Product Introduction

Anritsu envision : ensure

# High-Speed Serial Bus Interface Solution for PCI Express, Thunderbolt, USB

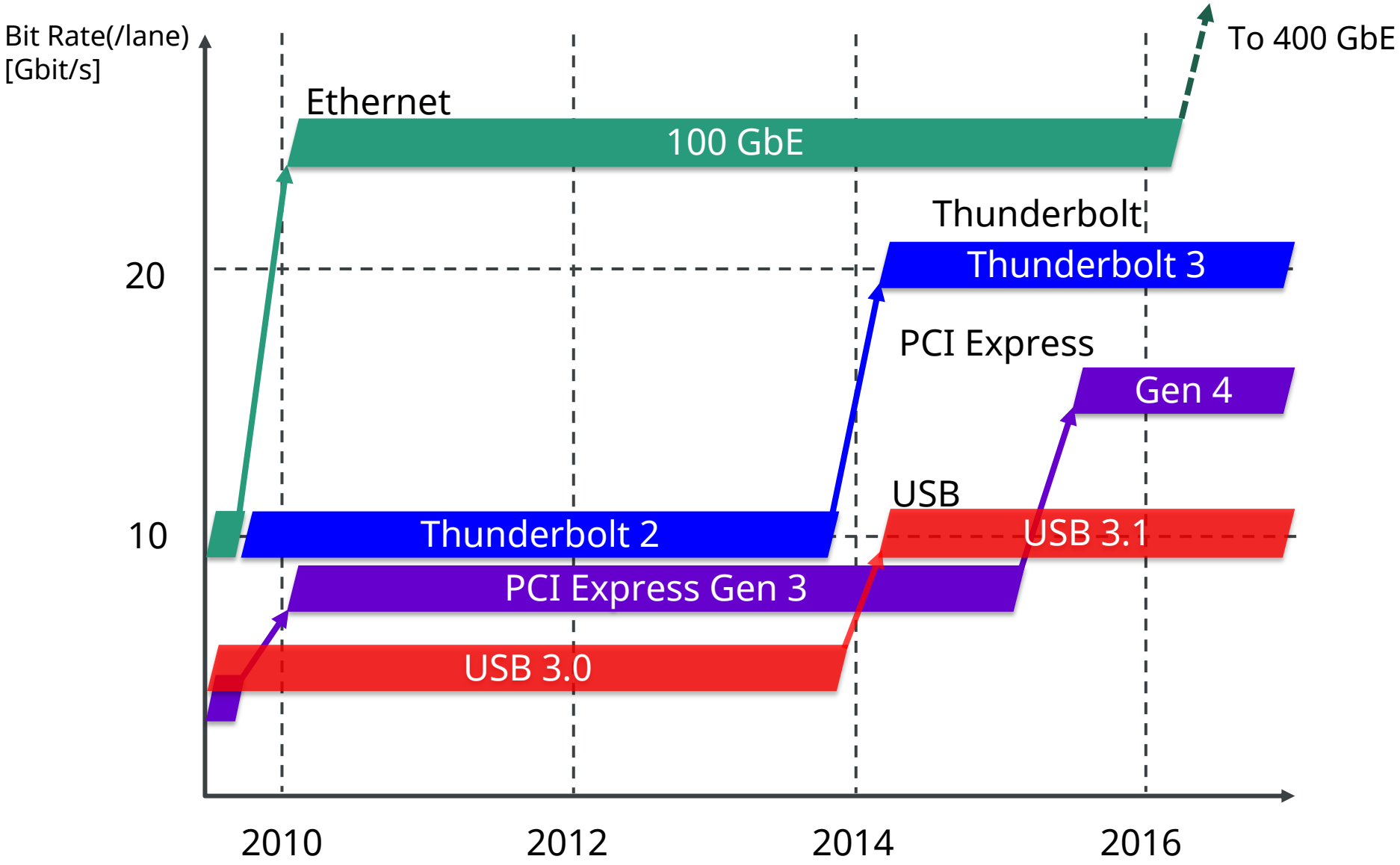
Signal Quality Analyzer

MP1800A Series

# Outline

- Traffic volumes at data centers are exploding due to the spread of cloud computing services. Consequently, faster interfaces such as 100 GbE, 400 GbE, InfiniBand EDR, etc., are being deployed for communications between the servers and network equipment, while on the other hand, speeding-up of equipment internal serial bus interfaces, such as PCI Express, is also being investigated.
- Moreover, USB Type-C connectors and cables are being deployed as high-end computing interfaces supporting faster Thunderbolt 3 and USB 3.1 speeds.
- This product introduction explains MP1800A measurement solutions for high-speed serial interfaces such as PCI Express, Thunderbolt, and USB.

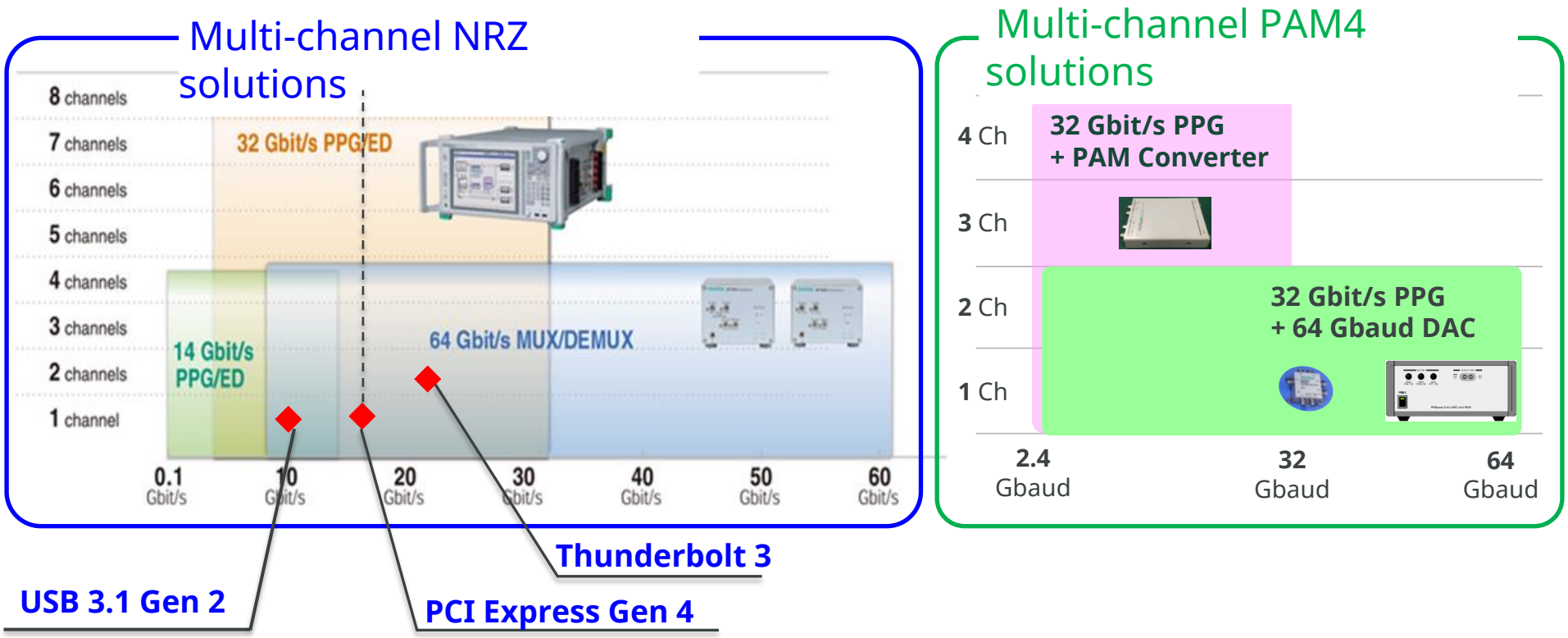
# Trends in Ethernet, Thunderbolt, PCI Express, USB Standards



# 32 Gbit/s Wideband Multi-interface Test

All-in-one MP1800A SQA expandability to 32 Gbit/s and 8CH max. for multi-interface evaluations

(PCI Express Gen 4 (16 G), USB 3.1 Gen 2 (10 G), Thunderbolt 3 (20 G),
100 GbE (25.78 G), 400 GbE (26.6 G/53.1 G), InfiniBand (25.78 G), CEI (28 G))



# MP1800A High-Speed Serial Bus Test Solution Features

## Supports multi-interface PHY layer tests using 32 Gbit/s MP1800A

- Applications: PCI Express Gen 4 (16 G), USB 3.1 Gen 2 (10 G), Thunderbolt 3 (20 G), 100 GbE (25.28 G), 400 GbE (26.6 G/53.1 G), InfiniBand (25.28 G), CEI (28 G)
- Multiple channels and high expandability
- Supports both 100 GbE equipment interconnects and equipment internal interfaces (PCI Express)
- Supports both USB 3.1 Gen 2 and Thunderbolt 3 via USB 3.1 Type-C connectors and cables
- Useful Jitter Tolerance measurement software supporting each standard (MX183000A-PL001)

## Link Sequence generation for device RX tests

- PCI Express Gen 1, 2 , 3, 4 (MX183000A-PL011)
- USB 3.0/3.1 Link Sequence Generation (MX183000A-PL012)

