saved in the CalibrationsOffline folder. Offline calibrations are for demonstration purposes only. They do not yield valid data.

Data

N5991MM5A MIPI M-PHY does not save any files in the Data folder.

History

The Product Numbers of the products that have been tested are saved in the History folder.

Pattern

In the Pattern folder, N5991MM5A MIPI M-PHY saves sequence (.seq) and data (.dat) files. There are subfolders UniProBurstMode and UniProContinuousMode.

Projects

The Projects folder is the default folder for ValiFrame project (.vfp) and configuration (.vfc) files. These can be saved by clicking the Save icon in the MIPI M-PHY ValiFrame main window. The latest project run is saved in the *Autosaved* subfolder, but always overwritten during the next run.

Settings

The Settings folder contains settings files. These will include the instrument connection setup, the Station Configuration setup and settings for the last configured DUT, for example.

SParameter

S-parameter and transfer function files are stored in the SParameter folder.

Results

Run-Time Data Display

Most procedures generate data output. While the procedure is running, the data is displayed in a results viewer window, which opens automatically for each individual procedure.

Any results windows that are open during the procedure runs are closed automatically once the specific procedure is finished. As long as the ValiFrame software is running, each test result file (HTML page) can be reopened by double-clicking the respective procedure. However, the individual files are lost when the ValiFrame application is closed, unless you save the individual files or a collection of them.

Description of Results

In this User Guide, the descriptions of the calibration and test procedures include example descriptions of the results. In addition to a graph and a table, there is a text in each set of results that records the conditions under which the procedure was carried out, including a list of the instruments used and their associated firmware.

If your setup is not compliant for some reason, a red stamp “[Not Compliant]” will appear in the Result Description. There are many examples in this User Guide because most of the tests were run “offline”, that is, in simulation mode. When you work online (with instruments connected), this stamp will appear only if there is a problem or if you are working in Expert Mode with non-default parameters. For more details about the “Compliant” parameter, see Table C-3 on page 219.

Exporting Results

For your convenience, all individual results are summarized in an HTML document at the end of the test run. All calibration and test data worksheets can be saved anytime in a workbook by clicking the Export button on the toolbar of the ValiFrame main window. More details can be found in the ValiFrame Getting Started Guide.

Keysight recommends exporting results at least at the end of each ValiFrame run to avoid any data loss. If several calibration and test procedures are conducted

during the same ValiFrame run, the resulting worksheets are combined in a workbook. If a test procedure is conducted without prior execution of calibration procedures in the same test run, only the test results will be saved to the workbook.

NOTE

As a safety feature, all calibration and test results are saved by default to the ValiFrame "Tmp" directory (*C:\ProgramData\BitifEye\ValiFrameK1\Tmp*). The sub-folder *Results\MPhy Station* contains the HTML files of the most-recent results measured for each calibration and test procedure.

In addition to the calibration data HTML files, calibration data files are generated. These files are saved by default to the ValiFrame calibrations folder *C:\ ProgramData\BitifEye\ValiFrameK1\MPhy\Calibrations*. If these calibrations are run again, the data file is overwritten. To save the calibration data files at each configuration, the files must be copied from this folder and saved manually in a different folder before the calibrations are rerun.

An exported workbook includes a summary of the procedures performed in that run (Figure 3-8) and a summary of the instruments used (Figure 3-9).

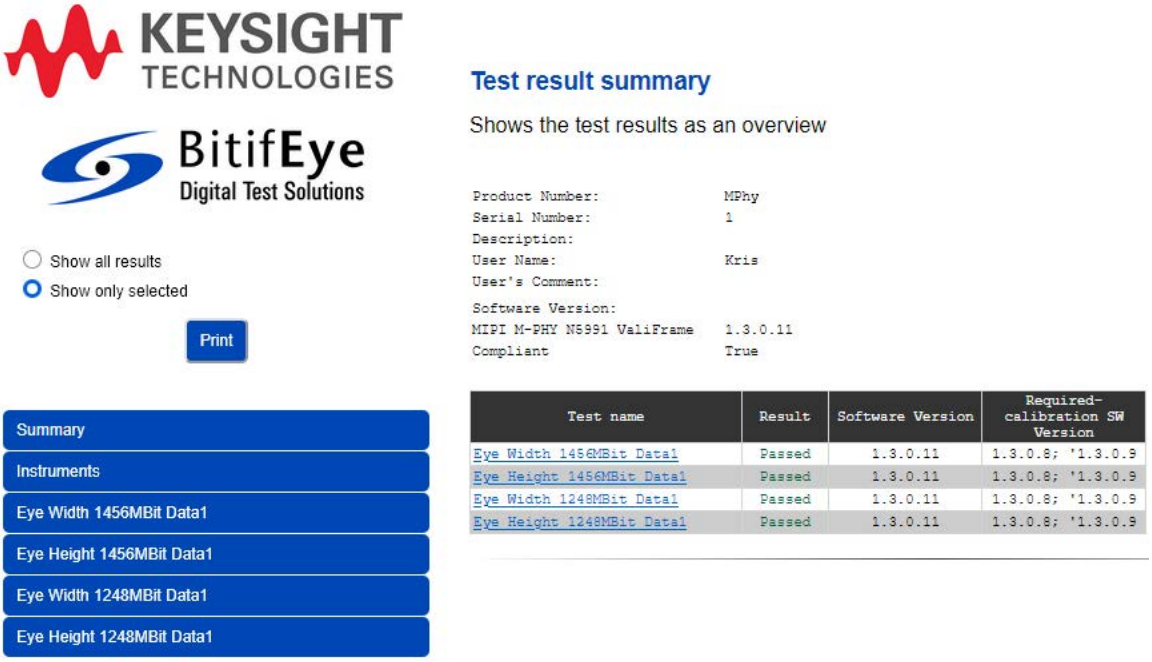
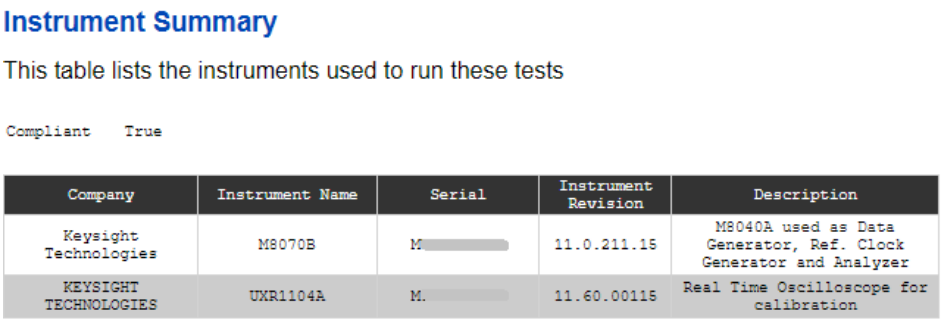


Figure 3-8 Example Test Result Summary page of a MIPI M-PHY ValiFrame workbook

- Test Name: Abbreviated name of the procedure (test or calibration).
- Result: Passed – The procedure was successful. Failed – The data did not fulfill the conditions required by the specification.
- Software Version: The version of the ValiFrame software used to perform the procedure (calibration or test).
- Required-Calibration SW Version: Tests, and some calibrations, rely on data obtained in calibrations. The Required-Calibration SW Version gives the version number of the ValiFrame software used to obtain the calibration data. N/A indicates that there are no required calibrations.



Instrument Summary

This table lists the instruments used to run these tests

Compliant True

Company	Instrument Name	Serial	Instrument Revision	Description
Keysight Technologies	M8070B	M	11.0.211.15	M8040A used as Data Generator, Ref. Clock Generator and Analyzer
KEYSIGHT TECHNOLOGIES	UXR1104A	M.	11.60.00115	Real Time Oscilloscope for calibration

Figure 3-9 Example Instrument Summary table from a MIPI M-PHY ValiFrame workbook

- Company: The manufacturer of the instrument.
- Instrument Name: The model number or name of the instrument.
- Serial: The serial number of the instrument.
- Instrument Revision: The revision number or version of the software running on the instrument.
- Description: The type of instrument, e.g., Real-Time Oscilloscope.

MIPI M-PHY ValiFrame Parameters

MIPI M-PHY ValiFrame parameters are of three types:

- Sequencer Parameters
- Common Parameters
- Procedure Parameters

Sequencer Parameters

The sequencer parameters control the flow of the test sequencer only, not the behavior of individual procedures. One of them, Repetitions, is available for all groups and all individual procedures in the procedure tree. The others are only available for individual procedures. Like all other parameters, the sequencer parameters are shown in the right half of the ValiFrame user interface, as illustrated in Figure 3-10, and you may manually change them. The sequencer parameters are described in Table C-1 on page 217.

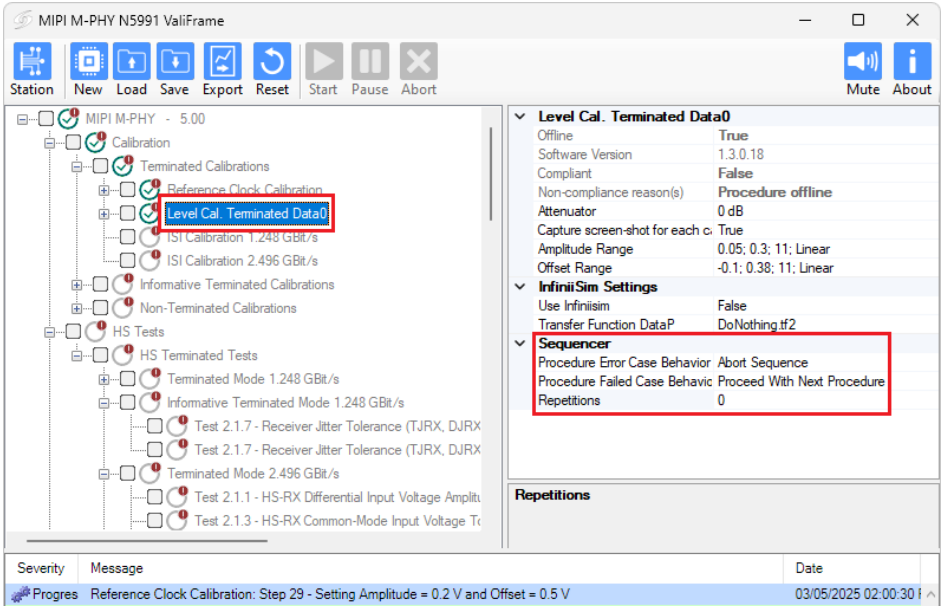


Figure 3-10 MIPI M-PHY ValiFrame sequencer parameters

Common Parameters

Common parameters are used for several related calibration or test procedures. They are shown on the right side of the ValiFrame user interface when the selected entry of the procedure tree on the left is a group instead of an individual procedure.

The common parameters used in MIPI M-PHY ValiFrame are listed in Table C-2 on page 218.

Procedure Parameters

The procedure parameters are all those parameters that are not part of either of the previously described categories. They are shown on the right-hand side of the ValiFrame user interface when the selected entry of the procedure tree on the left is an individual procedure. Their purpose is to modify the behavior of that single procedure. Different procedures often have parameters with the same name, but configured settings always apply to the selected procedure. The meanings of parameters with identical names may differ slightly between procedures.

- The MIPI M-PHY parameters that are used in (nearly) **all** individual procedures are listed in Table C-3 on page 219.
- The MIPI M-PHY **calibration** parameters used in individual procedures are listed in Table C-4.
- The MIPI M-PHY **receiver test and setup procedure** parameters used in individual procedures (including TX setup procedures) are listed in Table C-5.

NOTE Some parameters that are read-only in the user interface main window can be changed when you configure the station and others can be changed when you configure the DUT.

NOTE If the value of a parameter appears in boldface type in the parameter grid of the GUI, this indicates that the value is not the default value.

Application Programming Interface

The Test Automation Software Platform (ValiFrame) application programming interface (API) may be of use when an extra level of automation is required above that supplied by the Keysight N5991 Test Automation Software Platform, for example, if a set of tests is to be repeated several times at different temperatures or with other different parameters.

For more details about the API, see the Application Programming Interface for ValiFrame – User Guide.

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4 MIPI M-PHY Calibrations for Rx Tests

Before any receiver test procedures can be run, the MIPI M-PHY test system must be calibrated.

MIPI M-PHY Calibration Overview

The MIPI M-PHY receiver test system has to be calibrated before any receiver test procedure can be run.

The receiver test signal characteristics, such as the signal generator output voltage level and jitter parameters, are typically affected by the signal transmission between the generator output ports and the DUT input ports. Thus, for any signal output parameter that you may select (referred to as the 'set value'), the jitter and the signal received at the DUT input ports (referred to as the 'actual value') deviate from the set value. Additional deviations can be caused by effects such as offset errors, hysteresis, and nonlinear behavior of the signal generator. The ValiFrame calibration procedures compensate the actual value deviations of the relevant signal output parameter from the set values over the required parameter range.

All calibration procedures required for MIPI M-PHY receiver testing are included in the ValiFrame software. The ValiFrame calibration procedures are implemented such that the calibration process is conducted as fast as possible and is automated as much as possible, for example, by minimizing the number of reconfigurations of the hardware connections. Most of the calibration procedures are run individually for each clock and data lane.

The results of each calibration are stored in the ValiFrame 'Calibrations' folder (*C:\ProgramData\BitifEye\ValiFrameK1\MPhy\Calibrations*), so that they can be used for another calibration or test, as required.

Prerequisite Calibrations

Prerequisite calibrations are not listed explicitly for each procedure in this User Guide. However, they can be found directly in the application (see Required Calibration Data for details).

MIPI M-PHY ValiFrame Parameters

The MIPI M-PHY **common parameters for calibrations** are listed in the parameter grid (right half) of the main window of the user interface when you click the corresponding group in the procedure tree in the left half of the main window. For MIPI M-PHY there are only very few common parameters.

Details of MIPI M-PHY Common Parameters can be found in Table C-2 on page 218.

MIPI M-PHY **parameters for individual procedures** that can be changed in expert mode are not listed in this user guide explicitly. They are displayed in the parameter grid (right pane) of the main window of the user interface when you click on the corresponding entry in the procedure tree in the left half of the main window.

Details of MIPI M-PHY Calibration Parameters for individual procedures can be found in the section MIPI M-PHY ValiFrame Parameters for Individual Calibrations on page 220.

Example Connection Diagrams

In this User Guide, only example connection diagrams are given. The exact connection diagram for a specific situation can be viewed by right-clicking the appropriate procedure in the procedure tree of the main window of the user interface and selecting “Show Connection...”.

NOTE A procedure that is available for a certain configuration only in Expert mode can be found in the procedure tree under “Informative Terminated Calibrations” for that configuration.

NOTE In order to keep the number of cable re-connections and the testing time to a minimum, the calibrations required for the interference tests are conducted independently of the other calibrations. The calibrations are added under the subgroup “Interference Tests” in the procedure tree.

Calibration Procedures

Example Connection Diagrams

In this User Guide, only example connection diagrams are given. For example, the ones shown here are all for Lane 0. The exact connection diagram for a specific situation can be viewed by right-clicking the appropriate procedure in the procedure tree of the main window of the user interface and selecting “Show Connection...”.

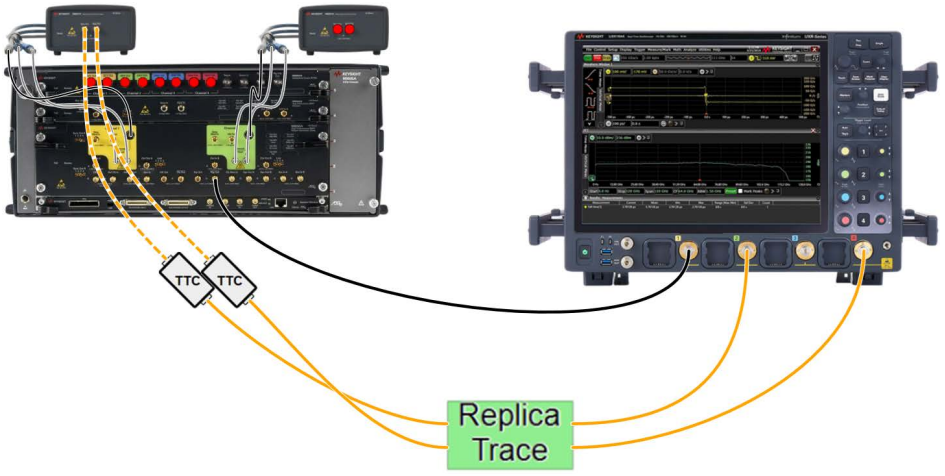


Figure 4-1 Example connection diagram for a Terminated Calibration Procedure without an ISI trace (M8040A, 4-channel scope)

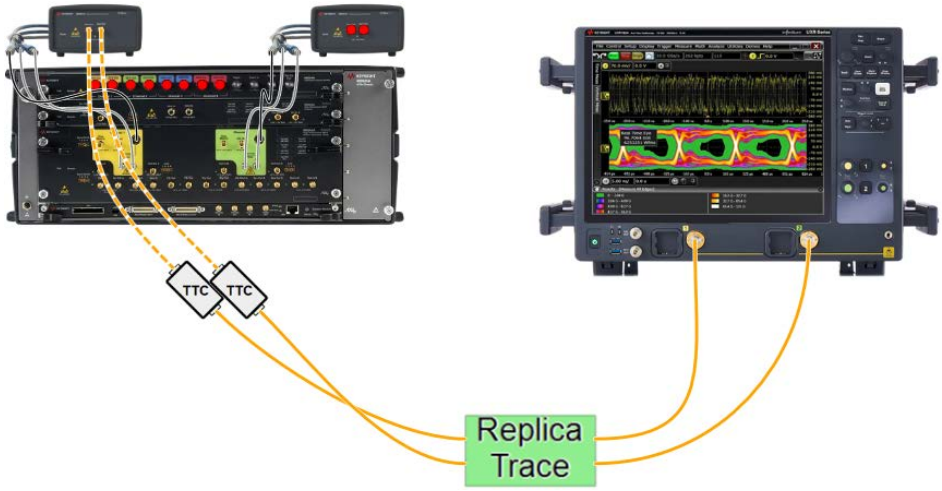


Figure 4-2 Example connection diagram for a Terminated Calibration Procedure without an ISI trace (M8040A, 2-channel scope)

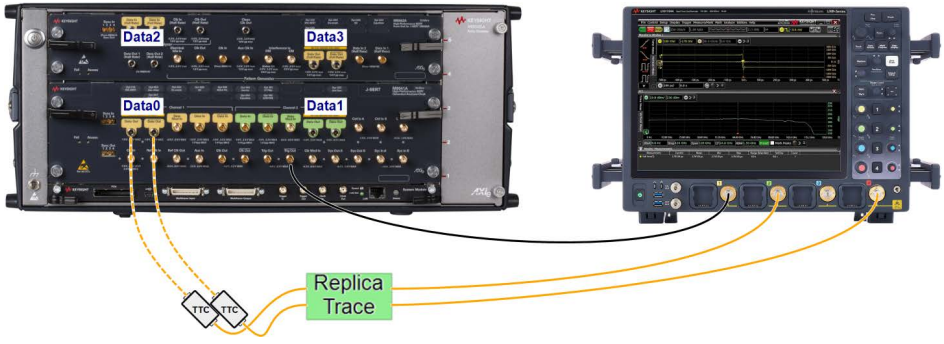


Figure 4-3 Example connection diagram for a Terminated Calibration Procedure without an ISI trace (M8020A, 4-channel scope)

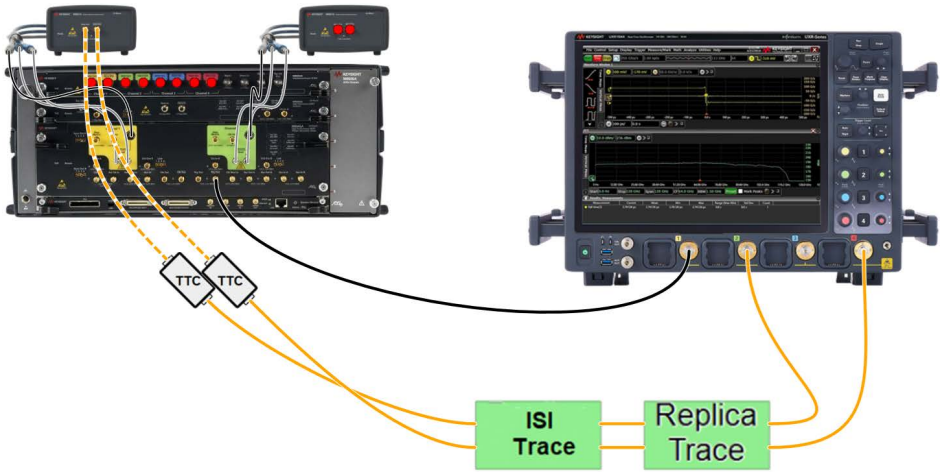


Figure 4-4 Example connection diagram for a Terminated Calibration Procedure with an ISI trace (M8040A)

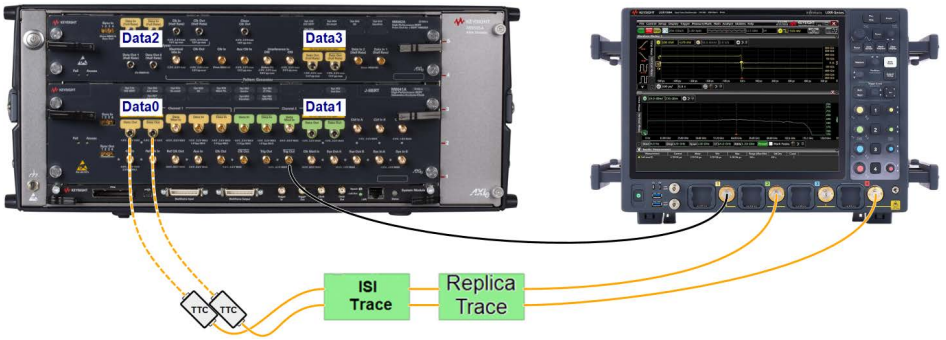


Figure 4-5 Example connection diagram for a Terminated Calibration Procedure with an ISI trace (M8020A)

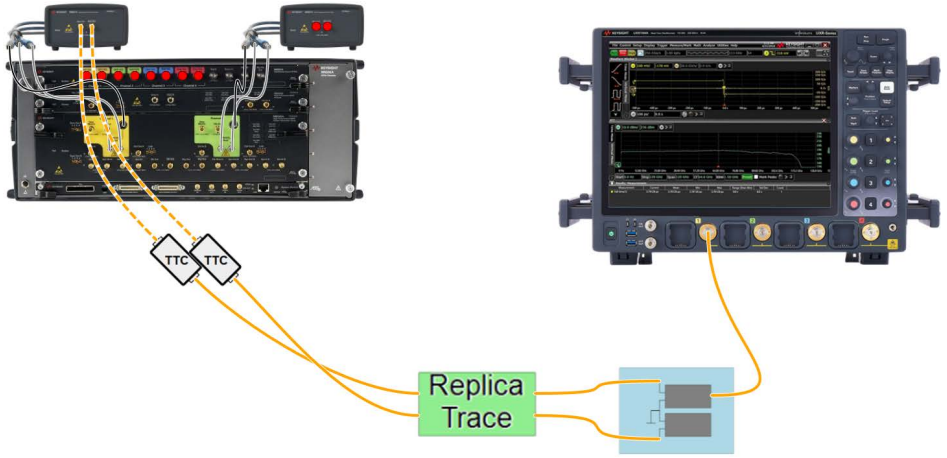


Figure 4-6 Example connection diagram for a Non-Terminated Calibration Procedure (M8040A)

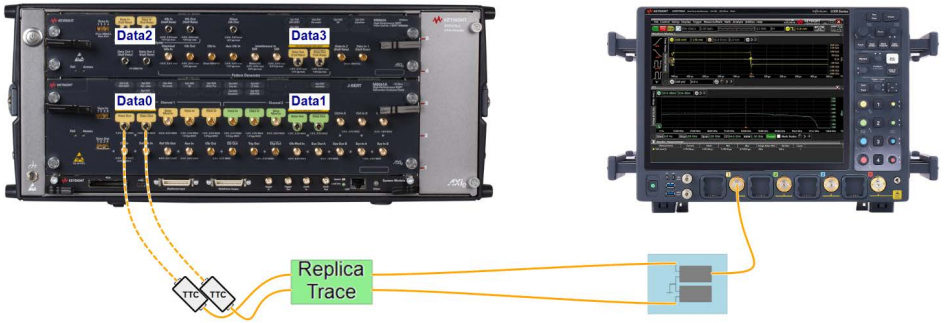


Figure 4-7 Example connection diagram for a Non-Terminated Calibration Procedure (M8020A)

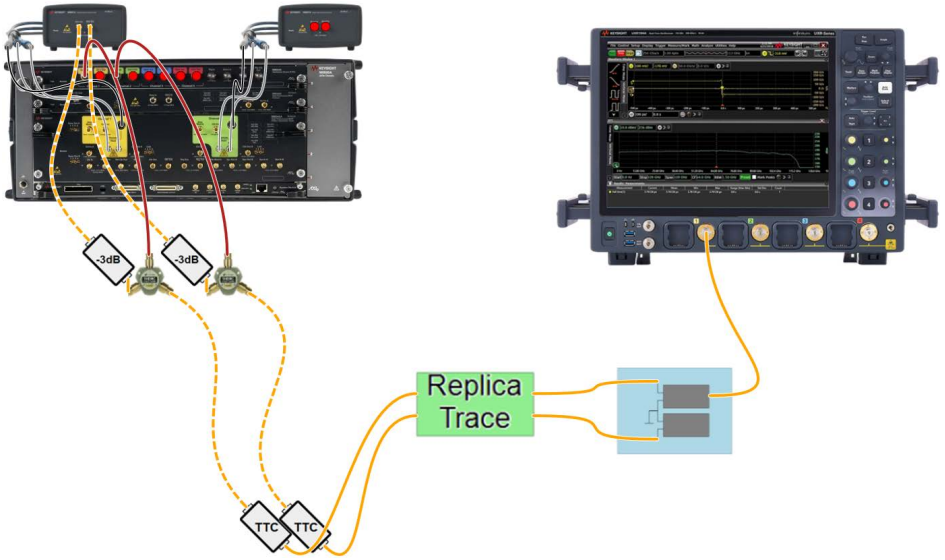


Figure 4-8 Example connection diagram for a Non-Terminated Calibration Procedure (Level Calibration for Squelch, M8040A)

Reference Clock Calibration

Availability

Hardware	All configurations
Termination	Terminated
Mode	Compliance, Expert

Purpose and Method

The purpose of this procedure is to calibrate the output levels (amplitude and offset) of the reference clock.

The output used to generate the reference clock is connected to the oscilloscope. The data generator sweeps the offset according to the range defined by the Offset Range parameter. For each offset value, a sweep of the voltage amplitude is also performed according to the range defined by the Amplitude Range parameter. Then, for each offset–amplitude pair set in the data generator, the actual values of offset and differential voltage amplitude are measured by the oscilloscope and stored.

The results are saved in two separate calibration data files, one for the offset and one for the amplitude.

Connection Diagram

Figure 4-9 Example connection diagram for Reference Clock Calibration (M8040A)

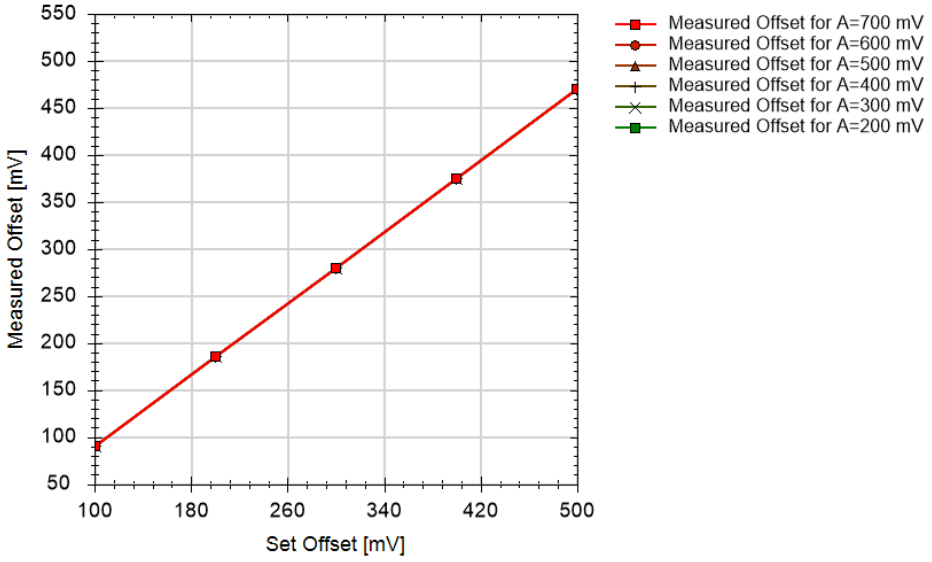
Result Description

The Reference Clock Calibration produces two sets of results: one for the offset (Figure 4-10) and one for the amplitude (Figure 4-11).

Reference Clock Calibration Offset

[Not Compliant]

Calibration of the generator Offset Terminated

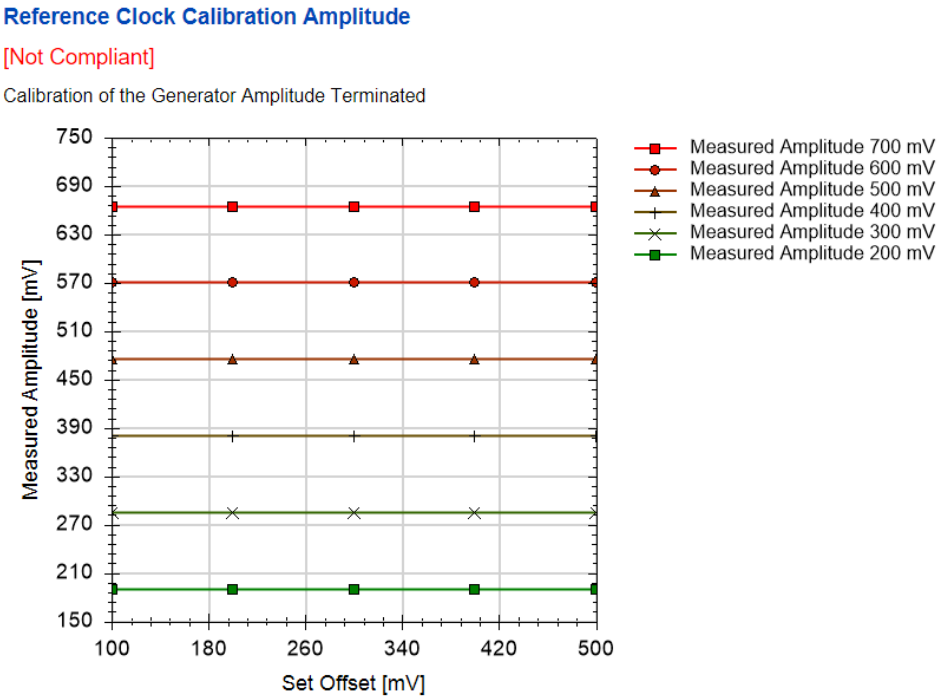


----General----	
Offline	True
Software Version	1.3.0.18
Required-calibration SW Version	N/A
Compliant	False
Non-compliance reason(s)	Procedure offline
Capture screen-shot for each calibration measurement	True
Amplitude Range	0.2; 0.7; 6; Linear
Offset Range	0.1; 0.5; 5; Linear
Capture Screenshot	True
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysigh
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEy
Measurement Instrument 1	Name: Keysight DSO ; Company: Keysight Technolo

Set Offset [mV]	Measured Offset for A=700 mV [mV]	Measured Offset for A=600 mV [mV]	Measured Offset for A=500 mV [mV]	Measured Offset for A=400 mV [mV]	Measured Offset for A=300 mV [mV]	Measured Offset for A=200 mV [mV]
100	90	90	90	90	90	90
200	185	185	185	185	185	185
300	280	280	280	280	280	280
400	375	375	375	375	375	375
500	470	470	470	470	470	470

Figure 4-10 Example result for Reference Clock Calibration – Offset

- Set Offset [mV]: The offset value set on the generator.
- Measured Offset for A = X mV [mV]: The effective offset value as measured with a DSO/UXR using the histogram technique for a generator set amplitude value of X mV



----General----	
Offline	True
Software Version	1.3.0.18
Required-calibration SW Version	N/A
Compliant	False
Non-compliance reason(s)	Procedure offline
Capture screen-shot for each calibration measurement	True
Amplitude Range	0.2; 0.7; 6; Linear
Offset Range	0.1; 0.5; 5; Linear
Capture Screenshot	True
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysigh
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEy
Measurement Instrument 1	Name: Keysight DSO ; Company: Keysight Technolo

Set Offset [mV]	Measured Amplitude 700 mV [mV]	Measured Amplitude 600 mV [mV]	Measured Amplitude 500 mV [mV]	Measured Amplitude 400 mV [mV]	Measured Amplitude 300 mV [mV]	Measured Amplitude 200 mV [mV]
100	665	570	475	380	285	190
200	665	570	475	380	285	190
300	665	570	475	380	285	190
400	665	570	475	380	285	190
500	665	570	475	380	285	190

Figure 4-11 Example result for Reference Clock Calibration – Amplitude

- Set Offset [mV]: The offset value set on the generator.
- Measured Amplitude X mV [mV]: The effective amplitude value as measured with a DSO/UXR using the histogram technique for a generator set amplitude value of X mV.

