SFP-DD Test Adapter

User Manual

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Introduction

This user's guide documents the SFP-DD Plug and Receptacle Test Adapters (SFPDD-TPA-HCB-P and SFPDD-TPA-MCB-R). The two test adapter types, shown in Figures 1 and 2, test SFP-DD interface cables, hosts, and modules to the requirements of the SFP-DD MSA, SFP-DD MIS and EEE 802.3ck standards.

Model Numbers:

HCB (Plug):	
SFPDD-TPA2.92-HCB-P	HCB with 2.92mm Female Connector
SFPDD-TPA2.4-HCB-P	HCB with 2.4mm Female Connector
SFPDD-TPA1.85-HCB-P	HCB with 1.85mm Female Connector
MCB (Receptacle):	
SFPDD-TPA2.92-MCB-R	MCB with 2.92mm Female Connector
SFPDD-TPA2.4-MCB-R	MCB with 2.4mm Female Connector
SFPDD-TPA1.85-MCB-R	MCB with 1.85mm Female Connector
MCB With Cooling Module	
SFPDD-TPA2.92-MCB-RC	MCB with 2.92mm Female Connector and Cooling Module
SFPDD-TPA2.4-MCB-RC	MCB with 2.4mm Female Connector and Cooling Module
SFPDD-TPA1.85-MCB-RC	MCB with 1.85mm Female Connector and Cooling Module

The SFP-DD HCB (Plug) and SFP-DD MCB (Receptacle) test adapter assemblies, allow easy access, via high-speed connections, to measure or inject data signals.

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.

SFPDD-TPAxxx-HCB-P

The SFP-DD Host Compliance Test Adapter can be used for testing the compliance of SFP-DD Host Devices to SFP-DD MSA and SFP-DD MIS specifications.

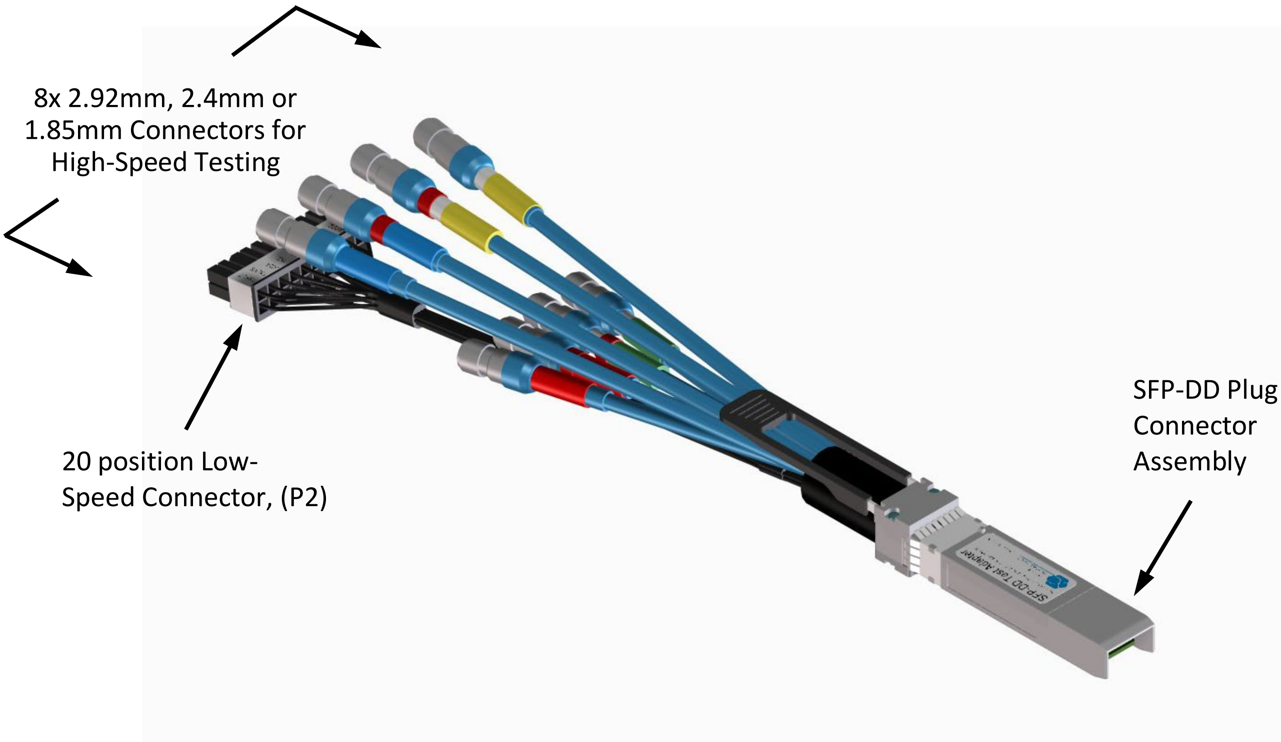

Figure 1. The SFP-DD HCB Test Adapter (Note: The coaxial cables are configuration dependent and may be terminated with different connectors and have different color-coding than what is shown)

NOTE: The metal shell of both the plug (SFP-DD HCB) and receptacle (SFP-DD MCB) connectors tie high-speed ground to chassis ground.

Included with the SFPDD-TPAxxx-HCB-P is a spare Molex plug connector, provided for users to interface with the Low-Speed connection on the HCB. The Molex part numbers for the included spare plug, and contact pins are as follows. Part numbers for the receptacle and it's contact pins, which make up the low-speed connector (P2) are also listed.

20-position MicroFit Receptacle Housing (P2)	Molex PN 43025-2000
Receptacle Female Terminal Pins (P2)	Molex PN 43030-0011
20-position MicroFit Plug Connector (Spare)	Molex PN 43020-2001
Plug Male Contact Pins (Spare)	Molex PN 43031-0011

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

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SFPDD-TPAxxx-MCB-R

The SFP-DD Module Compliance Board can be used for testing the compliance of SFP-DD Module Devices to SFP-DD MSA and SFP-DD MIS specifications.

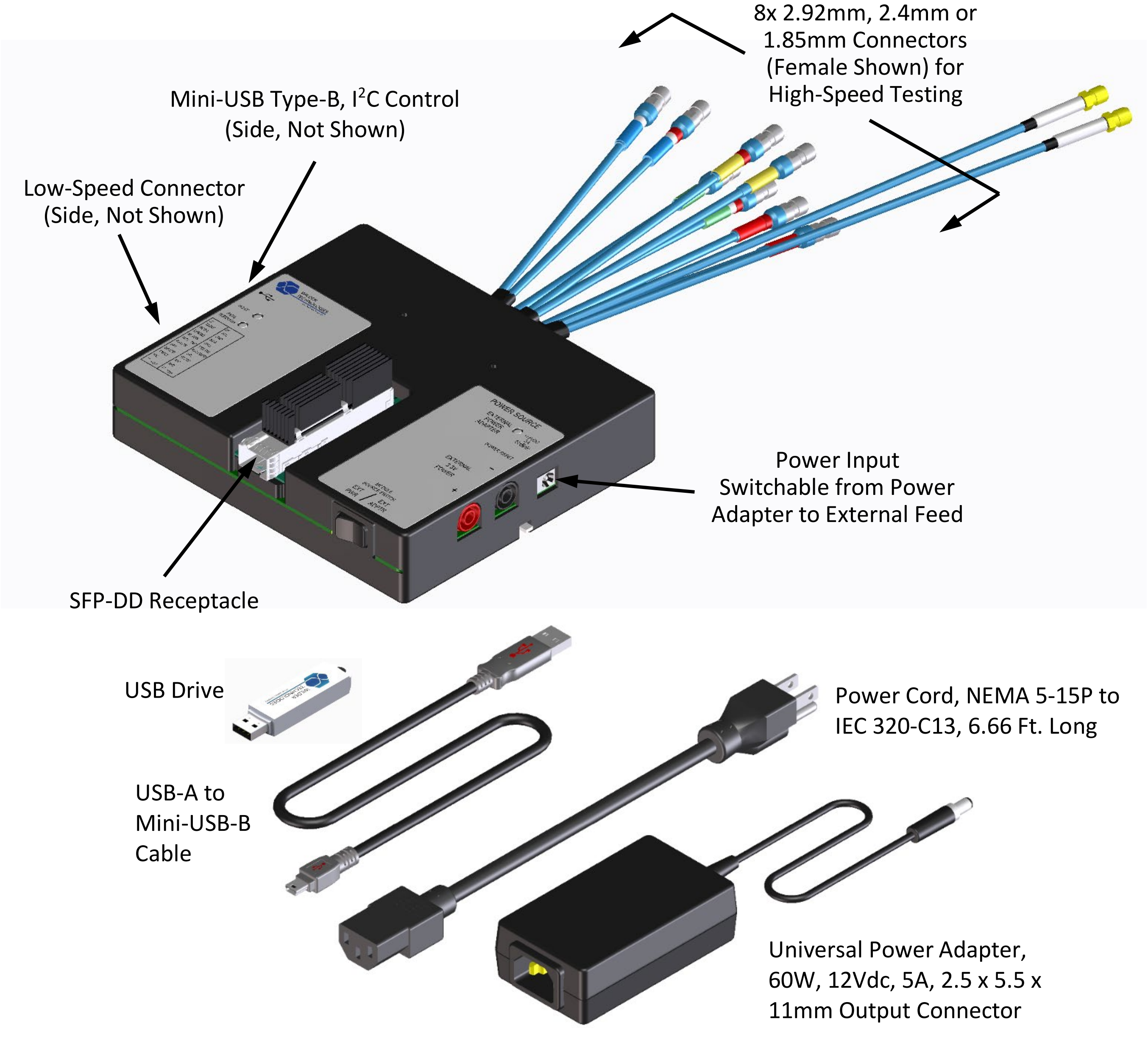


Figure 2. The SFP-DD MCB Test Adapter and its Included cabling (Note: The coaxial cables are configuration dependent and may be terminated with different connectors than what is shown).