## Reduces engineering test workload with high-reproducibility calibration and Jitter measurement functions

- Automatic calibration and Jitter tests
  - Supports PCI Express Gen 4 base spec, Thunderbolt 3/2, USB 3.1 Gen 2

*Automation software sold by Granite River Labs (http://graniteriverlabs.com/)

## Supports efficient device design tests with high-quality waveforms and high input sensitivity

- High-accuracy testing due to PPG outputting waveform with low Residual Jitter (RJ) of 200 fs (rms) and ED with high input sensitivity of 10 mV

# MP1800A Series Software Products

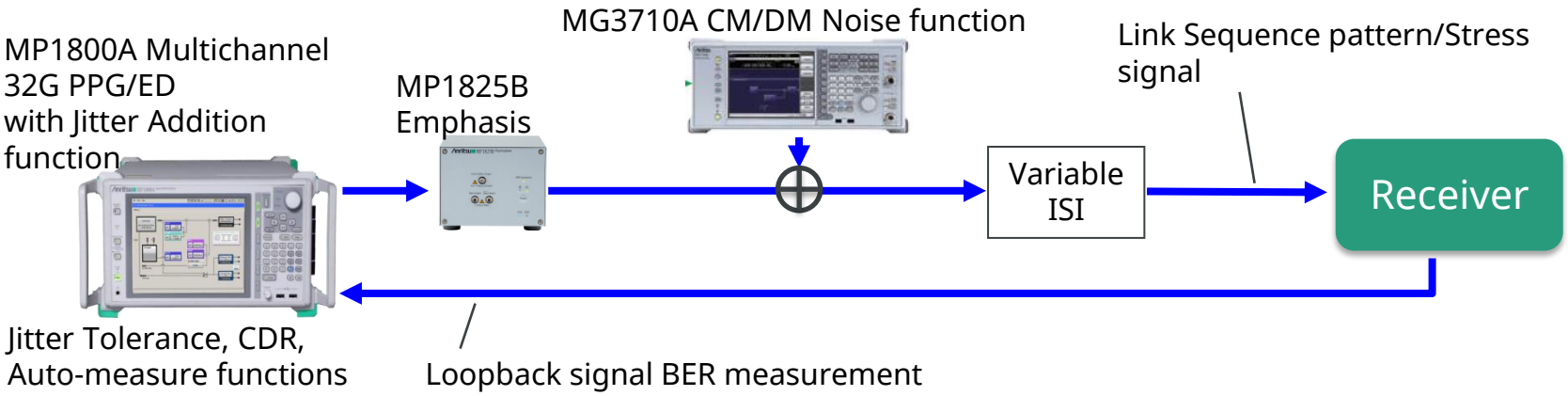
- High-expandability software solutions supporting multi-interface tests
- Calibration and test automation for device receiver tests

| Model | Name |
|---|---|
| MX183000A | High-Speed Serial Data Test Software (standard accessory) |
| MX183000A-PL001 | Jitter Tolerance Test |
| MX183000A-PL011 | PCIe Link Sequence |
| MX183000A-PL012 | USB Link Sequence |
| GRL-PCIE4-BASE-RXA* | PCIE Gen 4 Automation Software |
| GRL-TBT3-RXA* | Thunderbolt 3 Automation Software |

*Automation software sold by Granite River Labs (http://graniteriverlabs.com/)

# Generating Stressed Signal for Rx Tests and Measuring BER using MP1800A

- Generating Stressed Signal
  - Jitter Addition function: SJ/RJ/BUJ/SSC
  - Noise Addition function: Common Mode/Differential Mode (using MG3710A SG)
  - ISI Control (using Artek Variable ISI)
  - Emphasis Control
  - Crosstalk Signal Generation: 8CH max. with all-in-one MP1800A multichannel
  - Link sequence pattern generation for transitioning DUT state to Loopback
- BER Measurement
  - Jitter Tolerance measurement
  - High-sensitivity Input function: 10 mV (typ.) Eye Height input
  - CDR Function: 2.4 to 32.1 Gbit/s wideband
  - Auto-measurement function: Bathtub/Eye Diagram/Eye Contour/ Eye Margin



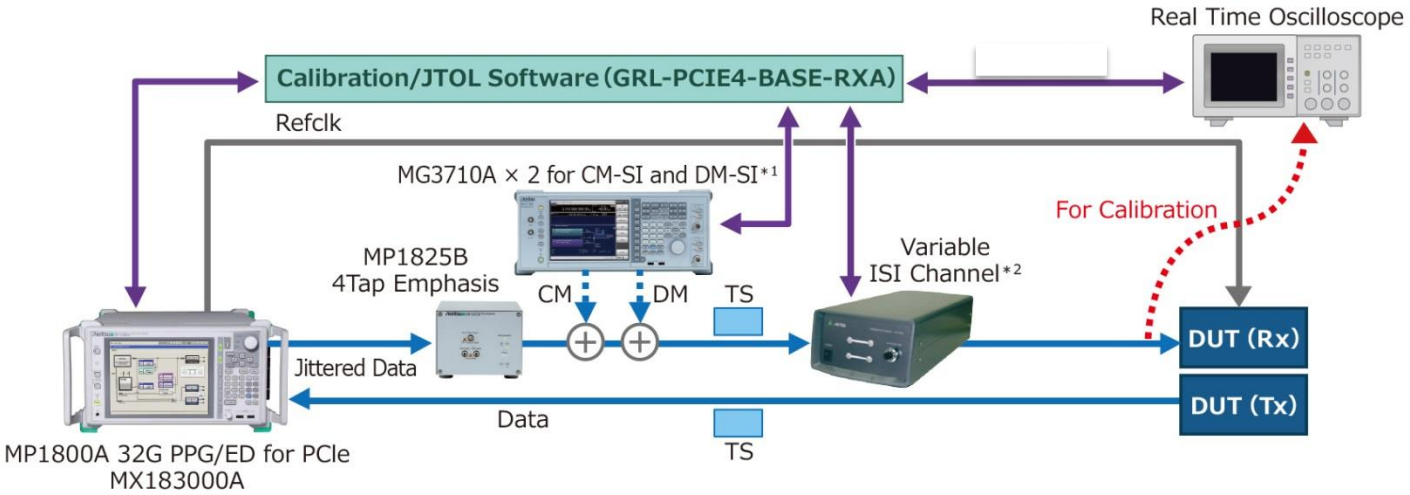
# PCI Express Gen 4 Base Specification Test Solution

# Outline of PCI Express Gen 4 Base Spec. Rx Test

➢ Flow of PCI Express PHY IP Device Rx Test

| | Stressed Signal Calibration | Transition to Loopback State | Stressed Signal Input Test |
|---|---|---|---|
| Used Software | Automation Software: GRL-PCIE4-BASE-RXA | Link Sequence Pattern Generation Software: MX183000A-PL011 | ・Jitter Tolerance Margin Inspection: MX183000A-PL001 or ・Jitter Sweep Test (Pass/Fail Evaluation): GRL-PCIE4-BASE-RXA |

**PCI Express Measurement Set-up**



# PCI Express Gen 4 Base Spec. Rx Test Features

✓ Key Features

- Automatic measurement and automatic calibration using GRL-PCIE4-BASE-RX Automation Software
- Logical Sub-Block evaluation using MX183000A
- Jitter Tolerance testing by transitioning to device status by generating Link Sequence

**Supported Standards**

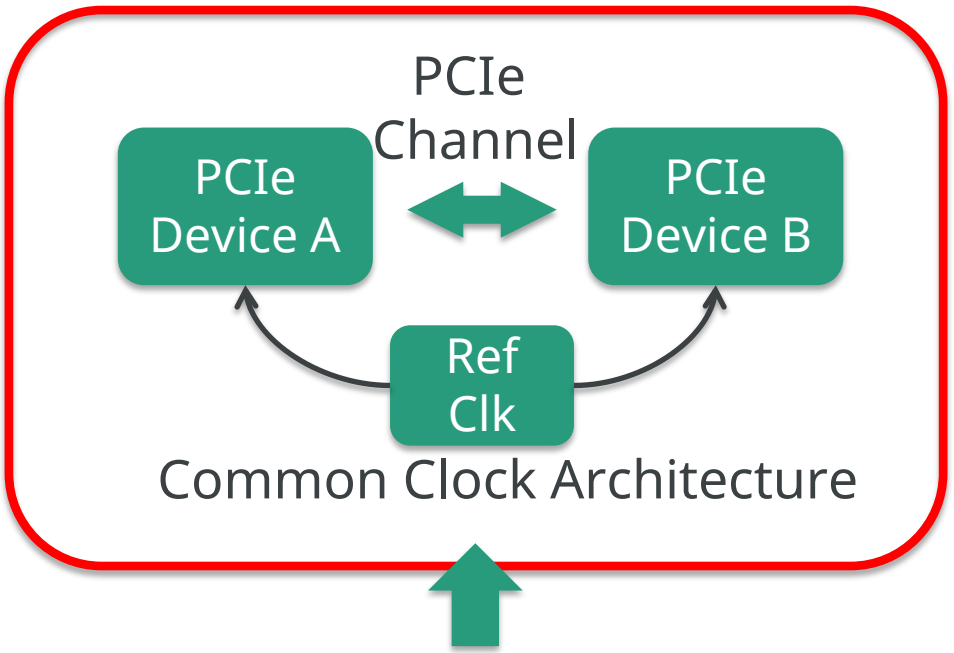
| Supported Standard | | DUT | Calibration | Link Sequence Generation | Jitter Tolerance Test |
|---|---|---|---|---|---|
| PCI Express | 1.x/2.0/3.x/4.0 | Host SERDES | Support v4.0 | Supported | Supported |
| | | End Point SERDES | Not supported | Not supported | Not supported |

| Jitter Tolerance Test Function (Option PL001) | PCI Express Link Sequence Generation Function (Option PL011) |
|---|---|
| ✓ Impress SJ/RJ to test PHY device Jitter Tolerance<br>✓ Test device margin using low-rate estimate BER measurement<br>✓ Output measurement results report in HTML and CSV format | ✓ Control status of PCIe Base Spec. Rev. 4.0 devices to support Logical Sub-Block evaluation<br>✓ Support 8B/10B, 128B/130B, Scramble, SKIP Insertion |