Level Calibration

Availability

Hardware	All configurations
Termination	Terminated and Non-Terminated (Into Open, Squelch)
Mode	Compliance, Expert

Purpose and Method

The purpose of this procedure is to calibrate the amplitude and offset of the signal generators when those are terminated or non-terminated.

This calibration should be run once at each selected lane, as listed separately in the procedure tree (e.g., Data0, Data1).

The normal and the complement output signals of the reference board are connected to the DSO/UXR channels with direct SMA connection in the terminated case and through a fixture without termination in the non-terminated case.

The data generator sends a slow clock pattern. It sweeps the offset according to the range defined by the Offset Range parameter. For each offset value, a sweep of the voltage amplitude is also performed according to the range defined by the Amplitude Range parameter. Then, for each offset–amplitude pair set on the data generator, the actual values of offset and differential voltage amplitude are measured by the oscilloscope and stored.

The results are saved in two separate calibration data files, one for the offset and one for the amplitude values.

Connection Diagram

Refer to Figure 4-1, Figure 4-2 and Figure 4-3 for terminated calibrations and Figure 4-6, Figure 4-7 and Figure 4-8 for non-terminated calibrations.

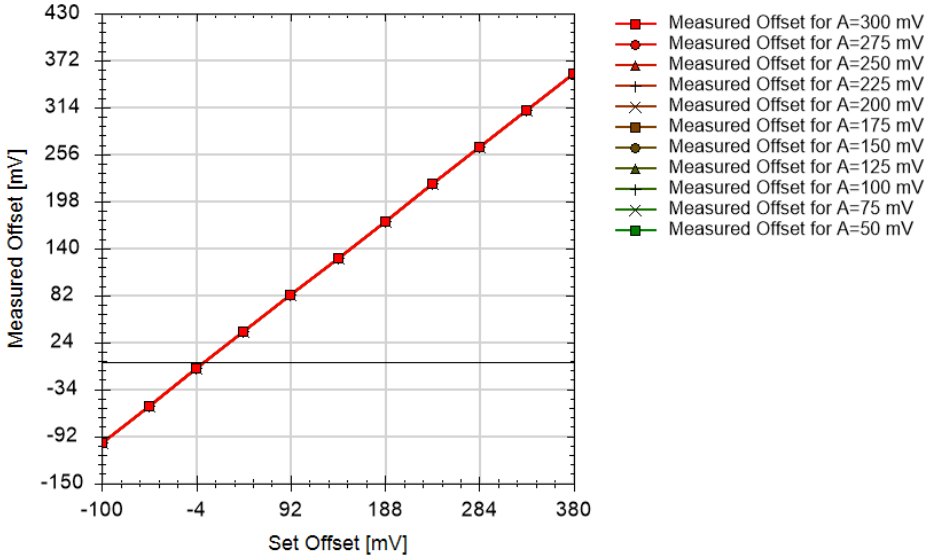
Result Description

The Level Calibration produces two sets of results: one for the offset (Figure 4-12) and one for the amplitude (Figure 4-13).

Levels Cal. Term Data0 Offset

[Not Compliant]

Calibration of the generator Offset Terminated



----General----	
Offline	True
Software Version	1.3.0.18
Required-calibration SW Version	N/A
Compliant	False
Non-compliance reason(s)	Procedure offline
Attenuator	0 dB
Capture screen-shot for each calibration measurement	True
Amplitude Range	0.05; 0.3; 11; Linear
Offset Range	-0.1; 0.38; 11; Linear
Capture Screenshot	True
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
----InfiniiSim Settings----	
Use Infiniisim	False
Transfer Function DataP	DoNothing.tf2
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysigh
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEy
Measurement Instrument 1	Name: Keysight DSO ; Company: Keysight Technolo

Set Offset [mV]	Measured Offset for A=300 mV [mV]	Measured Offset for A=275 mV [mV]	Measured Offset for A=250 mV [mV]	Measured Offset for A=225 mV [mV]	Measured Offset for A=200 mV [mV]	Measured Offset for A=175 mV [mV]	Measured Offset for A=150 mV [mV]	Measured Offset for A=125 mV [mV]	Measured Offset for A=100 mV [mV]	Measured Offset for A=75 mV [mV]	Measured Offset for A=50 mV [mV]
-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100
-52	-54	-54	-54	-54	-54	-54	-54	-54	-54	-54	-54
-4	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9
44	37	37	37	37	37	37	37	37	37	37	37
92	82	82	82	82	82	82	82	82	82	82	82
140	128	128	128	128	128	128	128	128	128	128	128
188	174	174	174	174	174	174	174	174	174	174	174
236	219	219	219	219	219	219	219	219	219	219	219
284	265	265	265	265	265	265	265	265	265	265	265
332	310	310	310	310	310	310	310	310	310	310	310
380	356	356	356	356	356	356	356	356	356	356	356

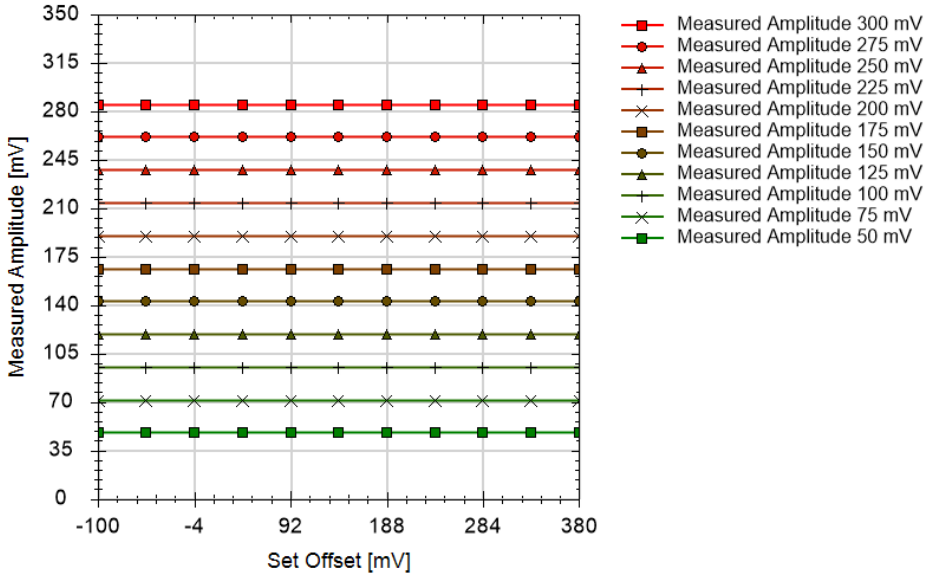
Figure 4-12 Example result for Level Calibration – Offset

- Set Offset [mV]: The offset value set on the generator.
- Measured Offset for A = X mV [mV]: The effective offset value as measured with a DSO/UXR using the histogram technique for a generator set amplitude value of X mV.

Levels Cal. Term Data0 Amplitude

[Not Compliant]

Calibration of the Generator Amplitude Terminated



----General----	
Offline	True
Software Version	1.3.0.18
Required-calibration SW Version	N/A
Compliant	False
Non-compliance reason(s)	Procedure offline
Attenuator	0 dB
Capture screen-shot for each calibration measurement	True
Amplitude Range	0.05; 0.3; 11; Linear
Offset Range	-0.1; 0.38; 11; Linear
Capture Screenshot	True
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
----InfiniiSim Settings----	
Use Infiniisim	False
Transfer Function DataP	DoNothing.tf2
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysigh
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEy
Measurement Instrument 1	Name: Keysight DSO ; Company: Keysight Technolo

Set Offset [mV]	Measured Amplitude 300 mV [mV]	Measured Amplitude 275 mV [mV]	Measured Amplitude 250 mV [mV]	Measured Amplitude 225 mV [mV]	Measured Amplitude 200 mV [mV]	Measured Amplitude 175 mV [mV]	Measured Amplitude 150 mV [mV]	Measured Amplitude 125 mV [mV]	Measured Amplitude 100 mV [mV]	Measured Amplitude 75 mV [mV]	Measured Amplitude 50 mV [mV]
-100	285	261	238	214	190	166	143	119	95	71	48
-52	285	261	238	214	190	166	143	119	95	71	48
-4	285	261	238	214	190	166	143	119	95	71	48
44	285	261	238	214	190	166	143	119	95	71	48
92	285	261	238	214	190	166	143	119	95	71	48
140	285	261	238	214	190	166	143	119	95	71	48
188	285	261	238	214	190	166	143	119	95	71	48
236	285	261	238	214	190	166	143	119	95	71	48
284	285	261	238	214	190	166	143	119	95	71	48
332	285	261	238	214	190	166	143	119	95	71	48
380	285	261	238	214	190	166	143	119	95	71	48

Figure 4-13 Example result for Level Calibration – Offset

- Set Offset [mV]: the offset value set on the generator.
- Measured Amplitude X mV [mV]: The effective amplitude value as measured with a DSO/UXR using the histogram technique for a generator set amplitude value of X mV.

Short Term RJ Calibration

Availability

Hardware	All configurations
Termination	Terminated
Mode	Compliance (Gears 1B, 2B) Expert (Gears 1A, 2A and 1B, 2B)
Data Rates	HS-Gears 1A, 1B, 2A, 2B

In the CTS for M-PHY v5.0, this procedure is mandatory only for B-series gears (for A-series, the procedure is shown in the test tree as informative).

Purpose and Method

The purpose of this procedure is to calibrate the high frequency RJ that is generated internally by the BERT.

This calibration should be run once at each HS data rate. For HS-G3 and above, this calibration has been replaced by RJ Calibration on page 90.

The pattern generator data outputs are connected to the UXR channels and a TTC is connected in between. In this calibration setup, a 1/30 UI TIE (Time Interval Error) high pass filter is applied by the oscilloscope to isolate the short term jitter components.

Starting at Min Jitter Value, the RJ value is increased by the Step Size value until the Max Jitter Value is reached. At each step, the values of random jitter are measured and both set and measured random jitter values are saved.

Connection Diagram

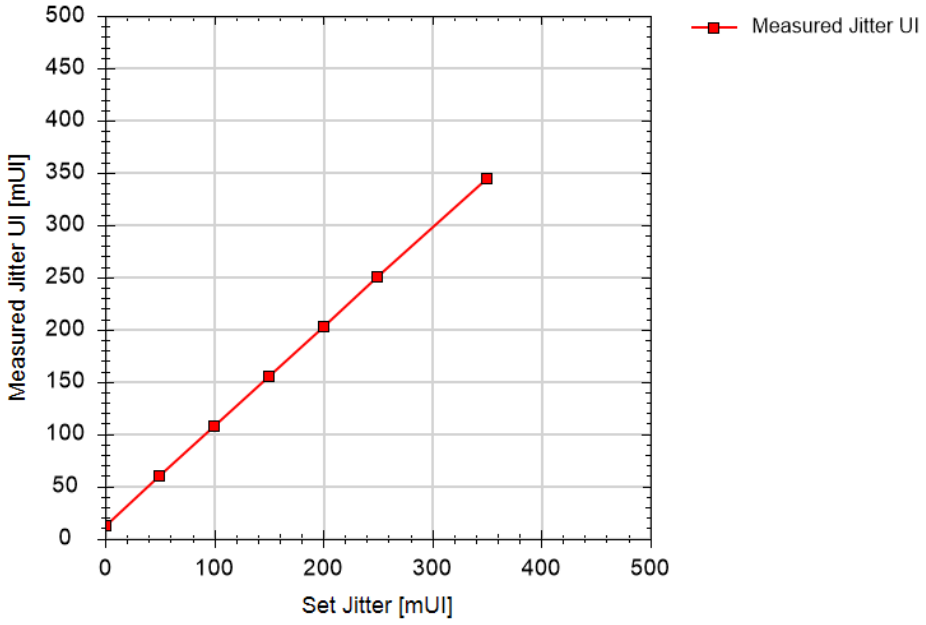
Refer to Figure 4-1, Figure 4-2 and Figure 4-3.

Result Description

STRJ Cal. 1248MBit

[Not Compliant]

Calibrates the Jitter Amplitude



----General----	
Offline	True
Software Version	1.3.0.18
Required-calibration SW Version	1.3.0.18
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant:
Attenuator	0 dB
Capture screen-shot for each calibration measurement	True
Oscilloscope Bandwidth	6 GHz
Amplitude	200 mV
Min Jitter Value	0 UI
Max Jitter Value	350 mUI
Step Size	50 mUI
Calibration transition count	500000
Capture Screenshot	True
Run without TTC	False
Wait for Manual Break	False

Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
----InfiniiSim Settings----	
Use Infiniisim	False
Transfer Function Data	DoNothing.tf2
Filter Delay Data	OFF
Max. Time Span Data	10 ns
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysigh
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEy
Measurement Instrument 1	Name: Keysight DSO ; Company: Keysight Technolo

Result	Set Jitter [mUI]	Measured Jitter UI [mUI]	Measured Jitter ps [ps]
pass	0	12	10.000
pass	50	60	48.061
pass	100	107	86.122
pass	150	155	124.183
pass	200	202	162.244
pass	250	250	200.304
pass	350	345	276.426

Figure 4-14 Example result for Short Term RJ Calibration

- Result: Pass/Fail — The calibration will fail if the measured values are non-monotonic.
- Set Jitter [mUI]: The jitter value set on the generator.
- Measured Jitter UI [mUI]: The value of jitter measured on the oscilloscope in terms of unit intervals.
- Measured Jitter ps [ps]: The value of jitter measured on the oscilloscope in units of picoseconds.

Low Frequency RJ Calibration

Availability

Hardware	All configurations
Termination	Terminated
Mode	Compliance (Gears 1B, 2B) Expert (Gears 1A, 2A and 1B, 2B)
Data Rates	HS-Gears 1A, 1B, 2A, 2B

In the CTS for M-PHY v5.0, this procedure is mandatory only for B-series gears (for A-series, the procedure is shown in the test tree as informative).

Purpose and Method

The purpose of this procedure is to calibrate the low frequency RJ that is generated internally by the BERT.

This calibration should be run once at HS-G1 and HS-G2. For HS-G3 and above, this calibration has been replaced by RJ Calibration on page 90.

Starting at Min Jitter Value, the RJ value is increased by the Step Size value until the Max Jitter Value is reached. The short term random jitter is kept stable at 100 mUI. At each step, the actual values of random jitter are measured by the oscilloscope and both set and measured random jitter values are saved.

Connection Diagram

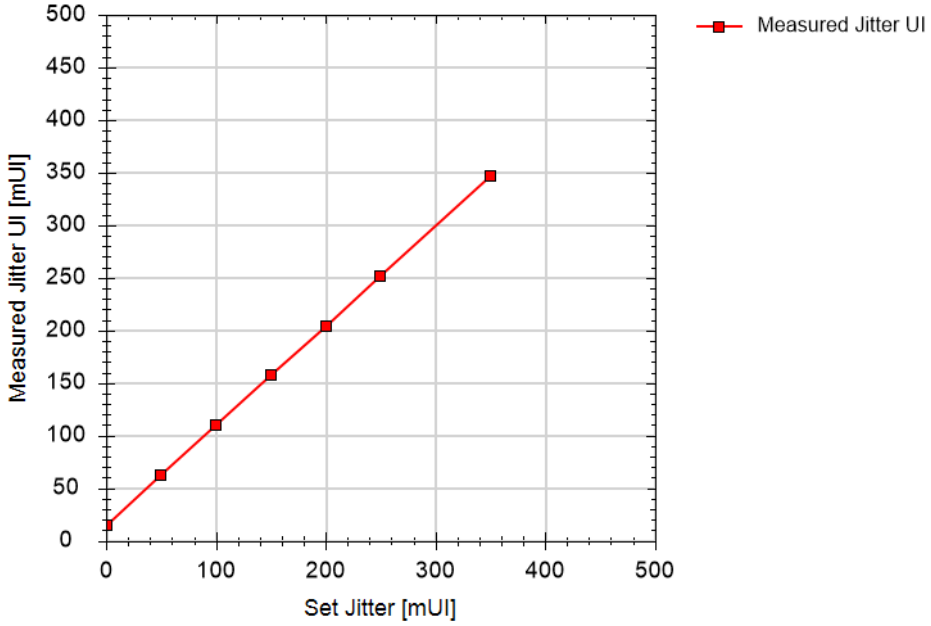
Refer to Figure 4-1, Figure 4-2 and Figure 4-3.

Result Description

LFRJ Cal. 1456MBit

[Not Compliant]

Calibrates the Jitter Amplitude



----General----	
Offline	True
Software Version	1.3.0.18
Required-calibration SW Version	1.3.0.18
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant:
Attenuator	0 dB
Capture screen-shot for each calibration measurement	True
Oscilloscope Bandwidth	6 GHz
Amplitude	200 mV
Short Term Random Jitter	100 mUI
BUJ Polynomial	PRBS7
Analysis Method	Spectral
Min Jitter Value	0 UI
Max Jitter Value	350 mUI
Step Size	50 mUI
Calibration transition count	500000

Capture Screenshot	True
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
----InfiniiSim Settings----	
Use Infiniisim	False
Transfer Function Data	DoNothing.tf2
Filter Delay Data	OFF
Max. Time Span Data	10 ns
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysigh
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEy
Measurement Instrument 1	Name: Keysight DSO ; Company: Keysight Technolc

Result	Set Jitter [mUI]	Measured Jitter UI [mUI]	Measured Jitter ps [ps]
pass	0	15	10.000
pass	50	62	42.624
pass	100	110	75.247
pass	150	157	107.871
pass	200	205	140.495
pass	250	252	173.118
pass	350	347	238.365

Figure 4-15 Example result for Low Frequency RJ Calibration

- Result: Pass/Fail — The calibration will fail if the measured values are non-monotonic.
- Set Jitter [mUI]: The jitter value set on the generator.
- Measured Jitter UI [mUI]: The value of jitter measured on the oscilloscope in terms of unit intervals.
- Measured Jitter ps [ps]: The value of jitter measured on the oscilloscope in units of picoseconds.

RJ Calibration

Availability

Hardware	All configurations
Termination	Terminated
Mode	Compliance (Gears 3B–5B) Expert (Gears 3A–5A and 3B–5B)
Data Rates	HS Gears 3A–5A and 3B–5B

In the CTS for M-PHY v5.0, this procedure is mandatory only for B-series gears (for A-series, the procedure is shown in the test tree as informative).

Purpose and Method

The RJ calibration for HS Gear 3–Gear 5 combines the two procedures defined for HS Gear 1 and Gear 2: Short Term RJ Calibration on page 84 and Low Frequency RJ Calibration on page 87. It eliminates the low frequency RJ component, so that the entire RJ budget of 0.17 UI is allotted to wide-band RJ, above 10 MHz.

This calibration should be run once at each HS Gear 3–Gear 5 data rate.

The pattern generator does a sweep of the random jitter values starting with the Min Jitter Value and increasing using the Step-Size value until the specified Max Jitter Value is reached. The oscilloscope measures the actual random jitter at each step and then the set and actual jitter values are stored.

Connection Diagram

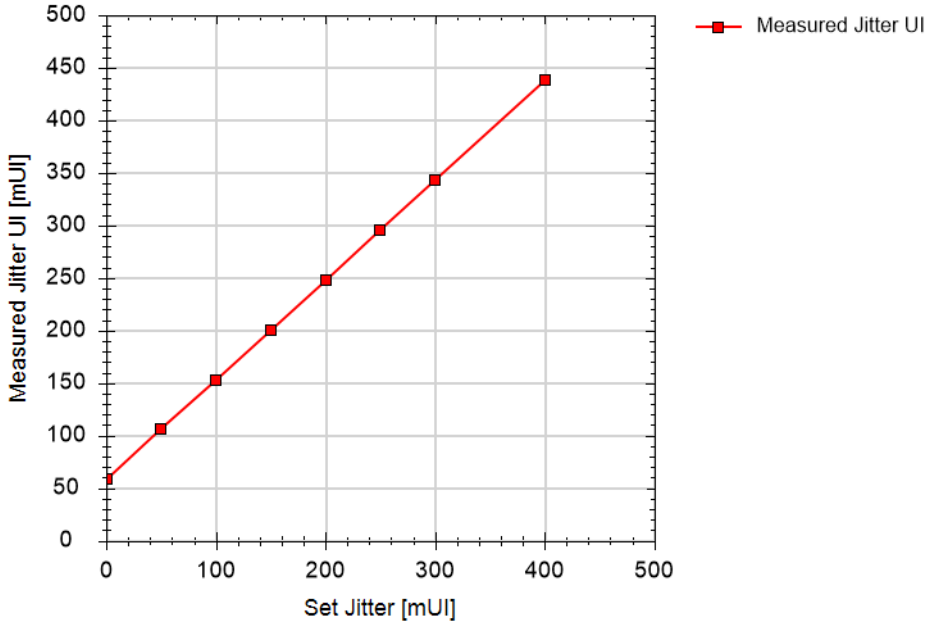
Refer to Figure 4-1, Figure 4-2 and Figure 4-3.

Result Description

RJ Cal. 5824MBit

[Not Compliant]

Calibrates the Jitter Amplitude



----General----	
Offline	True
Software Version	1.3.0.18
Required-calibration SW Version	1.3.0.18
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant:
Attenuator	0 dB
Capture screen-shot for each calibration measurement	True
Oscilloscope Bandwidth	20 GHz
Amplitude	200 mV
Min Jitter Value	0 UI
Max Jitter Value	400 mUI
Step Size	50 mUI
Calibration transition count	500000
Capture Screenshot	True
Run without TTC	False
Wait for Manual Break	False

Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
----InfiniiSim Settings----	
Use Infiniisim	False
Transfer Function Data	DoNothing.tf2
Filter Delay Data	OFF
Max. Time Span Data	10 ns
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysigh
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEy
Measurement Instrument 1	Name: Keysight DSO ; Company: Keysight Technolo

Result	Set Jitter [mUI]	Measured Jitter UI [mUI]	Measured Jitter ps [ps]
pass	0	58	10.000
pass	50	106	18.156
pass	100	153	26.312
pass	150	201	34.468
pass	200	248	42.624
pass	250	296	50.780
pass	300	343	58.935
pass	400	438	75.247

Figure 4-16 Example result for RJ Calibration

- Result: Pass/Fail – The calibration will fail if the measured values are non-monotonic.
- Set Jitter [mUI]: The jitter value set on the generator.
- Measured Jitter UI [mUI]: The value of jitter measured on the oscilloscope in terms of unit intervals.
- Measured Jitter ps [ps]: The value of jitter measured on the oscilloscope in units of picoseconds.

ISI Calibration

Availability

Hardware	All configurations
Termination	Terminated
Mode	Compliance (Gears 1B–5B) Expert (Gears 1A–5A and 1B–5B)
Data Rates	All HS-gear data rates

In the CTS for M-PHY v5.0, this procedure is mandatory only for B-series gears (for A-series, the procedure is shown in the test tree as informative).

Purpose and Method

The receiver test setup requires an ISI compliance channel capable of introducing a channel loss as defined in the MIPI M-PHY specification. This procedure calibrates the ISI of the trace used for that purpose.

Instead of using a physical ISI channel, embedded ISI of M8020A can be used, if available.

This calibration should be run once at each HS data rate.

The data generator sends a continuous CJTPAT signal at the selected HS-gear data rate. The ISI is then measured and saved.

Connection Diagram

Refer to Figure 4-4 and Figure 4-5.

Result Description

ISI Cal. 5824MBit

[Not Compliant]

Calibrates the Jitter Amplitude

----General----	
Offline	True
Software Version	1.3.0.18
Required-calibration SW Version	1.3.0.18
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant:
Attenuator	0 dB
Capture screen-shot for each calibration measurement	True
Oscilloscope Bandwidth	20 GHz
Amplitude	200 mV
Jitter Calibration File	JitterCalibration2015.seq
Calibration transition count	500000
Capture Screenshot	True
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
----InfiniiSim Settings----	
Use Infiniisim	False
Transfer Function Data	DoNothing.tf2
Filter Delay Data	OFF
Max. Time Span Data	10 ns
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysigh
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEy
Measurement Instrument 1	Name: Keysight DSO ; Company: Keysight Technolo

Result	Data Rate [GBit/s]	Measured ISI [mUI]
pass	5.824	145.6

Figure 4-17 Example result for ISI Calibration

- Result: Pass/Fail – The result is pass if the measured ISI agrees with that defined in the MIPI M-PHY specification.
- Data Rate [GBit/s]: HS-gear data rate at which the ISI was calibrated.
- Measured ISI [mUI]: Value of the measured ISI.

High Frequency SJ Calibration

Availability

Hardware	All configurations
Termination	Terminated
Mode	Compliance (Gears 1B–5B) Expert (Gears 1A–5A and 1B–5B)
Data Rates	All HS-gear data rates

In the CTS for M-PHY v5.0, this procedure is mandatory only for B-series gears (for A-series, the procedure is shown in the test tree as informative).

Purpose and Method

This procedure calibrates the high-frequency sinusoidal jitter that is added to the generated signal.

This calibration should be run once at each selected HS-gear data rate.

For this calibration, the TIE high pass filter (1/30 UI) is not applied. While calibrating the STDJ (short term deterministic jitter) higher than 1/30 UI, the low frequency DDJ is not filtered from the DJ measurement.

The data generator does a sweep of the SJ amplitude between the given minimum and the maximum jitter values. Each jitter value is calibrated for several frequency points (given by the Frequency Range and Additional Jitter Frequencies parameters). At each step, the actual value of jitter amplitude, measured with the DSO/UXR, and the set value are saved.

Connection Diagram

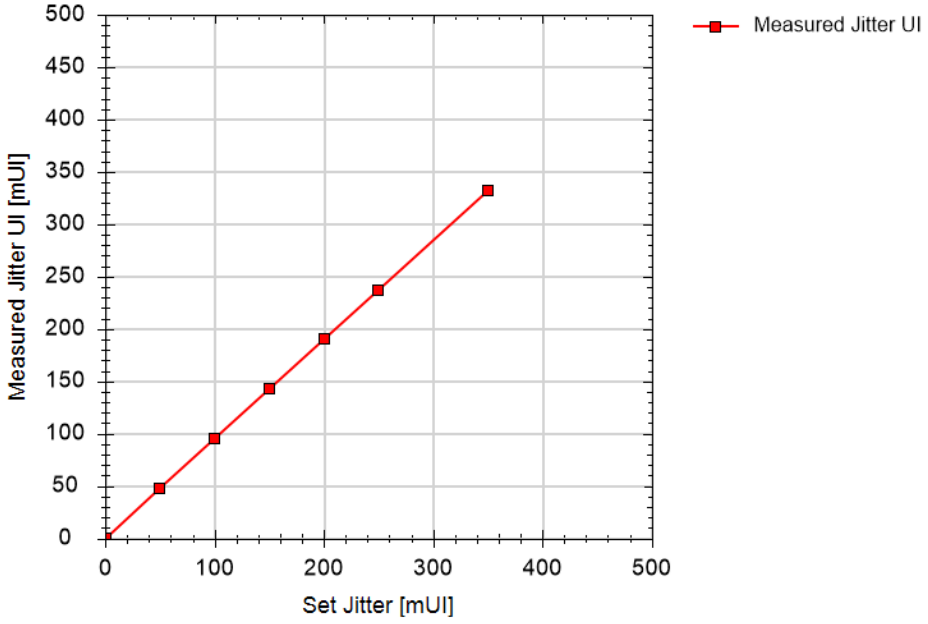
Refer to Figure 4-4 and Figure 4-5.

Result Description

HFSJ Cal. 5824MBit

[Not Compliant]

Calibrates the Jitter Amplitude



----General----	
Offline	True
Software Version	1.3.0.18
Required-calibration SW Version	1.3.0.18
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant:
Attenuator	0 dB
Capture screen-shot for each calibration measurement	True
Oscilloscope Bandwidth	20 GHz
Amplitude	200 mV
HFSJ Frequency	240 MHz
Min Jitter Value	0 UI
Max Jitter Value	350 mUI
Step Size	50 mUI
Jitter Calibration File	JitterCalibration2015.seq
Calibration transition count	14000
Capture Screenshot	True
Run without TTC	False

Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
----InfiniiSim Settings----	
Use Infiniisim	False
Transfer Function Data	DoNothing.tf2
Filter Delay Data	OFF
Max. Time Span Data	10 ns
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysigh
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEy
Measurement Instrument 1	Name: Keysight DSO ; Company: Keysight Technolo

Result	Set Jitter [mUI]	Measured Jitter UI [mUI]	Measured Jitter ps [ps]
pass	0	0	0.000
pass	50	48	8.156
pass	100	95	16.312
pass	150	143	24.468
pass	200	190	32.624
pass	250	238	40.780
pass	350	333	57.091

Figure 4-18 Example result for High Frequency SJ Calibration

- Result: Pass/Fail – The result is fail if the results are not monotonic.
- Set Jitter [mUI]: The jitter value set on the generator.
- Measured Jitter UI [mUI]: The value of jitter measured on the oscilloscope in terms of unit intervals.
- Measured Jitter ps [ps]: The value of jitter measured on the oscilloscope in units of picoseconds.

SJ Calibration

Availability

Hardware	All configurations
Termination	Terminated
Mode	Compliance (Gears 1B–5B) Expert (Gears 1A–5A and 1B–5B)
Data Rates	All HS-gear data rates

In the CTS for M-PHY v5.0, this procedure is mandatory only for B-series gears (for A-series, the procedure is shown in the test tree as informative).

Purpose and Method

This procedure calibrates the low frequency SJ that is injected internally by the BERT.

This calibration is run once at each selected HS data rate.

The generator data outputs are connected to the DSO/UXR and an ISI board is connected in between.

The BERT sends a CJTPAT signal. The data generator does a sweep of the SJ amplitude between the given Min Jitter Value and the Max Jitter Value. Each jitter value is calibrated for several frequency points (given by the Frequency Range and Additional Jitter Frequencies parameters). At each step, the actual value of jitter amplitude, measured with the DSO/UXR, and the set value are saved.