Included with the SFPDD-TPAxxx-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 spare receptacle, and contact pins are as follows. The part number for the low-speed connector (header) is also listed.

20-position MicroFit Receptacle Housing (Spare)	Molex PN 43025-2000
Female 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 SFP-DD are normally AC coupled. The SFP-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 Specfications 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
2.4mm	≤10MHz - 50GHz	1.35:1	≤1.25	Centric RF Part Number C0150
2.92mm	≤10MHz - 40GHz	1.3:1	≤1.2	Centric RF Part Number C0140

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 Specfications 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
2.4mm	0 - 50GHz	1.3:1	1W	Centric RF Part Number C505 Pasternack Part Number PE6TR1103
2.92mm	0 - 40GHz	1.2:1	1W	Centric RF Part Number C401 Pasternack Part Number PE6TR1106

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

Cooling Module (Optional Accessory)

The Cooling Module can be installed to the SFP-DD MCB (Receptacle) Test Adapter to increase airflow through a device module (DUT) connector's heat sink and subsequently keep the device module case temperature within recommended ranges (per SFP-DD MSA). The Cooling Module may be required when testing SFP-DD and there is a need to reduce case temperatures lower. The recommended maximum case temperature is 70°C.

The Cooling Module is shipped disassembled from the SFP-DD MCB TPA. To install the cooling module onto the MCB apply the mounting rail supplied with the cooling fan to the top case of 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 and AC Cable is also provided (not shown) with the assembly and plugs into the Cooling Module DC Jack.

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

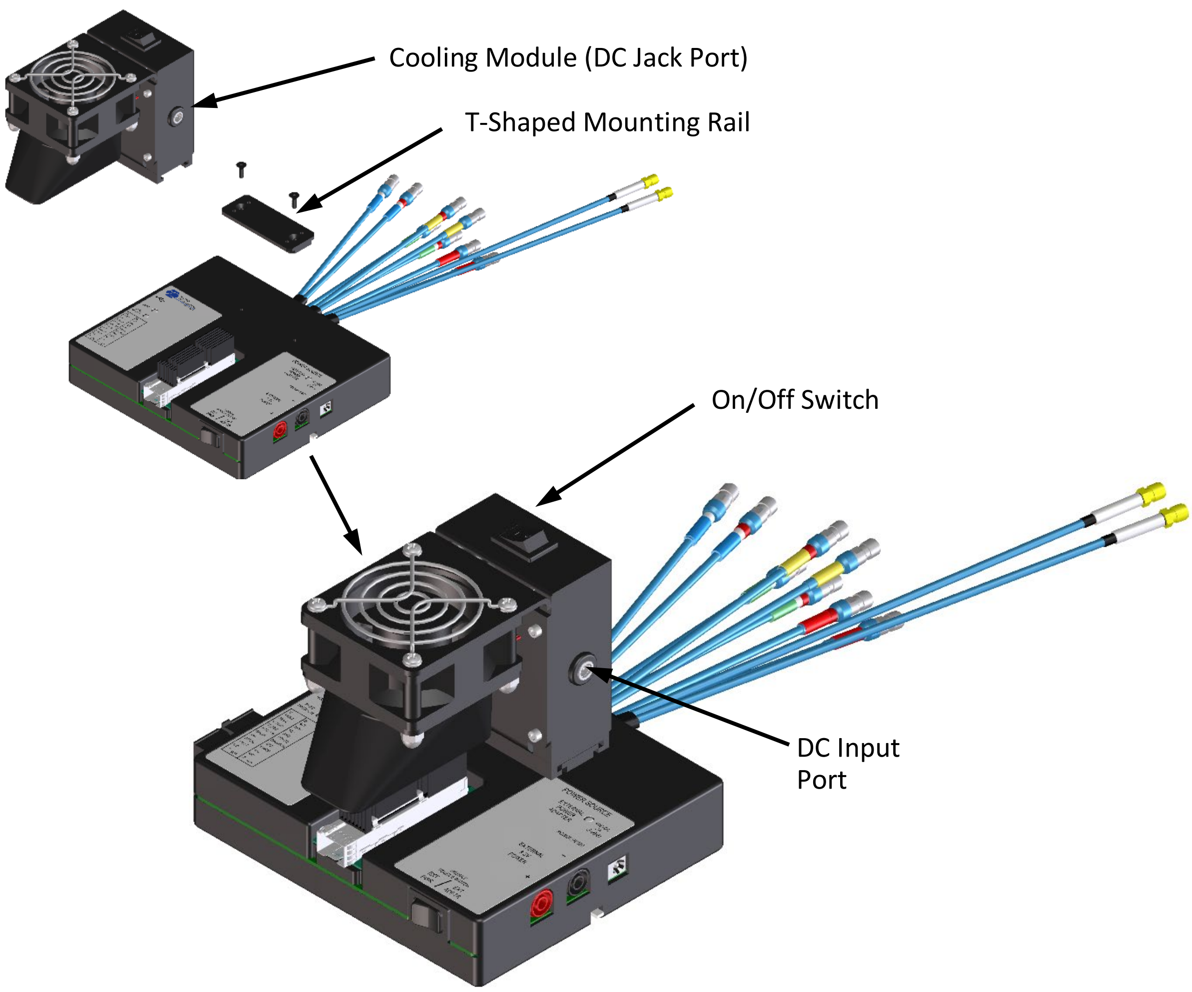


Figure 3. The SFP-DD MCB (Receptacle) Test Adapter with Cooling Module

Thermal Data for SFPDD-TPAxxx-MCB-R

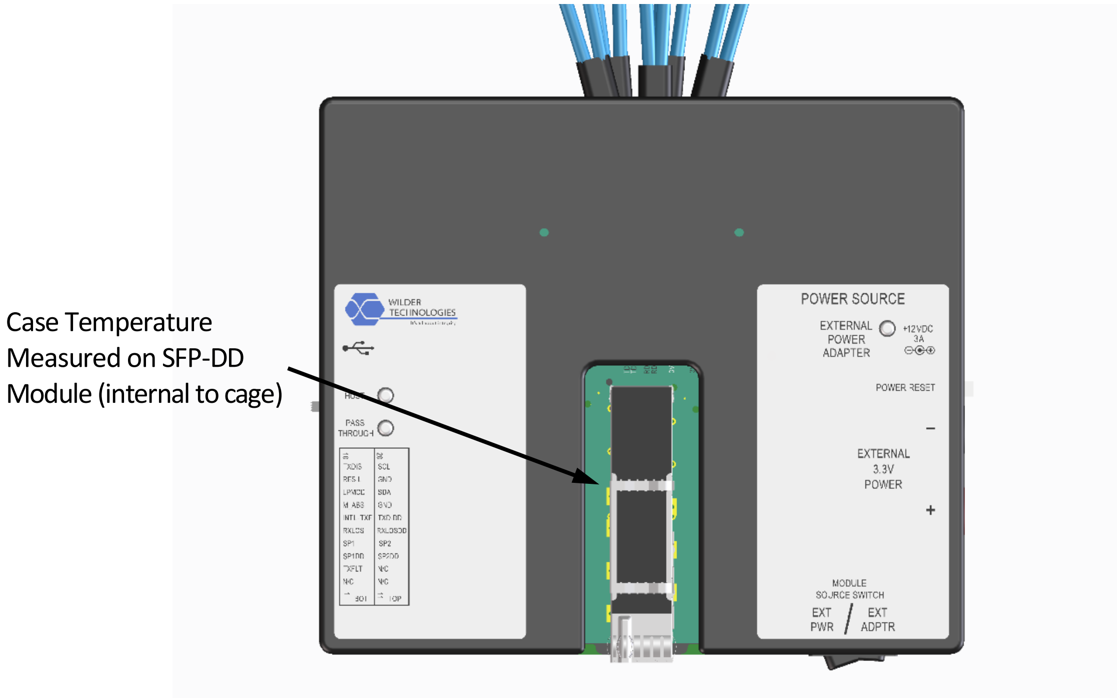


Figure 4. SFP-DD MCB with DUT Temperature locations, Cooling Module not shown

The SFP-DD is designed using the standard high-level finned cage. Table 1 lists the SFP-DD module power classes and their effects on case temperatures and MCB heatsink temperatures. These temperatures were obtained through experimentation by Wilder Technologies. Case and heatsink temperatures without the Cooling Module are included in the table. No Cooling Module temperatures were taken as all measurements were below 70°C maximum, as defined by SFP-DD MSA Standards.