*Control items: Only at following measurements

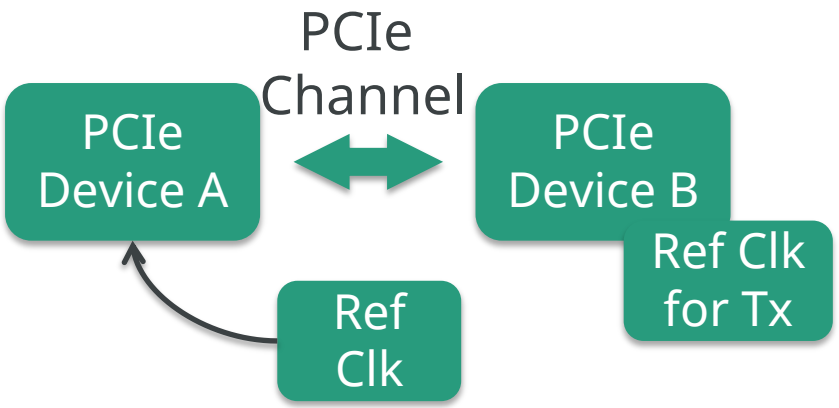
- Common Clock Architecture
- Loopback data from DUT only at SSC Off

# Supported PCI Express Clock Architecture

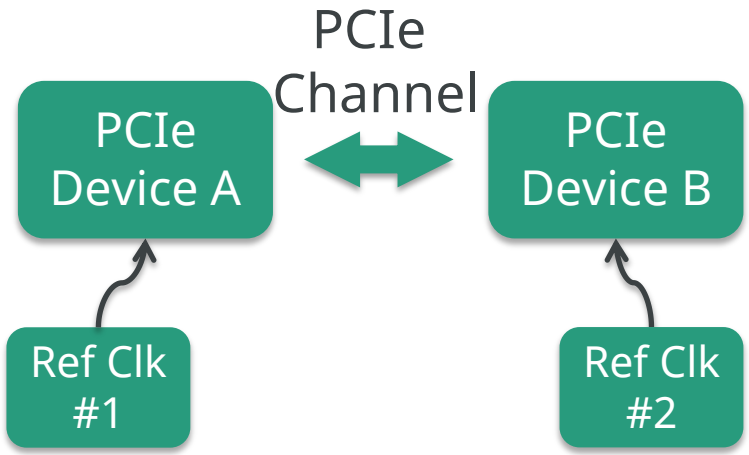



Common Clock Architecture

Only Supports Common Clock Architecture




Data Clocked Architecture




Separate Ref Clk Architecture

# PCI Express Gen 4 Base Spec. Calibration Points

**Stressed Signal Calibration** → **Transition to Loopback State** → **Stressed Signal Input Test**

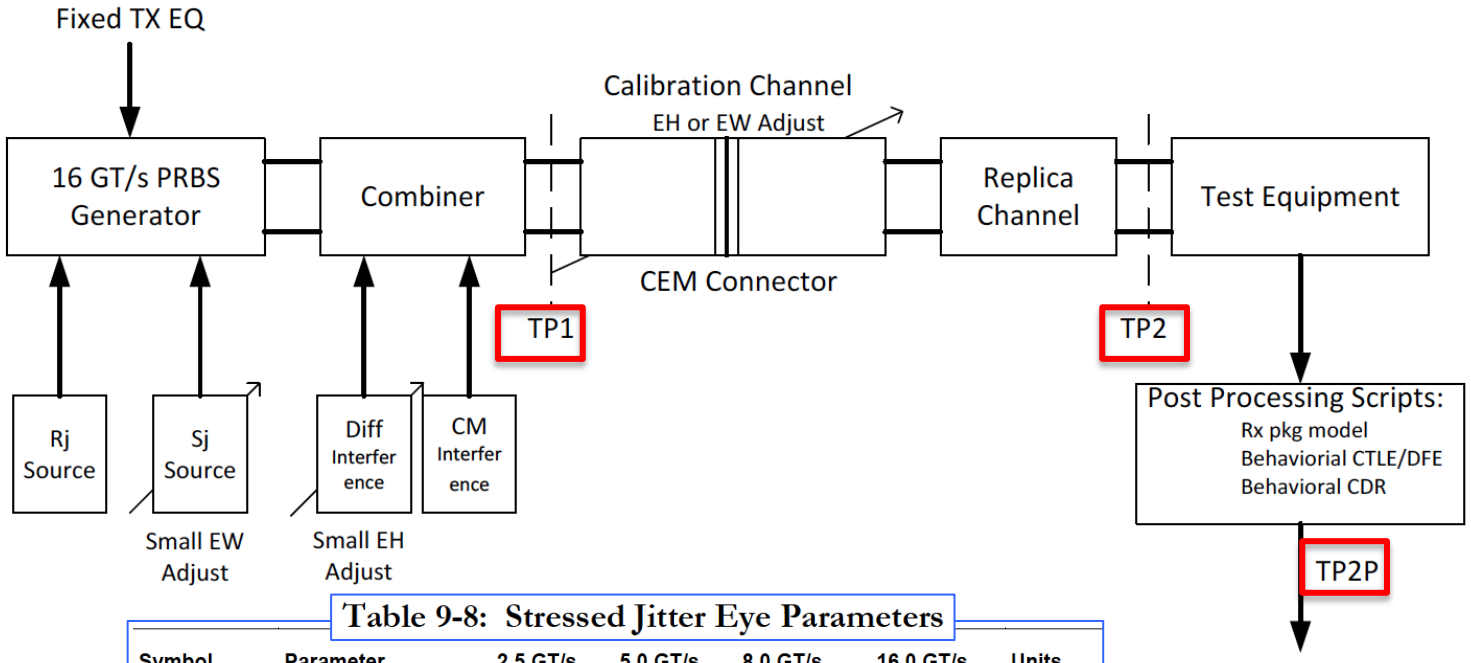
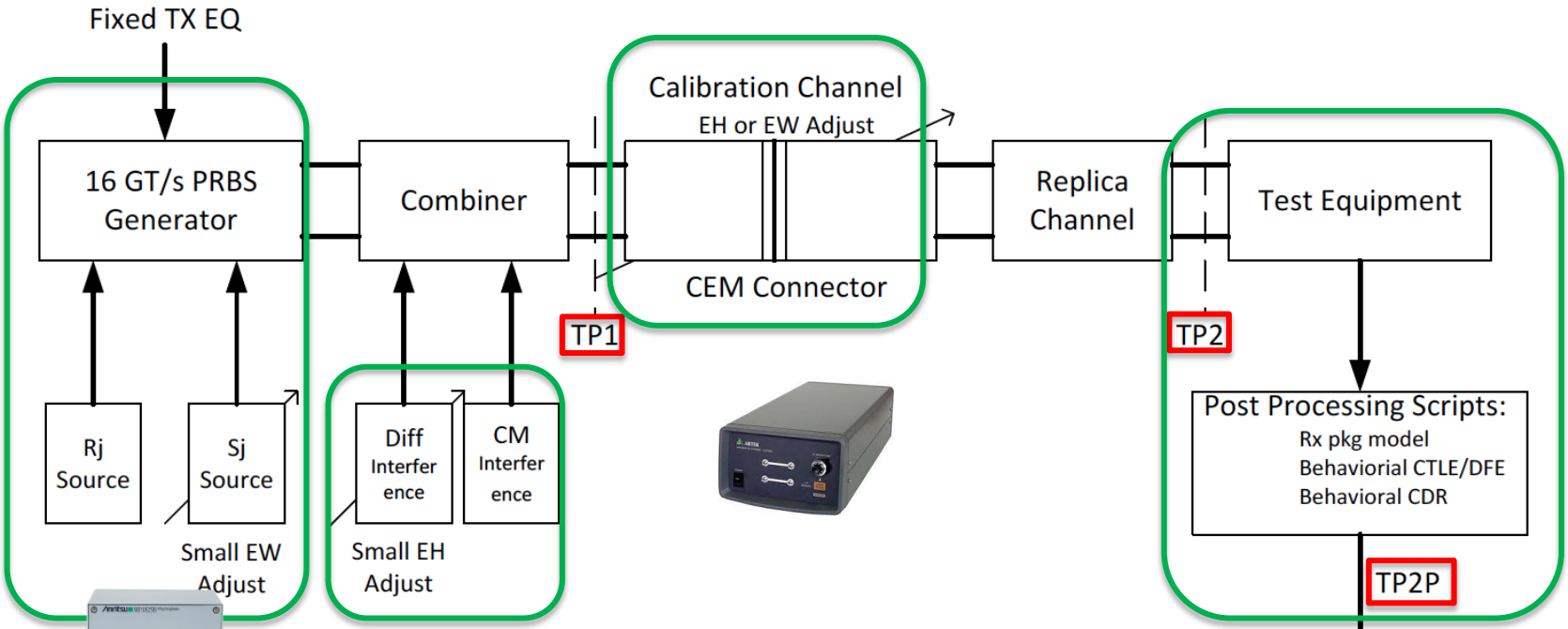