Connection Diagram

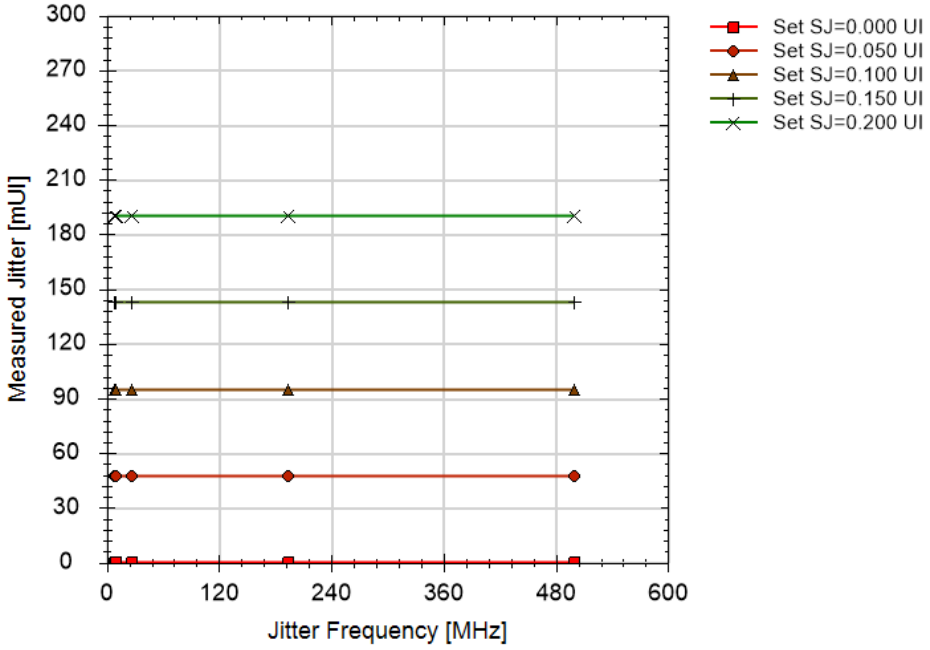
Refer to Figure 4-4 and Figure 4-5.

Result Description

SJ Cal. 5824MBit

[Not Compliant]

Calibrates the Jitter Amplitude



----General----	
Offline	True
Software Version	1.3.0.18
Required-calibration SW Version	1.3.0.18
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant:
Attenuator	0 dB
Capture screen-shot for each calibration measurement	True
Oscilloscope Bandwidth	20 GHz
Amplitude	200 mV
Additional Jitter Frequencies [MHz]	8;10;26.26;194.133;500
Min Jitter Value	0 UI
Max Jitter Value	200 mUI
Step Size	50 mUI
Jitter Calibration File	JitterCalibration2015.seq
Calibration transition count	14000
Capture Screenshot	True

Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
----InfiniiSim Settings----	
Use Infiniisim	False
Transfer Function Data	DoNothing.tf2
Filter Delay Data	OFF
Max. Time Span Data	10 ns
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysigh
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEy
Measurement Instrument 1	Name: Keysight DSO ; Company: Keysight Technolo

Result	Jitter Frequency [MHz]	Set SJ=0.000 UI [mUI]	Set SJ=0.050 UI [mUI]	Set SJ=0.100 UI [mUI]	Set SJ=0.150 UI [mUI]	Set SJ=0.200 UI [mUI]
pass	8.00	0	48	95	143	190
pass	10.00	0	48	95	143	190
pass	26.26	0	48	95	143	190
pass	194.13	0	48	95	143	190
pass	500.00	0	48	95	143	190

Figure 4-19 Example result for SJ Calibration

- Result: Pass/Fail – The result is fail if the results are not monotonic.
- Jitter Frequency [MHz]: The frequency of the jitter that is being calibrated.
- Set SJ = X UI [mUI]: The measured amplitude value of the sinusoidal jitter for the set amplitude value X.

Eye Opening Calibration with Jitter

Availability

Hardware	All configurations
Termination	Terminated
Mode	Compliance (Gears 1B–5B) Expert (Gears 1A–5A and 1B–5B)
Data Rates	All HS-gear data rates

In the CTS for M-PHY v5.0, this procedure is mandatory only for B-series gears (for A-series, the procedure is shown in the test tree as informative).

Purpose and Method

The purpose of this calibration is to fine-tune the (horizontal, time) jitter component and the (vertical) voltage amplitude to reach a target eye mask.

According to the CTS for M-PHY v5.0, this eye mask at a BER of 1E–6 must have a width of 0.52 UI ± 5% for G1–G4 and 0.39 UI ± 5% for G5. The eye mask at 1E–6, produced by adjusting the output swing for a target BER of 1E–12, must have an amplitude (height) of 45 mV for G1, G2; 47 mV for G3, G4; and 37.5 mV for G5.

This calibration is run once at each selected HS data rate.

First, the Sinusoidal Jitter is adjusted until the measured eye width is within the specified limits. At each step, the SJ starts with the default value and is then recalculated based on the difference from the target value. Once the jitter components are set, a sweep over the differential voltage is performed until the measured eye height is below the target value.

The eye width and height values are obtained by using the histogram measurements of the UXR. Additionally, for HS-G4 and HS-G5, the jitter measurements are performed with the equalization (CTLE and DFE) settings of the oscilloscope and histogram measurements are used to measure the amount of jitter.

This procedure is repeated for different frequencies: f_{SJ0_RX}, f_{SJ2_RX}, f_{SJ3_RX}, f_{SJ4_RX} as defined in the specification.

Connection Diagram

Refer to Figure 4-4 and Figure 4-5. The required values of the TTCs depend on the HS data rate and are given in the connection diagrams in the ValiFrame software.

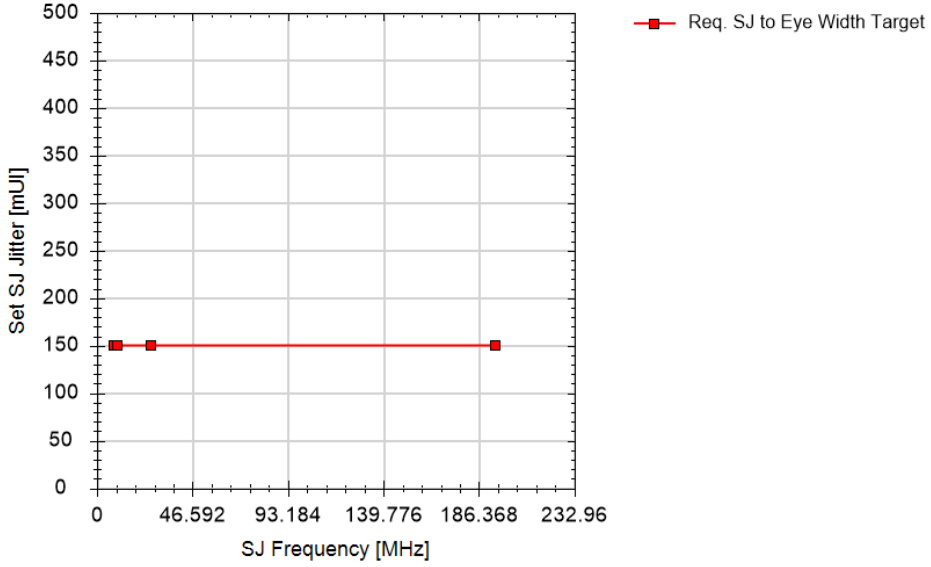
Result Description

This calibration produces two sets of results: one for eye width (Figure 4-20) and one for eye height (Figure 4-21).

Eye Width 5824MBit

[Not Compliant]

Calibrates the Eye Width with Jitter



----General----	
Offline	True
Software Version	1.3.0.18
Required-calibration SW Version	1.3.0.18
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant: GBit/s ; Required cal offline: Reference Clock
Attenuator	0 dB
Capture screen-shot for each calibration measurement	True
Oscilloscope Bandwidth	20 GHz
Jitter Frequencies [MHz]	8;10;26.26;194.133
Eye Width Target	520 mUI
Eye Width Max. Variation	5 %
Eye Height Target	47 mV
BER Target	1E-6
ISI (pk-pk)	0 UI
Calibration Sequence File	JitterCalibration2015.seq
Eye Mask Acquisition Time Out	60 s

Capture Screenshot	True
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
----InfiniiSim Settings----	
Use Infiniisim	False
Transfer Function Data	DoNothing.tf2
Filter Delay Data	OFF
Max. Time Span Data	10 ns
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysigh
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEy
Measurement Instrument 1	Name: Keysight DSO ; Company: Keysight Technolo

Result	SJ Frequency [MHz]	Req. SJ to Eye Width Target [mUI]	Jitter Cocktail Values	Eye Width [mUI]
pass	8.00	150	Data0: ISI=0 Target RJ=0.17 Target STSJ (PJ1) =0.2 Target SJ (PJ2) =0.15	520
pass	10.00	150	Data0: ISI=0 Target RJ=0.17 Target STSJ (PJ1) =0.2 Target SJ (PJ2) =0.15	520
pass	26.26	150	Data0: ISI=0 Target RJ=0.17 Target STSJ (PJ1) =0.2 Target SJ (PJ2) =0.15	520
			Data0: ISI=0	

(...)

Figure 4-20 Example result for Eye Opening Calibration with Jitter – Eye Width (top of table)

- Result: Pass/Fail — The result is Fail if it is not possible to reach the target eye width by adjusting the SJ.
- SJ Frequency [MHz]: The frequency of the applied SJ.
- Req. SJ to Eye Width Target [mUI]: The applied SJ amplitude that resulted in the target eye width.
- Jitter Cocktail Values: The amount of jitter applied in the calibration. ISI, RJ and STSJ are fixed, while SJ is adjusted to obtain the target eye width.

Eye Height 5824MBit

[Not Compliant]

Calibrates the Eye Height with Jitter

----General----	
Offline	True
Software Version	1.3.0.18
Required-calibration SW Version	1.3.0.18
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant: GBit/s ; Required cal offline: Reference Clock
Attenuator	0 dB
Capture screen-shot for each calibration measurement	True
Oscilloscope Bandwidth	20 GHz
Jitter Frequencies [MHz]	8;10;26.26;194.133
Eye Width Target	520 mUI
Eye Width Max. Variation	5 %
Eye Height Target	47 mV
BER Target	1E-6
ISI (pk-pk)	0 UI
Calibration Sequence File	JitterCalibration2015.seq
Eye Mask Acquisition Time Out	60 s
Capture Screenshot	True
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
----InfiniiSim Settings----	
Use Infiniisim	False
Transfer Function Data	DoNothing.tf2
Filter Delay Data	OFF
Max. Time Span Data	10 ns
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysigh
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEy
Measurement Instrument 1	Name: Keysight DSO ; Company: Keysight Technolo

Result	Voltage Amplitude [mV]	Eye Height [mV]	Maximum V_diff_ac_tx [mV]
pass	310	155	620
pass	202	101	403
pass	131	65	262
pass	85	43	170

Figure 4-21 Example result for Eye Opening Calibration with Jitter – Eye Height

- Result: Pass/Fail. — The result is Fail if it is not possible to reach the target eye height by adjusting the voltage amplitude.
- Voltage Amplitude [mV]: The applied value of the voltage amplitude.
- Eye Height [mV]: Measured value of the eye height for the set voltage amplitude.
- Maximum V_diff_ac_tx [mV]: The differential voltage measured for the set voltage amplitude.

Embedded Fixture ISI Calibration

Availability

Hardware	Only M8020A configurations
Termination	Terminated
Mode	Compliance, Expert
Data Rates	Data rates corresponding to HS gears 3A, 3B, 4A, 4B, but only if the preset for each gear is set to Automatic. See below.

Purpose and Method

This calibration is available for the M8020A configurations. It is required for HS Gear 3 and Gear 4 when the M8020A ISI preset is selected as Automatic (see M8020 ISI Setting on page 44).

The receiver test setup must include an ISI Compliance Channel capable of introducing a channel loss as defined in the M-PHY specification. This procedure calibrates the ISI when it is generated with the embedded M8020A ISI fixture and the preset is selected as Automatic (see M8020 ISI Setting on page 44).

Unlike the ISI Calibration, which only measures the ISI generated by the selected ISI trace, the Embedded Fixture ISI Calibration is used to find the optimal insertion loss configuration that achieves an ISI closest to the target value.

The data generator sends a continuous CJTPAT pattern. Then it does a sweep of the insertion loss at the second frequency point, which is set to 4.992 GHz. At each step, the ISI is measured and stored. The insertion loss is increased by the defined “Step Size” until the “Target ISI Value” is reached.

Connection Diagram

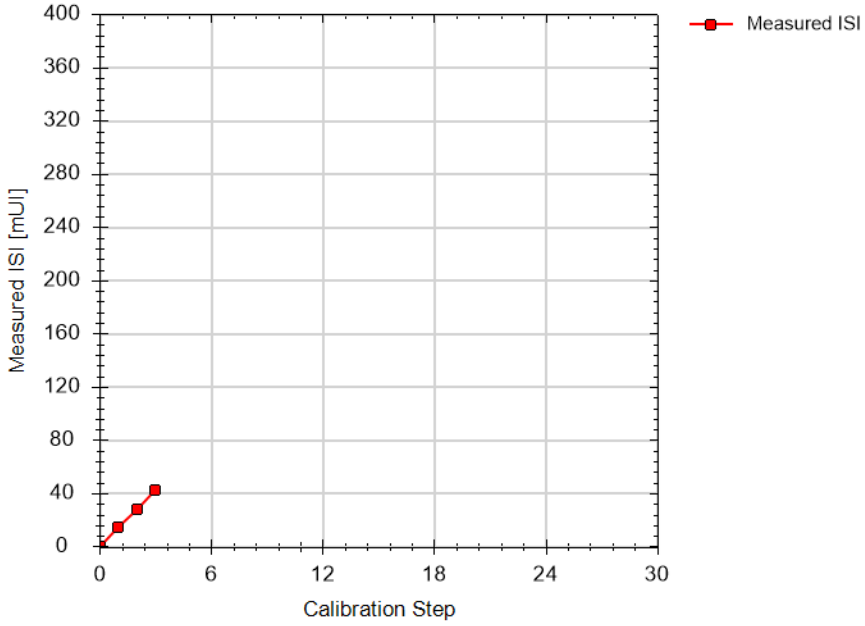
Figure 4-22 Example connection diagram for Embedded Fixture ISI Calibration

Result Description

ISI Cal. 5824MBit P2

[Not Compliant]

Calibrates the ISI Amplitude




```
----General----
Offline                          True
Software Version                 1.3.0.18
Required-calibration SW Version  1.3.0.18
Compliant                        False
Non-compliance reason(s)         Procedure offline; Required cal not compliant: Reference Clock Calib
Oscilloscope Bandwidth           20 GHz
ISI Calibration Sequence-File    C:\ProgramData\BitifEye\ValiFrameK1\MPhy\Pattern\JitterCalibrationCJ
Target ISI Value                 46.84 mUI
Step Size                        1 dB
Accuracy of the Calibration      10 mUI
Transitions                      500000
Capture Screenshot               True
Run without TTC                  False
Wait for Manual Break            False
Show DUT Configure Dialog        False
Sampling Rate                    Default
TrigThreshold Mode               0
```

```
----InfiniiSim Settings----
Use Infiniisim                  False
Transfer Function Data          DoNothing.tf2
Filter Delay Data               OFF
Max. Time Span Data             10 ns
----Instruments----
Calibrated Instrument 1         Name: Keysight M8020A J-BERT ; Company: Keysight Technologies ; Mode
Calibrated Instrument 2         Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A
Measurement Instrument 1        Name: Keysight DSO ; Company: Keysight Technologies ; Model: DSO Inf
```

Result	Calibration Step []	Measured ISI [mUI]	Set Insertion Loss of Point2 [dB]	Frequency of Point2 [GHz]
pass	0	0.00	-0.200	5.824
pass	1	14.05	-1.200	5.824
pass	2	28.10	-2.200	5.824
pass	3	42.16	-3.200	5.824

Figure 4-23 Example result for Embedded Fixture ISI Calibration

- Result: Pass/Fail — The calibration will fail if the measured values are non-monotonic.
- Calibration Step: The step number.
- Measured ISI [mUI]: The ISI measured at each step.
- Set Insertion Loss of Point2 [dB]: The insertion loss that the M8020A sets at the second frequency point.
- Frequency of Point2 [GHz]: Frequency of second frequency point.

Inter Pair Skew Calibration

Availability

Hardware	All configurations
Termination	Terminated
Channels	More than one channel
Mode	Compliance, Expert
Protocol	UniPro
Data Rates	HS Gears 1–5 (M8040A) HS Gears 1–4 (M8020A)

NOTE

If the M8040A is used, there is a random skew of ±300 ps between Data Output Chan1 and Chan2 on changing the data rate. Therefore, in this case, the Inter Pair Skew Calibration needs to be performed directly before Test 2.1.6 for each gear. For this reason this calibration appears in the procedure tree under the node “Skew Tests” immediately before Test 2.1.6 for each gear.

If the M8020A is used, the calibration appears under “Terminated Calibrations,” as expected.

Purpose and Method

The purpose of this procedure is to calibrate the inter-channel timing behavior.

The outputs of data lanes are directly connected to the DSO/UXR inputs via SMA connectors. The skew is measured for all DUT lanes with respect to Lane 0. For Lane 1, the skew between Lane 0 and Lane 1 is given as:

$Skew_{(L1\text{-}to\text{-}L0)}$ = mean[(Lane 1 crossing times) – (Lane 0 crossing times)]

The skew is measured and calibrated iteratively until its value is smaller than the specification conformance limit.

Connection Diagram

Figure 4-24 Example connection diagram for Inter Pair Skew Calibration (M8040A)

Result Description

Inter Pair Skew Cal

[Not Compliant]

Skew Calibration

----General----	
Offline	True
Software Version	1.3.0.18
Required-calibration SW Version	1.3.0.18
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant: Calibration
Attenuator	0 dB
Capture screen-shot for each calibration measurement	True
Skew Tolerance	10 ps
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
Capture Screenshot	True
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysigh
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEy
Measurement Instrument 1	Name: Keysight DSO ; Company: Keysight Technolo

Result	Lane	Skew Value [ps]
pass	Data0	0.0
pass	Data1	1.0

Figure 4-25 Example result for Inter Pair Skew Calibration

- Result: Pass/Fail — The calibration will pass if the measured skew value is within the limits set by the specification.
- Lane: Data channel.
- Skew Value [ps]: Value of the inter pair skew.

Default Inter Pair Skew Calibration

Availability

Hardware	M8040A with or without DSGA
Termination	Terminated
Channel	More than one channel
Mode	Compliance, Expert
Protocol	UniPro, UFS

Purpose and Method

The purpose of this procedure is to calibrate the inter-channel timing behavior.

The normal outputs of data lanes are directly connected to the DSO/UXR inputs via SMA connectors. The complement outputs are terminated. The skew is measured for all DUT lanes with respect to Lane 0. For Lane 1, the skew between Lane 0 and Lane 1 is given as:

$Skew_{(L1\text{-}to\text{-}L0)}$ = mean [(Lane 1 crossing times) – (Lane 0 crossing times)]

The skew is measured and calibrated iteratively until its value is smaller than the specification conformance limit.

Connection Diagram

Refer to Figure 4-24.

Result Description

This is the same as for Inter Pair Skew Calibration.

NOTE

For M8040A, there is a random skew of ±300 ps between Data Output Chan1 and Chan2 on changing the data rate. Therefore, in this case, the Inter Pair Skew Calibration needs to be performed directly before Test 2.1.6 for each gear. For this reason, for M8040A, the “Non-Default” Inter Pair Skew Calibration appears in the procedure tree under the node “Skew Tests” immediately before Test 2.1.6 for each gear.

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5 MIPI M-PHY Receiver Tests

Once the MIPI M-PHY Test Station has been calibrated, MIPI M-PHY receiver test procedures can be run.

MIPI M-PHY Receiver Test Overview

The MIPI M-PHY Receiver test procedures are organized in the following groups:

- HS Tests
- Squelch Tests
- PWM Tests
- Interference Tests
- Manual Tests

Prerequisite Calibrations

Prerequisite calibrations are not listed explicitly for each procedure in this User Guide. However, they can be found directly in the application (see Required Calibration Data for details).

MIPI M-PHY ValiFrame Parameters

Apart from 'Repetitions', ValiFrame for MIPI M-PHY has no **common parameters** for Receiver Tests.

The MIPI M-PHY ValiFrame **parameters for individual procedures** that can be changed in expert mode are not listed in this user guide explicitly. They are displayed in the parameter grid (right pane) of the main window of the user interface when you click on the corresponding entry in the procedure tree in the left half of the main window.

Details of MIPI M-PHY Receiver Test Parameters for individual procedures can be found in Table C-3 on page 219 and Table C-5 on page 226.

Connection Diagrams

In this User Guide, only example connection diagrams are given at the beginning of each section, for example for HS Tests. The exact connection diagram for a specific situation can be viewed by right-clicking the appropriate procedure in the procedure tree of the main window of the user interface and selecting "Show Connection...".

HS Tests

Example Connection Diagrams

In this User Guide, only example connection diagrams are given. The exact connection diagram for a specific situation can be viewed by right-clicking the appropriate procedure in the procedure tree of the main window of the user interface and selecting “Show Connection...”.

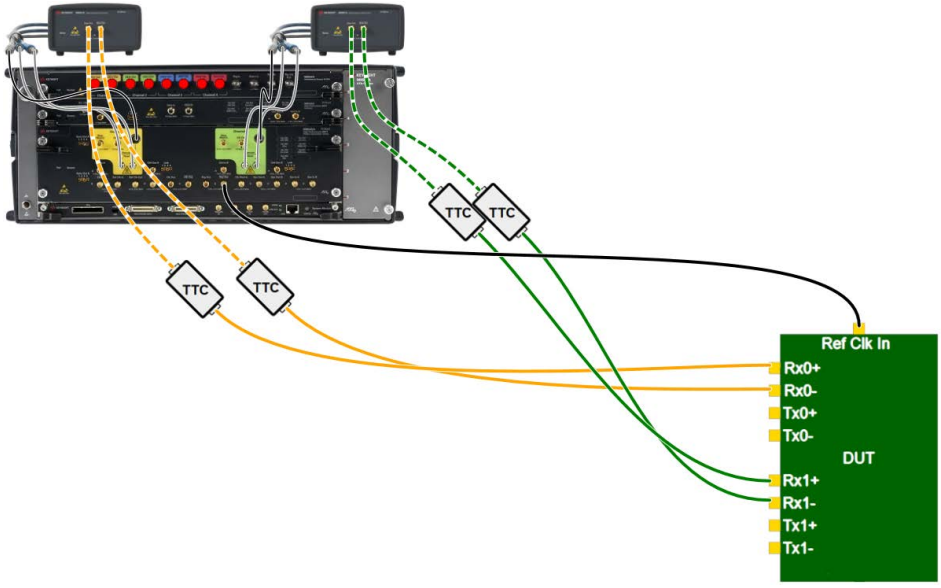


Figure 5-1 Example connection diagram for HS Terminated Tests (two channels, M8040A)

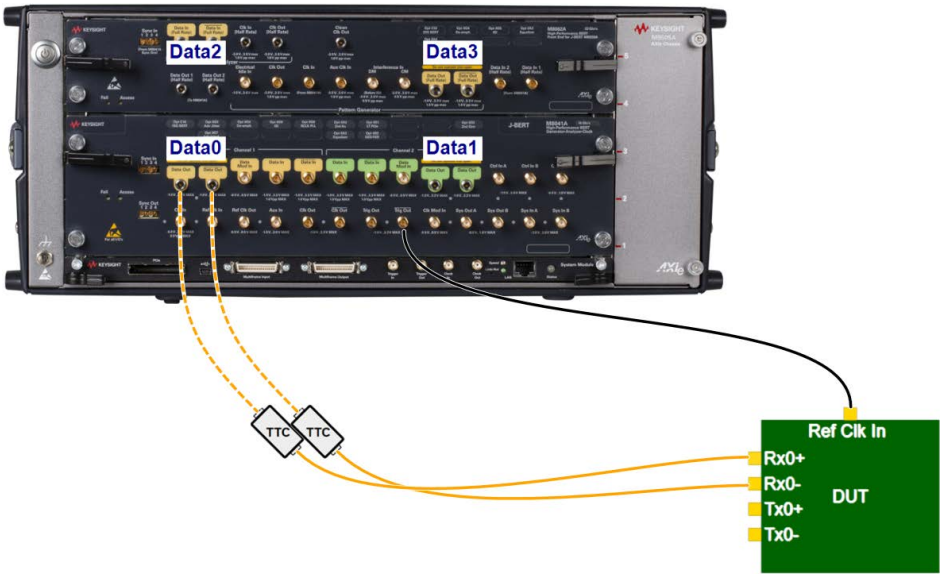


Figure 5-2 Example connection diagram for HS Terminated Tests (one channel, M8020A)

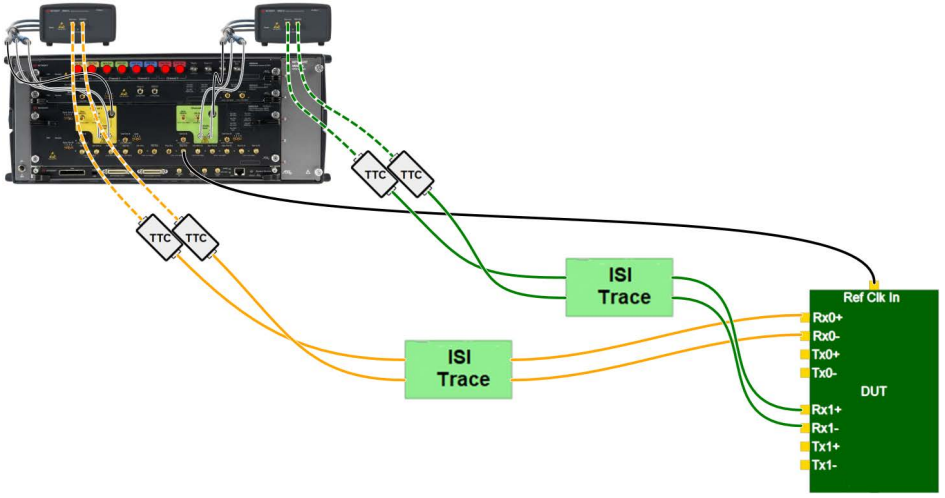


Figure 5-3 Example connection diagram for HS Terminated Tests with an ISI trace (two channels, M8040A)

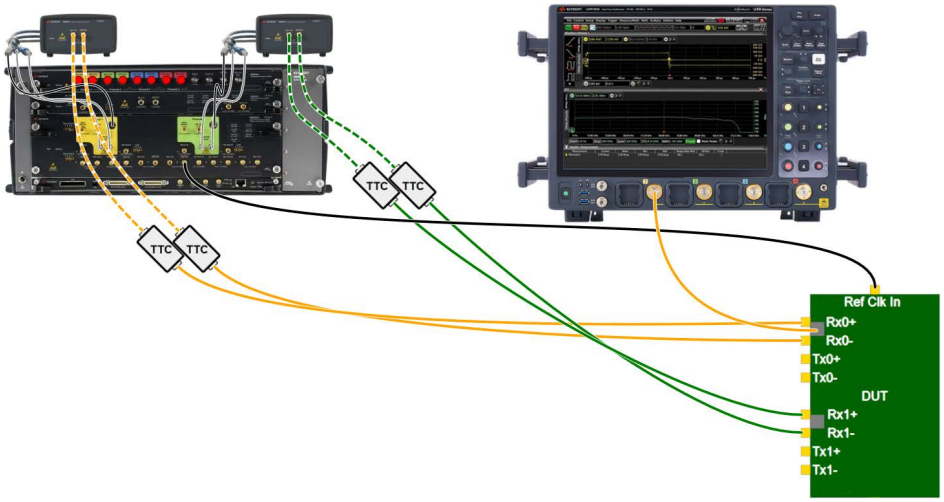


Figure 5-4 Example connection diagram for HS-RX termination enable/ disable time tests (M8040A)

Test 2.1.1 – HS-RX Differential Input Voltage Amplitude Tolerance

(V_DIF-DC-HS-RX)

Availability

Hardware	All configurations
Termination	Terminated
Mode	Compliance, Expert
Data Rates	HS Gears 1–5 (M8040A) HS Gears 1–4 (M8020A)

Purpose and Method

The purpose of this procedure is to verify that the M-RX is able to receive HS data successfully with the VDIF-RX values according to the specification.

The data generator sends burst-mode CJTPAT signals while the DUT is configured for terminated mode.

In **Compliance Mode**, the data generator sets the calibrated differential voltage amplitude to the minimum (60 mV) and maximum (245 mV) conformance values for the terminated case. The common mode voltage is fixed to the nominal value (150 mV) according to the specification. No other signal impairments (ISI or jitter) are added. At each step, the BER is measured and compared with the target BER to determine the pass/fail result.

In **Expert Mode**, the differential voltage component of each level pair is tested over the given amplitude range. In this case, the result will show the minimum and maximum differential voltage values at which the DUT works properly and the test will pass if those values are within the specification limits.

This test is performed for all selected HS gears and lanes. How the different lanes are tested for each gear depends on the option chosen for “Lane Test Mode”.

Connection Diagram

Refer to Figure 5-1 and Figure 5-2.

Result Description

Ampl Sens. Data0 1248MBit

[Not Compliant]

Test 2.1.1: Verify the level tolerance Terminated

```
----General----
Offline                          True
Software Version                 1.3.0.18
Required-calibration SW Version  1.3.0.18
Compliant                        False
Non-compliance reason(s)         Procedure offline; Required cal not compliant: Level Cal. Terminated
HS Prepare Length                15
HS Sync Length                   7
Stall length                     20
Initial Adapt Length             0
Initial Adapt Type               Fine
Refresh Adapt Length             0
Refresh Adapt Type               Fine
LS Prepare length                7
Sleep length                     5
PWM Tail of Burst                10
Reset Pulse Width                100 us
PWM Burst Closure Extension      32
Ref Clock Frequency              26 MHz
Target BER                       1E-12
IBerReader Init Mode             Data0; 1.248 GBit/s; RT
Voltage Levels                   Calibrated
Retrial Number                   2
Test Sequence                    MPhyCompliance.seq
Re-Init sequence after Reset DUT True
Show Dialog at UniPro Reset DUT  False
Binary Search                    False
Run without TTC                  False
Wait for Manual Break            False
Show DUT Configure Dialog        False
Sampling Rate                    Default
TrigThreshold Mode               0
Capture Screenshot               True
Tested Differential Voltage      0
----Instruments----
Calibrated Instrument 1          Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mode
Calibrated Instrument 2          Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A
```

Result	Amplitude [mV]	Offset [mV]	Min Passed Amplitude [mV]	Min Spec Amplitude [mV]	Max Passed Amplitude [mV]	Max Spec Amplitude [mV]	Error Count [ ]
pass	310	150	N/A	N/A	310	310	0.000E+000
pass	60	150	60	60	N/A	N/A	0.000E+000

Figure 5-5 Example result for Test 2.1.1 – HS-RX Differential Input Voltage Amplitude Tolerance (Compliance Mode)

- Result: Pass/Fail — If the amplitude tolerance is less than the specification limit, the value is “Fail”.
- Amplitude [mV]: The value of the differential voltage amplitude to be tested.
- Offset [mV]: The value of the common mode voltage to be tested.
- Min Passed Amplitude [mV]: The minimum differential voltage amplitude value where the DUT has no errors.
- Min Spec Amplitude [mV]: The minimum differential voltage amplitude value where the DUT must work according to the specification.
- Max Passed Amplitude [mV]: The maximum differential voltage amplitude value where the DUT has no errors.
- Max Spec Amplitude [mV]: The maximum differential voltage amplitude value where the DUT must work according to the specification.
- Error Count: The number of errors reported by the DUT.

Test 2.1.3 – HS-RX Common-Mode Input Voltage Tolerance (V_CM-RX)

Availability

Hardware	All configurations
Termination	Terminated
Mode	Compliance, Expert
Data Rates	HS Gears 1–5 (M8040A) HS Gears 1–4 (M8020A)

Purpose and Method

This test determines whether the M-RX is able to receive the HS data with the specified values of V_{CM-RX}.

The data generator sends Burst-mode CJTPAT signaling while the DUT is configured for Terminated mode.

In **Compliance Mode**, the calibrated Level Pairs (V_{DIF-RX} and V_{CM-RX}) are set to four different test cases:

- nominal differential voltage and maximum common-mode (V_{DIF-RX} = 150 mV and V_{CM-RX} = 330 mV)
- nominal differential voltage and minimum common-mode ($_{VDIF-RX}$ = 150 mV and V_{CM-RX} = 25 mV)
- maximum differential voltage and maximum common-mode (V_{DIF-RX} = 245 mV and V_{CM-RX} = 330 mV)
- minimum differential voltage and minimum common-mode (V_{DIF-RX} = 60 mV and V_{CM-RX} = 25 mV)

At each step, the BER is measured and compared with the Target BER to determine the pass/fail result.