The Cooling Module is recommended at case temperatures greater than 70°C based on SFP-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*).

Table 1. Cooling Module Recommended Use

		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	1.0	31.8	25.9	N/A	N/A	No
2	1.5	38.6	31.2	N/A	N/A	No
3	2.0	45.6	35.6	N/A	N/A	No
4	3.5	53.9	40.0	N/A	N/A	No
5	5.0	60.6	42.8	N/A	N/A	No
6	Res.					Optional
7	Res.					Optional
8	See MSA Spec.					Optional

Based on measurements conducted by Wilder Technologies, the Cooling Module is an optional recommendation for use on the SFP-DD MCB (Receptacle) when testing modules of Power Class 6 or greater (not yet defined by specification). At these power classes, the case temperatures and heatsink temperatures of the SFP-DD MCB may exceed recommended limits (Per MSA and ASTM standards). Thus, the Cooling Module may be required for use to reduce temperatures to be within safe operating ranges.

[1] Temperatures interpolated from experimental data.
[2] "SFP-DD/SFP-DD112/QSFP112 Hardware Specification for SFP Double Density Pluggable Transceivers, Revision 5.1."
[3] "Standard Guide for Heated System Surface Conditions that Produce Contact Burn Injuries (ASTM C1055-20)." American Society for Testing and Materials, Philadelphia, PA.

Product Inspection

Upon receiving the SFP-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 SFP-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 SFP-DD Test Adapter Care and Handling Precautions

The SFP-DD Test Adapter requires 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 SFP-DD TPA's life, observe the following handling precautions:

- **CAUTION 1: Avoid Torque Forces** (Twisting)
  While individual coaxial cables within the test adapter have some rotational freedom, twisting the SFP-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 SFP-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 SFP-DD TPA and cables. Use adjustable elevation stands or apparatus to accurately place and support the SFP-DD TPA.

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

  If the SFP-DD TPA must be turned or twisted to make connection to the DUT, avoid using the SFP-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 SFP-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 SFPDD-TPA to or from the DUT. Pulling directly on the SFPDD-TPA cables or using them to insert the SFPDD-TPA may cause damage.

- **CAUTION 5: Carefully Make High-Speed (2.92mm, 2.4mm, 1.85mm) Connections**
  To connect the SFP-DD TPA High-Speed connectors, follow these steps:

  1. Hold the cable stationary by grasping the cable at the black heat-shrink 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 SFP-DD TPA coaxial cable.

  3. The SFP-DD TPA High-Speed connectors have flats that accept an open-end 1/4-inch or 5/16-inch wrench, depending on configuration. When attaching instrument cables to the SFP-DD TPA, it is recommended that the SFP-DD TPA connectors be mechanically held and the test leads be tightened to the equipment manufacturer's torque recommendations, normally 5 in-lbs., using an open-end torque wrench.

     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 SFP-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 SFP-DD test adapters are predominantly passive components and are not in themselves sensitive to electrostatic discharge. However, when an active DUT is installed, that device becomes susceptible to ESD. Observe proper ESD precautions, further discussed later in this document.

General Test Adapter, Cable, and Connector

Observing simple precautions can ensure accurate and reliable measurements.

Handling and Storage

Before each use of the SFP-DD TPA, ensure that all connectors are clean. Handle all cables carefully and store the SFP-DD TPA in the foam-lined instrument case when not in use, if possible. Do not set connectors contact end down. Install the coax connector protective end caps when the SFP-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 (normally 5-inch pounds)

Electrostatic Discharge Information

Protection against electrostatic discharge (ESD) is essential while connecting, inspecting, or cleaning the SFP-DD 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.

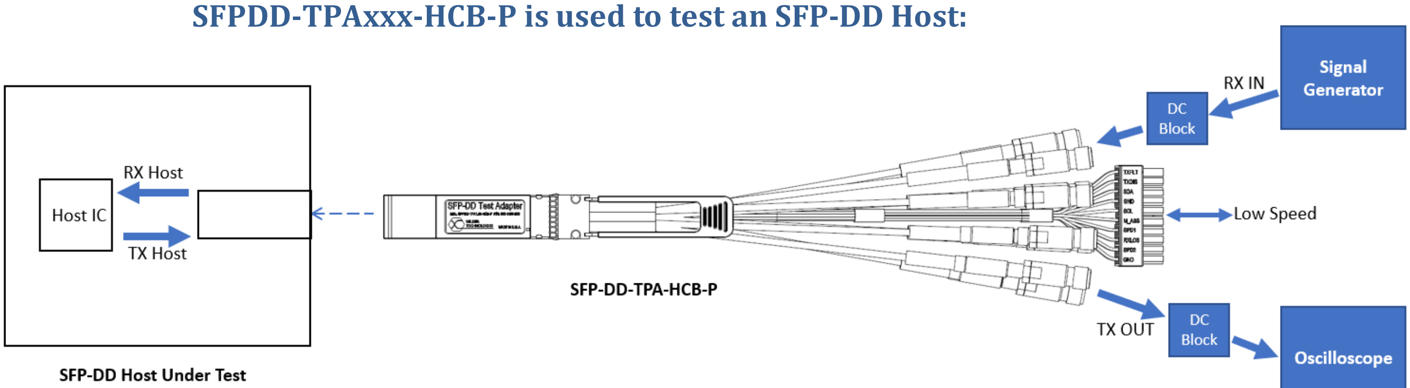
User Model

The SFP-DD TPAs are capable of performing to the requirements defined by SFP-DD MSA and SFP-DD MIS limited only by the specifications, environmental, care and handling of this document.

In the case where the laboratory source or load is not used in the test, it must be replaced with RF terminations on each unused signal (RF terminators are optionally offered by Wilder Technologies).

The two most common testing configuration is shown below.

SFPDD-TPAxxx-HCB-P is used to test an SFP-DD Host:



*DC Blocks are accessories and are not supplied with the product

Figure 5. SFP-DD HCB User Model

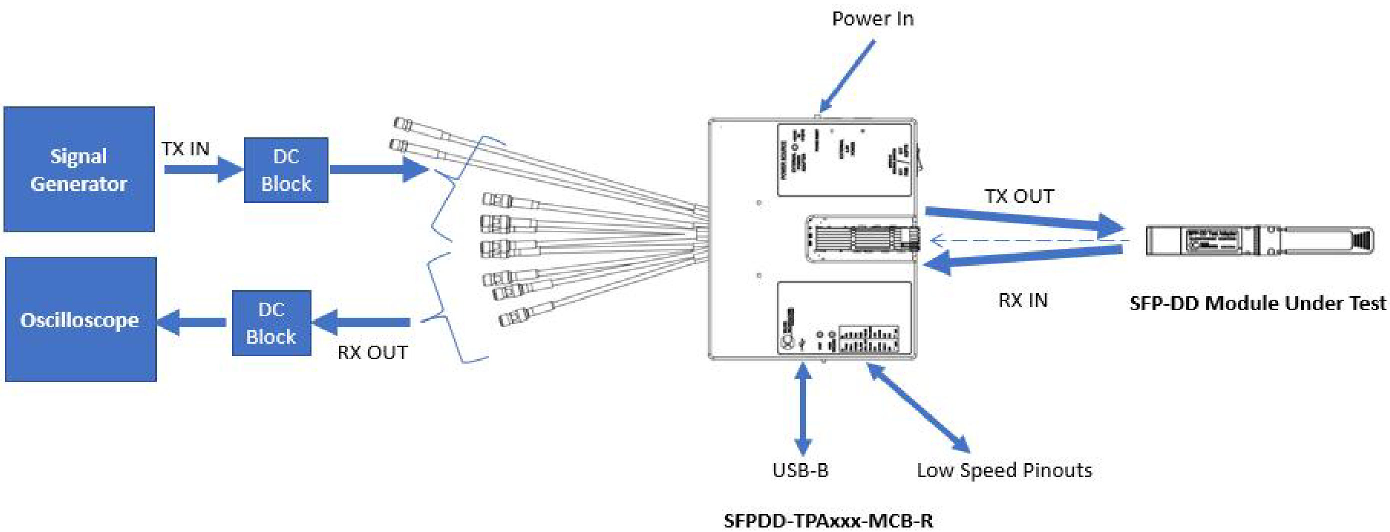
In this configuration, the SFP-DD HCB is used to test an SFP-DD Host.

