QSFP-DD 1.6T Test Adapters

Preliminary User Manual

Table of Contents

Introduction

This user's guide documents the QSFP-DD 1.6T Host Compliance Board (HCB), and QSFP-DD 1.6T Module Compliance Board (MCB) Test Point Adapters (TPA). These test adapters can be used in various configurations for compliance testing. Each TPA has two variations of connector types with 1.85mm and 1.00mm connectors. The model numbers are as follows:

Model Numbers:

HCB (Plug):

QSFPDD-1.6T-TPA1.85-HCB-P	1.6T HCB with 1.85mm Female Connectors
QSFPDD-1.6T-TPA1.00-HCB-P	1.6T HCB with 1.00mm Female Connectors

MCB (Receptacle):

QSFPDD-1.6T-TPA1.85-MCB-R	1.6T MCB with 1.85mm Female Connectors
QSFPDD-1.6T-TPA1.00-MCB-R	1.6T MCB with 1.00mm Female Connectors

MCB with Cooling Module Accessory:

QSFPDD-1.6T-TPA1.85-MCB-RC	1.6T MCB with 1.85mm Female Connectors and Cooling Module
QSFPDD-1.6T-TPA1.00-MCB-RC	1.6T MCB with 1.85mm Female Connectors and Cooling Module

The QSFP-DD 1.6T HCB (Plug) and QSFP-DD 1.6T MCB (Receptacle) TPAs, shown in Figures 1 and 2 below, test 224 Gbps PAM4 QSFP-DD interface cables, hosts, and modules to the requirements of the QSFP-DD MSA and IEEE 802.3dj™/D1.2 standards.

NOTE: To avoid damaging the cables, use the handling techniques described in the Care and Handling section before making any connections or configuring a test setup.

Always use a static-safe workstation when performing tests, as explained in the "Electrostatic Discharge Information" section.

QSFPDD-1.6T-TPA1.XX-HCB-P

The QSFP-DD 1.6T Host Compliance Test Adapter can be used for testing the compliance of QSFP-DD Host Devices to the QSFP-DD MSA and IEEE 802.3dj™/D1.2 standards.

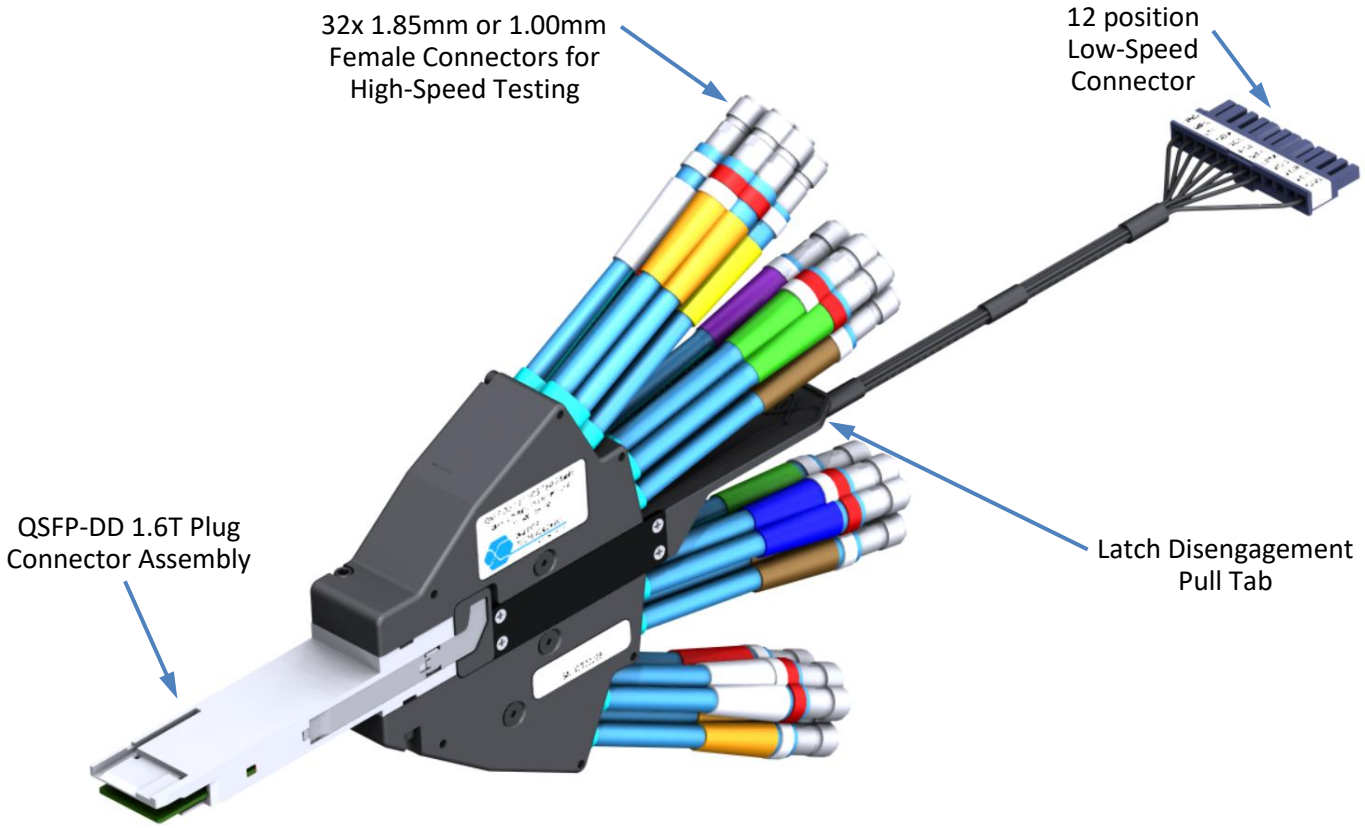


Figure 1. The QSFP-DD 1.6T HCB (Plug) Test Adapter (Note: The coaxial cables are configuration dependent and may be terminated with different connectors and have different color-coding than what is shown.)

Included with the QSFP-DD-1.6T-TPA1.XX-HCB-P are spare Molex plug connectors, provided for users to interface with the Low-Speed connection on the HCB. The Molex part numbers for the included separate plug and contact pins are as follows. Part numbers for the receptacle and its contact pins, which make up the low speed connector (P2) are also listed.

12-position MicroFit Receptacle Housing (P2)	Molex PN 43645-1200
Receptacle Female Terminal Pins (P2)	Molex PN 43030-0011
12-position MicroFit Plug Header (Spare)	Molex PN 43640-1201
Plug Male Contact Pins (Spare)	Molex PN 43031-0011

QSFP-DD-1.6T-TPA1.XX-MCB-R

The QSFP-DD 1.6T Module Compliance Board can be used for testing the compliance of the QSFP-DD MSA and IEEE 802.3dj™/D1.2 standards.

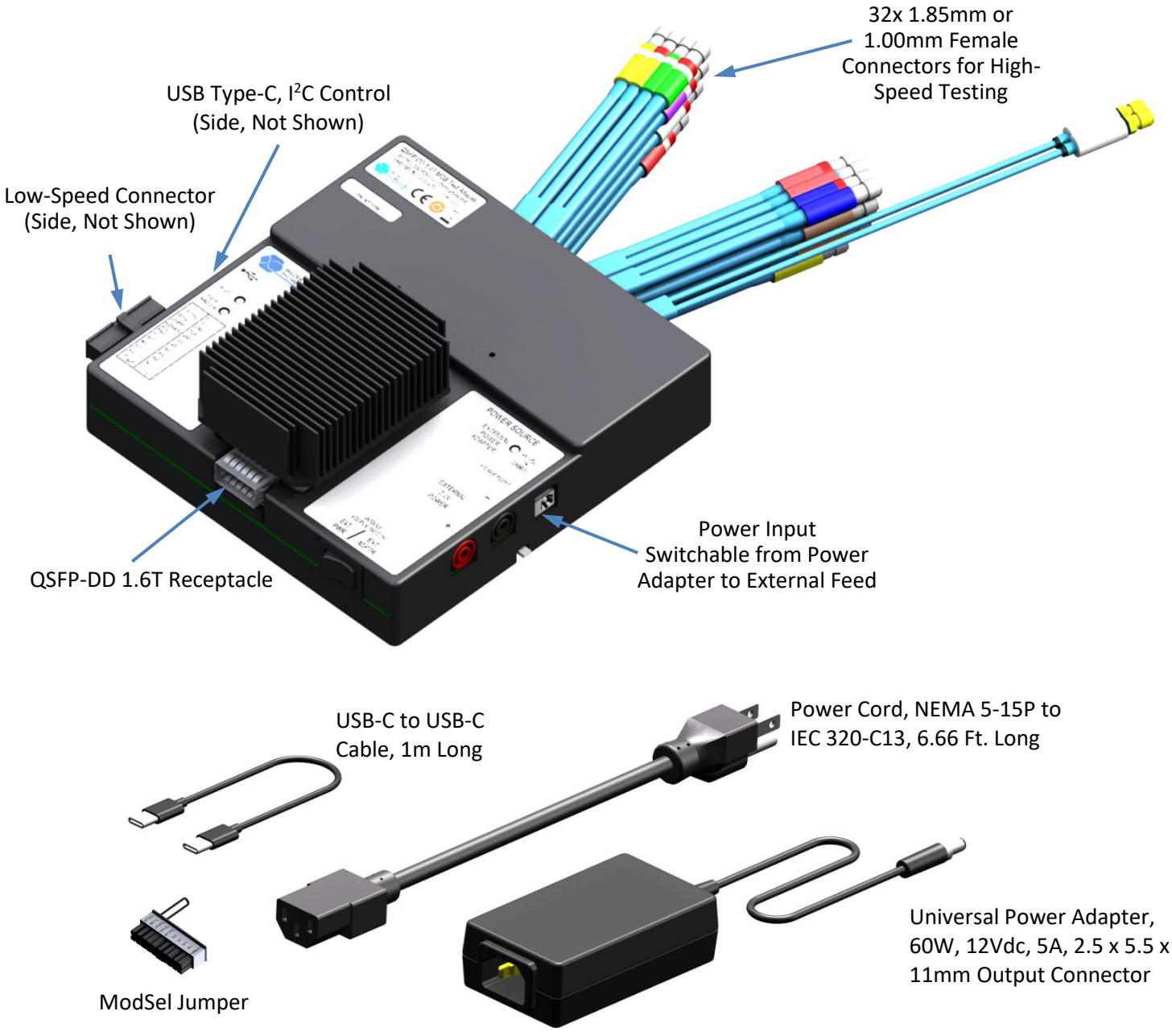


Figure 2. The QSFP-DD 1.6T MCB (Receptacle) Test Adapter (Note: The coaxial cables are configuration dependent and may be terminated with different connectors than what is shown).

Included with the QSFP-DD-1.6T-TPA1.XX-MCB-R is a spare Molex receptacle connector, provided for users to interface with the Low-Speed connection on the MCB. The Molex part numbers for the included receptacle, and contact pins are as follows.

20-position 2 row MicroFit Receptacle Housing (Spare)	Molex PN 43025-2000
Receptacle Female Contact Terminal Pins (Spare)	Molex PN 43030-0011

Replacement parts for the MCB and HCB low speed connections can be additionally purchased through Molex distributors.