In **Expert Mode**, the common-mode voltage component of each Level Pair is tested over the given Offset Range. In this case, the result will show the minimum and maximum offset values at which the DUT works properly and the test will pass if those values are within the specification limits.

This test is performed for all selected HS gears and lanes. How the different lanes are tested for each gear depends on the option chosen for “Lane Test Mode”.

The Unterminated case is not tested because of the difficulties with measuring and calibrating while using the unterminated signaling.

Connection Diagram

Refer to Figure 5-1 and Figure 5-2.

Result Description

Offset Sens. Data0 1248MBit

[Not Compliant]

Test 2.1.3: Verify the level tolerance Terminated

----General----	
Offline	True
Software Version	1.3.0.18
Required-calibration SW Version	1.3.0.18
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant: Level Cal. Terminate
HS Prepare Length	15
HS Sync Length	7
Stall length	20
Initial Adapt Length	0
Initial Adapt Type	Fine
Refresh Adapt Length	0
Refresh Adapt Type	Fine
LS Prepare length	7
Sleep length	5
PWM Tail of Burst	10
Reset Pulse Width	100 us
PWM Burst Closure Extension	32
Ref Clock Frequency	26 MHz
Target BER	1E-12
IBerReader Init Mode	Data0; 1.248 GBit/s; RT
Voltage Levels	Calibrated
Retrial Number	2
Test Sequence	MPhyCompliance.seq
Re-Init sequence after Reset DUT	True
Show Dialog at UniPro Reset DUT	False
Binary Search	False
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
Capture Screenshot	True
Tested Differential Voltage	0

```
----Instruments----
Calibrated Instrument 1          Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mod
Calibrated Instrument 2          Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A
```

Result	Amplitude [mV]	Offset [mV]	Min Passed Offset [mV]	Min Spec Offset [mV]	Max Passed Offset [mV]	Max Spec Offset [mV]	Error Count [ ]
pass	310	330	N/A	N/A	330	330	0.000E+000
pass	60	25	25	25	N/A	N/A	0.000E+000
pass	150	330	N/A	N/A	330	330	0.000E+000
pass	150	25	25	25	N/A	N/A	0.000E+000

Figure 5-6 Example result for Test 2.1.3 – HS-RX Common-Mode Input Voltage Tolerance (Compliance Mode)

- Result: Pass/Fail — If the value is “Fail”, the voltage amplitude tolerance is less than the specification limit.
- Amplitude [mV]: The value of the differential voltage amplitude tested.
- Offset [mV]: The common mode voltage value tested.
- Min Passed Offset [mV]: The minimum common mode voltage value where the DUT has no errors.
- Min Spec Offset [mV]: The minimum common mode voltage value where the DUT must work according to the specification.
- Max Passed Offset [mV]: The maximum common mode voltage value where the DUT has no errors.
- Max Spec Offset [mV]: The maximum common mode voltage value where the DUT must work according to the specification.
- Error Count: The number of error bits reported by the DUT.

Test 2.1.8 – HS-RX Prepare Length Capability Verification

(T_HS-PREPARE-RX)

Availability

Hardware	All configurations
Termination	Terminated
Mode	Compliance, Expert
Data Rates	HS Gears 1–5 (M8040A) HS Gears 1–4 (M8020A)

Purpose and Method

The purpose of this procedure is to determine whether the DUT is able to receive HS-Burst data successfully with a PREPARE length according to the specification.

The data generator sends Burst-mode CJTPAT signaling while the DUT is configured for terminated mode.

In **Compliance Mode**, the differential voltage amplitude and the common mode are set to the nominal values (200 mV).

In **Expert Mode**, two Level Pairs are tested, the differential voltage amplitude is set to the minimum (60 mV) and maximum (245 mV) conformance values while the common-mode voltage is kept at the nominal value (150 mV). The test must be performed using the maximum f_{OFFSET} value of +2000 ppm. No other signal impairments such as ISI channel or jitter sources are added to the signal.

The duration of HS-Prepare Length ($T_{HS\text{-}PREPARE}$) is measured in SI (symbol interval), where 1 SI = 10 UI_{HS} and its value is calculated as given in Table 5-1. This $T_{HS\text{-}PREPARE}$ is tested over the HS-Prepare Range given in the parameter grid of the ValiFrame GUI. At each step, the BER is measured and compared with the Target BER to determine the pass/fail result. The DUT must be able to successfully receive bursts whose PREPARE length is within ±1 UI of the calculated $T_{HS\text{-}PREPARE}$.

NOTE **The ±1 UI tolerance is specified to allow for any natural measurement tolerance variation.**

This test is performed for all selected HS gears and lanes. How the different lanes are tested for each gear depends on the option chosen for “Lane Test Mode”. It is only required for the Terminated case.

Table 5-1 HS-PREPARE Length Values

Parameter Name	Parameter Value	Parameter Unit
HS_PREPARE_Length	0 to 15	N/A
$T_{HS\text{-}PREPARE}$	HS_PREPARE_Length * 2 * (GEAR-1)	SI (1 SI = 10 UI_{HS})

Connection Diagram

Refer to Figure 5-1 and Figure 5-2.

Result Description

THS-PREPARE Data0 1248MBit

[Not Compliant]

Test 2.1.8: Verify HS_Prepare_length Terminated

```
----General----
Offline                          True
Software Version                 1.3.0.18
Required-calibration SW Version  1.3.0.18
Compliant                        False
Non-compliance reason(s)         Procedure offline; Required cal not compliant: Level Cal. Terminate
HS Sync Length                   7
Stall length                     20
Initial Adapt Length             0
Initial Adapt Type               Fine
Refresh Adapt Length             0
Refresh Adapt Type               Fine
LS Prepare length                7
Sleep length                     5
PWM Tail of Burst                10
Reset Pulse Width                100 us
PWM Burst Closure Extension      32
Ref Clock Frequency              26 MHz
Target BER                       1E-12
IBerReader Init Mode             Data0; 1.248 GBit/s; RT
Voltage Levels                   Calibrated
Retrial Number                   2
Test Sequence                    MPhyCompliance.seq
```

Re-Init sequence after Reset DUT	True
Show Dialog at UniPro Reset DUT	False
HS-Prepare Length	15
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
Capture Screenshot	True
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mod
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A

Result	Tested HS_Prepare_length []	Tested Amplitude [mV]	Tested Offset [mV]
pass	15	200	200

Figure 5-7 Example result for Test 2.1.8 – HS-RX Prepare Length Capability Verification (Compliance Mode)

- Result: Pass/Fail — If the value is Fail, the DUT does not support the tested HS-Prepare length.
- Tested HS_Prepare_length: The value of the tested HS-Prepare length.
- Tested Amplitude [mV]: The differential voltage amplitude value tested.
- Tested Offset [mV]: The common-mode voltage value tested.

Test 2.1.9 – HS-RX Sync Length Capability Verification

(T_SYNC-RX)

Availability

Hardware	All configurations
Termination	Terminated
Mode	Compliance, Expert
Data Rates	HS Gears 1–5 (M8040A) HS Gears 1–4 (M8020A)

Purpose and Method

This procedure tests that the DUT receives the HS Burst with a SYNC length that is consistent with the given value in the M-PHY specification.

The data generator sends Burst-mode CJTPAT signaling while the DUT is configured for Terminated mode.

In **Compliance Mode**, the differential voltage amplitude and the common-mode are set to the nominal values (200 mV).

In **Expert Mode**, two Level Pairs are tested, the differential voltage amplitude is set to the minimum (60 mV) and maximum (245 mV) conformance values while the common-mode is kept to the nominal value ( ). It must be performed using the maximum f_{OFFSET} value of +2000 ppm. No other signal impairments such as ISI channel or jitter sources are added to the signal.

The duration of HS-Sync Length ($T_{HS\text{-}SYNC}$) is measured in SI (symbol intervals), where 1 SI = 10 UI_{HS} and its value is calculated as given in Table 5-2. This HS-SYNC Length is tested over the given HS-Sync Range. At each step, the BER is measured and compared with the Target BER to determine the pass/fail result. The DUT must be able to successfully receive bursts whose sync length is greater than or equal to the RX_HS_Gx_SYNC_LENGTH_Capability attribute.

This test is performed for all selected HS gears and lanes. How the different lanes are tested for each gear depends on the option chosen for “Lane Test Mode”.

This test is only required for the Terminated case.

Table 5-2 Sync Length Values

Parameter Name	Parameter Value	Parameter Unit
Sync Length	0 to 15	N/A
Sync Range	0 to 1	N/A

T_{SYNC}	IF (SYNC_range = FINE)
	T_SYNC = SYNC_length
	ELSE (IF SYNC_range = COARSE)
	If (M RX or OMC)
	T_SYNC = MIN (2^SYNC_length, 2^14)
	ELSE
	T_SYNC = 2^SYNC_length
	END
	END
		SI (1 SI = 10 UI_{HS})

Connection Diagram

Refer to Figure 5-1 and Figure 5-2.

Result Description

TSYNC Data0 1248MBit

[Not Compliant]

Test 2.1.9: Verify HS_Sync_length Terminated

----General----	
Offline	True
Software Version	1.3.1.2
Required-calibration SW Version	1.3.0.18
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant: Level Cal. Terminate
Attenuator	0 dB
HS Prepare Length	15
Stall length	20
Initial Adapt Length	0
Initial Adapt Type	Fine
Refresh Adapt Length	0
Refresh Adapt Type	Fine
LS Prepare length	7
Sleep length	5
PWM Tail of Burst	10
Reset Pulse Width	100 us
PWM Burst Closure Extension	32
Ref Clock Frequency	26 MHz
Target BER	1E-12
IBerReader Init Mode	Data0; 1.248 GBit/s; RT
Voltage Levels	Calibrated
Retrial Number	2
Test Sequence	MPhyCompliance.seq
Re-Init sequence after Reset DUT	True
Show Dialog at UniPro Reset DUT	False
HS-Sync Length	7
HS-Sync Range [SI]	-1; 1; 3; Linear
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
Capture Screenshot	True
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mod
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A

Result	Tested HS_Sync_length []	Min Passed [UI]	Min Tested [UI]	Max Passed [UI]	Max Tested [UI]	Tested Amplitude [mV]	Tested Offset [mV]
pass	7	60	60	80	80	310	150
pass	7	60	60	80	80	60	150

Figure 5-8 Example result for Test 2.1.9 – HS-RX Sync Length Capability Verification (Expert Mode)

- Result: Pass/Fail — If the value is Fail, the DUT does not support the tested sync length, otherwise Pass.
- Tested HS_Sync_length: The tested HS-Sync length value.
- Min Passed [UI]: The shortest HS-Sync length value supported by the DUT.
- Min Tested [UI]: The shortest HS-Sync length value tested.
- Max Passed [UI]: The maximum HS-Sync length value supported by the DUT.
- Max Tested [UI]: The maximum HS-Sync length value tested.
- Tested Amplitude [mV]: The value of the tested differential voltage amplitude.
- Tested Offset [mV]: The value of the tested common-mode voltage.

Test 2.1.2 – HS-RX Accumulated Differential Input Voltage Tolerance

(V_DIF-ACC-HS-Gx-RX)

Availability

Hardware	All configurations
Termination	Terminated
Mode	Compliance, Expert
Data Rates	HS Gears 1–5 (M8040A) HS Gears 1–4 (M8020A)

NOTE For HS Gear 4 and HS Gear 5, this test should be performed if Test 2.1.7 – HS-RX Receiver Jitter Tolerance fails.

Purpose and Method

This procedure determines whether the M-RX receives the HS-burst successfully with the requirements for $V_{DIF-ACC-RX}$ values.

The data generator sends burst-mode CJTPAT signaling while the DUT is configured for terminated mode. For eye closure, this procedure uses only the ISI channel and no additional jitter is injected into the signal.

In **Compliance Mode**, the data generator sets the calibrated accumulated differential voltage to the target value (40 mV) and the common mode level to the nominal value (150 mV) according to the specifications.

In **Expert Mode**, a sweep of the accumulated differential voltage is done over the given range.

At each step the BER is measured and compared with the Target BER to determine the pass/fail result.

This test is performed for all selected HS gears and lanes. How the different lanes are tested for each gear depends on the option chosen for “Lane Test Mode”.

It is only required for the terminated case.

CAUTION During the Accumulated Differential Voltage Calibration, if the Differential Voltage Start Value is increased to achieve the Minimum Accumulated Differential Voltage (that is, 40 mV), it could happen that the Differential Amplitude set during this test to achieve the required eye opening is outside of the specification values and may damage the DUT.

Connection Diagram

Refer to Figure 5-1 and Figure 5-2.

Result Description

Acc. Voltage Data0 1248MBit

[Not Compliant]

Test 2.1.2: Verify the level tolerance Terminated

----General----	
Offline	True
Software Version	1.3.1.2
Required-calibration SW Version	1.3.0.18
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant: Level Cal. Terminate
Attenuator	0 dB
HS Prepare Length	15
HS Sync Length	7
Stall length	20
Initial Adapt Length	0
Initial Adapt Type	Fine
Refresh Adapt Length	0
Refresh Adapt Type	Fine
LS Prepare length	7
Sleep length	5
PWM Tail of Burst	10
Reset Pulse Width	100 us
PWM Burst Closure Extension	32
Ref Clock Frequency	26 MHz
Target BER	1E-12
IBerReader Init Mode	Data0; 1.248 GBit/s; RT
Voltage Levels	Calibrated
Retrial Number	2
Test Sequence	MPhyCompliance.seq
Re-Init sequence after Reset DUT	True
Show Dialog at UniPro Reset DUT	False
Tested Differential Voltage	0
Tested DC Amplitude	60 mV
Tested DC Amplitude Range	0.01; -0.01; 5; Linear

Set Offset	150 mV
Binary Search	False
ISI (pk-pk)	31.2 mUI
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
Capture Screenshot	True
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mod
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A

Result	Amplitude [mV]	Offset [mV]	Min Spec Acc Voltage [mV]
pass	70	150	40
pass	65	150	40
pass	60	150	40
pass	55	150	40
pass	50	150	40

Figure 5-9 Example result for Test 2.1.2 – HS-RX Accumulated Differential Input Voltage Tolerance (Expert Mode)

- Result: Pass/Fail — If the value is “Fail”, the accumulated voltage tolerance is not within the specification limits.
- Amplitude [mV]: The differential voltage amplitude value set to achieve the required target eye opening.
- Offset [mV]: The common mode voltage value tested.
- Min Spec Acc Voltage [mV]: The minimum value of the accumulated differential voltage where the DUT must work according to the specification.

Test 2.1.7 – HS-RX Receiver Jitter Tolerance

(TJRX, DJRX, RJRX, STTRX, STDRX)

Availability

Hardware	All configurations
Termination	Terminated
Mode	Compliance (Gears 1B–5B)
	Expert (Gears 1A–5A and 1B–5B)
Data Rates	HS Gears 1–5 (M8040A)
	HS Gears 1–4 (M8020A)

In the CTS for M-PHY v5.0, this procedure is mandatory only for B-series gears (for A-series, the procedure is shown in the test tree as informative).

Purpose and Method

This procedure verifies that the M-RX receives the HS Burst successfully with a worst-case jitter scenario.

Before this test is run, the jitter stress elements such as RJ_{RX}, DJ_{RX}, $STRJ_{RX}$, ISI, and $STDJ_{RX}$ should be calibrated. During the calibration of the test signal, these jitter sources are tested over a range to achieve the maximum values that are defined in the specification. For this test, the DUT receives a CJTPAT pattern with sufficient levels of DJ and RJ and sent through the ISI test channel to meet the specified TJ_{RX} levels. The Total Jitter is the jitter value at the DUT RX pins, including the jitter coming from the ISI Trace, and is calculated as follows:

For HS-G1 and HS-G2:

- The STDJ is made up of ISI from the trace and STSJ to a total of 0.2 UI, that is, STSJ = 0.2 UI – Calibrated ISI.
- STTJ = STDJ + STRJ = 0.30 UI
  → STRJ = 0.30 UI – 0.2 UI = 0.1 UI.
- DJ = STDJ + LFSJ = 0.35 UI
  → LFSJ = 0.35 UI – 0.2 UI = 0.15 UI.
- TJ = DJ + RJ = 0.52 UI
  → RJ = 0.52 UI – 0.35 UI = 0.17 UI.

For HS-G3, HS-G4 and HS-G5:

- The STDJ is made up of ISI from the trace and STSJ to a total of 0.2 UI, that is, STSJ = 0.2 UI – Calibrated ISI.
- DJ = STDJ + LFSJ = 0.35 UI
  → LFSJ = 0.35 UI – 0.2 UI = 0.15 UI.
- For HS-G3, HS-G4, HS-G5, the low frequency RJ component is eliminated, so that the entire TJ budget is allotted to wideband RJ, above 10 MHz:
  TJ = DJ + RJ = 0.52 UI
  → RJ = 0.52 UI - 0.35 UI = 0.17 UI
  → RJ = STRJ = 0.17 UI
- Accordingly, the STTJ is greater than for HS-G1 and HS-G2:
  STTJ = STDJ + RJ = 0.2 UI + 0.17 UI = 0.37 UI

From these values and using the Eye Opening calibration with jitter to adjust the LFSJ if necessary, the resulting eye width is within ±5% of the conformance value (520 mV). Then, the same calibration is used to set the eye height according to the specification (45 mV for HS-G1 and HS-G2; 47 mV for HS-G3 and HS-G4; 37.5 mV for HS-G5).

In Spec 5.0, the test is performed twice at each gear, once for the positive Frequency Offset (+150 ppm) and once for the negative Frequency Offset (–150 ppm). The Frequency Offset is with respect to the nominal bit rate.

Three separate common-mode amplitude cases are tested.

1 a nominal amplitude of 180 mV

2 the minimum RX value of 25 mV

3 the maximum RX value of 330 mV

These compliance values can be modified in Expert Mode with the Common-Mode Voltage Levels parameter.

For each given jitter frequency the BER is measured and compared with the Target BER of 1E-12.

If the “Perform Jitter Limit Test” property is set to true (possible only in Expert mode), the value of SJ is increased until errors are found. The procedure performs a binary search to find the maximum tolerated value and “Jitter Increase Accuracy” defines the size of the window.

Connection Diagram

Refer to Figure 5-1 and Figure 5-2.

Result Description

JTol D0 1248MBit 26MHzN

[Not Compliant]

Test 2.1.7: Verify the Jitter Tolerance

----General----	
Offline	True
Software Version	1.3.1.2
Required-calibration SW Version	1.3.0.18; '1.3.1.2
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant: Reference Clock Cali GBit/s , SJ Calibration 1.248 GBit/s , Eye Opening Calibration with Calibration 1.248 GBit/s , High Frequency SJ Calibration 1.248 GBit
Attenuator	0 dB
Stall length	20
Initial Adapt Length	0
Initial Adapt Type	Fine
Refresh Adapt Length	0
Refresh Adapt Type	Fine
LS Prepare length	7
Sleep length	5
PWM Tail of Burst	10
Reset Pulse Width	100 us
PWM Burst Closure Extension	32
Ref Clock Frequency	26 MHz
Target BER	1E-12
IBerReader Init Mode	Data0; 1.248 GBit/s; RT
Voltage Levels	Calibrated
Retrial Number	2
Test Sequence	MPhyCompliance.seq
Re-Init sequence after Reset DUT	True
Show Dialog at UniPro Reset DUT	False
HS Prepare Length	15
HS Sync Length	7
SJ Frequencies [MHz]	0.2;2;10;26.26;41.6
Common-Mode Voltage Levels	0.18;0.025;0.33
Frequency Offset	-150 ppm
Accumulated Voltage Eye Opening	45 mV
Perform Jitter Limit Test	False
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
Capture Screenshot	True

```
----Instruments----
Calibrated Instrument 1          Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mod
Calibrated Instrument 2          Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A
```

Result	Target Eye Opening [mV]	Amplitude [mV]	Offset [mV]	Max Generator Jitter Capability [mUI]	Max. Passed TJ [mUI]	Max. Passed SJ [mUI]	Min. Failed TJ [mUI]	Min. Failed SJ [mUI]	SJ Frequency [MHz]	Error Count [ ]
pass	45	90	180	545	2020	100	NaN	NaN	0.2	0.000E+000
pass	45	90	180	545	520	150	NaN	NaN	2.0	0.000E+000
pass	45	90	180	545	520	150	NaN	NaN	10.0	0.000E+000
pass	45	90	180	545	520	150	NaN	NaN	26.3	0.000E+000
pass	45	90	180	545	520	150	NaN	NaN	41.6	0.000E+000
pass	45	90	25	545	2020	100	NaN	NaN	0.2	0.000E+000
pass	45	90	25	545	520	150	NaN	NaN	2.0	0.000E+000
pass	45	90	25	545	520	150	NaN	NaN	10.0	0.000E+000
pass	45	90	25	545	520	150	NaN	NaN	26.3	0.000E+000
pass	45	90	25	545	520	150	NaN	NaN	41.6	0.000E+000
pass	45	90	330	545	2020	100	NaN	NaN	0.2	0.000E+000
pass	45	90	330	545	520	150	NaN	NaN	2.0	0.000E+000
pass	45	90	330	545	520	150	NaN	NaN	10.0	0.000E+000
pass	45	90	330	545	520	150	NaN	NaN	26.3	0.000E+000
pass	45	90	330	545	520	150	NaN	NaN	41.6	0.000E+000

Figure 5-10 Example result for Test 2.1.7 – HS-RX Receiver Jitter Tolerance

- Result: Pass/Fail – For the result Pass, the DUT must be able to recover data without error from the jittery Test Data Frame it receives. Otherwise the result is Fail.
- Target Eye Opening [mV]: The eye opening required by the specification.
- Amplitude [mV]: The value of the differential voltage amplitude tested.
- Offset [mV]: The value of the common mode voltage tested.
- Max Generator Jitter Capability [mUI]: The maximum jitter that the setup can generate.
- Max Passed TJ [mUI]: The value of the largest TJ that passed.
- Max Passed SJ [mUI]: The value of the largest SJ that passed.
- Min Failed TJ [mUI]: The value of the smallest TJ that failed.
- Min Failed SJ [mUI]: The value of the smallest SJ that failed.
- SJ Frequency [MHz]: Frequency of the SJ.
- Error Count: Number of errors reported by the DUT.

Test 2.1.6 – HS-RX Lane-to-Lane Skew

(T_L2L-SKEW-HS-RX)

Availability

Hardware	All configurations
Termination	Terminated
Channels	More than one channel
Mode	Compliance, Expert
Protocol	UniPro, UFS
Data Rates	HS Gears 1–5 (M8040A) HS Gears 1–4 (M8020A) (For UFS, only B series in Compliance Mode)

NOTE

If the BERT is M8040A, Test 2.1.6 can be found under a separate node "Skew Tests," because the Inter Pair Skew Calibration needs to be performed directly before Test 2.1.6 for each gear (see Inter Pair Skew Calibration on page 110).

If the BERT is M8020A, Test 2.1.6 can be found for each data rate under "HS Terminated Tests," as expected.

Purpose and Method

The purpose of this procedure is to check that the MIPI M-PHY RX is able to receive HS-Burst signals successfully with the worst-case Lane-to-Lane skew value given by the specification.

This test is marked as informative in the CTS for M-PHY v5.0.

The data generator sends a Burst-mode CJTPAT signal while the DUT is configured for Terminated mode. The differential voltage amplitude and the common-mode voltage amplitude are set to their nominal values (both 200 mV). No other signal impairments such as the ISI channel or jitter sources are added to the signal.

A sweep of the calibrated Lane-to-Lane skew is done in the tested lane, starting with the minimum skew value (Min Tested Value) and increasing with the given Step Size value until the Max Tested Value is reached. At each step, the BER is measured and compared with the Target BER to give the pass/fail result.

Connection Diagram

Refer to Figure 5-1.

Result Description

Skew Test HS Data0 1248MBit

[Not Compliant]

Test 2.1.6: Test the skew tolerance Terminated

----General----	
Offline	True
Software Version	1.3.1.2
Required-calibration SW Version	1.3.0.18; '1.3.1.2
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant: Reference Clock Cali Cal. Terminated Data1, Inter Pair Skew Calibration 23296MBit/s
Attenuator	0 dB
HS Prepare Length	15
HS Sync Length	7
Stall length	20
Initial Adapt Length	0
Initial Adapt Type	Fine
Refresh Adapt Length	0
Refresh Adapt Type	Fine
LS Prepare length	7
Sleep length	5
PWM Tail of Burst	10
Reset Pulse Width	100 us
PWM Burst Closure Extension	32
Ref Clock Frequency	26 MHz
Target BER	1E-12
IBerReader Init Mode	Data0; 1.248 GBit/s; Skew; RT
Voltage Levels	Calibrated
Retrial Number	2
Test Sequence	MPhyCompliance.seq
Re-Init sequence after Reset DUT	True
Show Dialog at UniPro Reset DUT	False
Min. Spec.	30 UI
Min. Tested Value	100 mUI
Max. Tested Value	45 UI
Step Size	500 mUI
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
Capture Screenshot	True

```
----Instruments----
Calibrated Instrument 1            Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mod
Calibrated Instrument 2            Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A
```

Result	Max. Passed Skew [mUI]	Min. Failed Skew [mUI]	Min. Spec. Skew [mUI]	Tested Amplitude [mV]	Tested Offset [mV]
pass	45000	N/A	30000	200	200

Figure 5-11 Example result for Test 2.1.6 – HS-RX Lane-to-Lane Skew

- Result: Pass/Fail — If the value is “Fail”, the DUT skew tolerance is below the specification limit.
- Max. Passed Skew [mUI]: The maximum skew value at which the DUT shows no errors.
- Min. Failed Skew [mUI]: The minimum skew value at which the DUT does not work.
- Min. Spec. Skew [mUI]: The minimum skew value at which the DUT must work, according to the specification.
- Tested Amplitude [mV]: The tested value of the differential voltage amplitude.
- Test Offset [mV]: The tested value of the common-mode voltage.

Test 2.1.4 – HS-RX Differential Termination Enable Time

(T-TERM-ON-HS-RX)

Availability

Hardware	All configurations
Termination	Terminated
Mode	Compliance, Expert
Data Rates	HS Gears 1–5 (M8040A) HS Gears 1–4 (M8020A)

Purpose and Method

This procedure verifies that the HS-RX is able to properly enable its termination within the required time.

The data generator sends a Burst-mode CJTPAT signal with nominal amplitude settings while the DUT is configured for Terminated mode. Then the $T_{TERM-ON-HS-RX}$ (HS-RX differential termination enable time) is measured using a real-time oscilloscope. Of all the measured $T_{TERM-ON-HS-RX}$ values, the maximum and minimum values are considered as the final results.

The test is passed if the maximum $T_{TERM-ON-HS-RX}$ value is within the PREPARE time defined by the DUT's HS_PREPARE_Length_Capability attribute (Table 5-3).

Table 5-3 HS-PREPARE Length Capability Values

Parameter Name	Parameter Value	Parameter Unit
HS_PREPARE_Length_Capability	0 to 15	N/A
$T_{HS\_PREPARE}$	HS_PREPARE_Length_Capability * 2 * (GEAR-1)	SI, 1 SI = 10 UI

Connection Diagram

Refer to Figure 5-4.

Result Description

Term. On D0 1456MBit

[Not Compliant]

Test 2.1.4: Measure the Termination Delay Terminated

```
----General----
Offline                          True
Software Version                 1.3.1.2
Required-calibration SW Version  1.3.0.18
Compliant                        False
Non-compliance reason(s)         Procedure offline; Required cal not compliant: Level Cal. Terminated
Attenuator                       0 dB
HS Sync Length                   7
Initial Adapt Length             0
Initial Adapt Type               Fine
Refresh Adapt Length             0
Refresh Adapt Type               Fine
LS Prepare length                7
Sleep length                     5
PWM Tail of Burst                10
Reset Pulse Width                100 us
PWM Burst Closure Extension      32
Ref Clock Frequency              26 MHz
Scope Channel                    Channel1
Semi Automated Test              False
Set Single Ended Amplitude       200 mV
Set Offset                       100 mV
Prepare Length                   15
Stall Length [UI]                20
Prepare Length Capability        15
IMPhyBerReader Init Mode         Data0; 1.456 GBit/s; Termination; RT
Show Dialog at UniPro Reset DUT  False
Run without TTC                  False
Wait for Manual Break            False
Show DUT Configure Dialog        False
Sampling Rate                    Default
TrigThreshold Mode               0
Capture Screenshot               True
----Instruments----
Calibrated Instrument 1          Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mode
Calibrated Instrument 2          Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A
```

Result	Termination Time Min [ns]	Termination UI Min [UI]	Min Spec [UI]	Termination Time Max [ns]	Termination UI Max [UI]	Max Spec [UI]
pass	0	0	0	0	0	150

Figure 5-12 Example result for Test 2.1.4 – HS-RX Differential Termination Enable Time

- Result: Pass/Fail — The value is “Fail” if the termination enable time is not within the specification limit.
- Termination Time Min [ns]: The shortest (minimum) termination enable time in nanoseconds.
- Termination UI Min [UI]: The shortest (minimum) termination enable time in terms of unit intervals.
- Min Spec [UI]: The minimum value of the termination enable time at which the DUT must work, as given by the specification.
- Termination Time Max [ns]: The maximum termination enable time nanoseconds.
- Termination UI Max [UI]: The maximum termination enable time in terms of unit intervals.
- Max Spec [UI]: The maximum value of the termination enable time at which the DUT must work, as given by the specification.

Test 2.1.5 – HS-RX Differential Termination Disable Time

(T_TERM-OFF-HS-RX)

Availability

Hardware	All configurations
Termination	Terminated
Mode	Compliance, Expert
Data Rates	HS Gears 1–5 (M8040A) HS Gears 1–4 (M8020A)

Purpose and Method

This procedure verifies that the HS-RX is able to properly disable its termination within the required time.

The data generator sends a Burst-mode CJTPAT signal with nominal amplitude settings while the DUT is configured for Terminated mode. Then the $T_{TERM-OFF-HS-RX}$ (HS-RX differential termination disable time) is measured using a real-time oscilloscope. Of all the measured $T_{TERM-OFF-HS-RX}$ values, the maximum and minimum values are considered as the final results.

The test is passed if the maximum $T_{TERM-OFF-HS-RX}$ value is within the time defined by the DUT's Stall Time Capability attribute.

Connection Diagram

Refer to Figure 5-4.

Result Description

Term. Off D0 1456MBit

[Not Compliant]

Test 2.1.5: Measure the Termination Delay Terminated

```
----General----
Offline                          True
Software Version                 1.3.1.2
Required-calibration SW Version  1.3.0.18
Compliant                        False
Non-compliance reason(s)         Procedure offline; Required cal not compliant: Level Cal. Terminated
Attenuator                       0 dB
HS Sync Length                   7
Initial Adapt Length             0
Initial Adapt Type               Fine
Refresh Adapt Length             0
Refresh Adapt Type               Fine
LS Prepare length                7
Sleep length                     5
PWM Tail of Burst                10
Reset Pulse Width                100 us
PWM Burst Closure Extension      32
Ref Clock Frequency              26 MHz
Scope Channel                    Channel1
Semi Automated Test              False
Set Single Ended Amplitude       200 mV
Set Offset                       100 mV
Prepare Length                   15
Stall Length [UI]                20
Stall Time Capability [SI]       10
IMPhyBerReader Init Mode         Data0; 1.456 GBit/s; Termination; RT
Show Dialog at UniPro Reset DUT  False
Run without TTC                  False
Wait for Manual Break            False
Show DUT Configure Dialog        False
Sampling Rate                    Default
TrigThreshold Mode               0
Capture Screenshot               True
----Instruments----
Calibrated Instrument 1          Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mode
Calibrated Instrument 2          Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A
```

Result	Termination Time Min [ns]	Termination UI Min [UI]	Min Spec [UI]	Termination Time Max [ns]	Termination UI Max [UI]	Max Spec [UI]
pass	0	0	0	0	0	100

Figure 5-13 Example result for Test 2.1.5 – HS-RX Differential Termination Disable Time

- Result: Pass/Fail — The value is “Fail” if the termination disable time is not within the specification limit.
- Termination Time Min [ns]: The shortest (minimum) termination disable time in nanoseconds.
- Termination UI Min [UI]: The shortest (minimum) termination disable time in terms of unit intervals.
- Min Spec [UI]: The minimum value of the termination disable time at which the DUT must work, as given by the specification.
- Termination Time Max [ns]: The maximum termination disable time in nanoseconds.
- Termination UI Max [UI]: The maximum termination disable time in terms of unit intervals.
- Max Spec [UI]: The maximum value of the termination disable time at which the DUT must work, as given by the specification.