**Table 9-8: Stressed Jitter Eye Parameters**

| Symbol | Parameter | 2.5 GT/s | 5.0 GT/s | 8.0 GT/s | 16.0 GT/s | Units |
|---|---|---|---|---|---|---|
| $V_{RX-LAUNCH}$ | Generator launch voltage | 800-1200 | 800-1200 | 800-1200 | 800-1200 | mV PP |
| $T_{RX-UI}$ | Unit Interval | 400 | 200 | 125 | 62.5 | ps |
| $T_{RX-ST}$ | Eye width at TP2P | <0.4 | <0.32 | 0.30 | 0.30 | UI |
| $T_{RX-ST-SJ}$ | Swept Sj | 33 KHz spur only | 33 KHz spur only | Figure 9-29, Figure 9-30 | Figure 9-29, Figure 9-30 | UI PP |
| $T_{RX-ST-RJ}$ | Random Jitter | TBD | TBD | 3.0 (max) | ~1.0 (max) | ps RMS |
| $V_{RX-DIFF-INT}$ | Differential noise | TBD | TBD | TBD | TBD | mV PP |
| $V_{RX-CM-INT}$ | Common mode noise | 150 | 150 | 150 | 150 | mV PP |

# PCI Express Gen 4 Base Spec. Calibration Points

Stressed Signal Calibration → Transition to Loopback State → Stressed Signal Input Test

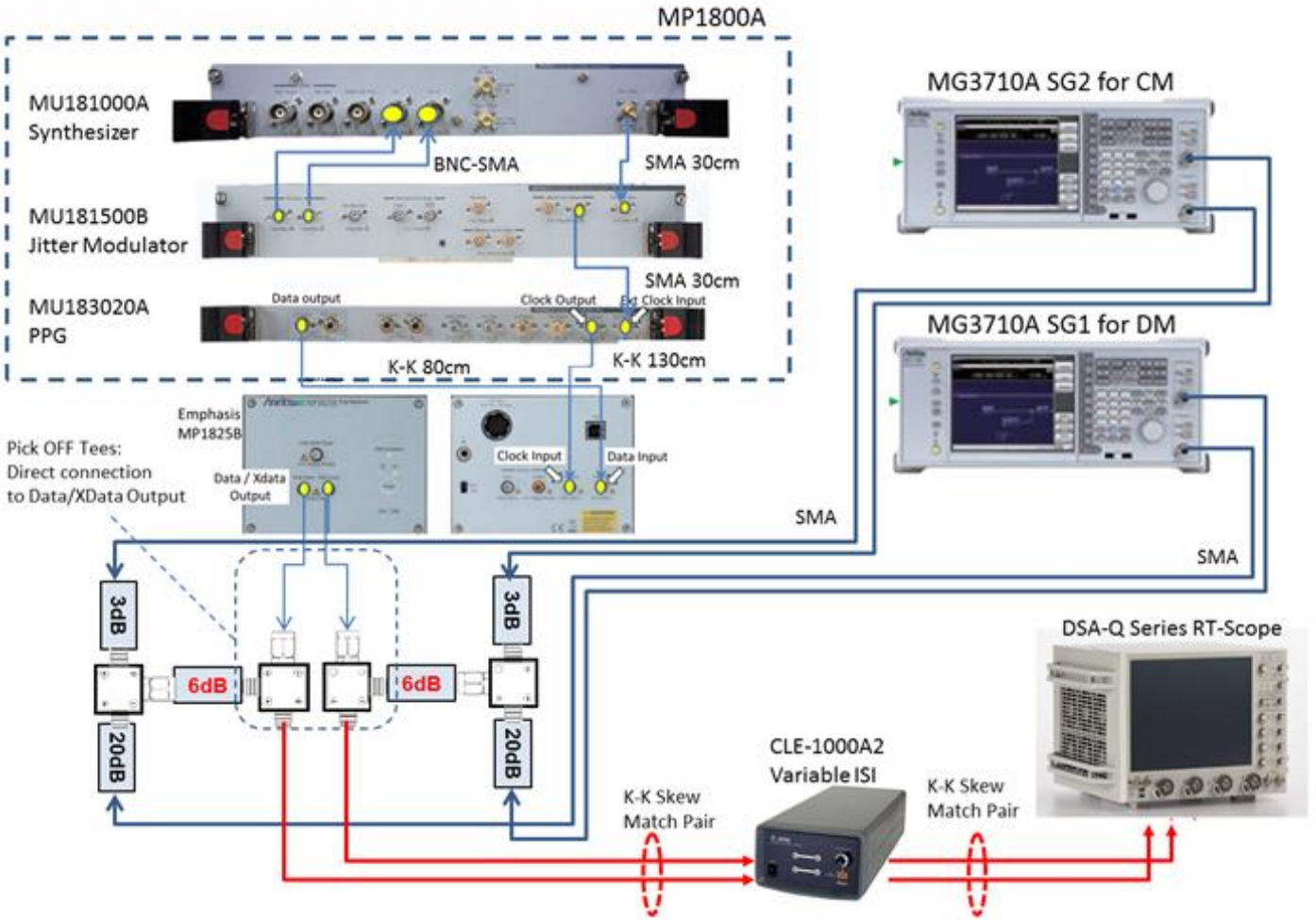



MP1800A

MG3710A

# PCI Express Gen 4 Base Spec. Calibration Test Setup for TP2

Stressed Signal Calibration → Transition to Loopback State → Stressed Signal Input Test



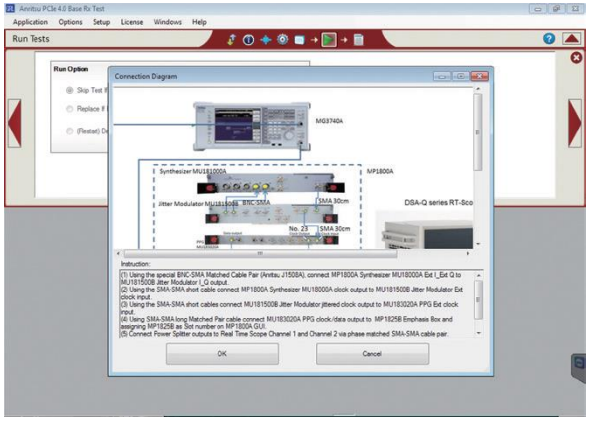
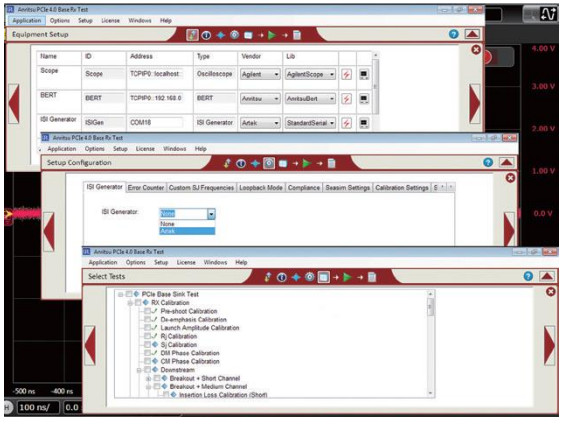
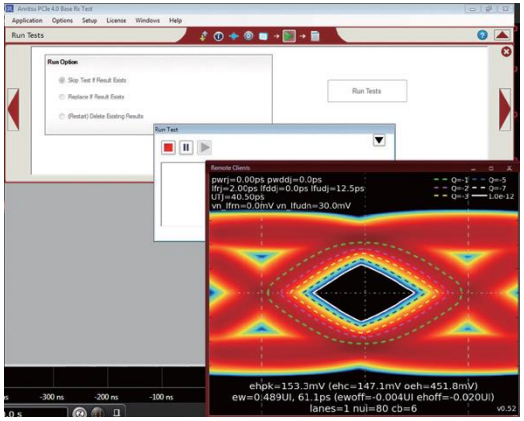