NOTE: The receiver High-Speed connections for QSFP-DD are normally AC coupled. The QSFP-DD plug and receptacle TPAs do NOT have internal DC Blocks. This allows for parametric testing through the TPAs. Normal testing may require DC Blocks (Some DC blocks may be optionally ordered from Wilder Technologies or refer to the following table for purchasing options).

DC Block Specifications and Source Information				
Interface	**Frequency Range**	**VSWR**	**IL**	**Possible DC Block Sources**
1.85mm	≤10MHz - 67GHz	1.5:1	≤1.25	Centric RF Part Number C1067
1.00mm	≤50KHz - 110GHz	1.4:1	≤2.5	Pasternack Part Number PE8259

NOTE: RF Terminators may be required to support specific user test configurations. (Some RF Terminators may be optionally ordered from Wilder Technologies or refer to the following table for purchasing options).

RF Terminator Specifications and Source Information				
Interface	**Frequency Range**	**VSWR**	**Power**	**Possible RF Terminator Sources**
1.85mm	0 - 67GHz	1.3:1	1W	Centric RF Part Number C673
1.00mm	0 - 110GHz	1.6:1	1W	Centric RF Part Number C1101

NOTE: The metal shell of both the plug (QSFP-DD HCB) and receptacle (QSFP-DD MCB) connector housing or cage tie high-speed ground to chassis ground.

Cooling Module Accessory

The Cooling Module Accessory (Included with product or optional accessory) can be installed to the QSFP-DD MCB (Receptacle) Test Adapter. This will increase airflow through a device module (DUT) connector's heat sink and subsequently keep the device module case temperature within recommended ranges (per QSFP-DD MSA). The Cooling Module is required when testing QSFP-DD modules at power classes 4 or greater.

The Cooling Module is shipped disassembled from the QSFP-DD 1.6T MCB TPA. To install the cooling module onto the MCB, slide the cooling module assembly onto the mounting rail guide until the assembly clicks in place on the rail. (Figure 3)

A 12V AC-DC Power Adapter is also provided with the assembly and plugs into the Cooling Module's DC Jack, to power the fan.

NOTE: The Cooling Module is required while testing high power modules but is detachable for carrying purposes.

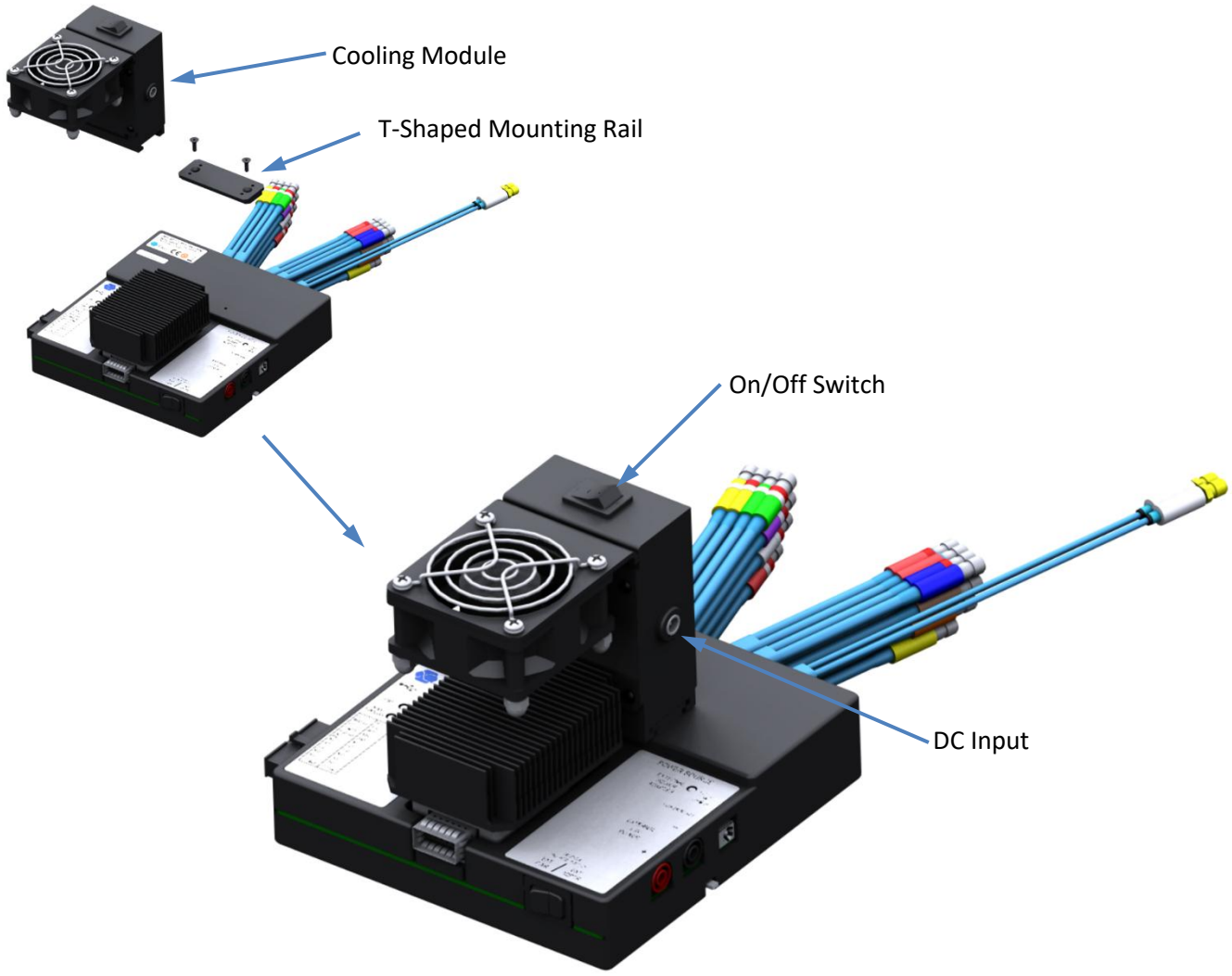


Figure 3. The QSFP-DD 1.6T MCB (Receptacle) Test Adapter with Cooling Module

Cooling Module Recommended Use

This table lists the QSFP-DD module power classes and their effects on case temperature and MCB heatsink temperature. These temperatures were obtained through experimentation by Wilder Technologies. Case and heatsink temperatures with and without the Cooling Module are included in the table.

The Cooling Module is recommended at case temperatures greater than 70°C based on QSFP-DD MSA Standards[2]. The Cooling Module is also recommended at Heatsink temperatures greater than 60°C based on ASTM C1055 (*Standard Guide for Heated System Surface Conditions that Produce Contact Burn Injuries*)[3].

		Without Cooling Module		With Cooling Module		
Power Class	**Max Power (W)**	**Case Temperature[1,2] (°C)**	**Heatsink Temperature[1,3] (°C)**	**Case Temperature[1,2] (°C)**	**Heatsink Temperature[1,3] (°C)**	**Cooling Module Recommended**
1	1.5	29.72	28.11	N/A	N/A	No
2	3.5	37.96	34.56	N/A	N/A	No
3	7	52.38	45.84	N/A	N/A	Optional
4	8	56.5	49.07	N/A	N/A	Optional
5	10	64.74	55.51	N/A	N/A	Optional
6	12	72.98	61.96	34.55	25.62	Yes
7	14	81.22	68.41	45.57	25.92	Yes
8	>14	>81.22	>68.41	>45.57	>25.92	Yes
8	22.53	105.4	87.2	53.4	29.5	Yes

Based on measurements conducted by Wilder Technologies, the Cooling Module is recommended for use on the QSFP-DD MCB (Receptacle) when testing modules of Power Class 6 or greater. At these power classes, the case temperatures and heatsink temperatures of the QSFP-DD MCB exceed recommended limits (Per MSA and ASTM standards). Thus, the Cooling Module must be used to reduce temperatures to be within safe operating ranges. **In all cases, the test operator must use caution when handling the QSFP-DD module as it is hot to touch**. **Refer to the 'Cooling Module Usage Recommendations and Thermal Safety Precautions' section below**.

[1] Temperatures interpolated from experimental data.
[2] "QSFP-DD/QSFP-DD800/QSFP112 Hardware Specification for QSFP Double Density 8X and QSFP 4X Pluggable Transceivers, Revision 6.3" QSFP-DD MSA.
[3] "Standard Guide for Heated System Surface Conditions that Produce Contact Burn Injuries (ASTM C1055-20)." American Society for Testing and Materials, Philadelphia, PA.

Thermal Caution

While inserted in the QSFP-DD MCB TPA, the QSFP-DD module is expected to exceed the recommended 70°C temperature at higher power consumptions. **Importantly, at lower power consumptions, the test operator should still use caution, since the DUT case will be hot**, just not so hot as to exceed the MSA recommended temperatures.

Cooling Module Usage Recommendations and Thermal Safety Precautions

While testing a QSFP-DD device module with the QSFP-DD 1.6T MCB TPA, the test operator should adhere to the following usage recommendations and thermal safety precautions.

- The Cooling Module should always be on while the DUT is inserted in the QSFP-DD MCB TPA.
- The user must manually turn on the Cooling Module.
- The user should acknowledge that the DUT case temperature will be hot while inserted in the QSFP-DD 1.6T MCB TPA.
- The user should minimize skin contact with the DUT case while it is being tested.
    - **DO NOT** hold any skin touch due to burn risk.
- When finished with testing, before turning off the Cooling Module, the user should leave the DUT inside the powered-off MCB for 15 seconds before removing it to allow adequate time for cooling.

Product Inspection

Upon receiving QSFP-DD Test Adapters from Wilder Technologies, perform the following product inspection:

- Inspect the outer shipping container, foam-lined instrument case, and product for damage. Retain the outer cardboard shipping container until the contents of the shipment have been inspected for completeness and the product has been checked mechanically and electrically. Use the foam-lined instrument-case for secure storage of the Wilder Technologies QSFP-DD Test Adapter when not in use.

- Locate the shipping list and verify that all items ordered were received.

- In the unlikely event that the product is defective or incomplete, the “Limited Warranty” (see the Wilder web site) discusses how to contact Wilder Technologies for technical assistance and/or how to package the product for return.

The QSFP-DD Test Adapter Care and Handling Precautions

The QSFP-DD Test Adapters require careful handling to avoid damage. Improper handling techniques, or using too small a cable bend radius, can damage the coaxial cable connections within the adapter housing or the cables themselves. This can occur at any point along the cable. To achieve optimum performance and to prolong the QSFP-DD TPA's life, observe the following handling precautions:

- **CAUTION 1: Avoid Torque Forces** (Twisting)
  Twisting any QSFP-DD TPA as a unit, with one end held stationary, may damage, or severely degrade performance. Adherence to Caution 5 (below) helps to avoid twisting.

- **CAUTION 2: Avoid Sharp Cable Bends**
  Never bend coaxial cables into a radius of 26 mm (1-inch) or less. Never bend cables greater than 90°. Single or multiple cable bends must be kept within this limit. Bending the QSFP-DD TPA cables less than a 26mm (1-Inch) radius will permanently damage or severely degrade test adapter performance.