Squelch Tests

Example Connection Diagrams

In this User Guide, only example connection diagrams are given. The exact connection diagram for a specific situation can be viewed by right-clicking the appropriate procedure in the procedure tree of the main window of the user interface and selecting “Show Connection...”.

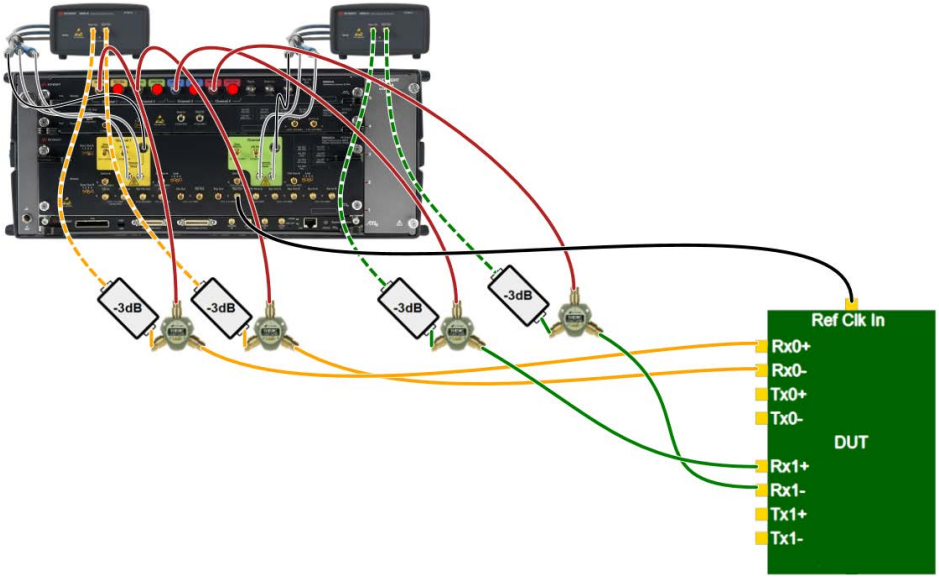


Figure 5-14 Example connection diagram for squelch tests for M8040A (two channels)

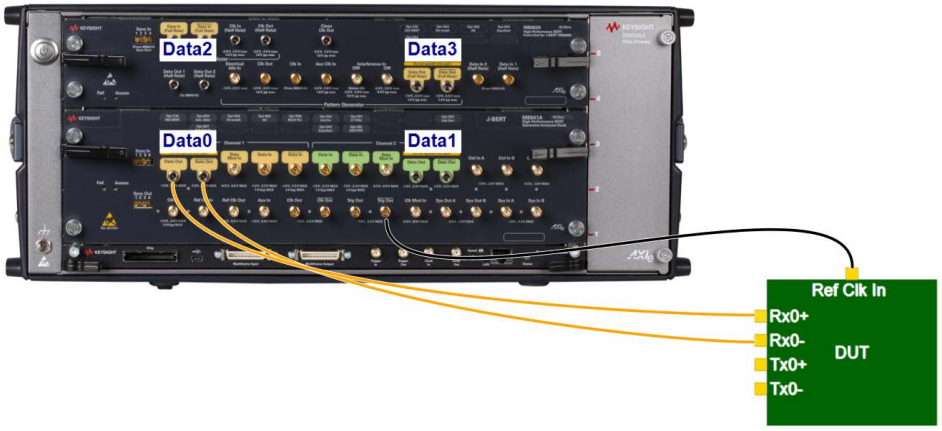


Figure 5-15 Example connection diagram for squelch tests for M8020A (one channel)

Test 2.4.3 – SQ-RX Squelch Exit Voltage

(V_SQ)

Availability

Hardware	All configurations
Termination	Non-Terminated
Mode	Compliance, Expert

Purpose and Method

The purpose of this procedure is to verify the minimum and maximum squelch exit voltage (V_{SQ}) levels according to the M-PHY specification.

The data generator sends a test sequence consisting of a single DIFN pulse among the DIFP states and starts with an amplitude less than the minimum squelch exit voltage. Then the voltage amplitude is increased by the value Step Size until the DUT exits the HIBERN8 state and enters the sleep state.

When using loopback, the HIBERN8 state exit is found by detecting that the DUT has activated the loopback mode and sent the test pattern back via the TX. The test pattern must contain a configuration block starting with the macro `SQUELCH()`.

When using UniPro Test Mode, it is observed that the DUT gets into Test Mode and starts sending FILLER symbols back.

The measured value of V_{SQ} must lie between 50 and 140 mV in order to be considered conform with the spec.

Connection Diagram

Refer to Figure 5-14 and Figure 5-15.

Result Description

SQ Exit Volt. Data0

[Not Compliant]

Test 2.4.3 : Test of the Squelch Exit Voltage

----General----	
Offline	True
Software Version	1.3.1.2
Required-calibration SW Version	1.3.0.18; '1.3.1.2
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant: Reference Clock Cali
Data Rate	Gear1A
Attenuator	-9 dB
HS Prepare Length	15
HS Sync Length	7
Stall length	20
Initial Adapt Length	0
Initial Adapt Type	Fine
Refresh Adapt Length	0
Refresh Adapt Type	Fine
LS Prepare length	7
Sleep length	5
PWM Tail of Burst	10
Reset Pulse Width	100 us
PWM Burst Closure Extension	32
Ref Clock Frequency	26 MHz
Target BER	1E-12
IBerReader Init Mode	Data0; 1.248 GBit/s; Squelch; NT
Voltage Levels	Calibrated
Squelch Test Sequence	MPhySquelchCompliance.seq
Re-Init sequence after Reset DUT	True
Min. Value	40 mV
Max. Value	150 mV
Step Size	10 mV
T Activate capability	200 us
Pulse Distance	500 ns
Tested Offsets [mV]	100
Show User Action Dialog	False
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
Capture Screenshot	True
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mod
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A

Result	Squelch Exit Voltage [mV]	Min. Spec [mV]	Max. Spec [mV]	Offset [V]
*** FAIL ***	40	50	140	0

Figure 5-16 Example result for Test 2.4.3 – SQ-RX Squelch Exit Voltage

- Result: Pass/Fail – The value is “Pass” if the value of the measured squelch exit voltage lies in the range given by the specification.
- Squelch Exit Voltage [mV]: The voltage amplitude value that causes the DUT to exit the HIBERN8 state.
- Min. Spec [mV]: Minimum voltage amplitude at which the DUT should exit the HIBERN8 state according to the specification.
- Max. Spec [mV]: Maximum voltage amplitude at which the DUT should exit the HIBERN8 state according to the specification.
- Offset [V]: Value of the tested offset.

Test 2.4.4 – SQ-RX Squelch Exit Time

(T_SQ)

Availability

Hardware	All configurations
Termination	Non-Terminated
Mode	Compliance, Expert

Purpose and Method

This test determines whether the duration of the time between no squelch detection and the DUT entering the sleep state, T_{SQ}, is in accordance with the M-PHY specification. It is the time for which a DIFN signal has to be present at the RX in order for the RX to exit the HIBERN8 state.

The data generator sends a test sequence consisting of a single DIFN pulse among the DIFP states and starts with a pulse width less than the minimum squelch width. The pulse width is increased stepwise until the DUT exits the HIBERN8 state into the sleep state.

When **using loopback**, the HIBERN8 state exit is found by detecting that the DUT has activated the loopback mode and sent the test pattern back via the TX. The test pattern must contain a configuration block starting with the macro `SQUELCH()`.

When **using UniPro Test Mode**, it is observed that the DUT gets into Test Mode and starts sending FILLER symbols back.

The measured value of T_{SQ} must be less than or equal to $T_{ACTIVATE}$ in order to be considered conform.

Connection Diagram

Refer to Figure 5-14 and Figure 5-15.

Result Description

T_SQ Data0

[Not Compliant]

Test 2.4.4: Test of the minimum DIFN duration for exiting hibernate mode

----General----	
Offline	True
Software Version	1.3.1.2
Required-calibration SW Version	1.3.0.18; '1.3.1.2
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant: Reference Clock Cali
Data Rate	Gear1A
Attenuator	-9 dB
HS Prepare Length	15
HS Sync Length	7
Stall length	20
Initial Adapt Length	0
Initial Adapt Type	Fine
Refresh Adapt Length	0
Refresh Adapt Type	Fine
LS Prepare length	7
Sleep length	5
PWM Tail of Burst	10
Reset Pulse Width	100 us
PWM Burst Closure Extension	32
Ref Clock Frequency	26 MHz
Target BER	1E-12
IBerReader Init Mode	Data0; 1.248 GBit/s; Squelch; NT
Voltage Levels	Calibrated
Squelch Test Sequence	MPhySquelchCompliance.seq
Re-Init sequence after Reset DUT	True
T Activate capability	200 us
Min. Value	20 ns
Max. Value	900 us
Step Size	89.998 us
Set Single Ended Amplitude	200 mV
Tested Offsets [mV]	100
Number of Pulses	1
Pulse Distance	500 ns
Pulse Width	20 ns
Show User Action Dialog	False
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
Capture Screenshot	True

Result	Squelch min. T_SQ [us]	Max. Spec [us]	Offset [V]
pass	180.016	900	0

Figure 5-17 Example result for Test 2.4.4 – SQ-RX Squelch Exit Time

- Result: Pass/Fail — The value is “Pass” if the value of the measured squelch exit time is shorter than the maximum time allowed time according to the specification.
- Squelch min. T_SQ [µs]: The lower bound of the measured squelch exit time.
- Max. Spec [µs]: The maximum time allowed to exit the HIBERN8 state according to the specification.
- Offset [V]: Value of the tested offset.

Test 2.4.5 – SQ-RX Squelch Noise Pulse Width

(T_PULSE-SQ)

Availability

Hardware	All configurations
Termination	Non-Terminated
Mode	Compliance, Expert

Purpose and Method

This procedure verifies that the DUT does not exit HIBERN8 upon detection of a Squelch Noise Pulse with duration $T_{PULSE-SQ} \leq 20$ ns.

The data generator sends a test sequence consisting of a single DIFN pulse among DIFP states, starting with a pulse width less than the minimum squelch pulse width. The pulse width is increased stepwise until the DUT exits the HIBERN8 state and enters the sleep state. The Step Size parameter for this test depends on the HS Gear data rate(s) selected in the Configure DUT panel (Figure 2-6 on page 29). This test runs at the highest gear when multiple gears are selected.

When **using loopback**, the HIBERN8 state exit is found by detecting that the DUT has activated the loopback mode and sent the test pattern back via the TX. The test pattern must contain a configuration block starting with the macro `SQUELCH()`.

When **using UniPro Test Mode**, it is observed that the DUT gets into Test Mode and starts sending FILLER symbols back.

The DUT should not exit HIBERN8 as long as the pulse width is less than the squelch detection limit ($T_{PULSE-SQ} = 20$ ns) in order to be considered conform.

Connection Diagram

Refer to Figure 5-14 and Figure 5-15.

Result Description

SQ Pulse Width Data0

[Not Compliant]

Test 2.4.5: Test of the maximum pulse width for staying in hibernate mode

----General----	
Offline	True
Software Version	1.3.1.2
Required-calibration SW Version	1.3.0.18; '1.3.1.2
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant: Reference Clock Cali
Data Rate	Gear1A
Attenuator	-9 dB
HS Prepare Length	15
HS Sync Length	7
Stall length	20
Initial Adapt Length	0
Initial Adapt Type	Fine
Refresh Adapt Length	0
Refresh Adapt Type	Fine
LS Prepare length	7
Sleep length	5
PWM Tail of Burst	10
Reset Pulse Width	100 us
PWM Burst Closure Extension	32
Ref Clock Frequency	26 MHz
Target BER	1E-12
IBerReader Init Mode	Data0; 1.248 GBit/s; Squelch; NT
Voltage Levels	Calibrated
Squelch Test Sequence	MPhySquelchCompliance.seq
Re-Init sequence after Reset DUT	True
Min. Value	0 s
Max. Value	25 ns
Step Size	5 ns
Set Single Ended Amplitude	200 mV
Tested Offsets [mV]	100
Number of Pulses	1
Pulse Distance	500 ns
Show User Action Dialog	False
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
Capture Screenshot	True
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mod
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A

Result	Tested Squelch noise pulse width [ns]	Max. required from Spec [ns]	Offset [V]
pass	25	20	0

Figure 5-18 Example result for Test 2.4.5 – SQ-RX Squelch Noise Pulse Width

- Result: Pass/Fail — The value is “Pass” if the minimum value of the measured squelch pulse width that caused the DUT to exit the HIBERN8 state lies above the specification limit.
- Tested Squelch noise pulse width [ns]: The measured minimum value of the squelch pulse width that caused the DUT to exit the HIBERN8 state.
- Max. required from Spec [ns]: The measured minimum value of the squelch pulse width that caused the DUT to exit the HIBERN8 state must be at least this value.
- Offset [V]: Tested voltage offset for interference source.

Test 2.4.6 – SQ-RX Squelch Noise Pulse Spacing

(T_SPACE-SQ)

Availability

Hardware	All configurations
Termination	Non-Terminated
Mode	Compliance, Expert

Purpose and Method

This test verifies that the DUT does not exit squelch upon detection of appropriate Squelch Noise Pulses with spacing $T_{SPACE-SQ}$ > 500 ns.

The data generator sends a test sequence consisting of a burst of DIFN pulses among DIFP states, which start with a pulse separation distance greater than the minimum squelch pulse distance. The pulse distance is decreased stepwise until the DUT exits the HIBERN8 state and enters the sleep state.

When **using loopback**, the HIBERN8 state exit is found by detecting that the DUT has activated the loopback mode and sent the test pattern back via the TX. The test pattern must contain a configuration block starting with the macro `SQUELCH()`.

When **using UniPro Test Mode**, it is observed that the DUT gets into Test Mode and starts sending FILLER symbols back.

The DUT should not exit HIBERN8 as long as the pulse distance is above the squelch detection limit (500 ns) in order to be considered conform with the spec.

Connection Diagram

Refer to Figure 5-14 and Figure 5-15.

Result Description

SQ Pulse Dist. Data0

[Not Compliant]

Test 2.4.6: Test of the minimum pulse distance for exiting hibernate mode

----General----	
Offline	True
Software Version	1.3.1.2
Required-calibration SW Version	1.3.1.2; '1.3.0.18
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant: Level Cal. For Squel
Data Rate	Gear1A
Attenuator	-9 dB
HS Prepare Length	15
HS Sync Length	7
Stall length	20
Initial Adapt Length	0
Initial Adapt Type	Fine
Refresh Adapt Length	0
Refresh Adapt Type	Fine
LS Prepare length	7
Sleep length	5
PWM Tail of Burst	10
Reset Pulse Width	100 us
PWM Burst Closure Extension	32
Ref Clock Frequency	26 MHz
Target BER	1E-12
IBerReader Init Mode	Data0; 1.248 GBit/s; Squelch; NT
Voltage Levels	Calibrated
Squelch Test Sequence	MPhySquelchCompliance.seq
Re-Init sequence after Reset DUT	True
Min. Value	300 ns
Max. Value	4.2 us
Step Size	200 ns
Set Single Ended Amplitude	200 mV
Tested Offsets [mV]	100
Number of Pulses	2
Pulse Width	20 ns
Show User Action Dialog	False
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
Capture Screenshot	True
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mod
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A

Result	Squelch min. exit pulse distance [ns]	Min. Spec [ns]	Offset [V]
pass	300	500	0

Figure 5-19 Example result for Test 2.4.6 – SQ-RX Squelch Noise Pulse Spacing

- Result: Pass/Fail — The value is “Pass” if the minimum value of the measured squelch pulse distance that caused the DUT to exit HIBERN8 lies below the limit given by the specification (“Min. Spec.”).
- Squelch min. exit pulse distance [ns]: The measured minimum value of the squelch pulse spacing that caused the DUT to exit the HIBERN8 state.
- Min. Spec [ns]: Minimum allowed value of the squelch exit pulse spacing according to the specification.
- Offset [V]: Value of the tested offset.

PWM Tests

Example Connection Diagrams

In this User Guide, only example connection diagrams are given. The exact connection diagram for a specific situation can be viewed by right-clicking the appropriate procedure in the procedure tree of the main window of the user interface and selecting “Show Connection...”.

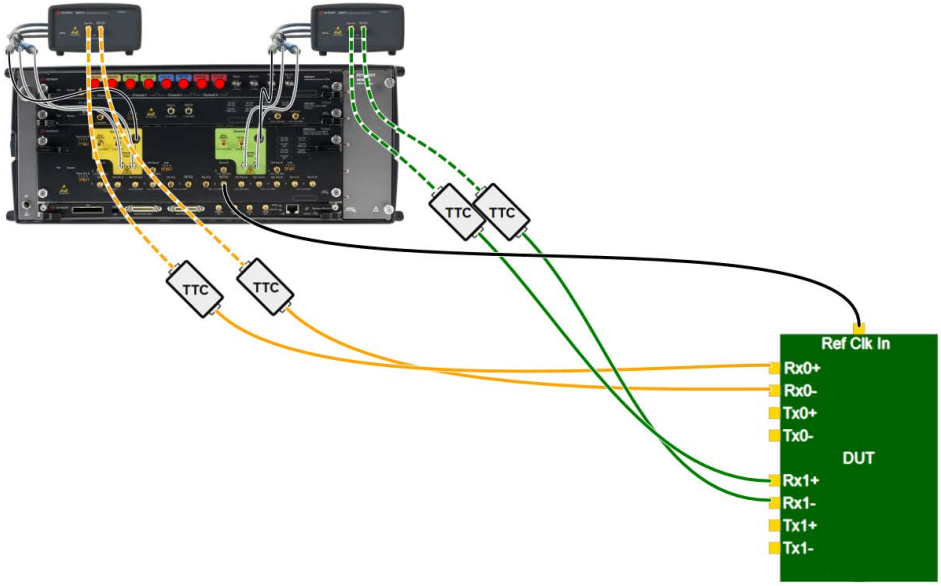


Figure 5-20 Example connection diagram for PWM tests (two channels, M8040A)

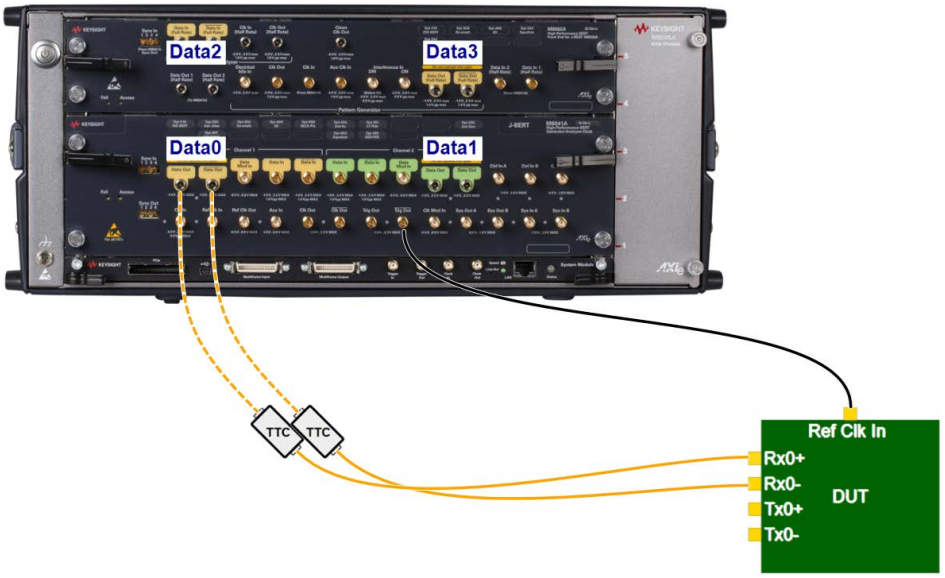


Figure 5-21 Example connection diagram for PWM tests (one channel, M8020A)

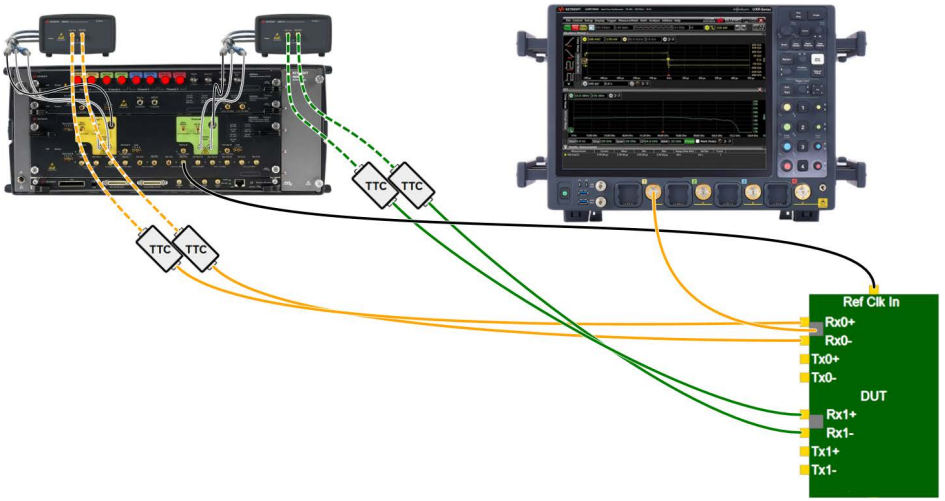


Figure 5-22 Example connection diagram for PWM-RX termination enable/ disable time tests (two channels, M8040A)

Test 2.2.1 – PWM-RX Differential DC Input Voltage Amplitude Tolerance

(V_DIF-DC-PWM-RX)

Availability

Hardware	All configurations
Termination	Non-Terminated, Terminated (if DUT supports this)
Channels	All lanes
Mode	Compliance, Expert
Data Rates	Maximum and minimum data rates of PWM Gear 1

Purpose and Method

The purpose of this procedure is to verify that the M-RX successfully receives the PWM signal that meets the maximum and minimum requirements for VDIF-RX according to the M-PHY specification.

The data generator sends Burst-mode CJTPAT signaling in PWM-G1 while the DUT is configured for Terminated mode or Non-Terminated mode, depending on the test case.

In **Compliance Mode**, the data generator sets the calibrated differential voltage amplitude to the minimum (60 mV for Terminated, 120 mV for Non-Terminated) and maximum (310 mV for Terminated, 620 mV for Non-Terminated) conformance values. The common mode voltage is fixed to the nominal value (150 mV) according to the specification. No other signal impairments (ISI or jitter) are added. At each step the BER is measured and compared with the Target BER to determine the pass/fail result.

In **Expert Mode**, the differential voltage component of each Level Pair is tested over the given Amplitude Range. In this case, the result will show the minimum and maximum differential voltage values at which the DUT works properly and the test will pass if those values are within the specification limits.

This test is performed for all selected lanes and at both the maximum and minimum rates within PWM-G1.

Connection Diagram

Refer to Figure 5-20 and Figure 5-21.

Result Description

Ampl Sens. NT Data0 Gear1

[Not Compliant]

Test 2.2.1: Verify the level tolerance Into Open

```
----General----
Offline                          True
Software Version                 1.3.1.2
Required-calibration SW Version  1.3.0.18; '1.3.1.2
Compliant                        False
Non-compliance reason(s)         Procedure offline; Required cal not compliant: Reference Clock Cali
Attenuator                       0 dB
HS Prepare Length                15
HS Sync Length                   7
Stall length                     20
Initial Adapt Length             0
Initial Adapt Type               Fine
Refresh Adapt Length             0
Refresh Adapt Type               Fine
LS Prepare length                7
Sleep length                     5
PWM Tail of Burst                10
Reset Pulse Width                100 us
PWM Burst Closure Extension      32
Ref Clock Frequency              26 MHz
Target BER                       100E-9
IBerReader Init Mode             Data0; 3 MBit/s; NT
Voltage Levels                   Calibrated
Retrial Number                   2
Test Sequence                    MPhyLsCompliance.seq
Re-Init sequence after Reset DUT True
Show Dialog at UniPro Reset DUT  False
HS Data Rate                     Gear3A
Amplitude Range                  -0.04; 0.04; 5; Linear
Run without TTC                  False
Wait for Manual Break            False
Show DUT Configure Dialog        False
Sampling Rate                    Default
TrigThreshold Mode               0
Capture Screenshot               True
Tested Differential Voltage      0
----Instruments----
Calibrated Instrument 1          Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mod
Calibrated Instrument 2          Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A
```

Result	PWM Data Rate [MBit/s]	Amplitude [mV]	Offset [mV]	Min Passed Amplitude [mV]	Min Spec Amplitude [mV]	Max Passed Amplitude [mV]	Max Spec Amplitude [mV]	Error Count [ ]
pass	3	620	150	N/A	N/A	660	620	0.000E+000
pass	3	120	150	80	120	N/A	N/A	0.000E+000
pass	5	620	150	N/A	N/A	660	620	0.000E+000
pass	5	120	150	80	120	N/A	N/A	0.000E+000

Figure 5-23 Example result for Test 2.2.1 – PWM-RX Differential DC Input Voltage Amplitude Tolerance

- Result: Pass/Fail – The result is “Pass” if the differential DC input voltage amplitude tolerance is equal to or greater than the range given by the specification.
- PWM Data Rate [MBit/s]: Tested PWM data rate.
- Amplitude [mV]: Tested differential DC input voltage amplitude.
- Offset [mV]: Value of the tested offset.
- Min Passed Amplitude [mV]: The lowest measured value of the differential DC input voltage amplitude where the DUT worked without error.
- Min Spec Amplitude [mV]: The lower limit of the range of the differential DC input voltage amplitude where the DUT must work without error (from the specification).
- Max Passed Amplitude [mV]: The highest measured value of the differential DC input voltage amplitude where the DUT worked without error.
- Max Spec Amplitude [mV]: The upper limit of the range of the differential DC input voltage amplitude where the DUT must work without error (from the specification).
- Error Count: The number of errors reported by the DUT.

Test 2.2.2 – PWM-RX Common-Mode Input Voltage Tolerance (V_CM-RX)

Availability

Hardware	All configurations
Termination	Non-Terminated, Terminated (if DUT supports this)
Channels	All lanes
Mode	Compliance, Expert
Data Rates	Maximum and minimum data rates of PWM Gear 1

Purpose and Method

The purpose of this procedure is to verify that the M-RX successfully receives PWM signaling that meets the conformance requirements of V_{CM-RX}.

The data generator sends a Burst-mode CJTPAT signal while the DUT is configured for Terminated mode or Non-Terminated mode, depending on the test case.

In **Compliance Mode**, the calibrated Level Pairs (V_{DIF-RX} and V_{CM-RX}) are set to two different test cases (see Table 5-4). At each step, the BER is measured and compared with the Target BER to determine the pass/fail result.

Table 5-4 PWM-RX Common-Mode Input Voltage Tolerance Test Cases

Test Case	Line State	V_{DIF-RX}	V_{CM-RX}
Max diff voltage, Max CM voltage	Non-Terminated	620 mV	330 mV
	Terminated	310 mV	330 mV
Min diff voltage, Min CM voltage	Non-Terminated	120 mV	25 mV
	Terminated	60 mV	25 mV

In **Expert Mode**, the common-mode voltage component of each Level Pair is tested over the given Offset Range. In this case, the result will show the minimum and maximum offset values at which the DUT works properly and the test will pass if those values are within the specification limits.

This test is performed for all selected lanes and at both the maximum and minimum rates within PWM-G1.

Connection Diagram

Refer to Figure 5-20 and Figure 5-21.

Result Description

Offset Sens. NT Data0 Gear1

[Not Compliant]

Test 2.2.2: Verify the level tolerance Into Open

```
----General----
Offline                          True
Software Version                 1.3.1.2
Required-calibration SW Version  1.3.0.18; '1.3.1.2
Compliant                        False
Non-compliance reason(s)         Procedure offline; Required cal not compliant: Reference Clock Cali
Attenuator                       0 dB
HS Prepare Length                15
HS Sync Length                   7
Stall length                     20
Initial Adapt Length             0
Initial Adapt Type               Fine
Refresh Adapt Length             0
Refresh Adapt Type               Fine
LS Prepare length                7
Sleep length                     5
PWM Tail of Burst                10
Reset Pulse Width                100 us
PWM Burst Closure Extension      32
Ref Clock Frequency              26 MHz
Target BER                       100E-9
IBerReader Init Mode             Data0; 3 MBit/s; NT
Voltage Levels                   Calibrated
Retrial Number                   2
Test Sequence                    MPhyLsCompliance.seq
Re-Init sequence after Reset DUT True
Show Dialog at UniPro Reset DUT  False
HS Data Rate                     Gear3A
Offset Range                     -0.03; 0.03; 5; Linear
Run without TTC                  False
Wait for Manual Break            False
Show DUT Configure Dialog        False
Sampling Rate                    Default
TrigThreshold Mode               0
Capture Screenshot               True
Tested Differential Voltage      0
----Instruments----
Calibrated Instrument 1          Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mod
Calibrated Instrument 2          Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A
```

Result	PWM Data Rate [MBit/s]	Amplitude [mV]	Offset [mV]	Min Passed Offset [mV]	Min Spec Offset [mV]	Max Passed Offset [mV]	Max Spec Offset [mV]	Error Count [ ]
pass	3	620	330	N/A	N/A	360	330	0.000E+000
pass	3	120	25	-5	25	N/A	N/A	0.000E+000
pass	5	620	330	N/A	N/A	360	330	0.000E+000
pass	5	120	25	-5	25	N/A	N/A	0.000E+000

Figure 5-24 Example result for Test 2.2.2 – PWM-RX Common-Mode Input Voltage Tolerance

- Result: Pass/Fail – If the value is Fail, the amplitude tolerance is below the specification limit.
- PWM Data Rate [MBit/s]: Value of the PWM data rate tested.
- Amplitude [mV]: Value of the tested common-mode input voltage amplitude.
- Offset [mV]: Value of the tested offset.
- Min Passed Offset [mV]: The lowest measured value of the offset at which the DUT works successfully.
- Min Spec Offset [mV]: The lowest offset value at which the DUT must work without error.
- Max Passed Offset [mV]: The highest measured value of the offset at which the DUT works successfully.
- Max Spec Offset [mV]: The highest offset value at which the DUT must work without error.
- Error Count: The number of errors reported by the DUT during the test.

Test 2.2.5a – PWM-RX Receive Bit Duration Tolerance

(TOLPWM-RX)

Availability

Hardware	All configurations
Termination	Non-Terminated, Terminated
Channels	All lanes
Mode	Compliance, Expert
Data Rates	Bitrate that spans the entire PWM-G1 range (3–9 MHz)

Purpose and Method

The purpose of this procedure is to determine that the PWM-RX detects the PWM input signal with PWM bit duration tolerance in the limits of $T_{OLPWM-RX}$, which is defined for non-OMC DUTs in Test 2.2.5 of the CTS for M-PHY v5.0.

The data generator sends a Burst-mode CJTPAT signal in PWM-G1 with a modulated bitrate spanning the entire PWM-G1 range and nominal amplitude settings. The DUT is configured for Terminated mode or Non-Terminated mode, depending on the test case.

$T_{OLPWM-RX}$ is the ratio of the PWM Receive Bit Duration (T_{PWM-RX}) to the average of *N* PWM receive bit durations in PWM mode. $T_{OLPWM-RX}$ is tested for the conformance limit values (0.82/1.18) and for the given Additional Steps. At each step, the BER is measured and compared with the Target BER to determine the pass/fail result.