An RX signal, inputted from a connected Signal Generator, is transferred through the HCB's RX lines into the SFP-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. RF terminators are not supplied, see references in this document.

SFPDD-TPAxxx-MCB-R is used to test an SFP-DD Module:



*DC blocks are accessories and are not supplied with the product

Figure 6. SFP-DD MCB User Model

In this configuration, the SFP-DD MCB is used to test an SFP-DD Module. The MCB must be powered by provided 12VDC source.

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 SFP-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

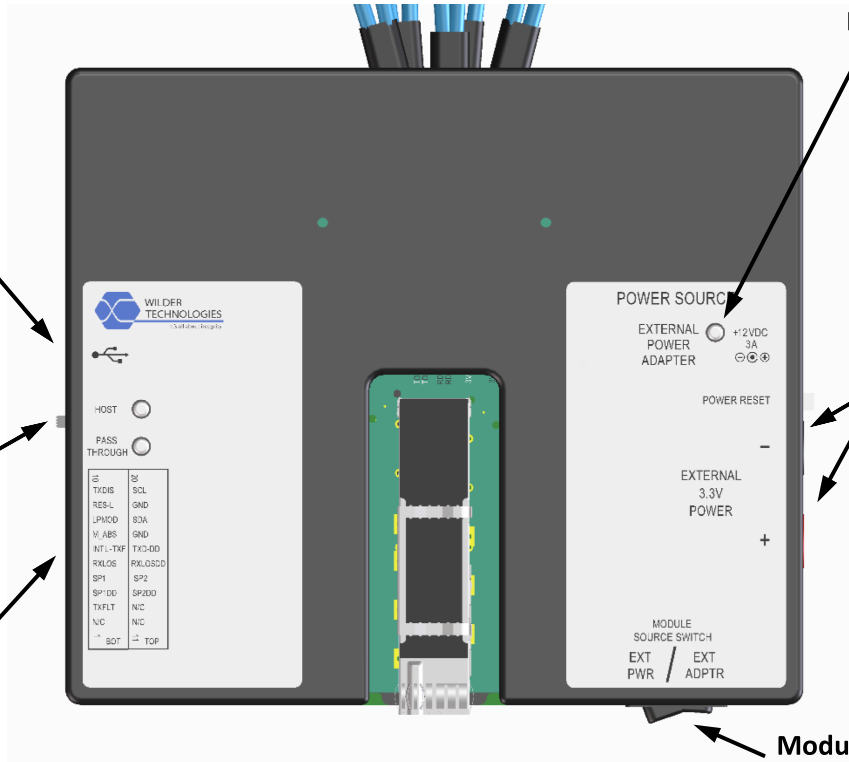


Figure 7. Closeup of SFP-DD I/O's and External Functions

The **Module Source Switch** allows a user to select which power input supplies the 3.3V SFP-DD module VCC 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: To run software applications, the external power adapter is required even when switched to **EXT PWR** mode.

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 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 (970-0070-000). This manual is supplied with USB Flash Drive supplied with the SFP-DD MCB product.

The **VCC Sense** SMA connectors (Cable interface at the rear of the unit) can be used to precisely monitor TX and RX supply voltages at SFP-DD ECB located near the primary connector contact-lead pads.

Calibration Through De-Embedding

The SFP-DD Test Adapters are fully passive components. Therefore, calibration compensating for the losses must occur within the test instrumentation that drives the SFP-DD Receivers or looks at the response of the SFP-DD Transmitters.

The SFP-DD TPA's have Touchstone S4P files for de-embedding the electrical length and losses within the TPA up to the SFP-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 SFPDD-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 2. General Specifications

ITEM	DESCRIPTION
Usage Environment	Controlled indoor environment
HCB (Plug) Test Adapter Length (w/2.92mm coax)	239.5 mm +/- 2 mm (9.43 inches +/- .08 inches) (Characteristic)
MCB (Receptacle) Test Adapter Length (w/2.92mm coax)	271.9 mm +/- 2 mm (10.7 inches +/- .08 inches) (Characteristic)
Receptacle Test Adapter Housing Dimensions	151.13 x 130.18 x 47.91 (5.95 x 5.13 x 1.9 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)

SFPDD-TPAxxx-HCB-P Cable Pin-out

The SFP-DD HCB TPA cables provide eight high-speed connectors (one lane of primary differential TX and RX). Labels clearly mark each cable or connector. The following figure refers to the pin-description table for the plug connector.

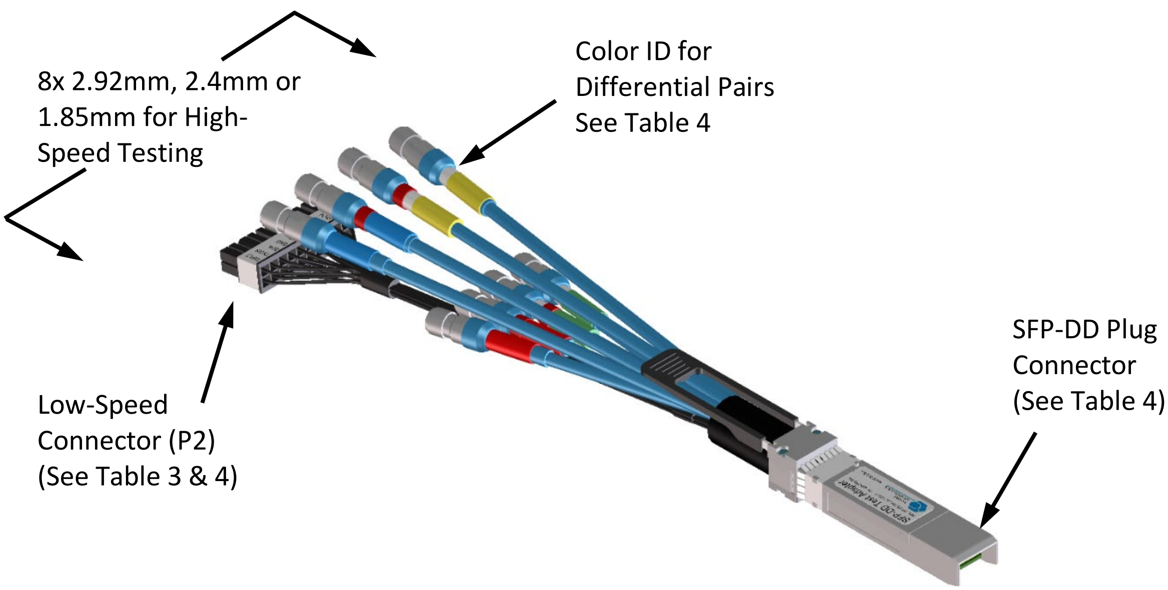


Figure 8. Cable Connectors (SFPDD-TPAxxx-HCB-P shown)

Table 3. SFPDD-TPAxxx-HCB-P (Plug) 20-Position Cable Connector (P2) (Low-Speed)

LABEL	Pin No.	Color ID for HCB	Description
TXFLT	Pin 1	Black/NA	Tx_Fault, Transmit fault
TXDIS	Pin 2	Black/NA	Tx_Disable, Transmit disable
SDA	Pin 3	Black/NA	SDA, I^2C Data for DDC
GND	Pin 4	Black/NA	VccR and VccT, RF Ground
SCL	Pin 5	Black/NA	SCL, I^2C Clock for DDC
M_ABS	Pin 6	Black/NA	MOD_ABS, Module absent
SPD1	Pin 7	Black/NA	Rx Rate Select for Legacy SFP Channel
RXLOS	Pin 8	Black/NA	Rx_LOS, Loss of Receive Signal
SPD2	Pin 9	Black/NA	Tx Rate Select for Legacy SFP Channel
GND	Pin 10	Black/NA	VccR and VccT, RF Ground
IntL/TXF-DD	Pin 11	Black/NA	Interrupt; or Transmitter Fault DD
TXD-DD	Pin 12	Black/NA	Transmitter Disable for DD Channel
VCCR	Pin 13	Black/NA	VccR, module receiver power supply
VCCT	Pin 14	Black/NA	VccT, module transmitter power supply
LPMODE	Pin 15	Black/NA	Low Power Mode
RES-L	Pin 16	Black/NA	Module Reset
SP1DD	Pin 17	Black/NA	Rx Rate Select for DD channel
RXLDD	Pin 18	Black/NA	Loss of Signal for DD channel
SP2DD	Pin 19	Black/NA	Tx Rate Select for DD channel
N/C	Pin 20	N/C	No Connection