- **CAUTION 3: Avoid Cable Tension** (Pull Forces)
  Never apply tension (pull forces) to an individual coaxial cable that is greater than 2.3 kg (5 lbs.). To avoid applying tension, always place accessories and equipment on a surface that allows adjustment to eliminate tension on the QSFP-DD TPA and cables. Use adjustable elevation stands or apparatus to accurately place and support the QSFP-DD TPA.

- **CAUTION 4: Connect the QSFP-DD Test Adapter First**
  To prevent twisting, bending, or applying tension to the coaxial cables when connecting a QSFP-DD TPA, always attach the QSFP-DD TPA to the device under test (DUT) or cable under test before attaching any High-Speed connectors. Carefully align the QSFP-DD connectors and then gently push the connectors together until fully seated.

  If the QSFP-DD TPA must be turned or twisted to make connection to the DUT, avoid using the QSFP-DD TPA housing alone to make this occur. Try to distribute the torque forces along the length of the test setup and cabling. If this is not possible, it is recommended to first loosen or disconnect the High-Speed connections at the QSFP-DD TPA, make the connection to the DUT and then re-tighten or attach the test equipment leads.

NOTE: Only grip the test adapter housing when inserting or extracting the QSFP-DD TPA to or from the DUT. Pulling directly on the QSFP-DD TPA cables or using them to insert the QSFP-DD TPA may cause damage.

- **CAUTION 5: Carefully Make High-Speed (1.85mm and 1.00mm) Connections**
  To connect the QSFP-DD TPA High-Speed connectors, follow these steps:

  1. Hold the cable stationary by grasping the cable at the heat shrink label section near the connector.

  2. Insert the mating High-Speed connector barrel and hand-tighten the free-spinning nut onto the connector while avoiding pulling, bending, or twisting the QSFP-DD TPA coaxial cable.

  3. The QSFP-DD TPA High-Speed connectors have flats that accept an open-end 15/64-inch or 13/64-inch wrench, depending on configuration. When attaching instrument cables to the QSFP-DD TPA, it is recommended that the QSFP-DD TPA connectors be mechanically held and the test leads be tightened to the equipment manufacturer's torque recommendations using an open-end torque wrench; normally 4 inch-lbs for 1.00mm connector and 8 inch-lbs for 1.85mm.

     If the test set-up requires repositioning, first loosen, or disconnect the coax cable connections to avoid twisting, bending, or tension.

     NOTE: A drop in signal amplitude by half or 6dB during the testing of a channel may indicate that a cable has been mechanically pulled free of coaxial cable connections internal to the assembly. This could be determined by checking if the cable has any lateral play relative to the TPA. This would only occur when the TPA has exceeded the pull force as specified within the mechanical specification. If the cable cannot be re-seated or continues to fail, the test adapter will need to be sent back to the factory for service.

- **CAUTION 6: Independently Support Instrument Cables or Accessories**
  Excessive weight from instrument cables and/or accessories connected to the QSFP-DD TPA can cause damage or affect the test adapter performance. Be sure to provide appropriate means to support and stabilize all test set-up components.

- **CAUTION 7: ESD Sensitivity**
  The QSFP-DD HCB is predominantly a passive component and is not in itself sensitive to electrostatic discharge (ESD). The QSFP-DD MCB has active components and is sensitive to ESD. When an active DUT is installed, both devices become susceptible to ESD. Observe proper ESD precautions, discussed further in the Electrostatic Discharge Information section.

General Test Adapter, Cable, and Connector

Observing simple precautions can ensure accurate and reliable measurements.

Handling and Storage

Before each use of the QSFP-DD TPA, ensure that all connectors are clean. Handle all cables carefully and store the QSFP-DD TPA in the foam-lined instrument case when not in use. Do not set connectors contact end down. Install the coax connector protective end caps when the QSFP-DD TPA is not in use.

Visual Inspection

Be sure to inspect all cables carefully before making a connection. Inspect all cables for metal particles, scratches, deformed threads, dents, or bent, broken, or misaligned center conductors. Do not use damaged cables.

Cleaning

If necessary, clean the connectors using low-pressure (less than 60 PSI) compressed air or nitrogen with an effective oil-vapor filter and condensation trap. Clean the cable threads, if necessary, using a lint-free swab or cleaning cloth moistened with isopropyl alcohol. Always completely dry a connector before use. Do not use abrasives to clean the connectors. Re-inspect connectors, making sure no particles or residue remains.

Making Connections

Before making any connections, review the “Care and Handling Precautions” section. Follow these guidelines when making connections:

- Align cables carefully
- Make preliminary connection lightly
- To tighten, turn connector nut only
- Do not apply bending force to cable
- Do not over-tighten preliminary connections
- Do not twist or screw-in cables
- Use an appropriately sized torque wrench, and do not tighten past the “break” point of the torque wrench

Electrostatic Discharge Information

Protection against electrostatic discharge (ESD) is essential while connecting, inspecting, or cleaning the QSFP-DD TPA test adapter and connectors attached to a static-sensitive circuit (such as those found in test sets).

Electrostatic discharge can damage or destroy electronic components. Be sure to perform all work on electronic assemblies at a static-safe workstation, using two types of ESD protection:

- Conductive tablemat and wrist-strap combination
- Conductive floor-mat and heel-strap combination

When used together, both types provide a significant level of ESD protection. Used alone, the tablemat and wrist-strap combination provide adequate ESD protection. To ensure user safety, the static-safe accessories must provide at least 1 MΩ of isolation from ground. Acceptable ESD accessories may be purchased from a local supplier.

WARNING: These techniques for a static-safe workstation should not be used when working on circuitry with a voltage potential greater than 500 volts.

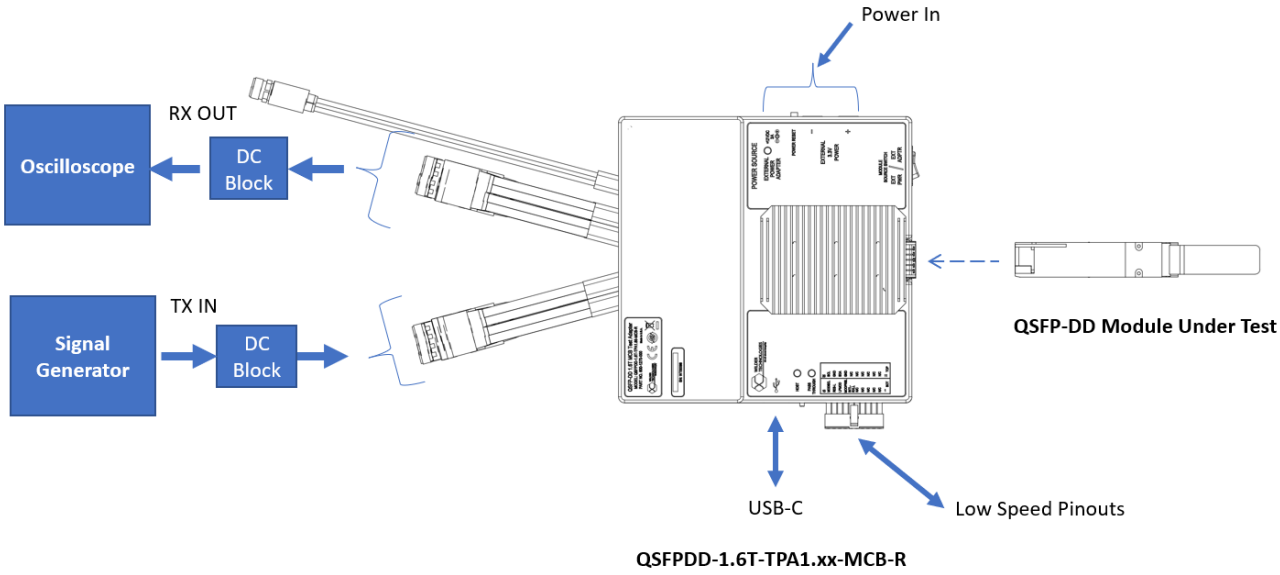
User Model

The QSFP-DD TPAs can perform to the requirements of both MSA and IEEE 802.3dj™/D1.2 specifications, limited only by the specifications, environmental, care and handling specified in this document.

The two most common testing configurations are shown below.

QSFP-DD-1.6T-MCB

QSFPDD-1.6T-TPA1.XX-MCB-R is used to test a QSFP-DD Module:



*DC blocks are accessories and not provided with this product

Figure 8. QSFP-DD 1.6T MCB User Model

In this configuration, the QSFP-DD 1.6T MCB is used to test a QSFP-DD Module. The MCB must be powered by an external source, either with the provided 12V power supply, or with the 3.3V banana plug jacks.

The MCB receives input signals from a signal generator connected to its TX lines (indicated by TX IN). These signals are then transferred to the QSFP-DD module under test (indicated by TX OUT). The module responds with the RX IN signal, which is transferred through the MCB, and outputted to a connected oscilloscope through its RX lines.

*Note that between the Signal Generator and MCB and the MCB and Oscilloscope are DC Blocks which need to be separately obtained.