This test is performed at each selected lane.

Connection Diagram

Refer to Figure 5-20 and Figure 5-21.

Result Description

TPWM-RX NT Data0 5MBit

[Not Compliant]

Test 2.2.5a: Verify TOL_PWM_RX Into Open

----General----	
Offline	True
Software Version	1.3.1.2
Required-calibration SW Version	1.3.0.18; '1.3.1.2
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant: Reference Clock Cali
Attenuator	0 dB
HS Prepare Length	15
HS Sync Length	7
Stall length	20
Initial Adapt Length	0
Initial Adapt Type	Fine
Refresh Adapt Length	0
Refresh Adapt Type	Fine
LS Prepare length	7
Sleep length	5
PWM Tail of Burst	10
Reset Pulse Width	100 us
PWM Burst Closure Extension	32
Ref Clock Frequency	26 MHz
Target BER	100E-9
IBerReader Init Mode	Data0; 4.5 MBit/s; NT
Voltage Levels	Calibrated
Retrial Number	2
Test Sequence	MPhyLsCompliance.seq
Re-Init sequence after Reset DUT	True
Show Dialog at UniPro Reset DUT	False
HS Data Rate	Gear3A
Min Tested	0.82
Max Tested	1.18
Additional Steps	0.95;1.05;0.8;1.2
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
Capture Screenshot	True
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mod
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A

Result	PWM Data Rate [MBit/s]	Tested Value	Min Spec	Max Spec
pass	4.5	0.82/1.18	0.82	1.18
pass	4.5	0.95/1.05	0.82	1.18
pass	4.5	0.8/1.2	0.82	1.18

Figure 5-25 Example result for Test 2.2.5a – PWM-RX Receive Bit Duration Tolerance

- Result: Pass/Fail — The result is “Pass” if the measured Receive Bit Duration Tolerance limits exceed the specification limits.
- PWM Data Rate [MBit/s]: Value of the PWM data rate tested.
- Tested Value: The minimum and maximum Receive Bit Duration values tested.
- Min Spec: The minimum value of the Receive Bit Duration at which the DUT must work successfully.
- Max Spec: The maximum value of the Receive Bit Duration at which the DUT must work successfully.

Test 2.2.5b – PWM-RX Receive Bit Duration Tolerance, During LINE-READ

(TOLPWM-G1-RX)

Availability

Hardware	All configurations
Termination	Non-Terminated, Terminated
Channels	All lanes
Mode	Compliance, Expert
Data Rates	Modulated bitrate that spans the entire PWM-G1 range

Purpose and Method

The purpose of this procedure is the same as for Test 2.2.5a but with the exception that it is performed during Line Read.

The method is the same as for Test 2.2.5a – PWM-RX Receive Bit Duration Tolerance on page 171.

Connection Diagram

Refer to Figure 5-20 and Figure 5-21.

Result Description

TPWM-G1-LR NT Data0 5MBit

[Not Compliant]

Test 2.2.5b: Verify TOL_PWM_G1_LR_RX Into Open

----General----	
Offline	True
Software Version	1.3.1.2
Required-calibration SW Version	1.3.0.18; '1.3.1.2
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant: Reference Clock Cali
Attenuator	0 dB
HS Prepare Length	15
HS Sync Length	7
Stall length	20
Initial Adapt Length	0
Initial Adapt Type	Fine
Refresh Adapt Length	0
Refresh Adapt Type	Fine
LS Prepare length	7
Sleep length	5
PWM Tail of Burst	10
Reset Pulse Width	100 us
PWM Burst Closure Extension	32
Ref Clock Frequency	26 MHz
Target BER	100E-9
IBerReader Init Mode	Data0; 4.5 MBit/s; NT
Voltage Levels	Calibrated
Retrial Number	2
Test Sequence	MPhyLsCompliance.seq
Re-Init sequence after Reset DUT	True
Show Dialog at UniPro Reset DUT	False
HS Data Rate	Gear3A
Min Tested	0.89
Max Tested	1.11
Additional Steps	0.95;1.05;0.8;1.2
Sequence	MPhyLsComplianceLineRead.seq
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
Capture Screenshot	True
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mod
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A

Result	PWM Data Rate [MBit/s]	Tested Value	Min Spec	Max Spec
pass	4.5	0.89/1.11	0.89	1.11
pass	4.5	0.95/1.05	0.89	1.11
pass	4.5	0.8/1.2	0.89	1.11

Figure 5-26 Example result for Test 2.2.5b – PWM-RX Receive Bit Duration Tolerance, During LINE-READ

- Result: Pass/Fail — The result is “Pass” if the measured Receive Bit Duration Tolerance limits exceed the specification limits.
- PWM Data Rate [MBit/s]: Value of the PWM data rate tested.
- Tested Value: The minimum and maximum Receive Bit Duration values tested.
- Min Spec: The minimum value of the Receive Bit Duration at which the DUT must work successfully.
- Max Spec: The maximum value of the Receive Bit Duration at which the DUT must work successfully.

Test 2.2.6 – PWM-RX Receive Ratio for PWM-G1

(kPWM-RX)

Availability

Hardware	All configurations
Termination	Non-Terminated, Terminated
Channels	All lanes
Mode	Compliance, Expert
Data Rates	Minimum and maximum data rates of PWM Gear 1

Purpose and Method

The purpose of this procedure is to confirm that the PWM-RX Receive Ratio tolerance (kPWM-RX) is within conformance limits.

PWM-RX Receive Ratio
= (Major Receive Bit Duration) / (Minor Receive Bit Duration)

or

$k_{PWM\text{-}RX} = T_{PWM\text{-}MAJOR\text{-}RX}/T_{PWM\text{-}MINOR\text{-}RX}$

The data generator sends a Burst-mode CJTPAT signal while the DUT is configured for Terminated mode or Non-Terminated mode, depending on the test case. The differential voltage amplitude and the common-mode voltage are set to the nominal values (200 mV). No other signal impairments, such as the ISI channel or the jitter sources, are added to the signal.

First, $k_{PWM\text{-}RX}$ is set to the default minimum value (0.60 / 0.40) according to the specification. Then the values of $T_{PWM\text{-}MAJOR\text{-}RX}$ and $T_{PWM\text{-}MINOR\text{-}RX}$ are increased and decreased, respectively, using a step-size value in order to sweep $k_{PWM\text{-}RX}$ until the maximum value (0.75 / 0.25) is reached. At each step, the BER is measured and compared with the Target BER to determine the pass/fail result.

This test is performed at each selected lane and at the minimum and maximum data rate values of PWM-G1.

Connection Diagram

Refer to Figure 5-20 and Figure 5-21.

Result Description

kPWM-RX NT Data0 Gear1

[Not Compliant]

Test 2.2.6: Verify k_PWM_RX Into Open

----General----	
Offline	True
Software Version	1.3.1.2
Required-calibration SW Version	1.3.0.18; '1.3.1.2
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant: Reference Clock Cali
Attenuator	0 dB
HS Prepare Length	15
HS Sync Length	7
Stall length	20
Initial Adapt Length	0
Initial Adapt Type	Fine
Refresh Adapt Length	0
Refresh Adapt Type	Fine
LS Prepare length	7
Sleep length	5
PWM Tail of Burst	10
Reset Pulse Width	100 us
PWM Burst Closure Extension	32
Ref Clock Frequency	26 MHz
Target BER	100E-9
IBerReader Init Mode	Data0; 3 MBit/s; NT
Voltage Levels	Calibrated
Retrial Number	2
Test Sequence	MPhyLsCompliance.seq
Re-Init sequence after Reset DUT	True
Show Dialog at UniPro Reset DUT	False
HS Data Rate	Gear3A
Minimum Tested	0.6
Maximum Tested	0.75
Steps	5
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
Capture Screenshot	True
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mod
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A

Result	PWM Data Rate [MBit/s]	Tested Value	Min Spec	Max Spec	Comments
pass	3.0	0.6/0.4	0.6/0.4	0.75/0.25	
pass	3.0	0.6375/0.3625	0.6/0.4	0.75/0.25	
pass	3.0	0.675/0.325	0.6/0.4	0.75/0.25	
pass	3.0	0.7125/0.2875	0.6/0.4	0.75/0.25	
pass	3.0	0.75/0.25	0.6/0.4	0.75/0.25	
pass	4.5	0.6/0.4	0.6/0.4	0.75/0.25	
pass	4.5	0.6375/0.3625	0.6/0.4	0.75/0.25	
pass	4.5	0.675/0.325	0.6/0.4	0.75/0.25	
pass	4.5	0.7125/0.2875	0.6/0.4	0.75/0.25	
pass	4.5	0.75/0.25	0.6/0.4	0.75/0.25	

Figure 5-27 Example result for Test 2.2.6 – PWM-RX Receive Ratio for PWM-G1

- Result: Pass/Fail — The result is “Pass” if the BER test is passed.
- PWM Data Rate [MBit/s]: Value of the PWM data rate tested.
- Tested Value: The value of the Receive Ratio tested.
- Min Spec: The minimum Receive Ratio value at which the DUT must work properly, according to the specification.
- Max Spec: The maximum Receive Ratio value at which the DUT must work properly, according to the specification
- Comments: If the DUT fails, comments may be provided here.

Test 2.2.3 – PWM-RX Differential Termination Enable Time

(T_TERM-ON-PWM-RX)

Availability

Hardware	All configurations
Termination	Terminated
Channels	All lanes
Mode	Compliance, Expert
Data Rates	Minimum and maximum data rates of PWM Gear 1

Purpose and Method

This procedure verifies that the PWM-RX enables the differential termination within the required time.

The data generator sends Burst-mode CJTPAT signaling with nominal amplitude settings while the DUT is configured for Terminated mode. Then the PWM-RX Differential Termination Enable Time, $T_{TERM-ON-PWM-RX}$, is measured using a real-time oscilloscope. Of all the measured $T_{TERM-ON-PWM-RX}$ values, the maximum and minimum $T_{TERM-ON-PWM-RX}$ values are considered as the final results.

The test will pass if the maximum $T_{TERM-ON-PWM-RX}$ value is less than the PREPARE time defined by the DUT's RX_LS_PREPARE_LENGTH_Capability attribute.

This test is performed at each selected lane and at the minimum and maximum data rate values for PWM-G1.

Connection Diagram

Refer to Figure 5-22.

Result Description

Term. On D0 RT Gear1

[Not Compliant]

Test 2.2.3: Measure the Termination Delay Terminated

```
----General----
Offline                          True
Software Version                 1.3.1.2
Required-calibration SW Version  1.3.0.18
Compliant                        False
Non-compliance reason(s)         Procedure offline; Required cal not compliant: Level Cal. Terminated
Attenuator                       0 dB
HS Prepare Length                15
HS Sync Length                   7
Stall length                     20
Initial Adapt Length             0
Initial Adapt Type               Fine
Refresh Adapt Length             0
Refresh Adapt Type               Fine
PWM Tail of Burst                10
Reset Pulse Width                100 us
PWM Burst Closure Extension      32
Ref Clock Frequency              26 MHz
Scope Channel                    Channel1
Semi Automated Test              False
Set Single Ended Amplitude       200 mV
Set Offset                       100 mV
Prepare Length                   7
Sleep Length [UI]                5
Prepare Length Capability        7
IMPhyBerReader Init Mode         Data0; 3 MBit/s; Termination; RT
Show Dialog at UniPro Reset DUT  False
Run without TTC                  False
Wait for Manual Break            False
Show DUT Configure Dialog        False
Sampling Rate                    Default
TrigThreshold Mode               0
Capture Screenshot               True
----Instruments----
Calibrated Instrument 1          Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mode
Calibrated Instrument 2          Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A
```

Result	PWM Data Rate [MBit/s]	Termination Time Min [ns]	Termination UI Min [UI]	Min Spec [UI]	Termination Time Max [ns]	Termination UI Max [UI]	Max Spec [UI]
pass	3	0	0	0	0	0	20
pass	5	0	0	0	0	0	20

Figure 5-28 Example result for Test 2.2.3 – PWM-RX Differential Termination Enable Time

- Result: Pass/Fail — The result is “Pass” if the termination enable time lies between the specification limits.
- PWM Data Rate [MBit/s]: Value of the PWM data rate tested.
- Termination Time Min [ns]: The shortest termination enable time.
- Termination UI Min [UI]: The shortest termination enable time in terms of unit intervals.
- Min Spec [UI]: The minimum value of the termination enable time (in UI) at which the DUT must work, according to the specification.
- Termination Time Max [ns]: The longest termination enable time.
- Termination UI Max [UI]: The longest termination enable time in terms of unit intervals.
- Max Spec [UI]: The maximum value of the termination enable time (in UI) for which the DUT must work, according to the specification.

Test 2.2.4 – PWM-RX Differential Termination Disable Time

(T_TERM-OFF-PWM-RX)

Availability

Hardware	All configurations
Termination	Terminated
Channels	All lanes
Mode	Compliance, Expert
Data Rates	Minimum and maximum data rates of PWM Gear 1

Purpose and Method

This procedure verifies that the PWM-RX disables the differential termination within the required time.

The data generator sends Burst-mode CJTPAT signaling with nominal amplitude settings while the DUT is configured for Terminated mode. Then the PWM-RX Differential Termination Disable Time, $T_{TERM-OFF-PWM-RX}$, is measured using a real-time oscilloscope. Of all the measured $T_{TERM-OFF-PWM-RX}$ values, the maximum and minimum $T_{TERM-OFF-PWM-RX}$ values are considered as the final results.

The test will pass if the maximum $T_{TERM-OFF-PWM-RX}$ value is less than the SLEEP time defined by the DUT's RX_Min_SLEEP_NoConfig_Time_Capability attribute in PWM-MODE.

This test is performed at each selected lane and at the minimum and maximum data rate values for PWM-G1.

Connection Diagram

Refer to Figure 5-22.

Result Description

Term. Off D0 RT Gear1

[Not Compliant]

Test 2.2.4: Measure the Termination Delay Terminated

```
----General----
Offline                          True
Software Version                 1.3.1.2
Required-calibration SW Version  1.3.0.18
Compliant                        False
Non-compliance reason(s)         Procedure offline; Required cal not compliant: Level Cal. Terminated
Attenuator                       0 dB
HS Prepare Length                15
HS Sync Length                   7
Stall length                     20
Initial Adapt Length             0
Initial Adapt Type               Fine
Refresh Adapt Length             0
Refresh Adapt Type               Fine
PWM Tail of Burst                10
Reset Pulse Width                100 us
PWM Burst Closure Extension      32
Ref Clock Frequency              26 MHz
Scope Channel                    Channel1
Semi Automated Test              False
Set Single Ended Amplitude       200 mV
Set Offset                       100 mV
Prepare Length                   7
Sleep Length [UI]                5
Sleep Time Capability [SI]       5
IMPhyBerReader Init Mode         Data0; 3 MBit/s; Termination; RT
Show Dialog at UniPro Reset DUT  False
Run without TTC                  False
Wait for Manual Break            False
Show DUT Configure Dialog        False
Sampling Rate                    Default
TrigThreshold Mode               0
Capture Screenshot               True
----Instruments----
Calibrated Instrument 1          Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mode
Calibrated Instrument 2          Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A
```

Result	PWM Data Rate [MBit/s]	Termination Time Min [ns]	Termination UI Min [UI]	Min Spec [UI]	Termination Time Max [ns]	Termination UI Max [UI]	Max Spec [UI]
pass	3	0	0	0	0	0	50
pass	5	0	0	0	0	0	50

Figure 5-29 Example result for Test 2.2.4 – PWM-RX Differential Termination Disable Time

- Result: Pass/Fail — The result is “Pass” if the termination disable time lies between the specification limits.
- PWM Data Rate [MBit/s]: Value of the PWM data rate tested.
- Termination Time Min [ns]: The shortest measured termination disable time.
- Termination UI Min [UI]: The shortest termination disable time in terms of unit intervals.
- Min Spec [UI]: The minimum value of the termination disable time (in UI) at which the DUT must work, according to the specification.
- Termination Time Max [ns]: The longest measured termination disable time.
- Termination UI Max [UI]: The longest termination disable time in terms
- of unit intervals.
- Max Spec [UI]: The maximum value of the termination disable time (in UI) at which the DUT must work, according to the specification.

Interference Tests

In order to keep the number of cable re-connections and the testing time to a minimum, the calibrations required for the Interference tests are conducted independently of the other calibrations. The calibrations are added under the node **Interference Tests** in the procedure tree, immediately before the Interference tests.

Example Connection Diagrams

In this User Guide, only example connection diagrams are given. The exact connection diagram for a specific situation can be viewed by right-clicking the appropriate procedure in the procedure tree of the main window of the user interface and selecting “Show Connection...”.

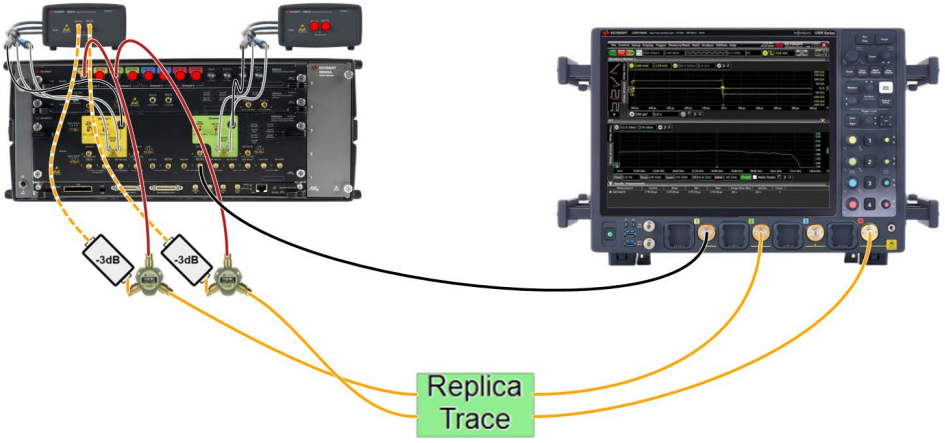


Figure 5-30 Example connection diagram for interference calibration (M8040A)

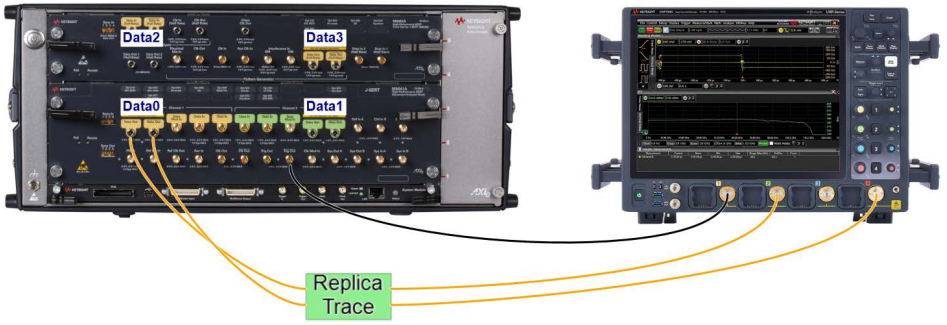


Figure 5-31 Example connection diagram for interference calibration (M8020A)

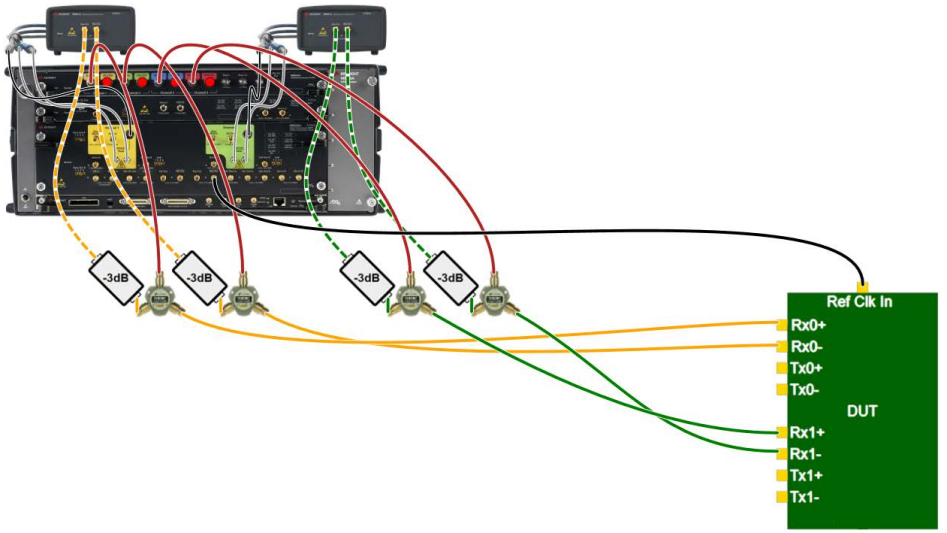


Figure 5-32 Example connection diagram for interference tests (two channels, M8040A)

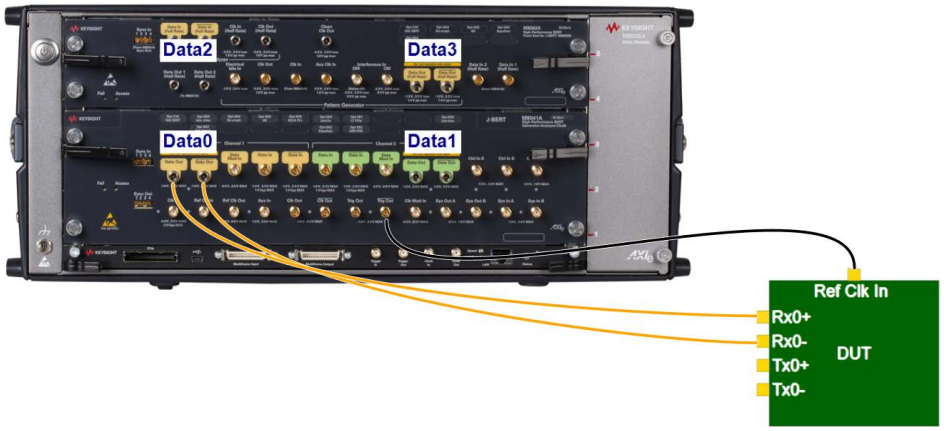


Figure 5-33 Example connection diagram for interference tests (one channel, M8020A)

Interference Calibration

Availability

Hardware	All configurations
Termination	Non-Terminated
Mode	Compliance, Expert

Purpose and Method

This calibration is used to adjust the amplitude of the common mode interference signal depending on the signal frequency.

The data generator sets the DC signal to '0' V. Then a sweep of the sinusoidal interference signal is done, starting with the Min Interference Value and increasing by the Step Size until the Max Interference Value is reached. Because of the low pass filter behavior of the signal, the voltage depends on the frequency of the interference signal. Therefore, the voltages are calibrated over a Frequency Range. At each step, the oscilloscope measures the common mode interference amplitude and then the set and the actual amplitude values are stored.

The measured values are used to calculate the voltage setting for the interference tests.

Connection Diagram

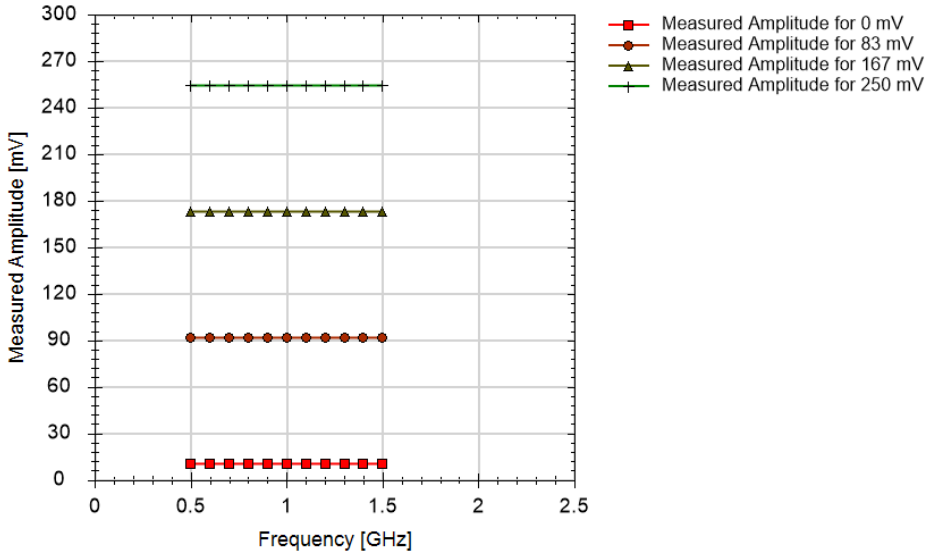
Refer to Figure 5-30 and Figure 5-31.

Result Description

Interference Calibration Data0

[Not Compliant]

Calibrates the Interference Amplitude



----General----	
Offline	True
Software Version	1.3.1.2
Required-calibration SW Version	1.3.0.18
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant:
Attenuator	-9 dB
Capture screen-shot for each calibration measurement	True
Oscilloscope Bandwidth	6 GHz
Min Interference Value	0 V
Max Interference Value	250 mV
Step Size	100 mV
Frequency Range Start Value	500 MHz
Frequency Range Stop Value	1.5 GHz
Frequency Range Scale Type	Linear
Frequency Range Number of Steps	11
Interference Attenuation Factor	0.922222222222222
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
Capture Screenshot	True

----InfiniiSim Settings----	
Use Infiniisim	False
Transfer Function Data	DoNothing.tf2
Filter Delay Data	OFF
Max. Time Span Data	10 ns
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8040A J-BERT ; Company: Keysigh
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEy
Measurement Instrument 1	Name: Keysight DSO ; Company: Keysight Technolc

Result	Interference Frequency [GHz]	Measured Amplitude for 0 mV [mV]	Measured Amplitude for 83 mV [mV]	Measured Amplitude for 167 mV [mV]	Measured Amplitude for 250 mV [mV]
pass	0.500	10	91	173	254
pass	0.600	10	91	173	254
pass	0.700	10	91	173	254
pass	0.800	10	91	173	254
pass	0.900	10	91	173	254
pass	1.000	10	91	173	254
pass	1.100	10	91	173	254
pass	1.200	10	91	173	254
pass	1.300	10	91	173	254
pass	1.400	10	91	173	254
pass	1.500	10	91	173	254

Figure 5-34 Example result for Interference Calibration

- Result: Pass/Fail – If the value is Fail, the amplitude value could not be measured using a DSO or the measured values do not increase monotonically.
- Interference Frequency [GHz]: Value of the interference frequency being calibrated.
- Measured Amplitude for X mV [mV]: Amplitude value measured for the applied amplitude value X mV.

Test 2.4.7 – SQ-RX Squelch RF Interference Tolerance

(V_INT-SQ, f_INT-SQ)

Availability

Hardware	All configurations
Termination	Non-Terminated
Channels	More than one lane
Mode	Compliance, Expert

Purpose and Method

The purpose of this procedure is to verify that the Squelch RF Interference tolerance meets the M-PHY specification.

The data generator sends a test sequence consisting of two DIFN pulses with width equal to the maximum $T_{PULSE-SQ}$, surrounded by DIFP states, and with a pulse distance equal to the minimum squelch $T_{SPACE-SQ}$. The calibrated common mode interference is set to an amplitude of 200 mV. The frequency of the RF interference is set to 500 MHz and then increased with steps of 100 MHz up to1.5 GHz. At each step, it is checked that the DUT does not exit the HIBERN8 state and enter the sleep state.

This HIBERN8 state exit is found by detecting that the DUT has activated the TX in a similar way to the other Squelch tests.

Connection Diagram

Refer to Figure 5-32.

Result Description

RF Interference Tolerance D0

[Not Compliant]

Test 2.4.7: Verify the interference tolerance

----General----	
Offline	True
Software Version	1.3.1.2
Required-calibration SW Version	1.3.0.18; '1.3.1.2
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant: Reference Clock Cali Squelch Data0, Interference Calibration
Data Rate	Gear1A
Attenuator	-9 dB
HS Prepare Length	15
HS Sync Length	7
Stall length	20
Initial Adapt Length	0
Initial Adapt Type	Fine
Refresh Adapt Length	0
Refresh Adapt Type	Fine
LS Prepare length	7
Sleep length	5
PWM Tail of Burst	10
Reset Pulse Width	100 us
PWM Burst Closure Extension	32
Ref Clock Frequency	26 MHz
Target BER	1E-12
IBerReader Init Mode	Data0; 1.248 GBit/s; Squelch; NT
Voltage Levels	Calibrated
Squelch Test Sequence	MPhySquelchCompliance.seq
Re-Init sequence after Reset DUT	True
Min Value	500 MHz
Max Value	1.5 GHz
Step Size	100 MHz
Set Single Ended Amplitude	200 mV
Tested Offsets [mV]	100
Number of Pulses	1
Pulse Distance	500 ns
Pulse Width	0 s
Min Interference Amplitude	200 mV
Max Interference Amplitude	200 mV
Steps Interference Amplitude	1
Show User Action Dialog	False
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
Capture Screenshot	True

```
----Instruments----
Calibrated Instrument 1          Name: Keysight M8040A J-BERT ; Company: Keysight Technologies ; Mod
Calibrated Instrument 2          Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: BIT-3000A
```

Result	Interference Frequency [MHz]	Max Passed [mV]	Max Spec [mV]	Offset [V]
pass	500	200	200	0
pass	600	200	200	0
pass	700	200	200	0
pass	800	200	200	0
pass	900	200	200	0
pass	1000	200	200	0
pass	1100	200	200	0
pass	1200	200	200	0
pass	1300	200	200	0
pass	1400	200	200	0
pass	1500	200	200	0

Figure 5-35 Example result for Test 2.4.7 – SQ-RX Squelch RF Interference Tolerance

- Result: Pass/Fail — The result is “Pass” if the DUT does not exit the HIBERN8 state.
- Interference Frequency [MHz]: Value of the interference frequency tested.
- Max Passed [mV]: The maximum interference voltage at which the test was passed.
- Max Spec [mV]: Maximum interference voltage required according to the specification.
- Offset [V]: Value of the offset during the test.

Common Mode Interference

Availability

Hardware	M8020A
Termination	Terminated
Channels	More than one lane
Mode	Expert

Purpose and Method

The purpose of this procedure is to characterize the Common Mode Interference tolerance of the DUT.

The data generator sends a Burst-mode CJTPAT signal with nominal amplitude settings while the DUT is configured for Terminated mode.

Short Term Random Jitter and Sinusoidal Jitter are added to the signal. A sweep of the common-mode interference amplitude (CMI Amplitude) is performed using the given range. The CMI Amplitude is tested over the defined Jitter Frequency Range and also at the given Additional Jitter Frequency values to find out how much interference the DUT can tolerate. At each step, the BER is measured and compared with the Target BER.

The test is passed if, for all the frequency points, the maximum CMI that meets the target BER is greater than the given Min User-Defined Interference amplitude.

Connection Diagram

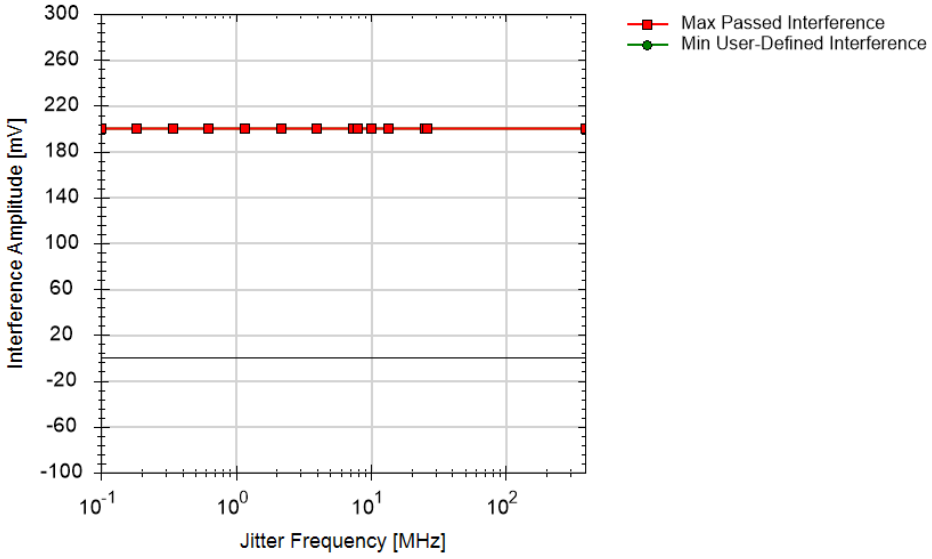
Refer to Figure 5-33.