Table 4. SFPDD-TPAxxx-HCB-P (Plug) Pin Assignments Per MSA

Pin Description	Connector Pin Number	Destination Number HCB	Color ID for Data Line Polarity	Color Identification (HCB/MCB)
Ground	1	P2 Pin 4,10	N/A	Black Insulation/NA
Tx Fault	2	P2 Pin 1	N/A	Black Insulation/NA
Tx Disable	3	P2 Pin 2	N/A	Black Insulation/NA
SDA	4	P2 Pin 3	N/A	Black Insulation/NA
SCL	5	P2 Pin 5	N/A	Black Insulation/NA
Mod_ABS	6	P2 Pin 6	N/A	Black Insulation/NA
Speed1	7	P2 Pin 7	N/A	Black Insulation/NA
Rx_LOS	8	P2 Pin 8	N/A	Black Insulation/NA
Speed2	9	P2 Pin 9	N/A	Black Insulation/NA
Ground	10	P2 Pin 4,10	N/A	Black Insulation/NA
Ground	11	P2 Pin 4,10	N/A	Black Insulation/NA
RD-	12	RD-	None	Blue Label
RD+	13	RD+	Red Band	Blue Label
Ground	14	P2 Pin 4,10	N/A	Black Insulation/NA
VccR	15	P2 Pin 13	N/A	Black Insulation/NA
VccT	16	P2 Pin 14	N/A	Black Insulation/NA
Ground	17	P2 Pin 4,10	N/A	Black Insulation/NA
TD+	18	TD+	Red and White Band	Yellow Label
TD-	19	TD-	White Band	Yellow Label
Ground	20	P2 Pin 4,10	N/A	Black Insulation/NA
Ground	21	P2 Pin 4,10	N/A	Black Insulation/NA
IntL/TXFaultDD	22	P2 Pin 11	N/A	Black Insulation/NA
TxDisableDD	23	P2 Pin 12	N/A	Black Insulation/NA
ePPS	24	N/A	N/A	N/A
LPMode	25	P2 Pin 15	N/A	Black Insulation/NA
ResetL	26	P2 Pin 16	N/A	Black Insulation/NA
Speed1DD	27	P2 Pin 17	N/A	Black Insulation/NA
RxLOSDD	28	P2 Pin 18	N/A	Black Insulation/NA
Speed2DD	29	P2 Pin 19	N/A	Black Insulation/NA
Ground	30	P2 Pin 4,10	N/A	Black Insulation/NA
Ground	31	P2 Pin 4,10	N/A	Black Insulation/NA
RD1-	32	RD1-	None	Red Label
RD1+	33	RD1+	Red Band	Red Label
Ground	34	P2 Pin 4,10	N/A	Black Insulation/NA
VccR1	35	P2 Pin 13	N/A	Black Insulation/NA
VccT1	36	P2 Pin 14	N/A	Black Insulation/NA
Ground	37	P2 Pin 4,10	N/A	Black Insulation/NA
TD1+	38	TD1+	Red and White Band	Green Label
TD1-	39	TD1-	White Band	Green Label
Ground	40	P2 Pin 4,10	N/A	Black Insulation/NA

SFPDD-TPAxxx-MCB-R Cable Pin-out

The SFP-DD MCB TPA cables provide eight high-speed connectors (one lane of primary differential TX and RX). Labels clearly mark each cable or connector. The following figure refers to the pin-description table for the SFPDD-TPA-MCB-R (Receptacle) test adapter.

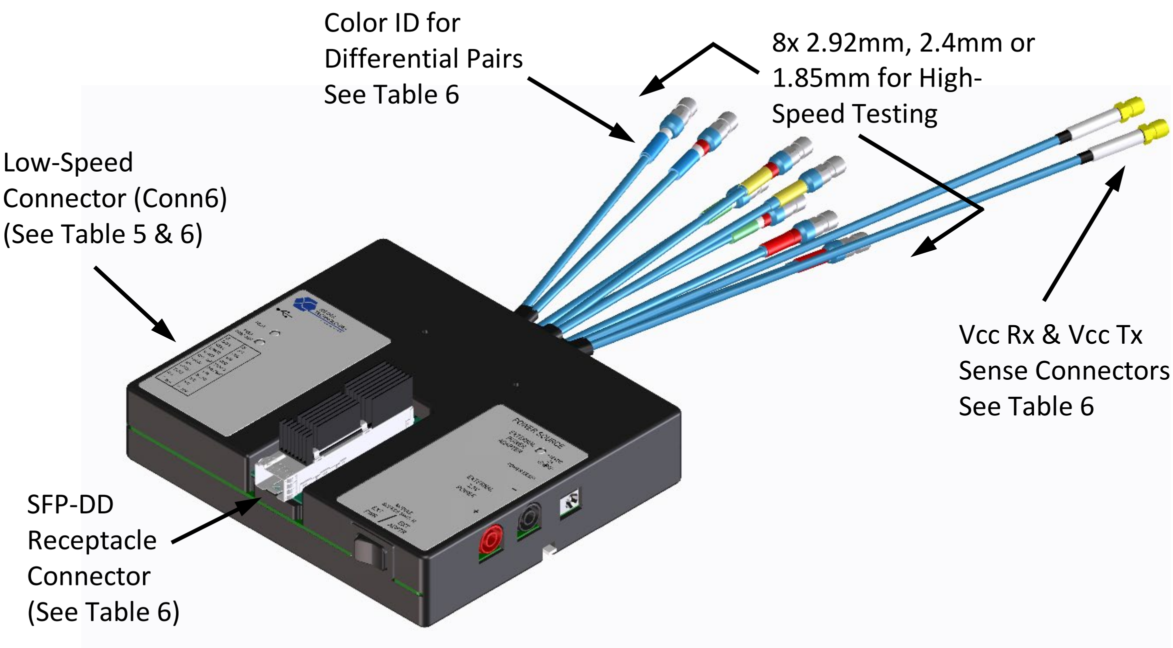


Figure 9. Cable Connectors (SFPDD-TPAxxx-MCB-R shown)

Table 5. SFPDD-TPAxxx-MCB-R 20-Position Male Connector (Conn6) (Low-Speed)

LABEL	Pin No.	Color ID for MCB	Description
N/C	Pin 1	N/C	No Connection
TXFLT	Pin 2	Black/NA	Tx_Fault, Transmit fault
SP1DD	Pin 3	Black/NA	Rx Rate Select for DD channel
SP1	Pin 4	Black/NA	Rx Rate Select for Legacy SFP Channel
RXLOS	Pin 5	Black/NA	Rx_LOS, Loss of Receive Signal
INTL-TXF	Pin 6	Black/NA	Interrupt; or Transmitter Fault DD
M_ABS	Pin 7	Black/NA	MOD_ABS, Module absent
LPMOD	Pin 8	Black/NA	Low Power Mode
RES-L	Pin 9	Black/NA	Module Reset
TXDIS	Pin 10	Black/NA	Tx_Disable, Transmit disable
N/C	Pin 11	N/C	No Connection
N/C	Pin 12	N/C	No Connection
SP2DD	Pin 13	Black/NA	Tx Rate Select for DD channel
SP2	Pin 14	Black/NA	Tx Rate Select for Legacy SFP Channel
RXLOSDD	Pin 15	Black/NA	Loss of Signal for DD channel
TXD-DD	Pin 16	Black/NA	Transmitter Disable for DD Channel
GND	Pin 17	Black/NA	VccR and VccT, RF Ground
SDA	Pin 18	Black/NA	SDA, I^2C Data for DDC
GND	Pin 19	Black/NA	VccR and VccT, RF Ground
SCL	Pin 20	Black/NA	SCL, I^2C Clock for DDC