Closeup of MCB Interface and Functional Ports

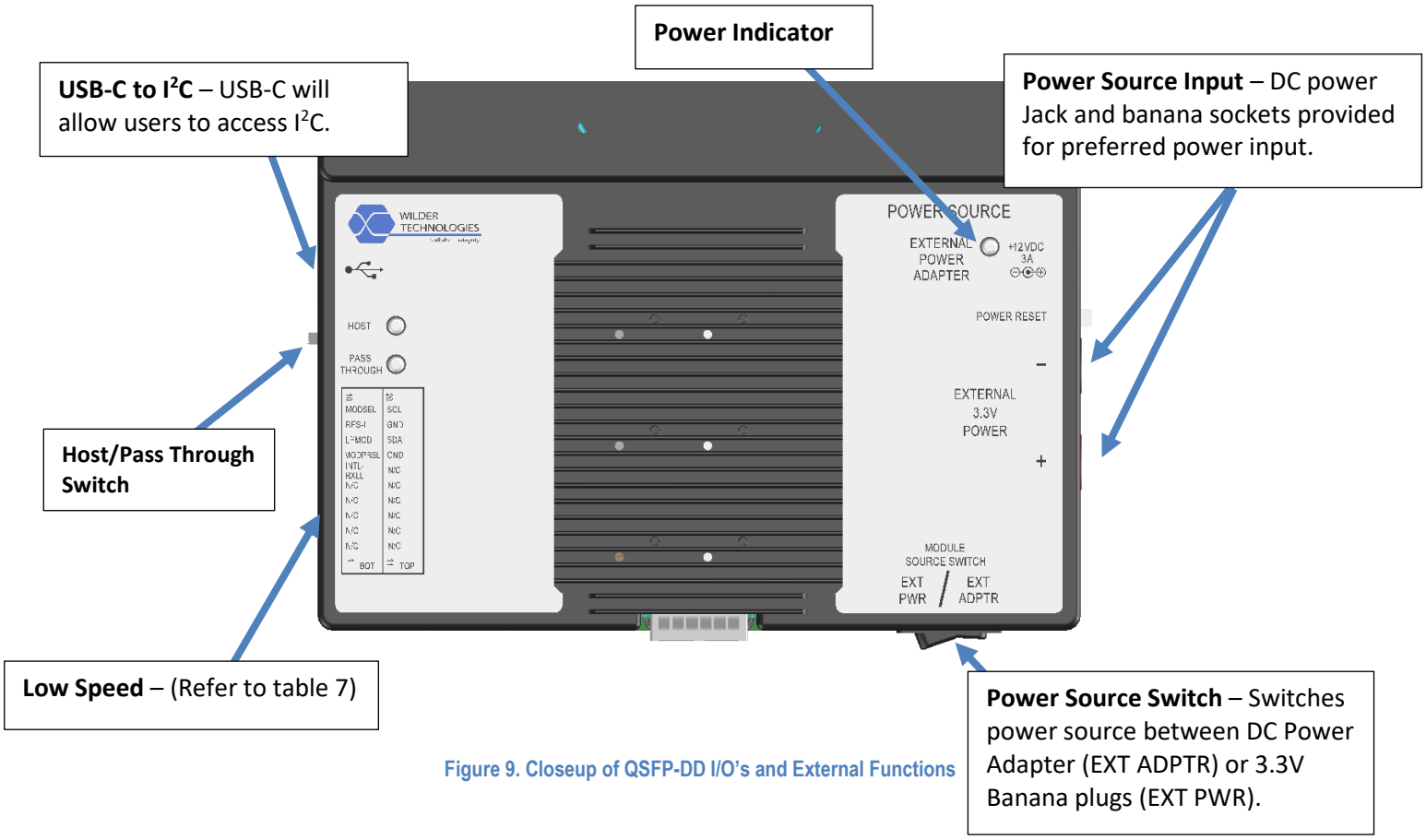


Figure 9. Closeup of QSFP-DD I/O's and External Functions

The **Module Source Switch** allows a user to select which power input supplies the 3.3V QSFP-DD connector pins. With the switch in the **EXT PWR** position the module will take power from the **External 3.3V Power** connectors (banana jacks). With the switch in the **EXT ADPTR** position the module will take power from the **External Power Adapter** (+12VDC, 60-Watt Power Adapter). The 12V to 3.3V regulator can supply up to 8 amps to the module. Note: The external power adapter is always required even when switched to External Power, to run software applications.

The **Power Reset** circuit breaker will trip if power consumption exceeds 38W while in **EXT ADPTR** Mode. When tripped, a **Power Reset** button will pop out of the MCB casing. The **Power Reset** button must be pushed back into the MCB casing to allow power into the MCB once again.

Note: The user should provide an external current limiter, fuse, or breaker to prevent any possible short circuit damage while in **EXT PWR** mode. In EXT PWR mode, the MCB **Power Reset** circuit breaker will still trip if there is a short circuit within the MCB host emulation circuitry.

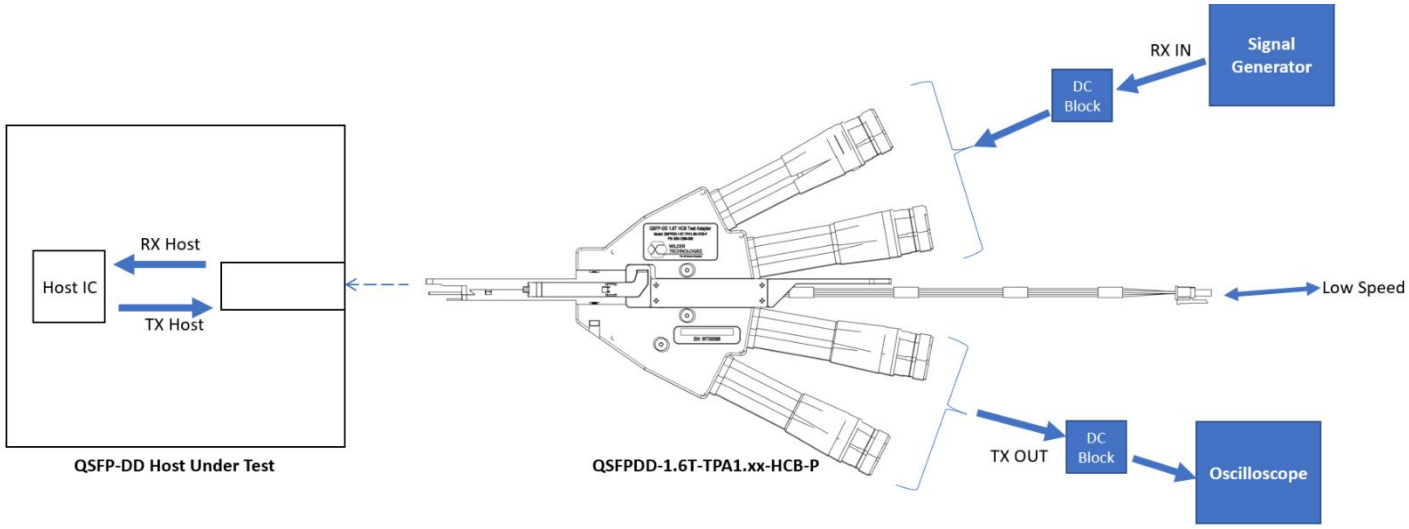
The **Host/Pass Through Switch** switches between a host emulation mode and a signal passthrough mode. In host emulation mode, the MCB can communicate with the Wilder Technologies CMIS GUI software that is running on an external PC. This allows the user to monitor and control the data registers of the system. In signal passthrough mode, the MCB will connect all low-speed signals to the low-speed header on the side of the MCB. This gives users access to all low-speed signals for their own monitoring and control. Note: CMIS GUI monitoring and control will be disabled in passthrough mode.

The **USB-C to I2C –** CMIS (Common Management Interface Specification) is a standardized way for manufacturers to define what data goes in registers based on Two Wire Interface. To access this information, use the Wilder Technologies CMIS GUI software. Installation and instructions are in the CMIS GUI user manual (910-0070-000). This manual is provided on USB Flash Drive supplied with the QSFP-DD MCB product.

The **VCC Sense** SMA connector (Cable interface at the rear of the unit) can be used to precisely monitor supply voltages just before the QSFP-DD primary connector contact-lead pads.

QSFP-DD-1.6T-HCB

QSFP-DD-1.6T-TPA1.XX-HCB-P is used to test a QSFP-DD Host:



*DC blocks are accessories and are not provided with this product

Figure 10. QSFP-DD 1.6T HCB User Model

In this configuration, the QSFP-DD 1.6T HCB is used to test a QSFP-DD Host.

An RX signal, inputted from a connected Signal Generator, is transferred through the HCB's RX lines into the QSFP-DD host under test. The Host responds by outputting TX signals which are transferred through the HCB, out through its TX lines into a connected Oscilloscope for measurement.

*Note that between the Signal Generator and MCB and the MCB and Oscilloscope are DC Blocks which need to be separately obtained.

Note: In the case where the laboratory source or load is not used in the test, each unused signal line must be replaced with RF terminators. Some RF terminators can be optionally purchased from Wilder Technologies.

Channel De-Embedding

The QSFP-DD TX and RX channels are fully passive. Therefore, calibration compensating for the losses must occur within the test instrumentation that drives the QSFP-DD Receivers or looks at the response of the QSFP-DD Transmitters.

The QSFP-DD TPA's have Touchstone S4P files for de-embedding the electrical length and losses within the TPA up to the QSFP-DD connector interface pads. (Contact Wilder Technologies, support@wilder-tech.com, to obtain a copy of the S4P files.) The Touchstone S4P files enable the test engineer to compensate for the last four of the following six repeatable, systematic errors that occur when moving the reference plane:

- Signal leakage effects: *Directivity errors*
- Signal leakage effects: *Crosstalk errors*
- Reflection effects: *Source Impedance Mismatching errors*
- Reflection effects: *Load Impedance Mismatching errors*
- Bandwidth effects: *Receiver Transmission in Test Equipment errors*
- Bandwidth effects: *Receiver Reflection-tracking in Test Equipment errors*

These errors are corrected on each port. Refer to the Instrument Manual for instructions on the instrument's specific de-embedding process.

NOTE: The reference plane is the boundary, both physically and electrically, between the calibrated and uncalibrated portions of the circuit. Everything outside the reference plane is considered part of the DUT. Any instrument that does not use calibration or de-embedding of the test fixture defines the DUT as the total of externally connected components. If the de-embedding file is not used, all of the QSFP-DD TPA and associated coaxial cables, as well as cables connecting the TPA assembly to the test instrument, would be a part of the DUT.

Non-repeatable errors, such as drift or random errors, can be reduced but not corrected. Drift errors aggregate over time or with environmental changes such as temperature shift. To eliminate drift errors, perform an instrumentation-level calibration.

A random error cannot be corrected through calibration since the error occurred randomly. Random errors are typically associated with either test instrument noise or test repeatability problems. Reduce test instrument noise by increasing source power, lowering the IF bandwidth, or averaging results over multiple sweeps. Reduce test repeatability problems through the use of a torque wrench or, again, by averaging over multiple sweeps.

Mechanical and Environmental Specifications

NOTE: All specifications in this manual are subject to change.

Table 3. General Specifications

ITEM	DESCRIPTION
Usage Environment	Controlled indoor environment
HCB (Plug) Test Adapter Length (w/ 1.85mm coax)	304.8 mm (12.0 inches) (Characteristic)
MCB (Receptacle) Test Adapter Length (w/ 1.85mm coax)	350.2 mm (13.8 inches)
Receptacle Test Adapter Housing Dimensions	154.94 x 151.1 x 35.6 mm (6.1 x 5.95 x 1.4 inches) (L, W, H)
Operating Temperature	0°C to +55°C (32°F to +131°F) (Characteristic)
Storage Temperature	-40°C to +70°C (-40°F to +158°F) (Characteristic)

QSFP-DD-1.6T-TPA1.XX-HCB-P (Plug)

The Plug-Type QSFP-DD-1.6T-TPA1.XX-HCB-P test adapter provides thirty-two 1.85mm or 1.00mm (High-Speed) connectors (eight lanes of primary differential signals). Color coded heat shrink labels mark each cable or connector. The following figure refers to the pin-description tables for the QSFPDD-1.6T-TPA1.XX-HCB-P (Plug) test adapters.