Result Description

CM Interf. Data0 at 11648MBit

[Not Compliant]

Verify the common mode interference Terminated



----General----	
Offline	True
Software Version	1.3.1.2
Required-calibration SW Version	1.3.0.18; '1.3.1.2
Compliant	False
Non-compliance reason(s)	Procedure offline; Required cal not compliant: Reference Cl Calibration, Level Cal. Terminated Data0, High Frequency SJ
Data Rate	Gear4B
HS Prepare Length	15
HS Sync Length	7
Stall length	20
Initial Adapt Length	0
Initial Adapt Type	Fine
Refresh Adapt Length	0
Refresh Adapt Type	Fine
LS Prepare length	7
Sleep length	5
PWM Tail of Burst	10
Reset Pulse Width	100 us
PWM Burst Closure Extension	32
Ref Clock Frequency	26 MHz
Target BER	1E-12

IBerReader Init Mode	Data0; 11.648 GBit/s; RT
Voltage Levels	Calibrated
Retrial Number	2
Test Sequence	MPhyCompliance.seq
Re-Init sequence after Reset DUT	True
Show Dialog at UniPro Reset DUT	False
Jitter Frequency Range [MHz]	0.1; 25; 10; Logarithmic
Additional Jitter Frequencies [MHz]	8;10;26;388.266666666667
Jitter Amplitude	0 UI
Short Term Random Jitter Amplitude (p-p)	170 mUI
CMI Amplitudes [Vp-p]	0; 0.2; 3; Linear
CMI Frequency	500 MHz
Min User-Defined Interference Amplitude	200 mV
Set Single Ended Amplitude	400 mV
Set Offset	100 mV
Run without TTC	False
Wait for Manual Break	False
Show DUT Configure Dialog	False
Sampling Rate	Default
TrigThreshold Mode	0
Capture Screenshot	True
----Instruments----	
Calibrated Instrument 1	Name: Keysight M8020A J-BERT ; Company: Keysight Technologi
Calibrated Instrument 2	Name: BitifEye BIT-3000 DSGA ; Company: BitifEye ; Model: B

Result	Jitter Frequency [MHz]	Max Passed Interference [mV]	Min User-Defined Interference [mV]
pass	0.10	200	200
pass	0.18	200	200
pass	0.34	200	200
pass	0.63	200	200
pass	1.16	200	200
pass	2.15	200	200
pass	3.97	200	200
pass	7.33	200	200
pass	8.00	200	200
pass	10.00	200	200
pass	13.54	200	200
pass	25.00	200	200
pass	26.00	200	200
pass	388.27	200	200

Figure 5-36 Example result for Common Mode Interference

- Result: Pass/Fail — The result is “Pass” if the maximum CMI that meets the target BER is greater than the given Min User-Defined Interference amplitude.
- Jitter Frequency [MHz]: Value of the jitter frequency tested.
- Max Passed Interference [mV]: The maximum value of common-mode interference where the DUT works without errors.

– Min User-Defined Interference [mV]: The minimum common-mode interference allowed in order for the DUT to pass.

Manual Tests

Setup Procedure Full

Availability

Hardware	All configurations
Termination	Terminated, Non-Terminated
Channels	All
Mode	Expert
Data Rates	HS Gears 1–5 (M8040A) HS Gears 1–4 (M8020A)

Purpose and Method

This procedure allows you to set a wide range of parameters as well as to measure the BER after those parameters have been set.

If any procedure has not been run previously, this procedure performs a full initialization of the generator and the DUT. The sequence, levels and all selected parameters are set, the generator started and the BER measurement taken.

Connection Diagram

No special connection diagram is available, but the setup given in Figure 5-1 or Figure 5-2 can be connected initially.

Result Description

– Result: Pass if the values of voltage and jitter are set properly, otherwise Fail.

Setup Procedure Fast

Availability

Hardware	All configurations
Termination	Terminated, Non-Terminated
Channels	All
Mode	Expert
Data Rates	HS Gears 1–5 (M8040A) HS Gears 1–4 (M8020A)

Purpose and Method

This procedure allows you to set a wide range of parameters as well as to measure the BER after those parameters have been set.

The difference compared to Setup Procedure Full is that Setup Procedure Fast does not perform DUT initialization.

Connection Diagram

No special connection diagram is available, but the setup given in Figure 5-1 or Figure 5-2 can be connected initially.

Result Description

Result: Pass if the values of voltage and jitter are set properly, otherwise Fail.

A Transmitter Tests Setup Procedures

In addition to procedures for calibrations and receiver tests, the Keysight N5991 MIPI M-PHY Test Automation Software Platform also provides procedures for preparing the setup for transmitter tests.

Overview

The available Transmitter Tests Setup Procedures are

- Transmitter HS Tests Setup (HS Gears 1–5)
- Transmitter PWM Tests Setup

Prerequisite Calibrations

Prerequisite calibrations are not listed explicitly for each procedure in this User Guide. However, they can be found directly in the application (see Required Calibration Data for details).

MIPI M-PHY ValiFrame Parameters

Apart from 'Repetitions', ValiFrame for MIPI M-PHY has no **common parameters** for Transmitter Tests Setup.

The MIPI M-PHY ValiFrame **parameters for individual procedures** that can be changed in expert mode are not listed in this user guide explicitly. They are displayed in the parameter grid (right pane) of the main window of the user interface when you click on the corresponding entry in the procedure tree in the left half of the main window.

Details of MIPI M-PHY Transmitter Tests Setup Parameters for individual procedures can be found in Table C-3 on page 219 and Table C-5 on page 226.

Connection Diagrams

In this User Guide, only example connection diagrams are given. The exact connection diagram for a specific situation can be viewed by right-clicking the appropriate procedure in the procedure tree of the main window of the user interface and selecting "Show Connection...".

Transmitter Tests Setup Procedures

Example Connection Diagram

In this User Guide, only example connection diagrams are given. The exact connection diagram for a specific situation can be viewed by right-clicking the appropriate procedure in the procedure tree of the main window of the user interface and selecting “Show Connection...”.

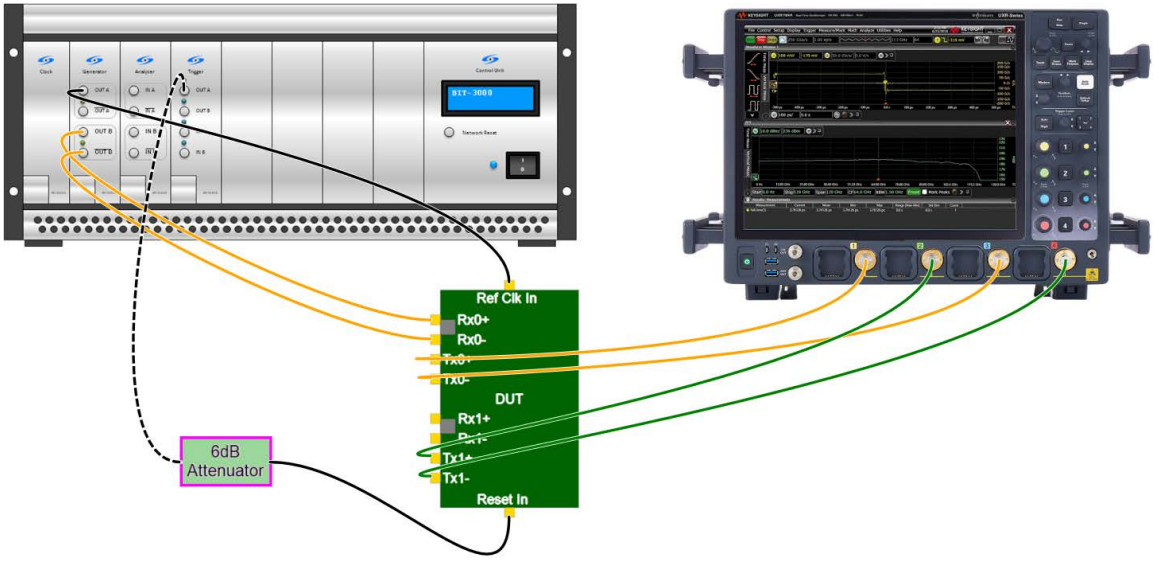


Figure A-1 Example connection diagram for Transmitter Tests Setup

Transmitter HS Tests Setup Procedure

Availability

Hardware	DSGA
Termination	Terminated
Channels	All lanes
Protocol	UniPro
Mode	Compliance, Expert
Data Rates	HS Gears 1–5
Sequences	Large Amplitude, Burst Large Amplitude, Continuous Small Amplitude, Burst Small Amplitude, Continuous

NOTE **In the Station Configuration window, check the box "Transmitter Tests Setup Procedure" in order to include this procedure in the procedure tree.**

Purpose and Method

The purpose of this procedure is to set up the DUT for transmitter HS tests.

The DUT is connected to the DSGA, and after successful link training through the DSGA, the DUT should activate its transmitter lane(s) and send the Test Data Frame in Burst or Continuous mode, based on the link training configuration.

Connection Diagram

Refer to Figure A-1.

Transmitter PWM Tests Setup Procedure

Availability

Hardware	DSGA
Termination	Terminated, Unterminated
Channels	All lanes
Mode	Compliance, Expert
Data Rates	PWM-G1
Sequences	Large Amplitude, Burst Small Amplitude, Burst

NOTE **In the Station Configuration window, check the box "Transmitter Tests Setup Procedure" in order to include this procedure in the procedure tree.**

Purpose and Method

The purpose of this procedure is to set up the DUT for transmitter PWM tests.

The DUT is connected to the DSGA, and after successful link training through the DSGA, the DUT should activate its transmitter lane(s) and send the Test Data Frame in PWM mode.

Connection Diagram

Refer to Figure A-1.

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B Using the UniPro Test Mode

Choose the UniPro Protocol and the UniPro BER Reader to test DUTs using this protocol. Details of implementation as well as generation of UniPro Sequences are given in this chapter.

Overview

UniPro, or Unified Protocol, is described by MIPI® Alliance on its website as “an application-agnostic transport layer for chip-to-chip/interprocessor communication (IPC) applications in traditional or modular device architectures.”

Use of the UniPro protocol in the Keysight N5991 MIPI M-PHY Test Automation Software Platform requires an additional license. See the product data sheet.

Implementing the UniPro Test Mode

To perform tests in UniPro Test Mode, choose the Protocol as UniPro or UFS in the Configure DUT dialog (see Configuring the DUT and Test Parameters) and select the UniPro BER Reader in the Special Parameters dialog (see Figure 2-10).

The main characteristics of this mode are as follows:

- Loopback to the Error Detector is not used.
- The device is set to Test Mode by means of UniPro PACP packets.
- PACP Frame and Error Counter requests are interleaved in the Test Pattern.
- PACP Packets can be HS or PWM.
- Data transmission can be bursts or continuous mode (bursts and FILLERS).
- The implementation always requires the DSGA and either M8040A or M8020A.
- The BERT (M8040A or M8020A) sends the training sequence in PWM mode.
- After the training sequence has been completed, the BERT sends the Test Data Frame in High Speed mode.
- Provided the DUT is in test mode, it analyzes the received data and updates the frame counter and the error counter.
- The BERT queries the error counter and the frame counter using the provided UniPro commands.
- The DSGA analyzes the responses from the DUT.

Since the DSGA is used for the analysis, DUT responses should be in PWM mode.

Training Sequence

The training sequence should have the following structure:

- Send PACP Test Mode Request (`TestModeReq()` macro).
- Bring TX out of HIBERN8 (`SetReq(…)` macro, set register 2B).
- Configure RX transmission Mode, Gear, etc.
- Configure TX transmission Mode, Gear, etc.
- Transmit Test Pattern with Equipment (`TestDataFrame` macro).
- Request Frame and Error Counter (`GetReq(…)` macro, registers 15C0 and 15C1).

UniPro Script Generation

To operate in UniPro Test mode, it is necessary to replace the default scripts by UniPro scripts. These are generated in the UniPro Script Generator dialog (see Figure B-1 and Figure B-2). Navigate to this from the N5991 MIPI M-PHY main window by

1. clicking 'New' (opens the Configure DUT dialog)
2. selecting 'UniPro' or 'UFS' as the Protocol
3. clicking Default Sequences (opens the Select M-PHY Sequences dialog)
4. clicking Generate UniPro Scripts

In the Select M-PHY Sequences dialog (provided you checked Transmitter Tests Setup Procedure in the Station Configuration window, see Figure 2-3 on page 24), you can choose between Rx and Tx as the Product Type. Otherwise only Rx is available, which is what is required for the RX tests.

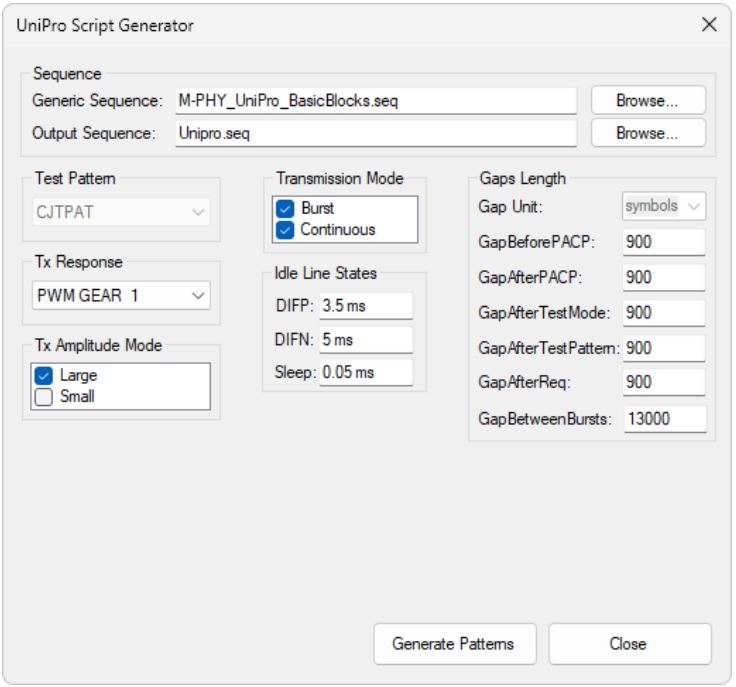

Figure B-1 UniPro Script Generator dialog for Product Type Rx

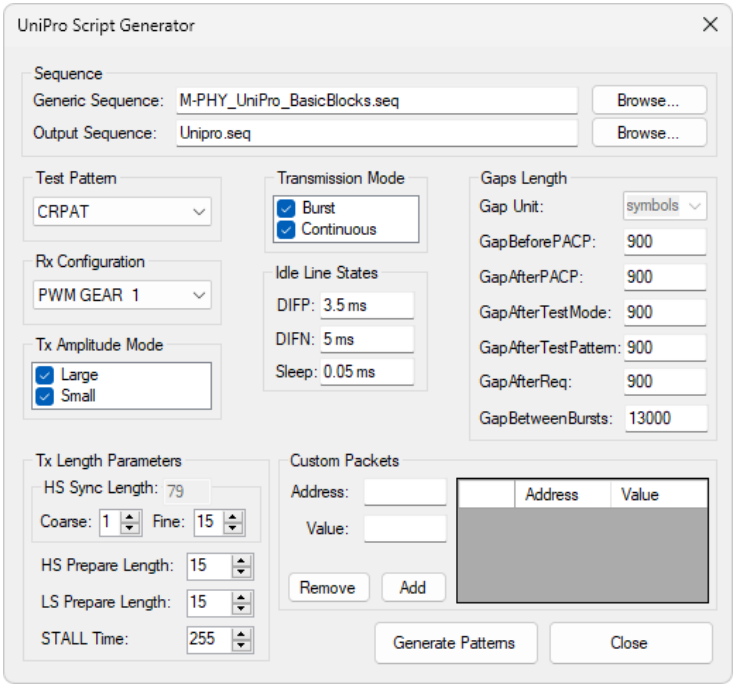

Figure B-2 UniPro Script Generator dialog for Product Type Tx

Sequence

Generic Sequence: The default Generic Sequence should be kept as M-PHY_UniPro_BasicBlocks.seq". This sequence can be edited and the changes will propagate to all the generated sequences. This sequence is a template, it cannot be used directly.

Output Sequence: Either set the path for the output sequence or keep the default one.

Test Pattern

Choose between two test patterns:

- CJTPAT
- CRPAT (only if Product Type is Tx)

Tx Response

For Product Type Rx, you can configure the DUT to transmit the response in high or low speed mode.

- PWM GEAR 1: The DUT transmits the signal in low speed mode (PWM). Use this option for setups that include the DSGA instrument as the Error Detector (M8020A + DSGA or M8040A + DSGA setup).
- HS same as Rx: The DUT transmits the signal at the same HS GEAR as used by the RX.
- HS GEAR 1-A, 1-B, ..., 5-B: The DUT transmits the signal in high speed mode. Note that HS-G5A and 5B are not available with the M8020A.

Rx Configuration

For Product Type Tx, the DUT will be trained to be prepared for TX purposes. This training is in low speed mode (PWM).

- PWM GEAR 1: The DUT receives the training signal in low speed mode (PWM).

Tx Amplitude Mode

You can configure the DUT to transmit with two different amplitude modes: Large or Small.

Select the desired amplitude mode(s). If both are selected, different scripts will be generated for each mode.

Transmission Mode

There are two transmission modes: Burst or Continuous.

Different scripts are generated for each transmission mode. Select **both** modes because there are procedures that require burst mode and others that require continuous mode.

Idle Line States

The length in time of the different Idle signals:

- DIFP
- DIFN
- Sleep

Gaps Length

The length in terms of symbols of the different GAPs that are used in the training sequence.

- Gap Unit: This is “symbols” by default.
- Gap Before PACP
- Gap After PACP
- Gap After Test Mode
- Gap After Test Pattern
- Gap After Request
- Gap Between Bursts

Tx Length Parameters

Only for Product Type TX.

All the lengths are given in terms of symbols.

- HS Sync Length: The length displayed here (max 79) can be altered by changing
  - Coarse
  - Fine
- HS Prepare Length (max 15)
- LS Prepare Length (max 15)
- STALL Time (max 255)

Custom Packets

Only for Product Type Tx. This area allows custom packets (specified by address and value) to be added and removed.

Generate Patterns

Click this button to generate the patterns once all the parameters have been set.

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C MIPI M-PHY Parameters

This Appendix contains lists and descriptions of parameters used in the Keysight N5991MM5A MIPI M-PHY Test Automation Software Platform user interface.

Overview

The parameters used in ValiFrame for MIPI M-PHY are divided here into:

- MIPI M-PHY ValiFrame Sequencer Parameters (Table C-1)
- MIPI M-PHY ValiFrame Common Parameters (Table C-2)
- MIPI M-PHY ValiFrame Parameters for Individual Procedures
  - MIPI M-PHY Parameters for All Individual Procedures (Table C-3)
  - MIPI M-PHY Parameters for Individual Calibrations (Table C-4)
  - MIPI M-PHY Parameters for Individual Tests and Setup Procedures (Table C-5)

With the exception of Table C-2 and Table C-3, in the tables the parameters are listed in alphabetical order under each category heading.

NOTE If the value of a parameter appears in boldface type in the parameter grid of the GUI, this indicates that the value is not the default value.

NOTE If a parameter is read-only (gray) in the parameter grid, it can often be set when configuring the DUT.

MIPI M-PHY ValiFrame Sequencer Parameters

The parameter ‘Repetitions’ appears when you click a group node in the procedure tree or an individual procedure. The other sequencer parameters are available only for each individual procedure. They appear at the end of the parameter grid list.

Table C-1 ValiFrame Sequencer Parameters

Parameter Name	Description
Procedure Error Case Behavior	– Proceed With Next Procedure: If an error occurs in the test or calibration procedure, continue by running the nextprocedure in the sequence. – Abort Sequence”: Abort further running of the sequence.
Procedure Failed Case Behavior	– Proceed With Next Procedure: If the test or calibration procedure fails, continue by running the next procedure in the sequence. – Abort Sequence: Abort further running of the sequence.
Repetitions	The number of times that the group or procedure will be repeated. If the value is '0', it runs only once.

MIPI M-PHY ValiFrame Common Parameters

ValiFrame common parameters are displayed in the parameter grid when a level higher than an individual procedure is selected in the procedure tree. For MIPI M-PHY, these are all found at the topmost level “MIPI M-PHY – 5.00” unless otherwise stated. They are listed in the order they appear in the parameter grid.

Table C-2 Common Parameters

Category / Parameter Name	Description / Values
Run without TTC	In expert mode you can choose to run procedures without transition time converters, however, the connection diagrams in the software will still show the TTCs.
Re-init Sequence	If the value is set to True, the test sequence starts again from the beginning in each test step to ensure that the DUT is in a defined state. This results in an increased test duration.
Wait for Manual Break	If the value is set to True, a dialog asking the user to manually restart the DUT will be shown for every test step. This is useful for DUTs that come out of test mode when loopback is being used.
Show DUT Configure Dialog	If the Init step fails (where all parameters are at default values), a dialog pops up to check the configuration of the DUT.
Sampling Rate	Specify the sampling rate to use for all tests. If it is set to Default, the sample rate will be set to the appropriate value depending on the tested data rate.
Trig Threshold Mode	When this option is set to Auto, the application will automatically determine the threshold value. When this option is set to Manual, the value of the Trigger Level option will be used as the trigger threshold.
Trigger Level	When this option is set to Auto, the application will automatically determine the threshold value. When this option is set to Manual, the value of the Trigger Level option will be used as the trigger threshold.
Capture Screenshot	If the value is set to True, the procedure results will include a screenshot from the oscilloscope (if present in the setup). Additionally available to be changed at the level “Calibration”.

MIPI M-PHY ValiFrame Parameters for Individual Procedures

MIPI M-PHY ValiFrame Parameters Used in All Individual Procedures

Table C-3 lists the parameters that are used in (practically) all procedures. They appear at the top of the parameter grid and are listed here in the order in which they appear. They are mainly related to whether the procedure is compliant.

Table C-3 Parameters for All Individual Procedures

Parameter	Description
Offline	– If True, the test automation software is not connected to any instrument. This mode should be used for demonstrations and checks only. It is not valid for calibrations or measurements. – If False, the software is connected to instruments and produces valid data. It is read-only in the parameter grid. It can be set in the Instrument Configuration step of the Station Configurator.
Software Version	The version of the MIPI M-PHY N5991 ValiFrame software currently being used.
Required-Calibration SW Version	The version of the MIPI M-PHY N5991 ValiFrame software that was used to obtain the data of the prerequisite calibrations, i.e., the calibration data required in order to perform the procedure (test or calibration). (Only for procedures that require previously acquired calibration data.)
Compliant	Read-only in the parameter grid. This indicates whether the procedure you are running is compliant with the MIPI M-PHY specification. False is also shown if you are working offline or if any of the prerequisite calibrations were not performed in compliant conditions. If the value is False, an additional property (Non-compliance reason(s)) is shown to indicate why the data is not compliant.
Non-compliance reason(s)	Possible reasons include: the software is running offline or with non-default parameters, at least one of the required calibrations is non-compliant.

MIPI M-PHY ValiFrame Parameters for Individual Calibrations

The parameters for individual calibrations listed in the following tables are in addition to the parameters that are used in (practically) all procedures, which are listed in Table C-3. In each category, the parameters are listed alphabetically.

Table C-4 Parameters for Individual Calibrations

Category / Parameter Name	Description / Which Procedures
No Category Name	
Accuracy of the Calibration	This parameter specifies the percentage deviation allowed in the measurement of ISI using the embedded fixture ISI in the M8020A. – Embedded Fixture ISI Calibration
Additional Jitter Frequencies [MHz]	Additional jitter frequency points, beside the frequency range, where the actual jitter amplitude is measured. – SJ Calibration
Amplitude	The amplitude of the differential voltage of the data signal being calibrated. – ISI Calibration – Short Term RJ Calibration – Low Frequency RJ Calibration – High Frequency SJ Calibration – SJ Calibration – RJ Calibration
Amplitude Range	The range of amplitude values used in the calibration. It is defined with four values separated by semicolons: <Start Value>;<End Value>;<Number of Steps>;<Scale Type>. The scale type can be Linear or Logarithmic. – Reference Clock Calibration – Level Cal. Terminated / into Open / for Squelch
Analysis Method	Refer to the *Scope Manual* for more details, as it is related to the EZJIT+ Software. – Low Frequency RJ Calibration

Table C-4 Parameters for Individual Calibrations (cont.)

Category / Parameter Name	Description / Which Procedures
Attenuator	Only for M8040A. Owing to the limitation of the M8040A (min 50 mV amplitude, no internal interference source), for Level Calibration for Squelch, an attenuator, a power divider and an external interference source are required. Otherwise, an attenuator can be added in Expert Mode. – Level Cal. Terminated / into Open / for Squelch – ISI Calibration – Short Term RJ Calibration – Low Frequency RJ Calibration – High Frequency SJ Calibration – SJ Calibration – Eye Opening Calibration with Jitter – RJ Calibration – Default Inter Pair Skew Calibration
BER Target	The target BER used in the calibration. – Eye Opening Calibration with Jitter
BUJ Polynomial	The sequence used to simulate bounded uncorrelated jitter. The default values are PRBS7 for HS Gear 1 and PRBS31 for HS Gear 2. – Low Frequency RJ Calibration
Calibration Sequence File	The sequence file used for the calibration. – Eye Opening Calibration with Jitter
Calibration Transition Count	The required number of captured transitions in histogram measurements. – ISI Calibration – Short Term RJ Calibration – Low Frequency RJ Calibration – High Frequency SJ Calibration – SJ Calibration – RJ Calibration
Capture screen-shot for each calibration measurement	If this is True, the image on the oscilloscope will be captured and saved for each calibration measurement. – Reference Clock Calibration – Level Cal. Terminated / into Open / for Squelch – ISI Calibration – Short Term RJ Calibration – Low Frequency RJ Calibration – High Frequency SJ Calibration – SJ Calibration – Eye Opening Calibration with Jitter – RJ Calibration – Default Inter Pair Skew Calibration – Interference Calibration
Eye Height Target	The eye height to be calibrated. – Eye Opening Calibration with Jitter

Table C-4 Parameters for Individual Calibrations (cont.)

Category / Parameter Name	Description / Which Procedures
Eye Mask Acquisition Time Out	Maximum time that the calibration waits for valid Eye Mask measurements. If it takes longer than that, the calibration will stop. – Eye Opening Calibration with Jitter
Eye Width Max. Variation	The allowed variation of the target eye width. – Eye Opening Calibration with Jitter
Eye Width Target	The eye width to be calibrated. – Eye Opening Calibration with Jitter
Frequency Range Number of Steps	Total number of values of interference frequency that are used for the frequency range in the interference calibration. – Interference Calibration
Frequency Range Scale Type	Choose either linear or logarithmic. – Interference Calibration
Frequency Range Start Value	The initial value of the frequency of the sinusoidal interference. – Interference Calibration
Frequency Range Stop Value	The end value of the frequency of the sinusoidal interference. – Interference Calibration
HFSJ Frequency	The fixed frequency of the high frequency sinusoidal jitter used for the calibration. – High Frequency SJ Calibration
Interference Attenuation Factor	Calculated attenuation factor of the power dividers. – Interference Calibration
ISI Calibration Sequence-File	Only M8020A. Path to the sequence file used in the calibration. – Embedded Fixture ISI Calibration
ISI (pk-pk)	The amount of ISI added during the calibration. – Eye Opening Calibration with Jitter
Jitter Calibration File	The sequence file for the jitter calibration. – ISI Calibration SJ Calibration – High Frequency SJ Calibration

Table C-4 Parameters for Individual Calibrations (cont.)

Category / Parameter Name	Description / Which Procedures
Jitter Frequencies [MHz]	Jitter frequency points to be calibrated. – Eye Opening Calibration with Jitter
Max. Calibration Voltage Amplitude	The start voltage value to find the target eye height. – Eye Opening Calibration with Jitter
Max Interference Value	Maximum interference value to be calibrated. – Interference Calibration
Max Jitter Value	Maximum jitter value to be calibrated. – Short Term RJ Calibration – Low Frequency RJ Calibration – High Frequency SJ Calibration – SJ Calibration – RJ Calibration
Min Interference Value	Minimum interference value to be calibrated. – Interference Calibration
Min Jitter Value	Minimum jitter value to be calibrated. – Short Term RJ Calibration – Low Frequency RJ Calibration – High Frequency SJ Calibration – SJ Calibration – RJ Calibration
Offset Range	The range of offset values to be tested. It is defined with four values separated by semicolons: <Start Value>;<End Value>;<Number of Steps>;<Scale Type>. The scale type can be Linear or Logarithmic. – Reference Clock Calibration – Level Cal. Terminated / into Open / for Squelch
Oscilloscope Bandwidth	This allows modification of the oscilloscope bandwidth in calibrations. As it impacts the measured jitter, the default value is recommended. – ISI Calibration – Short Term RJ Calibration – Low Frequency RJ Calibration – High Frequency SJ Calibration – SJ Calibration – Eye Opening Calibration with Jitter – RJ Calibration – Embedded Fixture ISI Calibration – Interference Calibration

Table C-4 Parameters for Individual Calibrations (cont.)

Category / Parameter Name	Description / Which Procedures
Short Term Random Jitter	The amplitude of the short term random jitter added to the signal. – Low Frequency RJ Calibration
Skew Tolerance	Maximum skew allowed for a successful calibration. – Default Inter Pair Skew Calibration
Step Size	The value by which the parameter is increased/decreased at each step of the calibration procedure. – Short Term RJ Calibration – Low Frequency RJ Calibration – High Frequency SJ Calibration – SJ Calibration – RJ Calibration – Embedded Fixture ISI Calibration – Interference Calibration
Target ISI Value	Only M8020A. The target ISI effect [mUI] when the embedded fixture ISI is used. – Embedded Fixture ISI Calibration
Transitions	Only M8020A. Number of transitions required in histogram measurements. – Embedded Fixture ISI Calibration
Use EZJit	This indicates whether the jitter analysis software tool EZJIT is being used. – High Frequency SJ Calibration – SJ Calibration
InfiniiSim Settings	
Filter Delay Data	The filter delay can be enabled on the oscilloscope. – ISI Calibration – Short Term RJ Calibration – Low Frequency RJ Calibration – High Frequency SJ Calibration – SJ Calibration – Eye Opening Calibration with Jitter – RJ Calibration – Interference Calibration
Max Time Span Data	The maximum time span set on the oscilloscope channels. – ISI Calibration – Short Term RJ Calibration – Low Frequency RJ Calibration – High Frequency SJ Calibration – SJ Calibration – Eye Opening Calibration with Jitter – RJ Calibration – Interference Calibration

Table C-4 Parameters for Individual Calibrations (cont.)

Category / Parameter Name	Description / Which Procedures
Transfer Function Data	When Use InfiniiSim is set to True, the Transfer Function file (.tf2) located on the local machine at *C:\ProgrammData\BitifEye\ValiFrameK1\MPhy\SParameter* will be copied to the default folder on the oscilloscope at *C:\Users\Public\Documents\Infiniium\Filters\M-PHY*. The transfer function will be applied to the differential data channel. – ISI Calibration – Short Term RJ Calibration – Low Frequency RJ Calibration – High Frequency SJ Calibration – SJ Calibration – Eye Opening Calibration with Jitter – RJ Calibration – Interference Calibration
Transfer Function DataP	When Use InfiniiSim is set to True, the Transfer Function file (.tf2) located on the local machine at *C:\ProgrammData\BitifEye\ValiFrameK1\MPhy\SParameter* will be copied to the default folder on the oscilloscope at *C:\Users\Public\Documents\Infiniium\Filters\M-PHY*. The transfer function will be applied to the single data channel. – Level Cal. Terminated / into Open / for Squelch
Use InfiniiSim	When a replica channel is not available or you want to use the InfiniiSim Transfer Function instead of a replica channel, set the Use InfiniiSim parameter to True. – Level Cal. Terminated / into Open / for Squelch – ISI Calibration – Short Term RJ Calibration – Low Frequency RJ Calibration – High Frequency SJ Calibration – SJ Calibration – Eye Opening Calibration with Jitter – RJ Calibration – Interference Calibration
Sequencer – See Table C-1.	