Table 6. SFPDD-TPAxxx-MCB-R (Receptacle) Pin Assignments Per MSA

Pin Description	Connector Pin Number	Destination Number MCB	Color ID for Data Line Polarity	Color Identification (HCB/MCB)
Ground	1	Conn6 Pin 17,19	N/A	Black Insulation/NA
Tx Fault	2	Conn6 Pin 2	N/A	Black Insulation/NA
Tx Disable	3	Conn6 Pin 10	N/A	Black Insulation/NA
SDA	4	Conn6 Pin 18	N/A	Black Insulation/NA
SCL	5	Conn6 Pin 20	N/A	Black Insulation/NA
Mod_ABS	6	Conn6 Pin 7	N/A	Black Insulation/NA
Speed1	7	Conn6 Pin 4	N/A	Black Insulation/NA
Rx_LOS	8	Conn6 Pin 5	N/A	Black Insulation/NA
Speed2	9	Conn6 Pin 14	N/A	Black Insulation/NA
Ground	10	Conn6 Pin 17,19	N/A	Black Insulation/NA
Ground	11	Conn6 Pin 17,19	N/A	Black Insulation/NA
RD-	12	RD-	None	Blue Label
RD+	13	RD+	Red Band	Blue Label
Ground	14	Conn6 Pin 17,19	N/A	Black Insulation/NA
VccR	15	Vcc RX	N/A	White Label
VccT	16	Vcc Tx	N/A	White Label
Ground	17	Conn6 Pin 17,19	N/A	Black Insulation/NA
TD+	18	TD+	Red and White Band	Yellow Label
TD-	19	TD-	White Band	Yellow Label
Ground	20	Conn6 Pin 17,19	N/A	Black Insulation/NA
Ground	21	Conn6 Pin 17,19	N/A	Black Insulation/NA
IntL/TXFaultDD	22	Conn6 Pin 6	N/A	Black Insulation/NA
TxDisableDD	23	Conn6 Pin 16	N/A	Black Insulation/NA
ePPS	24	N/A	N/A	N/A
LPMode	25	Conn6 Pin 15	N/A	Black Insulation/NA
ResetL	26	Conn6Pin 9	N/A	Black Insulation/NA
Speed1DD	27	Conn6Pin 3	N/A	Black Insulation/NA
RxLOSDD	28	Conn6 Pin 15	N/A	Black Insulation/NA
Speed2DD	29	Conn6 Pin 13	N/A	Black Insulation/NA
Ground	30	Conn6 Pin 17,19	N/A	Black Insulation/NA
Ground	31	Conn6 Pin 17,19	N/A	Black Insulation/NA
RD1-	32	RD1-	None	Red Label
RD1+	33	RD1+	Red Band	Red Label
Ground	34	Conn6 Pin 17,19	N/A	Black Insulation/NA
VccR1	35	SMA, Vcc RX	N/A	White Label
VccT1	36	SMA, Vcc TX	N/A	White Label
Ground	37	Conn6 Pin 17,19	N/A	Black Insulation/NA
TD1+	38	TD1+	Red and White Band	Green Label
TD1-	39	TD1-	White Band	Green Label
Ground	40	Conn6 Pin 17,19	N/A	Black Insulation/NA

Electrical Responses

Documented in the following pages are the electrical responses of the Wilder 112G SFP-DD TPAs. HCB loss, MCB loss, MTF response and ICN data is shown.

Wilder 112G SFP-DD HCB Response

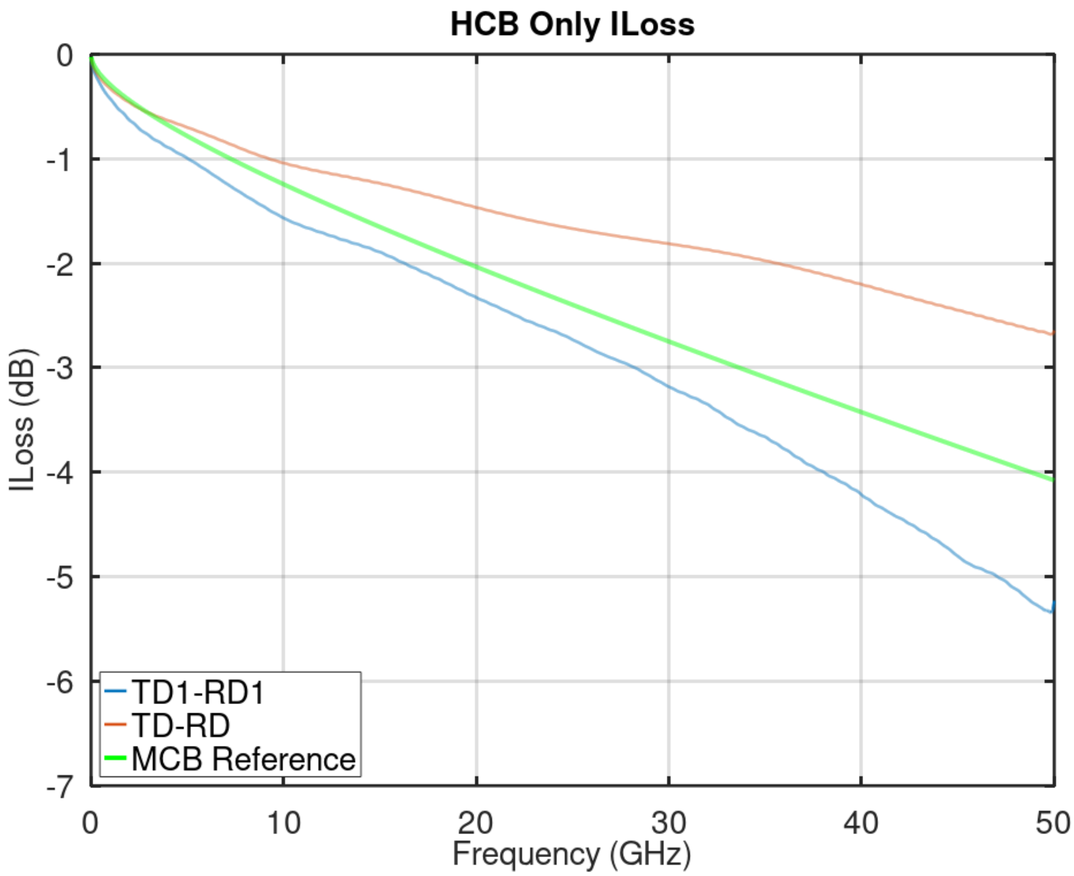


Figure 10. Plot of SFP-DD HCB Insertion Loss

The loss of the HCB up to but excluding the connector and its PCB pads is plotted in Figure 10. The loss at 28GHz is in table below. Note that the IEEE 802.3ck specification states that the difference between reference and true HCB response should be accounted for in the measurement.

Table 7. HCB Insertion Loss @ 28GHz

Channel Group	ILoss at 28GHz (dB)
TD1,RD1	-2.98
TD,RD	-1.76

Wilder 112G SFP-DD MCB Response

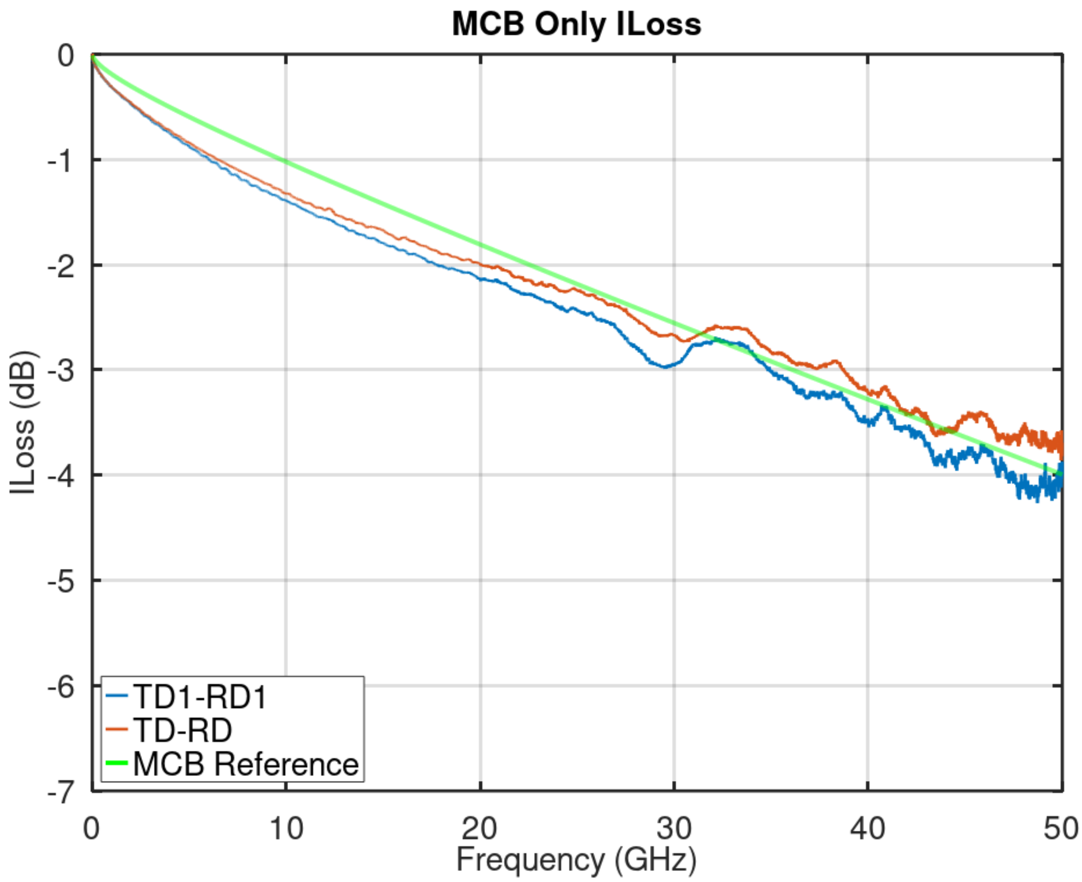


Figure 11. Plot of SFP-DD MCB Insertion Loss

The loss of the MCB up to but excluding the connector and its associated PCB pads is plotted in Figure 11. The loss at 28GHz is in table below. Note that the IEEE 802.3ck specification states that the difference between reference and MCB response should be accounted for in the measurement.