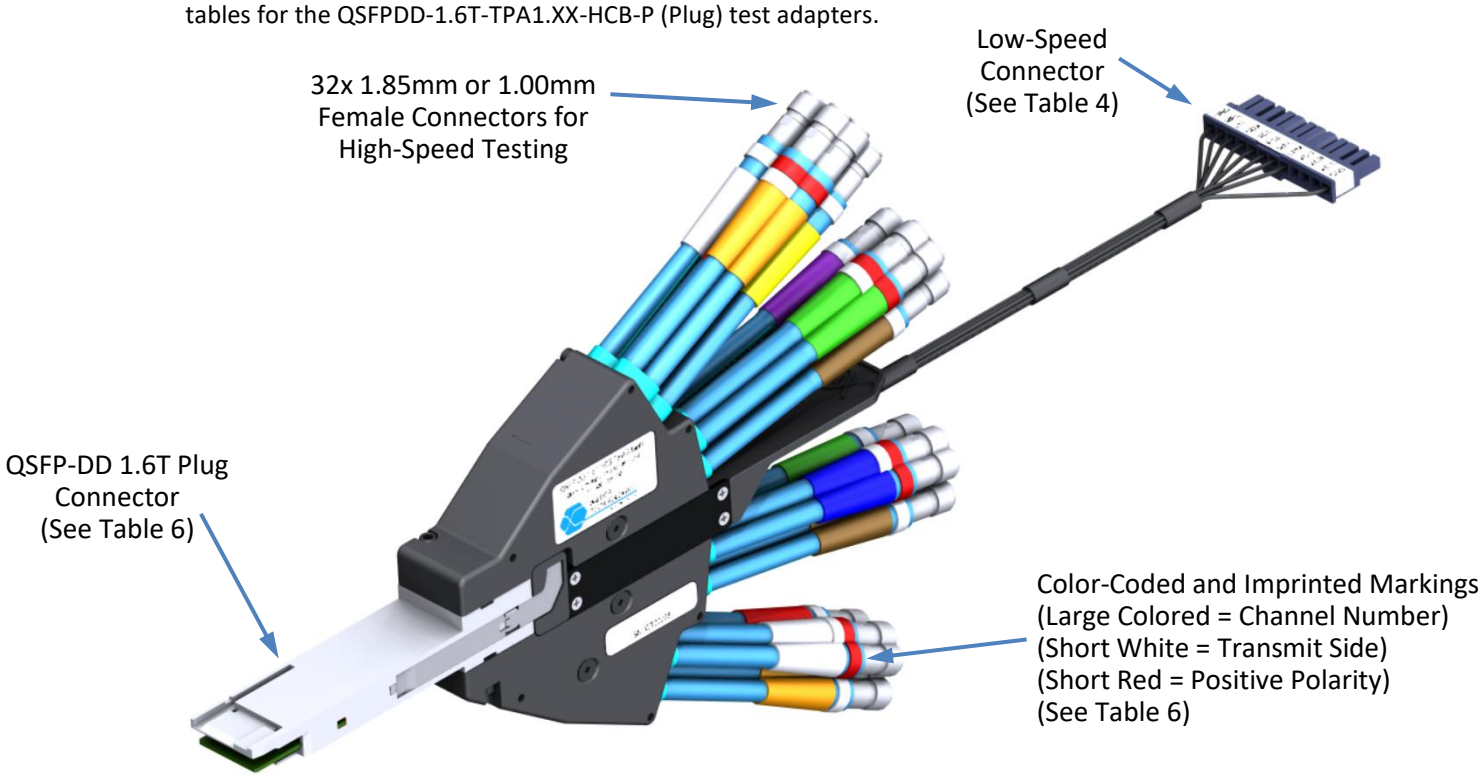


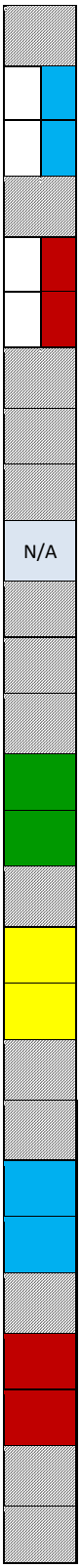
Figure 11. Cable Connectors (QSFP-DD-1.6T-TPA1.85-HCB-P shown).

Table 4. QSFP-DD-1.6T-TPA1.XX-HCB-P: 12-Position Cable Connector (Low-Speed).

LABEL	PIN NO.	COLOR ID FOR HCB	DESCRIPTION
GND	Pin 1	Black	Signal (RF Ground) and Supply (Power) Common
MPL	Pin 2	Black	Module Present
ITL	Pin 3	Black	Interrupt
SDA	Pin 4	Black	SDA, I^2C Data for DDC
SCL	Pin 5	Black	SCL, I^2C Clock for DDC
RSL	Pin 6	Black	Module Reset
MSL	Pin 7	Black	Module Select
LPM	Pin 8	Black	Low Power Mode
VCC	Pin 9	Not Present	Vcc1 module power supply (+3.3V)
VCR	Pin 10	Not Present	VccR, module receiver power supply (+3.3V)
VCT	Pin 11	Not Present	VccT, module transmitter power supply (+3.3V)
GND	Pin 12	Black	Signal (RF Ground) and Supply (Power) Common

Table 5. QSFP-DD-1.6T-TPA1.XX-HCB-P (Plug) Pin Assignements

Pin Description	Connector Pin Number	Destination (HCB)	Color ID for Data Line Polarity	Color Identification (HCB)
Ground	1	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation
Tx2n	2	Tx2-	N/A	White/Blue
Tx2p	3	Tx2+	Red	White/Blue
Ground	4	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation
Tx4n	5	Tx4-	N/A	White/Red
Tx4p	6	Tx4+	Red	White/Red
Ground	7	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation
MSL	8	P2 Pin 7	N/A	Black Insulation
RSL	9	P2 Pin 6	N/A	Black Insulation
VccR	10	No Present/Connected	N/A	No Present/Connected
SCL	11	P2 Pin 5	N/A	Black Insulation
SDA	12	P2 Pin 4	N/A	Black Insulation
Ground	13	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation
Rx3p	14	Rx3+	Red	Green
Rx3n	15	Rx3-	N/A	Green
Ground	16	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation
Rx1p	17	Rx1+	Red	Yellow
Rx1n	18	Rx1-	N/A	Yellow
Ground	19	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation
Ground	20	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation
Rx2n	21	Rx2-	N/A	Blue
Rx2p	22	Rx2+	Red	Blue
Ground	23	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation
Rx4n	24	Rx4-	N/A	Red
Rx4p	25	Rx4+	Red	Red
Ground	26	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation
MPL	27	P2 Pin 2	N/A	Black Insulation



ITL	28	P2 Pin 3	N/A	Black Insulation	
VccT	29	No Present/Connected	N/A	Not Present/Connected	N/A
Vcc1	30	No Present/Connected	N/A	No Present/Connected	N/A
LPM	31	P2 Pin 8	N/A	Black Insulation	
Ground	32	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation	
Tx3p	33	Tx3+	Red	White/Green	
Tx3n	34	Tx3-	N/A	White/Green	
Ground	35	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation	
Tx1p	36	Tx1+	Red	White/Yellow	
Tx1n	37	Tx1-	N/A	White/Yellow	
Ground	38	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation	
Ground	39	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation	
Tx6n	40	Tx6-	N/A	White/Brown	
Tx6p	41	Tx6+	Red	White/Brown	
Ground	42	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation	
Tx8n	43	Tx8-	N/A	White/White	
Tx8p	44	Tx8+	Red	White/White	
Ground	45	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation	
Reserved	46	Not Present/Connected	N/A	No Present/Connected	N/A
VS1	47	No Present/Connected	N/A	No Present/Connected	N/A
VccRx1	48	No Present/Connected	N/A	No Present/Connected	N/A
VS2	49	No Present/Connected	N/A	No Present/Connected	N/A
VS3	50	No Present/Connected	N/A	No Present/Connected	N/A
Ground	51	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation	
Rx7p	52	Rx7+	Red	Violet	
Rx7n	53	Rx7-	N/A	Violet	
Ground	54	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation	

Rx5p	55	Rx5+	Red	Orange	
Rx5n	56	Rx5-	N/A	Orange	
Ground	57	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation	
Ground	58	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation	
Rx6n	59	Rx6-	N/A	Brown	
Rx6p	60	Rx6+	Red	Brown	
Ground	61	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation	
Rx8n	62	Rx8-	N/A	White	
Rx8p	63	Rx8+	Red	White	
Ground	64	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation	
NC	65	No Present/Connected	N/A	Not Present/Connected	N/A
Reserved	66	No Present/Connected	N/A	No Present/Connected	N/A
VccTx1	67	No Present/Connected	N/A	No Present/Connected	N/A
Vcc2	68	No Present/Connected	N/A	No Present/Connected	N/A
ePPS	69	No Present/Connected	N/A	No Present/Connected	N/A
Ground	70	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation	
Tx7p	71	Tx7+	Red	White/Violet	
Tx7n	72	Tx7-	N/A	White/Violet	
Ground	73	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation	
Tx5p	74	Tx5+	Red	White/Orange	
Tx5n	75	Tx5-	N/A	White/Orange	
Ground	76	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation	

QSFP-DD-1.6T-TPA1.XX-MCB-R (Receptacle) Cable Pin-out

The QSFP-DD-1.6T-TPA1.XX-MCB-R test adapter provides thirty-two 1.85mm or 1.00mm connectors (eight lanes of primary differential signals) to access all QSFP-DD high-speed signals. Labels clearly mark each cable or connector. The following figure refers to the pin-description tables for the QSFP-DD-1.6T-TPA1.XX-MCB-R (Receptacle) test adapter.