*Variable ISI filtered at TP1

# PCI Express Gen 4 Base Spec. Calibration

**Stressed Signal Calibration** → Transition to Loopback State → Stressed Signal Input Test

- Stressed Signal Calibration

Features of GRL-PCIE4-BASE-RXA Automation Software

Calibration Setting and Measurement Screens

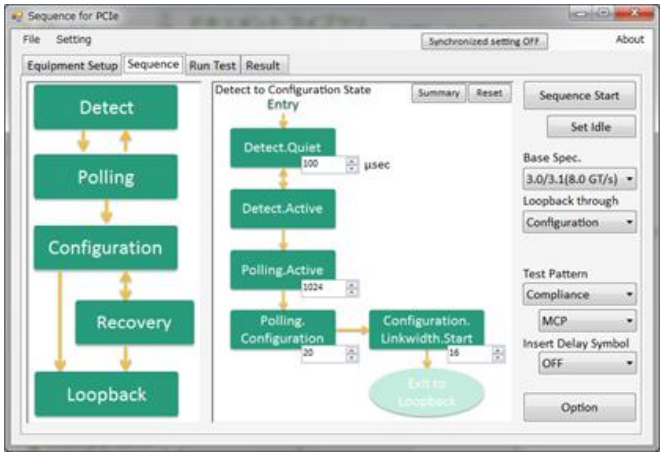
One-button calibration and testing of stress input signals using GRL-PCIE4-BASE-RXA

- ✓ Supports PCIe Gen 4 Rev. 0.5 devices
- ✓ Calibration of high-reproducibility test signal and Rx tests
- ✓ Auto-control of variable ISI channel and Eye opening calibration

# PCI Express Gen 4 Base Spec. Rx Test

Stressed Signal Calibration → **Transition to Loopback State** → Stressed Signal Input Test

## ➢ Generating Link Sequence using MX183000A-PL011




PCI Express Link Sequence Setting Screen

PPG Pattern control using MX183000A

- ✓ GUI for easy setting of measurement conditions and simple test execution
- ✓ Built-in PDF format reporting function
- ✓ Control of PCIe device status using sequence generation and evaluation of Logical Sub-Block
- ✓ 8B/10B, 128B/130B, Scramble SKIP Insertion

| Item | MX183000A-PL011 Specification |
|---|---|
| Supported Standards | PCIe Rev 1.x (2.5 GT/s), 2.0 (5 GT/s), 3.x (8 GT/s), 4.0 (16 GT/s) |
| Test Pattern | Compliance (MCP, CP), PRBS (7, 9, 10, 11, 15, 20, 23, 31) |
| LTSSM State | Transition to Detect, Polling, Configuration, Recovery, Loopback |
| Loopback Through | Configuration, Recovery |
| TS Setting Parameters | SKIP Insertion, 8B/10B,128B/130B, FTS, Link Number, Lane Number, Scrambling |

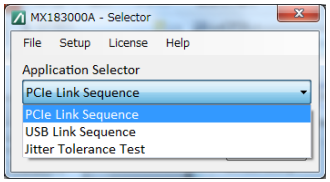
# PCI Express Gen 4 Base Spec. Rx Test

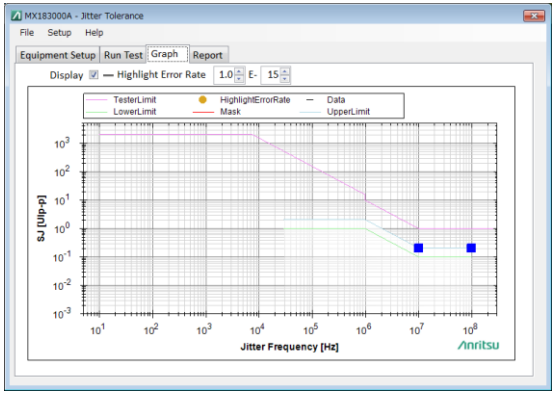
Stressed Signal Calibration → Transition to Loopback State → **Stressed Signal Input Test**

## ➢ Stressed Signal Input Test (Jitter Tolerance Margin test using MX183000A-PL001)

Control Jitter and measure Jitter Tolerance using MX183000A

- ✓ Impress SJ/RJ to test Jitter Tolerance of PHY devices
- ✓ Test device margin using low-rate estimate BER measurement
- ✓ Create measurement results reports in HTML and CSV format



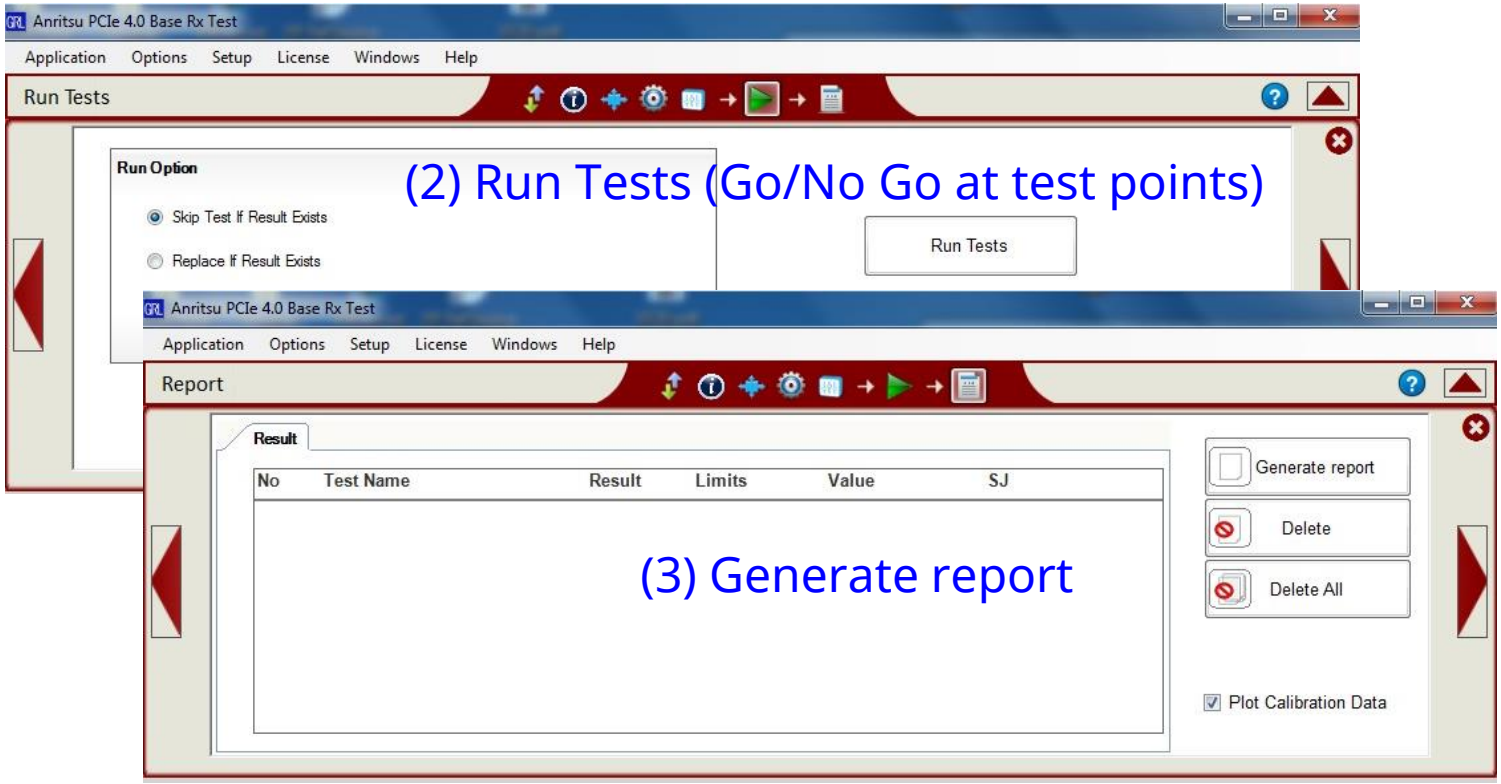




| Item | MX183000A-PL001 Specifications |
|---|---|
| Jitter Setting Range | Based on MU181500B Jitter Modulation Source spec. |
| Direction Search | Binary, Downward Linear, Downward Log, Upward Linear, Upward Log, Binary + Linear |
| Detection | Error Rate, Error Count, Estimate |
| Error Threshold | 1.0E-3 to 1.0E-14 |
| Highlight Error Rate | 9.9E-9 to 1.0E-20 (at estimate) |
| Report Function | Reports results in HTML and CSV formats |

# PCI Express Gen 4 Base Spec. Rx Test

Stressed Signal Calibration → Transition to Loopback State → **Stressed Signal Input Test**

- Stressed Signal Input Test (GRL-PCIE4-BASE-RXA Pass/Fail Test)