Table 8. MCB Insertion Loss @ 28GHz

Channel Group	ILoss at 28GHz (dB)
TD1,RD1	-2.78
TD,RD	-2.52

Wilder 112G SFP-DD Typical MTF Response

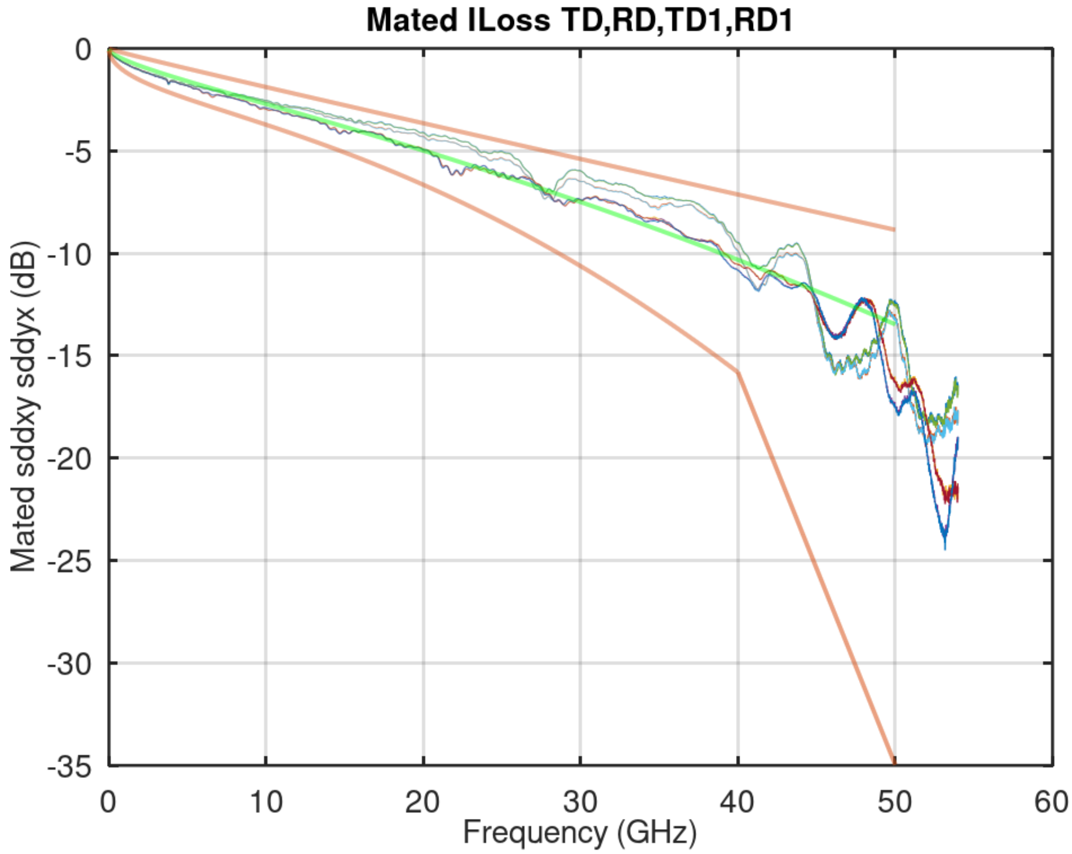


Figure 12. Plot of SFP-DD Mated Test Fixture Response (CK Limits)

MTF ILoss is plotted with 802.3ck limits and ILoss at 28GHz is in the table below.

Table 9. MTF Insertion Loss @ 28GHz

MTF Channel	SDD21 at 28GHz (dB)
TD	-6.83
RD	-7.22
TD1	-7.07
RD1	-7.13

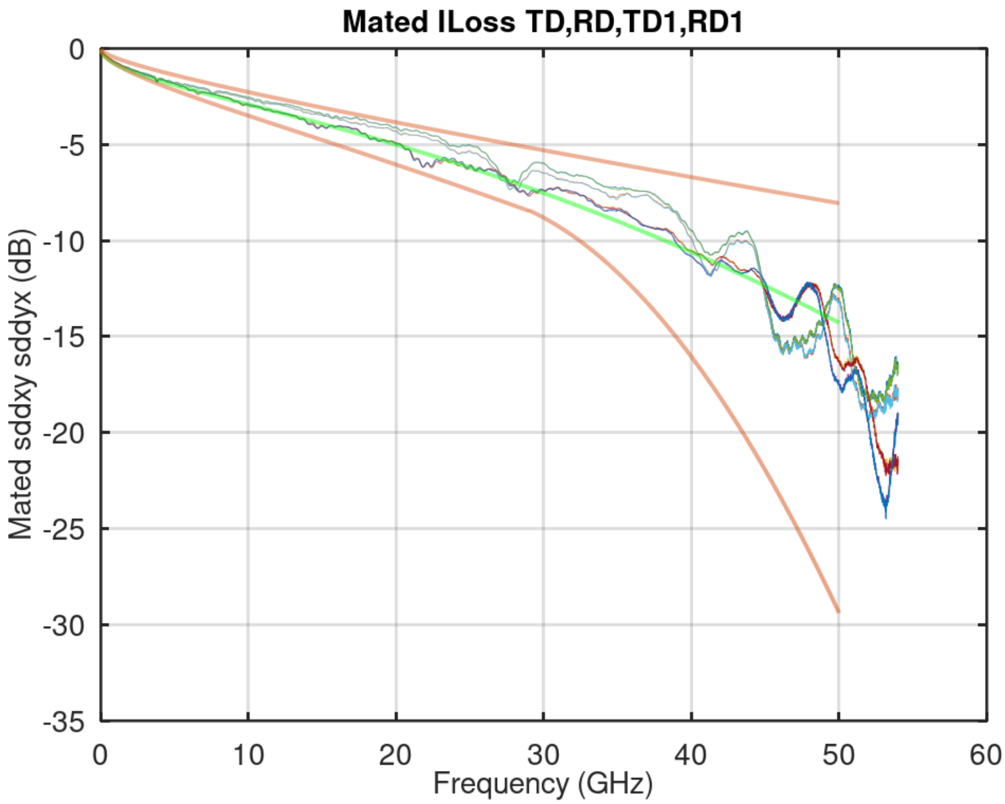


Figure 13. Plot of SFP-DD Mated Test Fixture Response (CEI Limits)

MTF ILoss is plotted with OIF CEI VSR limits.