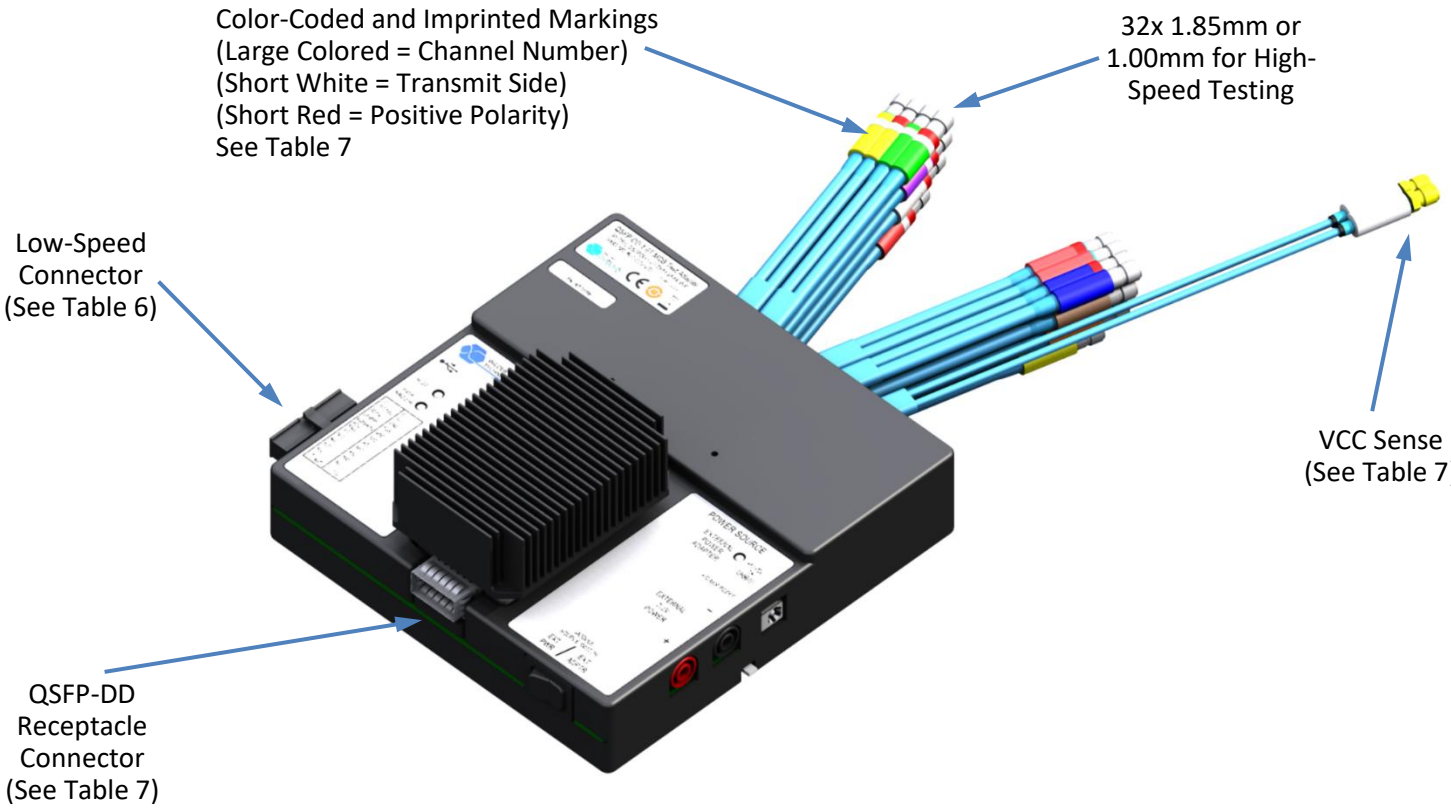


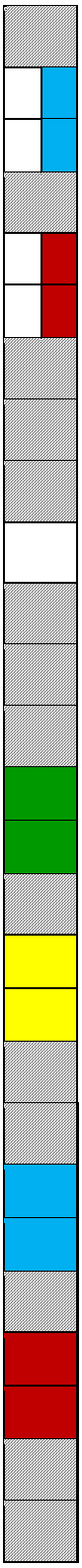
Figure 12. Cable Connectors (QSFP-DD-1.6T-TPA1.XX-MCB-R shown)

Table 6. QSFP-DD-1.6T-TPA1.XX-MCB-R (CONN6) 20-Position Fixture-Mounted Connector (Low-Speed)

LABEL	PIN NO.	DESCRIPTION
N/C	Pin 1	No Connection
N/C	Pin 2	No Connection
N/C	Pin 3	No Connection
N/C	Pin 4	No Connection
N/C	Pin 5	No Connection
INTL-RXLL	Pin 6	Interrupt
MODPRSL	Pin 7	Module Present
LPMOD/TxDis	Pin 8	Low Power Mode Optional TX Disable
RESET-L	Pin 9	Module Reset
MODSEL	Pin 10	Module Select
N/C	Pin 11	No Connection
N/C	Pin 12	No Connection
N/C	Pin 13	No Connection
N/C	Pin 14	No Connection
N/C	Pin 15	No Connection
N/C	Pin 16	No Connection
GND	Pin 17	Signal (RF Ground) and Supply (Power) Common
SDA	Pin 18	SDA, I^2C Data
GND	Pin 19	Signal (RF Ground) and Supply (Power) Common
SCL	Pin 20	SCL, I^2C Clock

Table 7. QSFP-DD-1.6T-TPA1.XX-MCB-R (Receptacle) Pin Assignements

Pin Description	Connector Pin Number	Destination (MCB)	Color ID for Data Line Polarity	Color Identification (MCB)
Ground	1	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation
Tx2n	2	Tx2-	N/A	White/Blue
Tx2p	3	Tx2+	Red	White/Blue
Ground	4	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation
Tx4n	5	Tx4-	N/A	White/Red
Tx4p	6	Tx4+	Red	White/Red
Ground	7	Coax Shield and Conn 6 Pin 17,19	N/A	Black Insulation
ModSelL	8	Low-Speed Conn6 Pin 10 (MODSEL)	N/A	Black Insulation
ResetL	9	Low-Speed Conn6 Pin 9 (RESETL)	N/A	Black Insulation
VccRx	10	Int/Ext Supply SMA (VCCR Sense)	N/A	White
SCL	11	Low-Speed Conn6 Pin 20 (SCL)	N/A	Black Insulation
SDA	12	Low-Speed Conn6 Pin 18 (SDA)	N/A	Black Insulation
Ground	13	Coax Shield and Conn 6 Pin 17, 19	N/A	Black Insulation
Rx3p	14	Rx3+	Red	Green
Rx3n	15	Rx3-	N/A	Green
Ground	16	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation
Rx1p	17	Rx1+	Red	Yellow
Rx1n	18	Rx1-	N/A	Yellow
Ground	19	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation
Ground	20	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation
Rx2n	21	Rx2-	N/A	Blue
Rx2p	22	Rx2+	Red	Blue
Ground	23	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation
Rx4n	24	Rx4-	N/A	Red
Rx4p	25	Rx4+	Red	Red
Ground	26	Coax Shield and Conn 6 Pin 17, 19	N/A	Black Insulation
ModPrsL	27	Low-Speed Conn6 Pin 7 (MODPRSL)	N/A	Black Insulation



IntL/RxLOS	28	Low-Speed Conn6 Pin 6 (INTL)	N/A	Black Insulation	
VccTx	29	Int/Ext Supply Fltr SMA (VCCT Sense)	N/A	White	
Vcc1	30	Int/Ext Supply (Filtered)	N/A	N/A	N/A
LPMode/TxDis	31	Low-Speed Conn6 Pin 8 (LPMODE)	N/A	Black Insulation	
Ground	32	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation	
Tx3p	33	Tx3+	Red	White/Green	
Tx3n	34	Tx3-	N/A	White/Green	
Ground	35	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation	
Tx1p	36	Tx1+	Red	White/Yellow	
Tx1n	37	Tx1-	N/A	White/Yellow	
Ground	38	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation	
Ground	39	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation	
Tx6n	40	Tx6-	N/A	White/Brown	
Tx6p	41	Tx6+	Red	White/Brown	
Ground	42	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation	
Tx8n	43	Tx8-	N/A	White/White	
Tx8p	44	Tx8+	Red	White/White	
Ground	45	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation	
P/VS4	46	No Present/Connected	N/A	No Present/Connected	N/A
P/VS1	47	No Present/Connected	N/A	No Present/Connected	N/A
VccRx1	48	Int/Ext Supply SMA (VCCR Sense)	N/A	White	
P/VS2	49	No Present/Connected	N/A	No Present/Connected	N/A
P/VS3	50	No Present/Connected	N/A	No Present/Connected	N/A
Ground	51	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation	
Rx7p	52	Rx7+	Red	Violet	
Rx7n	53	Rx7-	N/A	Violet	
Ground	54	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation	
Rx5p	55	Rx5+	Red	Orange	
Rx5n	56	Rx5-	N/A	Orange	

Ground	57	Coax Shield and Conn6 Pin 1719	N/A	Black Insulation	
Ground	58	Coax Shield and P2 Pin 1, 12	N/A	Black Insulation	
Rx6n	59	Rx6-	N/A	Brown	
Rx6p	60	Rx6+	Red	Brown	
Ground	61	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation	
Rx8n	62	Rx8-	N/A	White	
Rx8p	63	Rx8+	Red	White	
Ground	64	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation	
NC	65	No Present/Connected	N/A	No Present/Connected	N/A
Reserved	66	No Present/Connected	N/A	No Present/Connected	N/A
VccTx1	67	Int/Ext Supply Filter SMA (VCCT Sense)	N/A	White	
Vcc2	68	Int/Ext Supply (Filtered)	N/A	N/A	N/A
ePPS/Clock	69	No Present/Connected	N/A	No Present/Connected	N/A
Ground	70	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation	
Tx7p	71	Tx7+	Red	White/Violet	
Tx7n	72	Tx7-	N/A	White/Violet	
Ground	73	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation	
Tx5p	74	Tx5+	Red	White/Orange	
Tx5n	75	Tx5-	N/A	White/Orange	
Ground	76	Coax Shield and Conn6 Pin 17, 19	N/A	Black Insulation	

Electrical Responses

Documented in the following pages are the electrical responses of the Wilder Technologies QSFP-DD 1.6T TPAs. HCB loss, MCB loss, and MTF response data is shown. The following data is pending upon ratification of the final specification: ICN, ERL, and other electrical responses and limits.

Wilder QSFP-DD 1.6T HCB Response

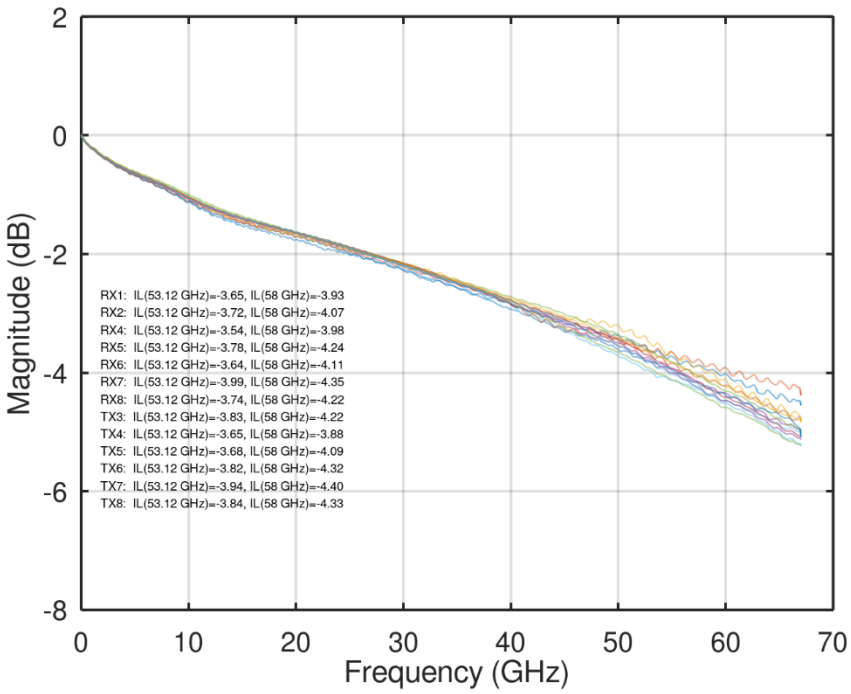


Figure 13. Plot of QSFP-DD 1.6T HCB Insertion Loss

The loss of the HCB up to but excluding the connector and its associated PCB pads is plotted in Figure 13. Note that the IEEE 802.3dj™/D1.2 specification states that the difference between reference and true HCB response should be accounted for in the measurement.