# Thunderbolt 3  Test Solution

# Thunderbolt 3 Rx Test Outline

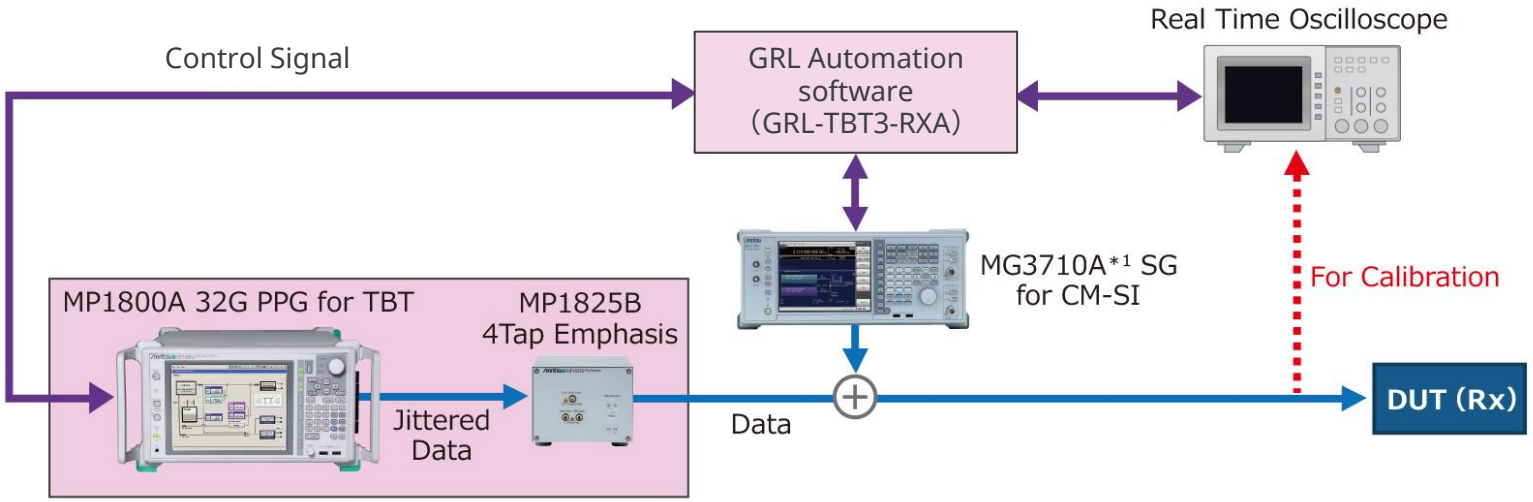
➢ Flow of Thunderbolt 3 Rx Test

Stressed Signal Calibration → Stressed Signal Input Test

Used Software

Automation Software:
GRL-TBT3-RXA

Thunderbolt Measurement Set-up



# Thunderbolt 3 Rx Test Features

- ✓ Key Features
  - Supported Standard: Thunderbolt 2/3
  - As in Recommended Equipment for Thunderbolt Compliance Test Standard
  - As in Thunderbolt 3 (including USB Type-C Thunderbolt Alternate Mode Electrical Host/Device Compliance Test Specification) Standard, automatic calibration of signal loss due to Stressed Rx Jitter parameter configuration
  - Rx BER measurement as required by Host/Device  compliance test
  - Automatic Rx test using Tenlira scripts

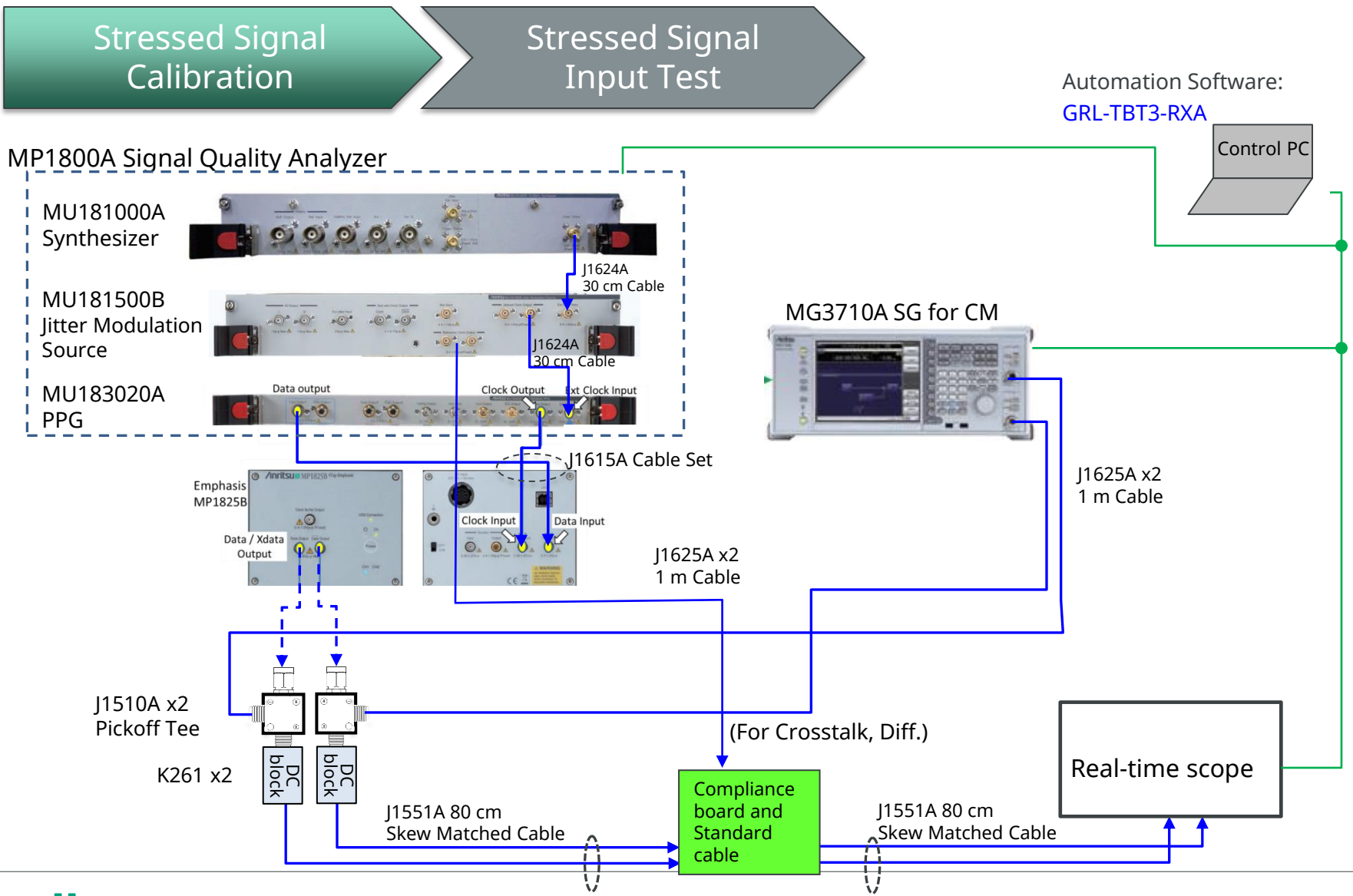
Supported Standard

| Supported Standard | DUT |
|---|---|
| Thunderbolt 2 (10 G)<br>Thunderbolt 3 (20 G) | Device |