MIPI M-PHY ValiFrame Parameters for Individual Tests and Setup Procedures

The parameters for individual setup verification procedures listed in the following tables are in addition to the parameters that are used in (practically) all procedures, which are listed in Table C-3. In each category, the parameters are listed alphabetically.

NOTE Although Interference Calibration is listed under Interference Tests in the procedure tree, the description of the corresponding parameters can be found in Table C-4 Parameters for Individual Calibrations on page 220.

Table C-5 Parameters for Individual Tests and Setup Procedures

Category / Parameter Name	Description / Which Procedures
No Category Name	
Accumulated Voltage Eye Opening	The accumulated voltage set on the data generator to get the desired eye opening. – Test 2.1.7 – RX Jitter Tolerance
Additional Jitter Frequencies	Values of jitter frequency that are also tested, in addition to the values given by Jitter Frequency Range. – Common Mode Interference
Additional Steps	Only Expert Mode. Different combinations of upper and lower limits (of TOL_{PWM-RX} or $TOL_{PWM-G1-RX}$) that are also tested, in addition to the conformance limits given by the specification. They are written as pairs of values (minimum and maximum, separated by semicolons), which are separated by |. – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX
Amplitude Range	The range of amplitude values to be tested. It is defined with four values separated by semicolons: <Start Value>;<End Value>;<Number of Steps>;<Scale Type>. The scale type can be Linear or Logarithmic. – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.2.1 – V_DIF-DC-PWM-RX

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures
Attenuator	Only for M8040A. Owing to the limitation of the M8040A (min 50 mV amplitude, no internal interference source): – **For Squelch and HS Interference Tests: An attenuator, a power divider and an external interference** source are required. – **For HS Tests and PWM Tests: Attenuators are applicable only in Expert Mode.** All individual tests and setup procedures when using M8040A
Binary Search	For True, a binary search is used to approach the test limit. For False, the linear search approach is used. – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.3 – V_CM-RX
Check Pattern	If set to True, the selected BER reader is used to verify that the DUT is in loopback mode and transmitting the test pattern properly. – Setup Procedure Full – Setup Procedure Fast – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure
CMI Amplitudes [Vp-p]	The range of common-mode interference values to be tested over the jitter frequency range. It is defined with four values separated by semicolons: <Start Value>;<End Value>;<Number of Steps>;<Scale Type>. The scale type can be Linear or Logarithmic. – Common Mode Interference
CMI Frequency	Frequency of the Common Mode Interference to be tested. – Common Mode Interference
Common-Mode Voltage Levels	The common-mode voltage levels to be tested. – Test 2.1.7 – RX Jitter Tolerance
Data Rate	Choose the HS Gear to set the data rate for the test. – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ – Common Mode Interference – Setup Procedure Full
Data Rate Deviation over Nominal Value	Deviation of the data rate from the nominal value as a percentage. – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures
Frequency Deviation	Deviation of the frequency value. – Setup Procedure Full
Frequency Offset	Frequency deviation relative to the nominal bit rate, in ppm. – Test 2.1.7 – RX Jitter Tolerance
HS Data Rate	Choose the HS Gear to set the data rate for the test. – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX – Test 2.2.3 – T_TERM-ON-PWM-RX – Test 2.2.4 – T_TERM-OFF-PWM-RX – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX – Test 2.2.6 – kPWM-RX
HS Prepare Length	Length of HS PREPARE, the period in the initial sub-state of BURST that allows settling of LINE levels and transceiver settings before the bitstream is started. In HS mode, the PREPARE period is followed by a SYNC sequence. – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.3 – V_CM-RX – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.1.7 – RX Jitter Tolerance – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX – Test 2.2.3 – T_TERM-ON-PWM-RX – Test 2.2.4 – T_TERM-OFF-PWM-RX – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX – Test 2.2.6 – kPWM-RX – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ – Common Mode Interference – Setup Procedure Full – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure
HS-Prepare Range [UI]	The range of HS-Prepare values to be tested. It is defined with four values separated by semicolons: <Start Value>;<End Value>;<Number of Steps>;<Scale Type>. The scale type can be Linear or Logarithmic. – Test 2.1.8 – T_HS-PREPARE-RX

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures
HS Sync Length	The number of sync pattern symbols before the data burst. It must be specified in SI (1 SI = 10 UI). – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.3 – V_CM-RX – Test 2.1.4 – T TERM-ON-HS-RX – Test 2.1.5 – T_TERM-OFF-HS-RX – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.1.7 – RX Jitter Tolerance – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX – Test 2.2.3 – T_TERM-ON-PWM-RX – Test 2.2.4 – T_TERM-OFF-PWM-RX – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX – Test 2.2.6 – kPWM-RX – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ – Common Mode Interference – Setup Procedure Full – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure
HS Sync Range	The range of the HS SYNC sequence. It can be set as Fine or Coarse. – Setup Procedure Full – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure
HS Sync Range [SI]	The range of HS SYNC values to be tested. It is defined with four values separated by semicolons: <Start Value>;<End Value>;<Number of Steps>;<Scale Type>. The scale type can be Linear or Logarithmic. – Test 2.1.9 – T_SYNC-RX

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures
IBerReader Init Mode	The configuration parameters of the Custom BER reader for the system initialization mode with the parameters data channel, data rate and termination mode (terminated, T, or non-terminated, NT). – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.3 – V_CM-RX – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.1.7 – RX Jitter Tolerance – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX – Test 2.2.6 – kPWM-RX – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ – Common Mode Interference
IMPhyBerReader Init Mode	This is the same as IBerReader Init Mode, but applies to the BERT Analyzer, Offline or UniPro case. – Test 2.1.4 – T TERM-ON-HS-RX – Test 2.1.5 – T_TERM-OFF-HS-RX – Test 2.2.3 – T_TERM-ON-PWM-RX – Test 2.2.4 – T_TERM-OFF-PWM-RX – Setup Procedure Full – Setup Procedure Fast
Initial Adapt Length	The length of the ADAPT sequence, in bits, used initially. Fine: 650*[ADAPT Length]. Coarse: 650*2^[ADAPT Length], where ADAPT Length is less than 18. – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.3 – V_CM-RX – Test 2.1.4 – T_TERM-ON-HS-RX – Test 2.1.5 – T_TERM-OFF-HS-RX – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.1.7 – RX Jitter Tolerance – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX – Test 2.2.3 – T_TERM-ON-PWM-RX – Test 2.2.4 – T_TERM-OFF-PWM-RX – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX – Test 2.2.6 – kPWM-RX – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ – Common Mode Interference – Setup Procedure Full – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures
Initial Adapt Type	The type of the Initial ADAPT sequence. 0: Fine. 1: Coarse. – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.3 – V_CM-RX – Test 2.1.4 – T_TERM-ON-HS-RX – Test 2.1.5 – T_TERM-OFF-HS-RX – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.1.7 – RX Jitter Tolerance – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX – Test 2.2.3 – T_TERM-ON-PWM-RX – Test 2.2.4 – T_TERM-OFF-PWM-RX – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX – Test 2.2.6 – kPWM-RX – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ – Common Mode Interference – Setup Procedure Full – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure
ISI (pk-pk)	The amplitude of the ISI, peak to peak. – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX
Jitter Amplitude	The amplitude of the jitter. – Common Mode Interference
Jitter Amplitude Increase Upper Limit	Only if Perform Jitter Limit Test is set to True. Maximum step size allowed during the Jitter Tolerance characterization. – Test 2.1.7 – RX Jitter Tolerance
Jitter Frequency Range [MHz]	The range of jitter frequency values to be tested. It is defined with four values separated by semicolons: <Start Value>;<End Value>;<Number of Steps>;<Scale Type>. The scale type can be Linear or Logarithmic. – Common Mode Interference
Jitter Increase Accuracy	Only if Perform Jitter Limit Test is set to True. Minimum step size allowed during the Jitter Tolerance characterization. – Test 2.1.7 – RX Jitter Tolerance

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures
Lane Under Test Termination Model	It is necessary to indicate the termination model as 50 ohm to ground (e.g., direct oscilloscope connection) or 100 ohm differential (e.g., DUT, probe). If the selected mode is not right, the BERT outputs will be turned off. If the 100 ohm termination board is not available, you can set this parameter to T50Ohm and connect SMA cables directly to the oscilloscope. – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.3 – V_CM-RX – Test 2.1.4 – T_TERM-ON-HS-RX – Test 2.1.5 – T_TERM-OFF-HS-RX – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.1.7 – RX Jitter Tolerance – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX – Test 2.2.3 – T_TERM-ON-PWM-RX – Test 2.2.4 – T_TERM-OFF-PWM-RX – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX – Test 2.2.6 – kPWM-RX – Common Mode Interference – Setup Procedure Full – Setup Procedure Fast – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure
Level Pairs	Pairs of single-ended amplitudes and offsets separated by "|". – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.3 – V_CM-RX – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures
LS Prepare Length	This defines the LS PREPARE sub-state. It specifies the number of DIFP states before the LS burst starts. It must be specified in SI (1 SI = 10 UI). – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.3 – V_CM-RX – Test 2.1.4 – T TERM-ON-HS-RX – Test 2.1.5 – T_TERM-OFF-HS-RX – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.1.7 – RX Jitter Tolerance – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX – Test 2.2.6 – kPWM-RX – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ – Common Mode Interference – Setup Procedure Full – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure
LS Sync Length	The length of the LS SYNC sequence. It has a permitted range of 0 to 15 SI (1 SI = 10 UI). – Setup Procedure Full – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure
LS Sync Range	The range of the LS SYNC sequence. It can be set as Fine or Coarse. – Setup Procedure Full – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure
Max. Interference Amplitude	The maximum tested value of the interference amplitude. – Test 2.4.7 – V_INT-SQ, f_INT-SQ
Maximum Tested	The maximum tested value of k_{PWM-RX}. – Test 2.2.6 – kPWM-RX
Max. Tested	The maximum tested value of TOL_{PWM-RX} (Test 2.2.5a) or $TOL_{PWM-G1-RX}$ (Test 2.2.5b). – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX
Max. Tested Value	The maximum tested value of lane-to-lane skew. – Test 2.1.6 – T_L2L-SKEW-HS-RX

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures
Max. Value	In Test 2.4.3: The maximum tested value of the voltage amplitude of the DIFN pulse. In Test 2.4.4 and Test 2.4.5: The maximum tested value of the pulse width of the DIFN pulse. In Test 2.4.6: The maximum tested value of the spacing between the DIFN pulses. In Test 2.4.7: The maximum tested value of the frequency of the RF interference. – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ
Min. Interference Amplitude	The minimum tested value of the interference amplitude. – Test 2.4.7 – V_INT-SQ, f_INT-SQ
Min. Spec.	The minimum value of the parameter that the DUT must tolerate according to the specification. – Test 2.1.6 – T_L2L-SKEW-HS-RX
Minimum Tested	The minimum tested value of k_{PWM-RX}. – Test 2.2.6 – kPWM-RX
Min. Tested	The minimum tested value of TOL_{PWM-RX} (Test 2.2.5a) or $TOL_{PWM-G1-RX}$ (Test 2.2.5b). – Test 2.2.5a – TOLPWM-RX Test 2.2.5b – TOLPWM-G1-RX
Min. Tested Value	The minimum tested value of lane-to-lane skew. – Test 2.1.6 – T_L2L-SKEW-HS-RX
Min User-Defined Interference Amplitude	The minimum interference value for which the DUT must meet the target BER in order for the test to count as passed. The value is user defined. – Common Mode Interference
Min. Value	In Test 2.4.3: The minimum tested value of the voltage amplitude of the DIFN pulse. In Test 2.4.4 and Test 2.4.5: The minimum tested value of the pulse width of the DIFN pulse. In Test 2.4.6: The minimum tested value of the spacing between the DIFN pulses. In Test 2.4.7: The minimum tested value of the frequency of the RF interference. – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures
Number of Pulses	In Test 2.4.4, Test 2.4.5 and Test 2.4.7, the default value is 1, that is, only one DIFN pulse is generated. In Test 2.4.6 the default value is 2. – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ
Offset Range	The range of the offset values to be tested. It is defined with four values separated by semicolons: <Start Value>;<End Value>;<Number of Steps>;<Scale Type>. The scale type can be Linear or Logarithmic. – Test 2.1.3 – V_CM-RX – Test 2.2.2 – V_CM-RX
Perform Jitter Limit Test	Set to True to search for the maximum amount of jitter that the DUT can tolerate. The SJ component is increased until the BER test fails. If it is set to False, the total jitter is set to the worst case scenario defined in the CTS. – Test 2.1.7 – RX Jitter Tolerance
PJ Amplitude	Amplitude of the periodic jitter. – Setup Procedure Full – Setup Procedure Fast
PJ Frequency	Frequency of the periodic jitter. – Setup Procedure Full – Setup Procedure Fast
Prepare Length	The Prepare Length is a dimensionless parameter that is used to set the Prepare Length Time. The relations between Prepare Length and Prepare Length Time for HS and LS (PWM) are given in the specification. Value range for HS: 0, ..., 15. Value range for LS: 0, ..., 10. – Test 2.1.4 – T TERM-ON-HS-RX – Test 2.1.5 – T_TERM-OFF-HS-RX – Test 2.2.3 – T_TERM-ON-PWM-RX – Test 2.2.4 – T_TERM-OFF-PWM-RX
Prepare Length Capability	A DUT attribute that determines the minimum PREPARE time supported. – Test 2.1.4 – T TERM-ON-HS-RX – Test 2.2.3 – T_TERM-ON-PWM-RX
Pulse Distance	The distance between DIFN pulses. If only one pulse is applied, the Pulse Distance is the distance to the following DIFP state next to the DIFN state. – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ
Pulse Width	The width of the DIFN pulse. – Test 2.4.4 – T_SQ – Test 2.4.6 – T_SPACE-SQ Test 2.4.7 – V_INT-SQ, f_INT-SQ

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures	
PWM Burst Closure Extension	BURST CLOSURE sequence duration in SI. Possible values: 0, ..., 255. Default value: 32.	
	– Test 2.1.1 – V_DIF-DC-HS-RX	– Test 2.2.3 – T_TERM-ON-PWM-RX
	– Test 2.1.2 – V_DIF-ACC-HS-Gx-RX	– Test 2.2.4 – T_TERM-OFF-PWM-RX
	– Test 2.1.3 – V_CM-RX	– Test 2.2.5a – TOLPWM-RX
	– Test 2.1.4 – T TERM-ON-HS-RX	– Test 2.2.5b – TOLPWM-G1-RX
	– Test 2.1.5 – T_TERM-OFF-HS-RX	– Test 2.2.6 – kPWM-RX
	– Test 2.1.6 – T_L2L-SKEW-HS-RX	– Test 2.4.3 – V_SQ
	– Test 2.1.7 – RX Jitter Tolerance	– Test 2.4.4 – T_SQ
	– Test 2.1.8 – T_HS-PREPARE-RX	– Test 2.4.5 – T_PULSE-SQ
	– Test 2.1.9 – T_SYNC-RX	– Test 2.4.6 – T_SPACE-SQ
	– Test 2.2.1 – V_DIF-DC-PWM-RX	– Test 2.4.7 – V_INT-SQ, f_INT-SQ
	– Test 2.2.2 – V_CM-RX	– Common Mode Interference
PWM Data Rate	The data rate for the PWM mode.	
	– Setup Procedure Full	– TX PWM Tests Setup Procedure
	– TX HS Tests Setup Procedure	
PWM Receive Ratio	The PWM receive ratio provided for the test.	
	– Setup Procedure Full	– TX PWM Tests Setup Procedure
	– TX HS Tests Setup Procedure	

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures
PWM Tail of Burst	This part of the burst is a series of equal bits, which violates 8b10b code characteristics. In the case of PWM signaling, the last bit of the sequence is inverted to indicate the end of LINE activity. Value: At least 9 bit0 plus one bit1 at the end. – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.3 – V_CM-RX – Test 2.1.4 – T TERM-ON-HS-RX – Test 2.1.5 – T_TERM-OFF-HS-RX – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.1.7 – RX Jitter Tolerance – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX – Test 2.2.3 – T_TERM-ON-PWM-RX – Test 2.2.4 – T_TERM-OFF-PWM-RX – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX – Test 2.2.6 – kPWM-RX – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ – Common Mode Interference – Setup Procedure Full – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure
Ref Clock Adjustment	Select either NominalRefClock (default) or NominalDataRate. – Setup Procedure Full – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures
Ref Clock Frequency	Select the frequency of the reference clock – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.3 – V_CM-RX – Test 2.1.4 – T TERM-ON-HS-RX – Test 2.1.5 – T_TERM-OFF-HS-RX – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.1.7 – RX Jitter Tolerance – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX – Test 2.2.3 – T_TERM-ON-PWM-RX – Test 2.2.4 – T_TERM-OFF-PWM-RX – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX – Test 2.2.6 – kPWM-RX – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ – Common Mode Interference – Setup Procedure Full – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure
Refresh Adapt Length	The length of the Refresh ADAPT sequence, in bits. The ADAPT Length is calculated using the formula for T_{ADAPT} in Table 8 of the Specification. – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.3 – V_CM-RX – Test 2.1.4 – T TERM-ON-HS-RX – Test 2.1.5 – T_TERM-OFF-HS-RX – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.1.7 – RX Jitter Tolerance – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX – Test 2.2.3 – T_TERM-ON-PWM-RX – Test 2.2.4 – T_TERM-OFF-PWM-RX – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX – Test 2.2.6 – kPWM-RX – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ – Common Mode Interference – Setup Procedure Full – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures
Refresh Adapt Type	The type of Refresh ADAPT sequence. 0: Fine. 1: Coarse. – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.3 – V_CM-RX – Test 2.1.4 – T TERM-ON-HS-RX – Test 2.1.5 – T_TERM-OFF-HS-RX – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.1.7 – RX Jitter Tolerance – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX – Test 2.2.3 – T_TERM-ON-PWM-RX – Test 2.2.4 – T_TERM-OFF-PWM-RX – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX – Test 2.2.6 – kPWM-RX – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ – Common Mode Interference – Setup Procedure Full – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure
Re-Init Sequence after Reset DUT	If the value is set to True, the test sequence starts again from the beginning every time the DUT is reset. – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.3 – V_CM-RX – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.1.7 – RX Jitter Tolerance – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX – Test 2.2.6 – kPWM-RX – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ Common Mode Interference

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures	
Reset Pulse Width	The pulse width of the reset signal. The reset signal is an active low pulse with a default width of 100 µs.	
	– Test 2.1.1 – V_DIF-DC-HS-RX	– Test 2.2.3 – T_TERM-ON-PWM-RX
	– Test 2.1.2 – V_DIF-ACC-HS-Gx-RX	– Test 2.2.4 – T_TERM-OFF-PWM-RX
	– Test 2.1.3 – V_CM-RX	– Test 2.2.5a – TOLPWM-RX
	– Test 2.1.4 – T TERM-ON-HS-RX	– Test 2.2.5b – TOLPWM-G1-RX
	– Test 2.1.5 – T_TERM-OFF-HS-RX	– Test 2.2.6 – kPWM-RX
	– Test 2.1.6 – T_L2L-SKEW-HS-RX	– Test 2.4.3 – V_SQ
	– Test 2.1.7 – RX Jitter Tolerance	– Test 2.4.4 – T_SQ
	– Test 2.1.8 – T_HS-PREPARE-RX	– Test 2.4.5 – T_PULSE-SQ
	– Test 2.1.9 – T_SYNC-RX	– Test 2.4.6 – T_SPACE-SQ
	– Test 2.2.1 – V_DIF-DC-PWM-RX	– Test 2.4.7 – V_INT-SQ, f_INT-SQ
	– Test 2.2.2 – V_CM-RX	Common Mode Interference
Retrial Number	The maximum number of attempts in the case of failure.	
	– Test 2.1.1 – V_DIF-DC-HS-RX	– Test 2.2.1 – V_DIF-DC-PWM-RX
	– Test 2.1.2 – V_DIF-ACC-HS-Gx-RX	– Test 2.2.2 – V_CM-RX
	– Test 2.1.3 – V_CM-RX	– Test 2.2.5a – TOLPWM-RX
	– Test 2.1.6 – T_L2L-SKEW-HS-RX	– Test 2.2.5b – TOLPWM-G1-RX
	– Test 2.1.7 – RX Jitter Tolerance	– Test 2.2.6 – kPWM-RX
	– Test 2.1.8 – T_HS-PREPARE-RX	– Common Mode Interference
RJ (p-p) Amplitude	Peak-to-peak amplitude of the random jitter.	
	– Setup Procedure Full	– Setup Procedure Fast
Scope Channel	Indicates which oscilloscope channel is used for signal measurements.	
	– Test 2.1.4 – T_TERM-ON-HS-RX	– Test 2.2.3 – T_TERM-ON-PWM-RX
	– Test 2.1.5 – T_TERM-OFF-HS-RX	– Test 2.2.4 – T_TERM-OFF-PWM-RX
Search Resolution	Only if 'Binary Search' has the value True. The resolution of the binary search.	
	– Test 2.1.1 – V_DIF-DC-HS-RX	– Test 2.1.3 – V_CM-RX
	– Test 2.1.2 – V_DIF-ACC-HS-Gx-RX	

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures
Semi Automated Test	This property is used for Termination tests. If False, the software automatically measures the termination time. If True, the automation finds the spot where the burst starts but lets you place the markers manually. Then, using the position of the markers, the termination time is calculated. This is useful in cases where the software is unable to calculate this time automatically because of, for example, reflections in the signal that impair the algorithm. – Test 2.1.4 – T_TERM-ON-HS-RX – Test 2.1.5 – T_TERM-OFF-HS-RX – Test 2.2.3 – T_TERM-ON-PWM-RX – Test 2.2.4 – T_TERM-OFF-PWM-RX
Sequence	In Test 2.2.5b: The Line Read sequence used in the test. Otherwise: The sequence used for the setup. – Test 2.2.5b – TOLPWM-G1-RX – Setup Procedure Full – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure
Set Offset	The signal offset set for the data channel. – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.4 – T_TERM-ON-HS-RX – Test 2.1.5 – T_TERM-OFF-HS-RX – Test 2.2.3 – T_TERM-ON-PWM-RX – Test 2.2.4 – T_TERM-OFF-PWM-RX – Common Mode Interference – Setup Procedure Full – Setup Procedure Fast – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure
Set Single Ended Amplitude	The single ended amplitude value set for the data channel. – Test 2.1.4 – T TERM-ON-HS-RX – Test 2.1.5 – T_TERM-OFF-HS-RX – Test 2.2.3 – T_TERM-ON-PWM-RX – Test 2.2.4 – T_TERM-OFF-PWM-RX – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ – Common Mode Interference – Setup Procedure Full – Setup Procedure Fast – TX HS Tests Setup Procedure TX PWM Tests Setup Procedure
Short Term Random Jitter Amplitude (p-p)	The amount (amplitude) of short term random jitter added to the signal. – Common Mode Interference

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures
Show Dialog at UniPro Reset DUT	If set to True, a pop-up dialog appears and waits for user confirmation on manual reset of the DUT. – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.3 – V_CM-RX – Test 2.1.4 – T TERM-ON-HS-RX – Test 2.1.5 – T_TERM-OFF-HS-RX – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.1.7 – RX Jitter Tolerance – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX – Test 2.2.3 – T_TERM-ON-PWM-RX – Test 2.2.4 – T_TERM-OFF-PWM-RX – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX – Test 2.2.6 – kPWM-RX Common Mode Interference
Show User Action Dialog	If set to True, a pop-up dialog appears and waits for user confirmation on pass/fail of manual measurements. – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ
SJ Frequencies [MHz]	The list of applicable SJ frequencies based on the M-PHY Specification v5.0. – Test 2.1.7 – RX Jitter Tolerance
Skip Connection Diagram	If set to True, the connection diagram is not displayed before the procedure is run. – Setup Procedure Full – Setup Procedure Fast – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures
Sleep Length	The sleep length value provided (the power-saving state between LS bursts). – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.3 – V_CM-RX – Test 2.1.4 – T TERM-ON-HS-RX – Test 2.1.5 – T_TERM-OFF-HS-RX – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.1.7 – RX Jitter Tolerance – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX – Test 2.2.3 – T_TERM-ON-PWM-RX – Test 2.2.4 – T_TERM-OFF-PWM-RX – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX – Test 2.2.6 – kPWM-RX – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ – Common Mode Interference – Setup Procedure Full – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure
Sleep Time Capability [SI]	The SLEEP time required by the DUT in low speed mode (PWM) to disable termination. It has a permitted range of 1–15 SI (1 SI = 10 UI). **Note:** Do not use the maximum Spec value, as it is beyond the BERT capability! – Test 2.2.4 – T_TERM-OFF-PWM-RX
Squelch Test Sequence	The sequence file used during the squelch tests. – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures
Stall Length	This defines the STALL state. It specifies the number of DIFN states after the data burst. It is specified in UI. – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.3 – V_CM-RX – Test 2.1.4 – T TERM-ON-HS-RX – Test 2.1.5 – T_TERM-OFF-HS-RX – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.1.7 – RX Jitter Tolerance – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX – Test 2.2.3 – T_TERM-ON-PWM-RX – Test 2.2.4 – T_TERM-OFF-PWM-RX – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX – Test 2.2.6 – kPWM-RX – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ – Common Mode Interference – Setup Procedure Full – TX HS Tests Setup Procedure TX PWM Tests Setup Procedure
Stall Time Capability [SI]	The STALL time required by the DUT. It has a permitted range of 1 to 255 SI (1 SI = 10 UI). – Test 2.1.5 – T_TERM-OFF-HS-RX
Step Size	The value by which the parameter is increased/decreased at each step of the test procedure. – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ
Steps	Number of tests (steps) performed, in total, on going from the Minimum Tested to the Maximum Tested values. – Test 2.2.6 – kPWM-RX
Steps Interference Amplitude	Number of tests (steps) performed, in total, on going from the Min Interference Amplitude value to the Max Interference Amplitude value. – Test 2.4.7 – V_INT-SQ, f_INT-SQ
T Activate Capability	The Activate time required by the DUT to exit the HIBERN8 state and enter the sleep state. – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ
Tail of Burst	See “PWM Tail of Burst”.

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures
Target BER	If the measured BER is smaller than the target value, the test is considered as passed. – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.3 – V_CM-RX – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.1.7 – RX Jitter Tolerance – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX – Test 2.2.6 – kPWM-RX – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ – Common Mode Interference
Terminated	If the setup is terminated: True. Otherwise, False. – Setup Procedure Full – TX HS Tests Setup Procedure – TX PWM Tests Setup Procedure
Test Sequence	The sequence file used during the DUT test. – Test 2.1.1 – V_DIF-DC-HS-RX – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX – Test 2.1.3 – V_CM-RX – Test 2.1.6 – T_L2L-SKEW-HS-RX – Test 2.1.7 – RX Jitter Tolerance – Test 2.1.8 – T_HS-PREPARE-RX – Test 2.1.9 – T_SYNC-RX – Test 2.2.1 – V_DIF-DC-PWM-RX – Test 2.2.2 – V_CM-RX – Test 2.2.5a – TOLPWM-RX – Test 2.2.5b – TOLPWM-G1-RX – Test 2.2.6 – kPWM-RX – Common Mode Interference
Tested DC Amplitude	The amplitude of the DC voltage used for the test. – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX
Tested DC Amplitude Range	The range of DC Amplitude values (in volts) to be tested. It is defined with four values separated by semicolons: <Start Value>;<End Value>;<Number of Steps>;<Scale Type>. The scale type can be Linear or Logarithmic. – Test 2.1.2 – V_DIF-ACC-HS-Gx-RX
Tested Offsets [mV]	The list of common-mode voltage values tested. – Test 2.4.3 – V_SQ – Test 2.4.4 – T_SQ – Test 2.4.5 – T_PULSE-SQ – Test 2.4.6 – T_SPACE-SQ – Test 2.4.7 – V_INT-SQ, f_INT-SQ

Table C-5 Parameters for Individual Tests and Setup Procedures (cont.)

Category / Parameter Name	Description / Which Procedures	
Voltage Levels	Values of voltages.	
	– Test 2.1.1 – V_DIF-DC-HS-RX	– Test 2.2.5a – TOLPWM-RX
	– Test 2.1.2 – V_DIF-ACC-HS-Gx-RX	– Test 2.2.5b – TOLPWM-G1-RX
	– Test 2.1.3 – V_CM-RX	– Test 2.2.6 – kPWM-RX
	– Test 2.1.6 – T_L2L-SKEW-HS-RX	– Test 2.4.3 – V_SQ
	– Test 2.1.7 – RX Jitter Tolerance	– Test 2.4.4 – T_SQ
	– Test 2.1.8 – T_HS-PREPARE-RX	– Test 2.4.5 – T_PULSE-SQ
	– Test 2.1.9 – T_SYNC-RX	– Test 2.4.6 – T_SPACE-SQ
	– Test 2.2.1 – V_DIF-DC-PWM-RX	– Test 2.4.7 – V_INT-SQ, f_INT-SQ
	– Test 2.2.2 – V_CM-RX	Common Mode Interference
Sequencer – See Table C-1.		

D Acronyms and Abbreviations

This Appendix contains a list of acronyms and abbreviations used in this User Guide.

List of Acronyms

Acronym	Definition
A	
AWG	Arbitrary Waveform Generator
B	
BER	Bit Error Ratio
BERT	Bit Error Ratio Tester
BUJ	Bounded Uncorrelated Jitter
C	
CDR	Clock Data Recovery
CJTPAT	Compliant Jitter Tolerance Pattern
CM	Common Mode
CMI	Common Mode Interference
CRPAT	Compliant Random Pattern
CTS	Conformance Test Suite
D	
DDJ	Data Dependent Jitter
DIFN	Differential Negative Pulse
DIFP	Differential Positive Pulse
DJ	Deterministic Jitter
DR	Data Rate
DSGA	Dynamic Sequencing Generator and Analyzer
DSI	Display Serial Interface
DSO	Digital Storage Oscilloscope
DUT	Device Under Test
E	
ED	Error Detector

Acronym	Definition
G	
GUI	Graphical User Interface
H	
HiSLIP	High-Speed LAN Instrument Protocol
HS	High Speed
HS-G*n*	High Speed Gear *n*
HTML	HyperText Markup Language
I	
IO	Input–Output, Interface
IP	Internet Protocol
IPC	Interprocessor Communication
ISI	Inter-Symbol Interference
L	
LAN	Local Area Network
LFSJ	Low Frequency Sinusoidal Jitter
LR	Line Read
LS	Low Speed
N	
N/A	Not Applicable
O	
OMC	Optical Media Converter
P	
PACP	PHY Adapter Layer Control Primitive
PC	Personal Computer
PLL	Phase-Locked Loop
ppm	Parts Per Million
PRBS	Pseudorandom Binary Sequence

Acronym	Definition
PWM	Pulse Width Modulation
R	
RJ	Random Jitter
RX, Rx	Receiver
S	
SI	Symbol Interval
SJ	Sinusoidal Jitter
SMA	SubMiniature version A (connector)
STDJ	Short Term Deterministic Jitter
STRJ	Short Term Random Jitter
STSJ	Short Term Sinusoidal Jitter
STTJ	Short Term Total Jitter
T	
TIE	Time Interval Error
TJ	Total Jitter
TTC	Transition Time Converter
TX, Tx	Transmitter
U	
UFS	Universal Flash Storage
UI	Unit Interval
UniPro	Unified Protocol
USB	Universal Serial Bus
UXR	A series of Keysight Infiniium oscilloscopes
V	
VISA	Virtual Instrument System Architecture

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