Wilder QSFP-DD 1.6T MCB Response

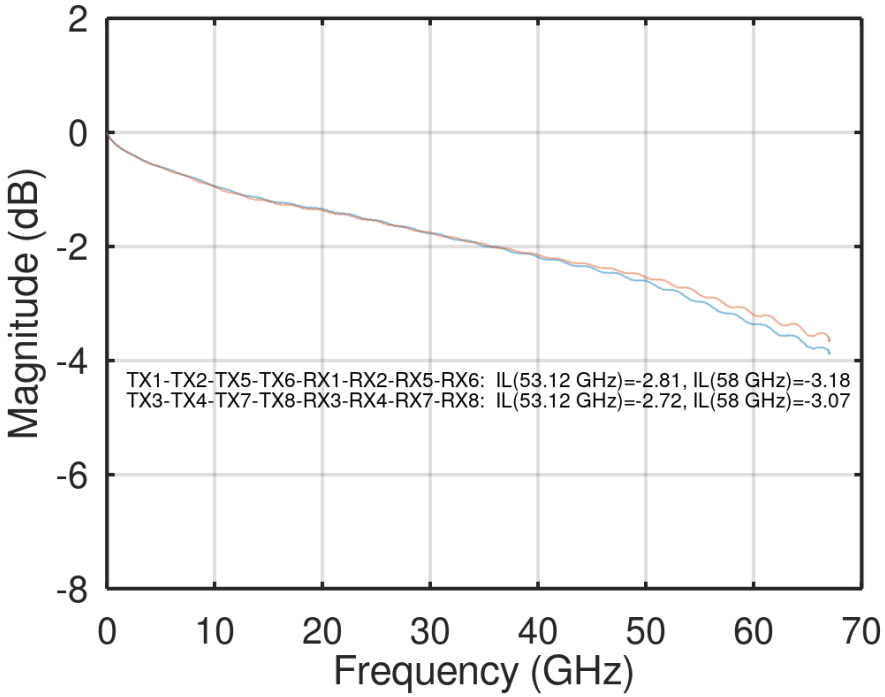


Figure 14. Plot of QSFP-DD 1.6T MCB Insertion Loss

The loss of the MCB up to but excluding the connector and its associated PCB pads is plotted in Figure 14. Note that the IEEE 802.3dj™/D1.2 specification states that the difference between reference and MCB response should be accounted for in the measurement.

Wilder QSFP-DD 1.6T Typical MTF Response

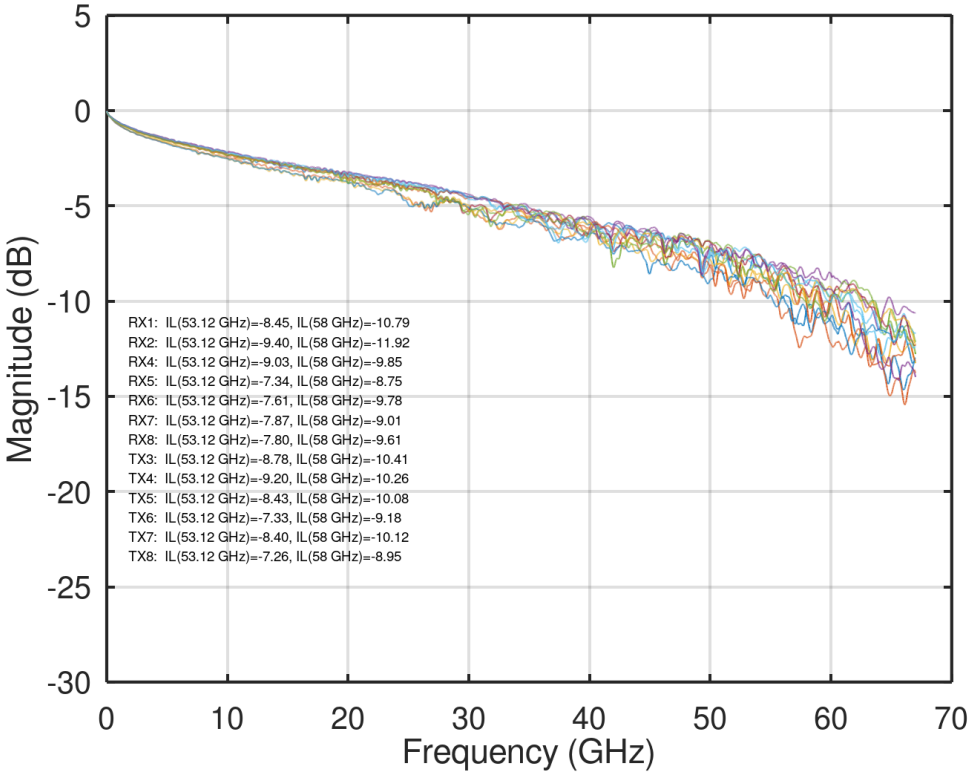


Figure 15. Plot of QSFP-DD 1.6T Mated Differential Insertion Loss Response

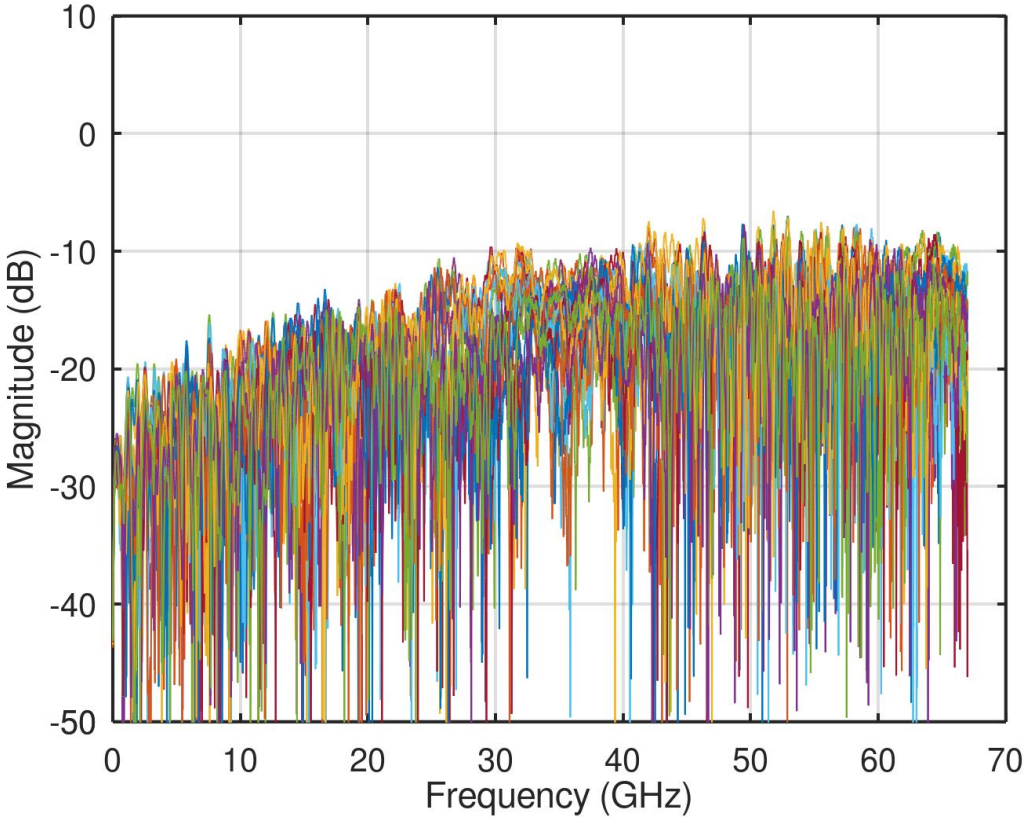


Figure 16. Plot of QSFP-DD 1.6T Mated Differential Return Loss Response

MTF RLoss is shown for information only.