# Thunderbolt 3 Rx Test

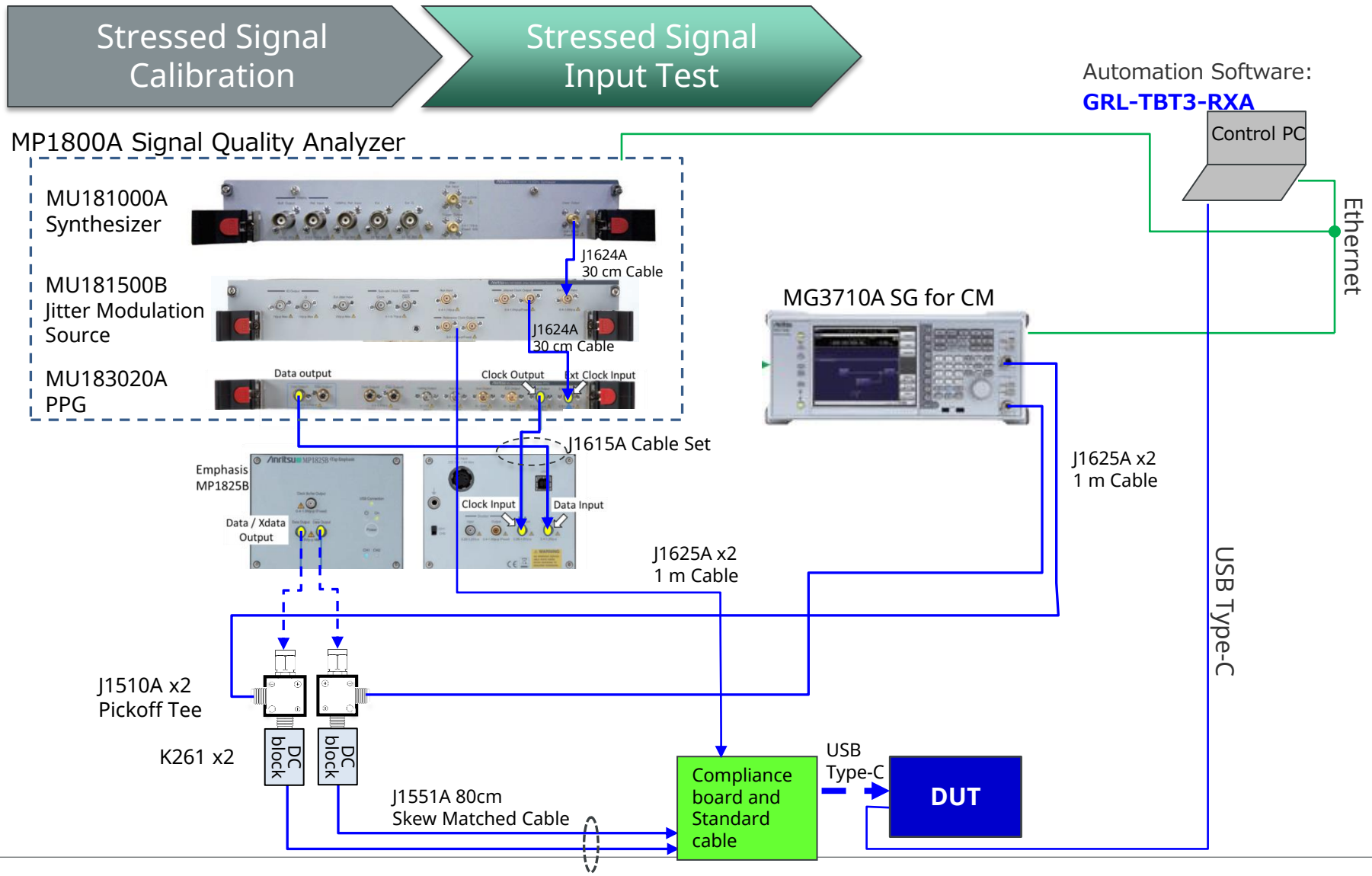
## ➢ Stressed Signal Calibration

**Stressed Signal Calibration** → **Stressed Signal Input Test**



# Thunderbolt 3 Rx Test

➢ Stressed Signal Input Test (Jitter Sweep Test (Pass/Fail Evaluation))

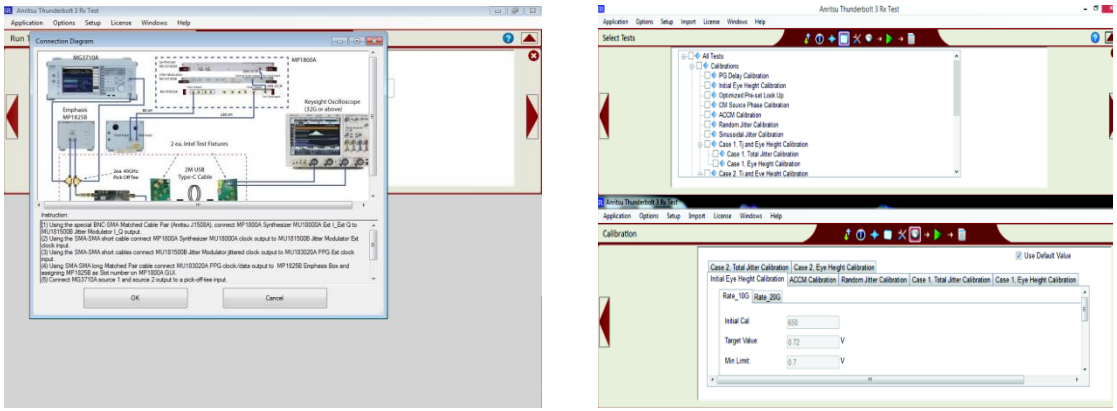


# Thunderbolt 3 Rx Test

Stressed Signal Calibration → Stressed Signal Input Test

- Stressed Signal Calibration

Features of Automation Software GRL-TBT3-RXA



Calibration Setting Screen

Performs one-button calibration of stressed input signal using GRL-TBT3-RXA

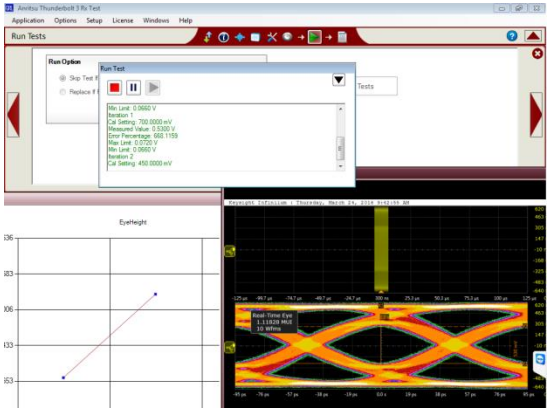
- ✓ Supports Thunderbolt 3 (USB Type-C Thunderbolt Alternate Mode Electrical Host/Device Compliance Test Specification)
- ✓ Performs calibration of high-reproducibility test signal and executes receiver test

# Thunderbolt 3 Rx Test

Stressed Signal Calibration → Stressed Signal Input Test

- Stressed Signal Input Test

Features of automation software GRL-TBT3-RXA



Measurement Screen

Performs one-button stressed input signal test using GRL-TBT3-RXA

- ✓ Performs calibration of high-reproducibility test signal and executes Rx test
- ✓ GUI screen for easy setting of test conditions and test execution
- ✓ Built-in PDF format reporting function

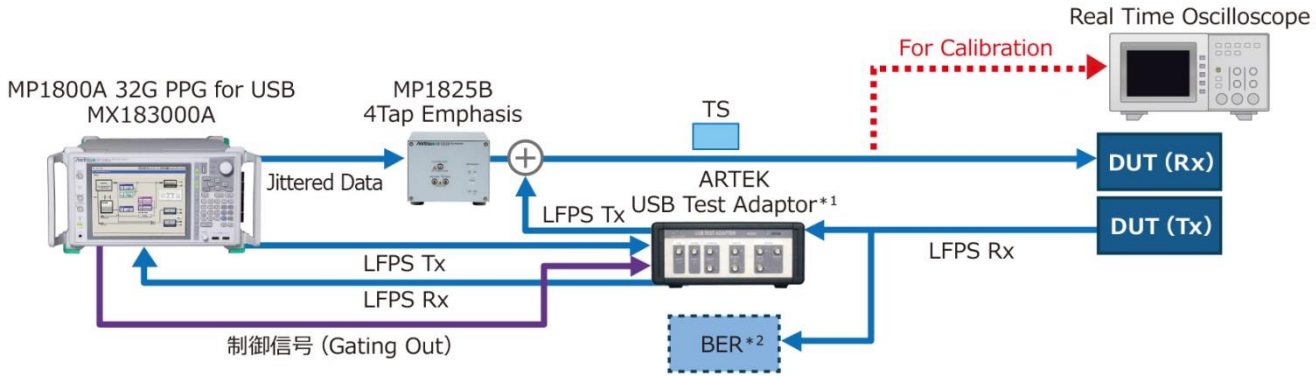
# USB 3.1 Test Solution

# USB 3.1 Rx Test Outline

## ➢ Flow of USB 3.1 Rx Test

| Stressed Signal Calibration | Transition to Loopback State | Stressed Signal Input Test |
|---|---|---|
| Used Software: Automation Software: GRL Automation Software (TBT) | Link Sequence Pattern Generation Software: MX183000A-PL012 | ・Jitter Sweep Test (Pass/Fail Evaluation) GRL Automation Software (TBT) |

USB 3.1 Measurement Set-up



# USB 3.1 Rx Test Features

✓ Key Features

- Automatic measurement and automatic calibration using automation software GRL Automation Software (TBT)
- Transition to Loopback mode for evaluating USB 3.1 Gen 1–2 devices

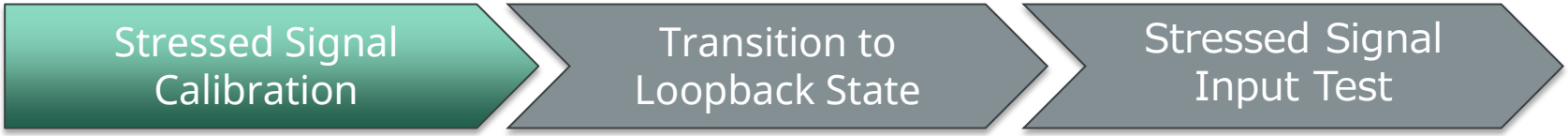
Supported Standard

| Supported Standard | | DUT | Link Sequence Generation | Jitter Tolerance Test |
|---|---|---|---|---|
| USB | 3.0/3.1 | Device | Supported | * |
| | | Host | Supported | * |

| USB Link Sequence Generation Function (MX183000A-PL012) |
|---|
| ✓ Supports transition to Loopback Mode for evaluation of USB 3.1 Gen 1–2 devices<br>✓ 8B/10B, 128B/132B, Scramble, SKIP Insertion, LFPS generation |

*Enquire about BER-related and Jitter power measurements

# USB 3.1 Rx Test




- Stressed Signal Calibration

Features of automation software GRL Automation Software (TBT)

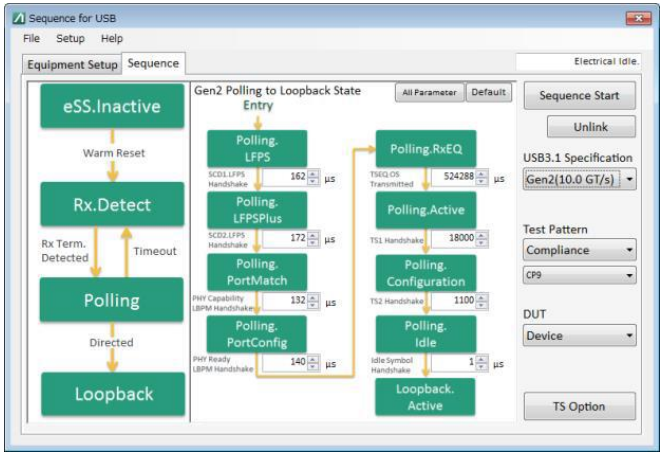
One-button calibration and testing of stressed input signal using GRL Automation Software (TBT)