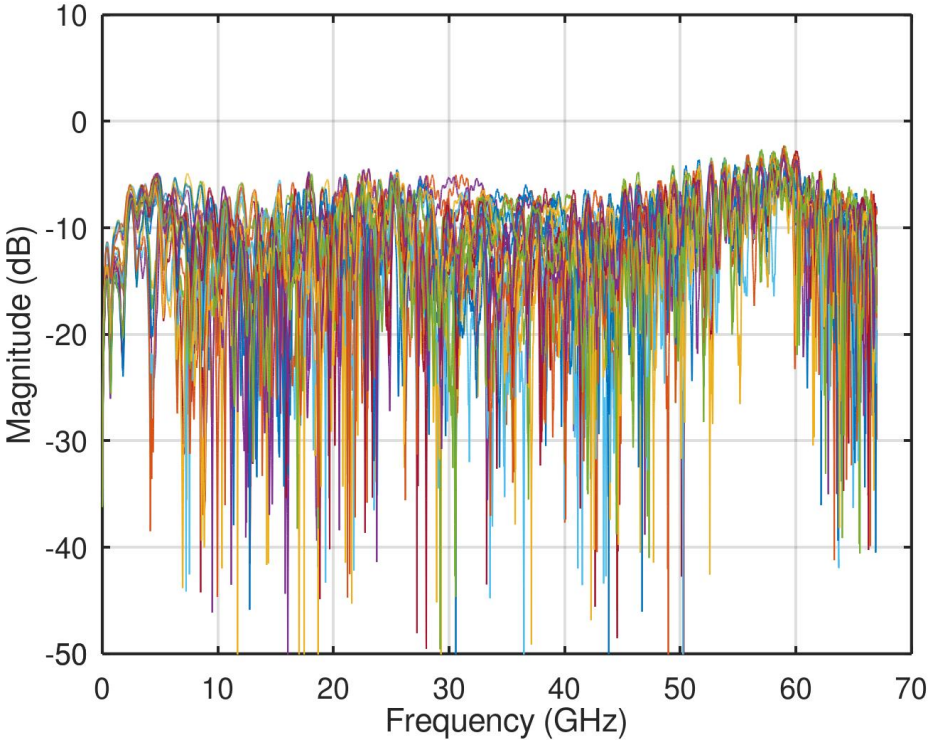


Figure 17. Plot of QSFP-DD 1.6T MTF Common Mode Return Loss

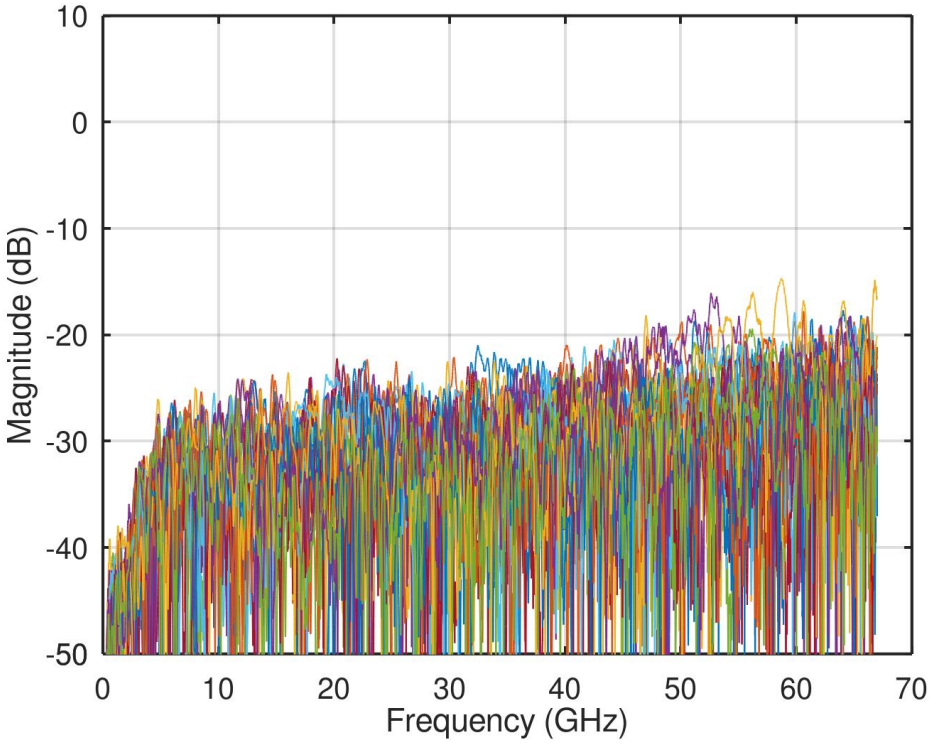


Figure 18. Plot of QSFP-DD 1.6T MTF Conversion Return Loss

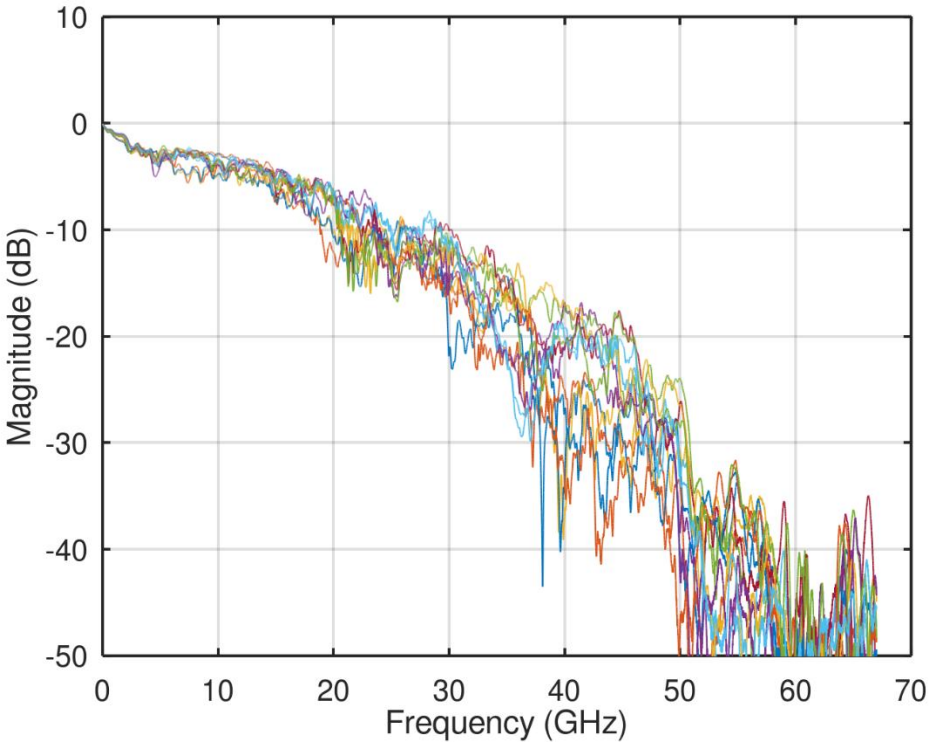


Figure 19. Plot of QSFP-DD 1.6T MTF Common Mode Return Loss

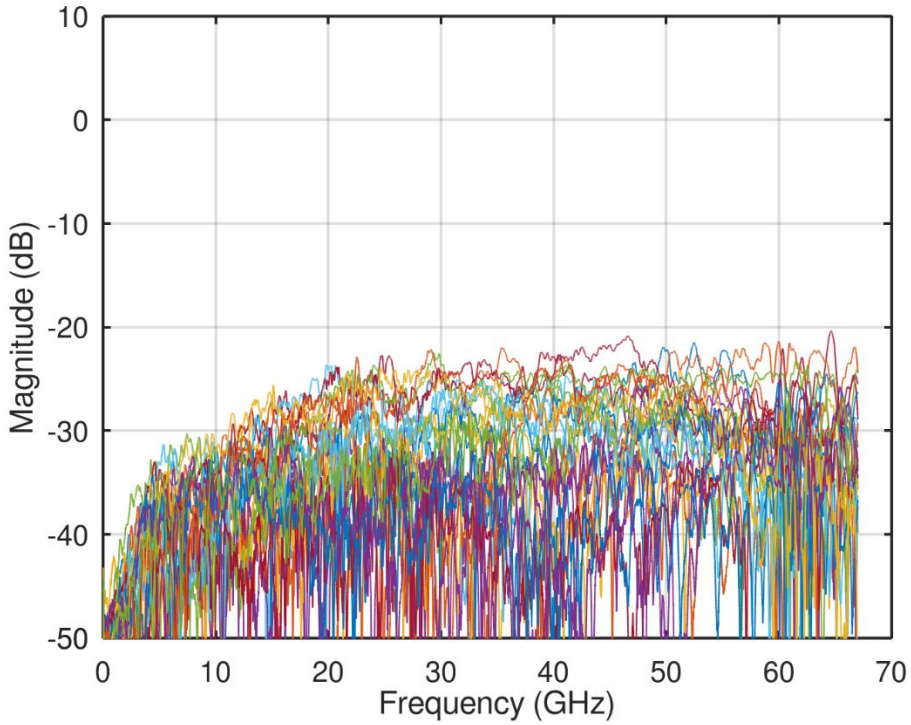


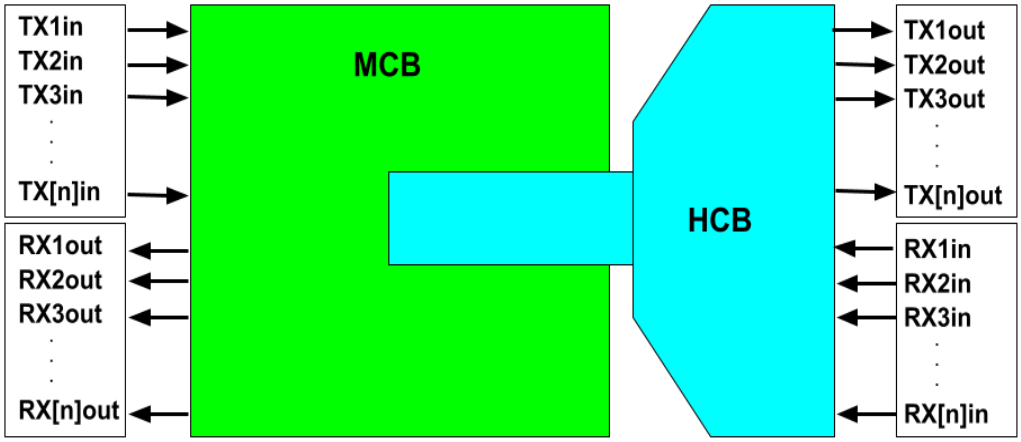
Figure 20. Plot of QSFP-DD 1.6T MTF Conversion Insertion Loss

Wilder QSFP-DD 1.6T ICN

TX victim is on HCB side and aggressors for TX victim are TX1in-TX[n]in on MCB (excluding thru channel) and TX1in-TX[n]in on MCB which make up the FEXT and NEXT responses, respectively.

RX victim is on MCB side and aggressors for RX victim are RX1in-RX[n]in on HCB (excluding thru channel) and TX1in-TX[n]in on MCB which make up the FEXT and NEXT responses, respectively.

For each victim, all FEXT aggressors are power summed, and all NEXT aggressors are power summed then each are integrated as outlined in the DJ specification. Both single valued integrated noise levels are then added RSS to give the total ICN value.



Compliance with Environmental Legislation

Wilder Technologies, LLC, is dedicated to complying with the requirements of all applicable environmental legislation and regulations, including appropriate recycling and/or disposal of our products.

WEEE Compliance Statement

The European Union adopted Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE), with requirements that went into effect August 13, 2005. WEEE is intended to reduce the disposal of waste from electrical and electronic equipment by establishing guidelines for prevention, reuse, recycling and recovery.

Wilder Technologies has practices and processes in place to conform to the requirements in this important Directive.

In support of our environmental goals, effective January 1st, 2009 Wilder Technologies, LLC has partnered with EG Metals Inc. – Metal and Electronics Recycling of Hillsboro, Oregon, www.egmetalrecycling.com, to recycle our obsolete and electronic waste in accordance with the European Union Directive 2002/96/EC on waste electrical and electronic equipment ("WEEE Directive").

As a service to our customers, Wilder Technologies is also available for managing the proper recycling and/or disposal of all Wilder Technologies products that have reached the end of their useful life. For further information and return instructions, contact support@wilder-tech.com.

Compliance To RoHS 2 Substance Restrictions

Wilder Technologies, LLC certifies that the parts described in this document are compliant to the substance restrictions of Directive 2011/65/EU of the European Parliament, and of the Council of 8 June, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS 2 Directive), prohibiting the use in homogeneous materials in excess of the listed maximum concentration value, except in cases where use is allowed by applicable exemptions listed in Annex III and Annex IV of the Directive.

Compliance with RoHS 2 has been verified through internal controls at design and production sites, including establishment of processes for specifying and controlling materials and segregation of non-compliant parts, receipt of supplier declarations of compliance and/or analytical test.

Glossary of Terms

TERMINOLOGY	DEFINITION
Aggressor	A signal imposed on a system (i.e., cable assembly) to measure response on other signal carriers.
Decibel (dB)	Ten times the common logarithm (i.e. log10) of the ratio of relative powers.
Far-end crosstalk or FEXT	Crosstalk that is propagated in a disturbed channel in the same direction as the propagation of a signal in the aggressor channel. The terminals of the aggressor channel and the victim channel are usually close to each other.
Informative	The designation of a test that is not required for compliance.
Insertion loss	The ratio, expressed in dB, of incident power to delivered power.
Near-end crosstalk or NEXT	Crosstalk that is propagated in a disturbed channel in the opposite direction as the propagation of a signal in the aggressor channel. The terminals of the aggressor channel and the victim channel are usually close to each other.
Normative	The designation of a test that is required for compliance.
Return Loss	The ratio, expressed in dB, of incident power to reflected power.
QSFP-DD	224 Gbps PAM4, 8X Pluggable Transceiver (Quad Small Form-factor Pluggable Double Density)
QSFP-DD Host	The QSFP-DD Host is the fixed end of the connection supporting IEEE 802.3dj™/D1.2.
QSFP-DD Module	The QSFP-DD Module is the moveable end of the connection supporting IEEE 802.3dj™/D1.2.
QSFP-DD TPA	QSFP-DD Test Point Access. A specialized assembly that interfaces to a QSFP-DD host or module and enables access of signals for measurement or stimulation.
Victim	A signal carrier on a system that has a response imposed on it by other signals in the system.

Index

Visit our website at www.wilder-tech.com

Wilder Technologies, LLC
11201 NE 9th St.
Vancouver WA, 98684
Phone: 360-859-3041
Fax: 360-859-3105
www.wilder-tech.com

Document No. 910-0080-000 Rev. A
Date Created: 1/23/2025