- ✓ Supports USB 3.1 Gen 1–2 devices
- ✓ Performs calibration and Rx test of high-reproducibility test signal
- ✓ Supports automatic control of variable ISI and calibration of EYE opening

# USB 3.1 Rx Test

## ➢ Generating Link Sequence using MX183000A-PL012

Stressed Signal Calibration → **Transition to Loopback State** → Stressed Signal Input Test




USB Link Sequence Setting Screen

Control PPG pattern using MX183000A

- ✓ Transition to Loopback Mode for evaluation of USB 3.1 Gen 1–2 devices
- ✓ 8B/10B, 128B/132B, Scramble, SKIP Insertion, LFPS generation function

| Item | MX183000A-PL012 Specifications |
|---|---|
| Support Standards | USB 3.0, 3.1 Gen 1 (5 Gbit/s), 3.1 Gen 2 (10 Gbit/s) |
| Test Pattern | Compliance (Gen 1: CP0, CP1, CP2, CP4, CP5, CP6, Gen 2: CP9), User |
| LTSSM State | Transition to eSS.Inactive, Rx.Detect, Polling, Loopback |
| Loopback Through | Configuration |
| TS Setting Parameters | SKIP Insertion, 8B/10B,128B/132B, Scrambling |

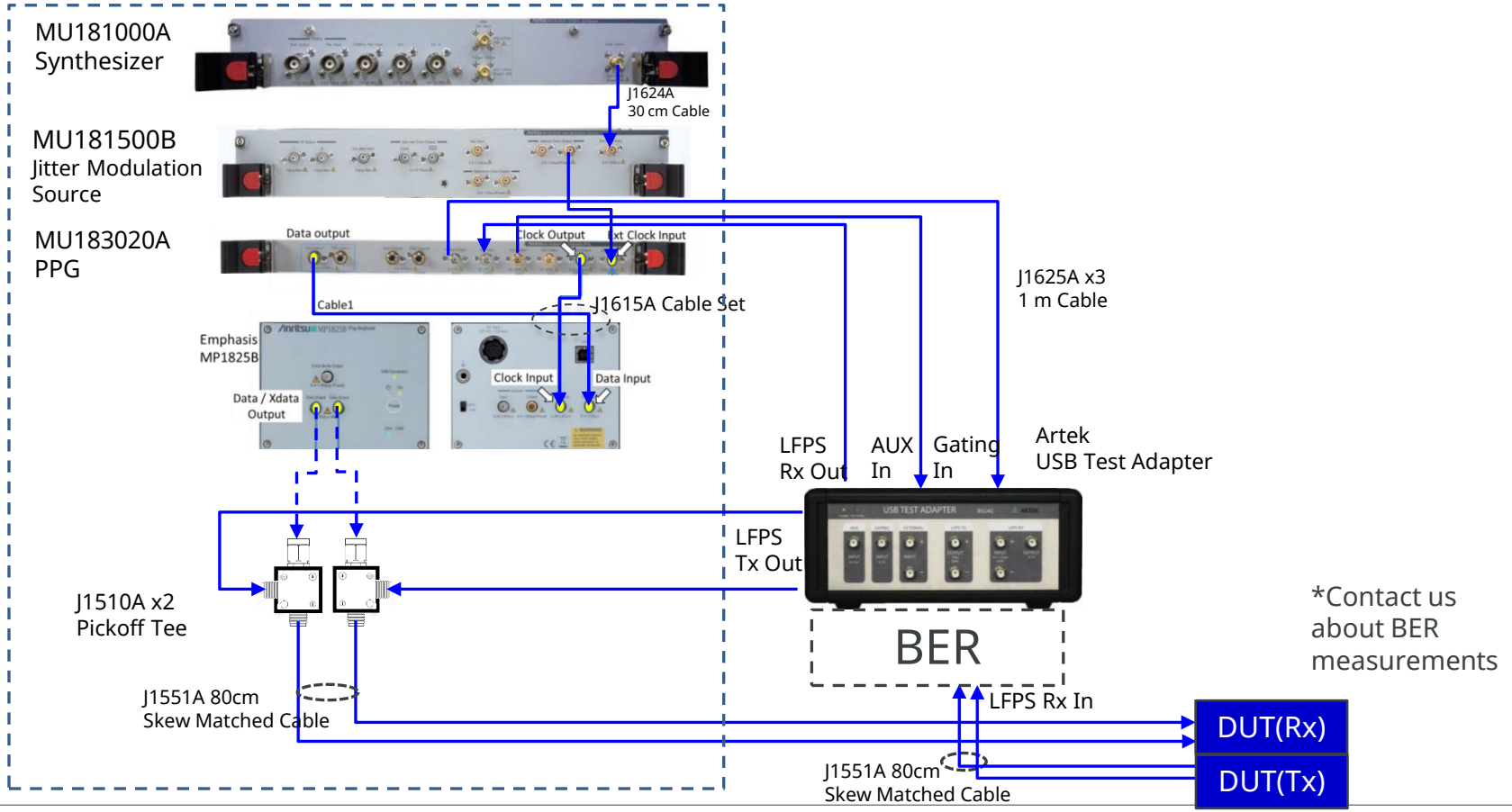
# USB 3.1 Rx Test

Stressed Signal Calibration → **Transition to Loopback State** → Stressed Signal Input Test

## ➢ Transition to Loopback State and Stressed Signal Input Test ①

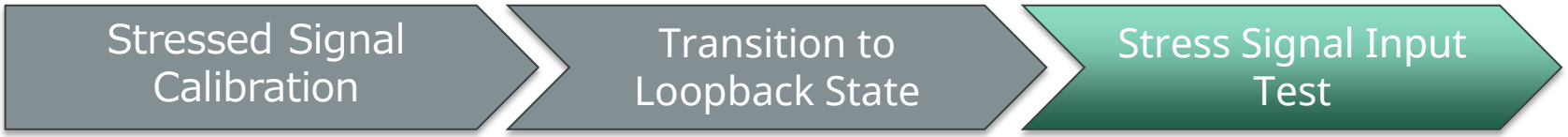
MP1800A Signal Quality Analyzer (Configuration using Artek USB Test Adapter)

MX183000A-PL012 USB Link Sequence (Installed in MP1800A or external PC)




*Contact us about BER measurements

# USB 3.1 Rx Test




- Stressed Signal Input Test (GRL Automation Software (TBT) Pass/Fail Test)

# Appendix

# Ordering Information

| Model | Name | Option | Qty. | | |
|---|---|---|---|---|---|
| | | | PCIe | TBT | USB |
| MP1800A | Signal Quality Analyzer | X02, x07, x32 | 1 | 1 | 1 |
| MU181000A/B | Synthesizer | - | - | - | 1 |
| | | x01 | 1 | - | - |
| MU181500B | Jitter Source | - | 1 | 1 | 1 |
| MU183020A | 32G PPG | X12/x30 | 1 | 1 | 1 |
| MU183040B | 32G ED | X10/X22 | 1 | - | - |
| MP1825B | Emphasis | x02 | 1 | 1 | 1 |
| MG3710A | Vector signal generator | x02, x29, x36, x41, x42, x66, x71, x72 | 2 | 1 | - |
| MX183000A | High-Speed Serial Data Test Software | - | 1 | - | 1 |
| GRL-PCIE4－BASE-RXA | | - | 1 | - | - |
| GRL-TBT3-RXA | | - | - | 1 | - |
| GRL Automation Software (TBT) | | - | - | - | 1 |
| USB Test Adapter | | - | - | - | 1 |

*Automation  software sold by Granite River Labs (http://graniteriverlabs.com/)
USB Test Adapter sold by Artek (http://www.artek.co.jp/jp/index.html)

# Ordering Information

| | Model | Name | Qty. | | |
|---|---|---|---|---|---|
| | | | PCIe | TBT | USB |
| Components | J1398A | N-SMA ADAPTER | 4 | 2 | - |
| | 41KC-3 | 3 dB ATT | 2 | - | - |
| | 41KC-6 | 6 dB ATT | 2 | - | - |
| | 41KC-20 | 20 dB ATT | 2 | 2 | - |
| | K241C | Splitter | 2 | - | - |
| | J1510A | Pickoff Tee | 2 | 2 | 2 |
| | Z1927A | USB Measurement Kit | - | - | 1 |
| | J1508A | BNC-SMA Connector Cable | 2* | - | - |
| | J1615A | Cable Set | 1* | 1* | 1* |
| | J1551A | Coaxial Skew Matched Cable (0.8 m, K-connector) | 2 | 2 | - |
| | J1624A | Coaxial Cable 0.3 m | 2* | 2* | 2* |
| | J1625A | Coaxial Cable 1 m | 6 | 3 | - |
| | J1715A | Coaxial Cable 0.1 m (SMP-J, SMA-J) | 4 | - | - |

*Standard accessory for MP1800A series

*1: Configuration without using Artek USB Test Adapter

*2: Configuration using Artek USB Test Adapter

Anritsu

envision : ensure

公知 2016-9 MG No. MP1800A_HSB-E-L-1-(1.00)