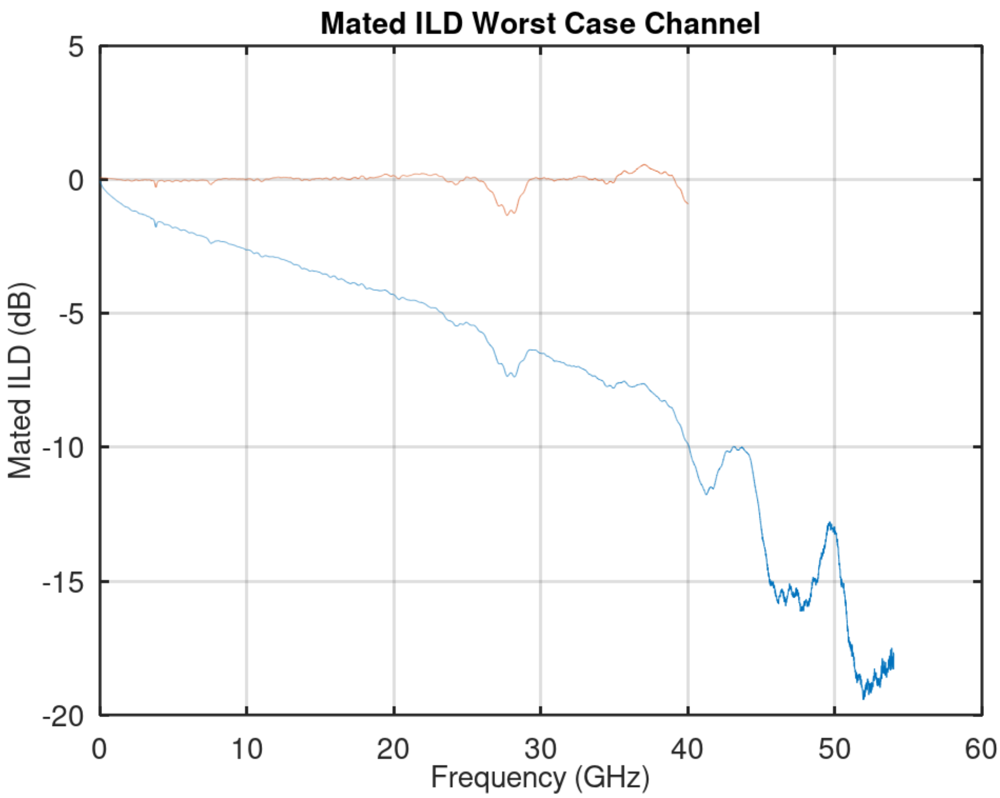


Figure 14. Plot of SFP-DD Mated Test Fixture Worst Case Response

Worst case FOM_ild is plotted in Figure 14 and typical results for all 4 channels are shown in the table below. FOM_ild below is calculated using IEEE 802.3ck and CEI VSR parameters.

Table 10. MTF FOM_ild for CK and VSR

MTF Channel	FOM_ild CK Parameters (dB)	FOM_ild VSR Parameters (dB)
TD	0.11	0.121
RD	0.112	0.124
TD1	0.099	0.105
RD1	0.096	0.102

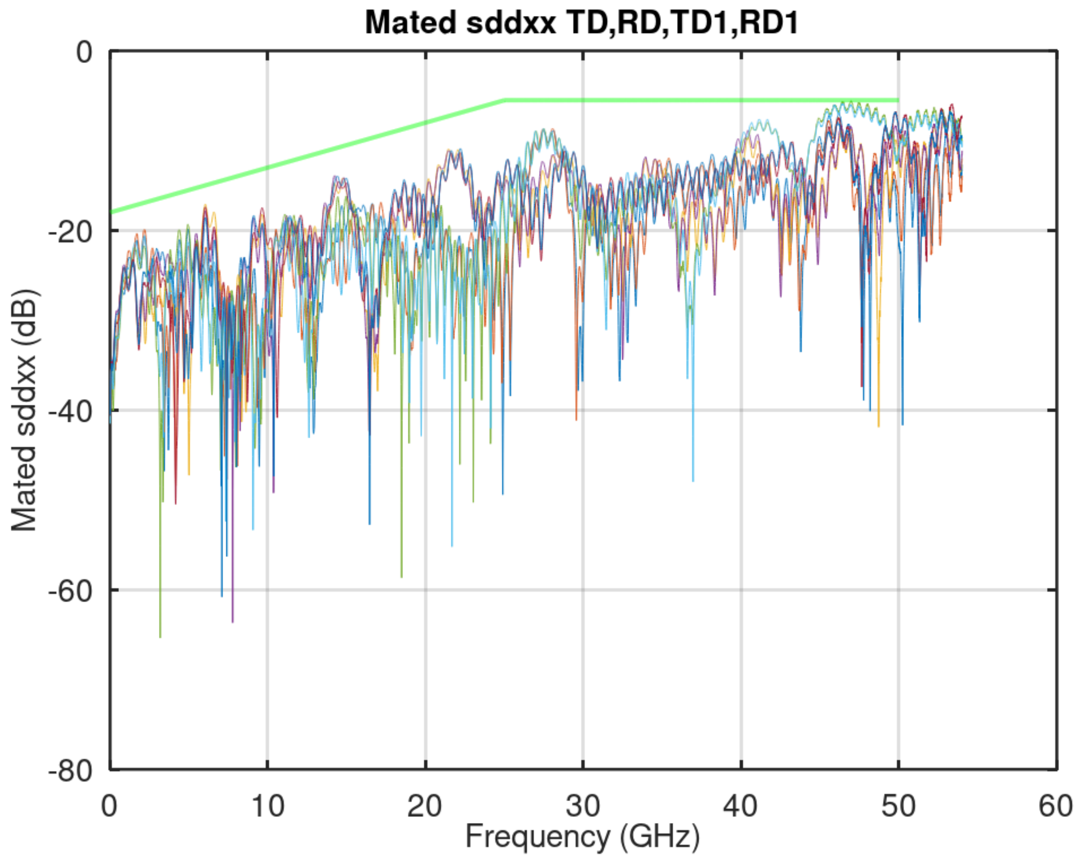


Figure 15. Plot of SFP-DD Mated Test Fixture Return Loss with Original 802.3ck Limit (Informative)

MTF RLoss is shown for information only.

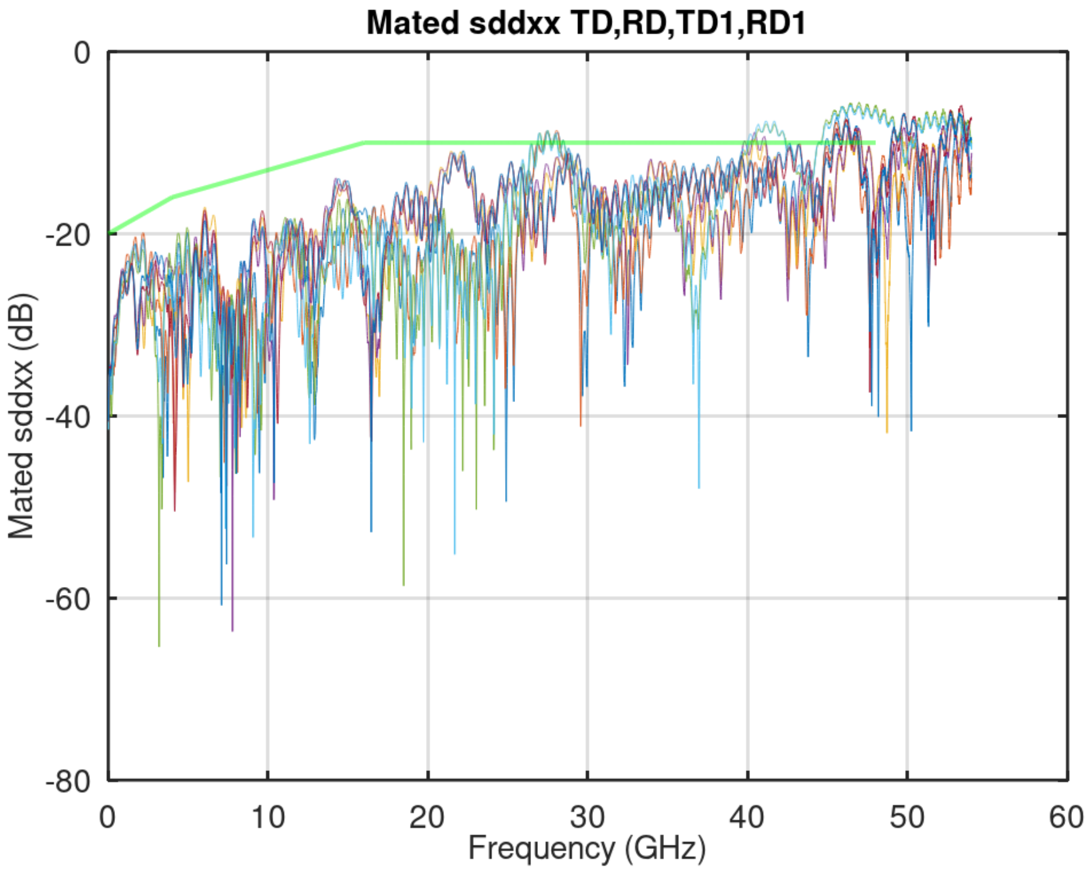


Figure 16. Plot of SFP-DD Mated Test Fixture Return Loss with Original CEI VSR Limit (Informative)

MTF RLoss is shown for information only.

The ERL numbers below are for all 4 measured channels and are calculated with no gating.

Table 11. ERL Numbers

	RD	RD1	TD	TD1
ERL11 (dB)	13.58	11.79	13.215	11.99
ERL22 (dB)	14.5	12.15	14.5	11.93
ERL (dB)	13.58	11.79	13.21	11.93
ERL Limit (dB)	10.3			

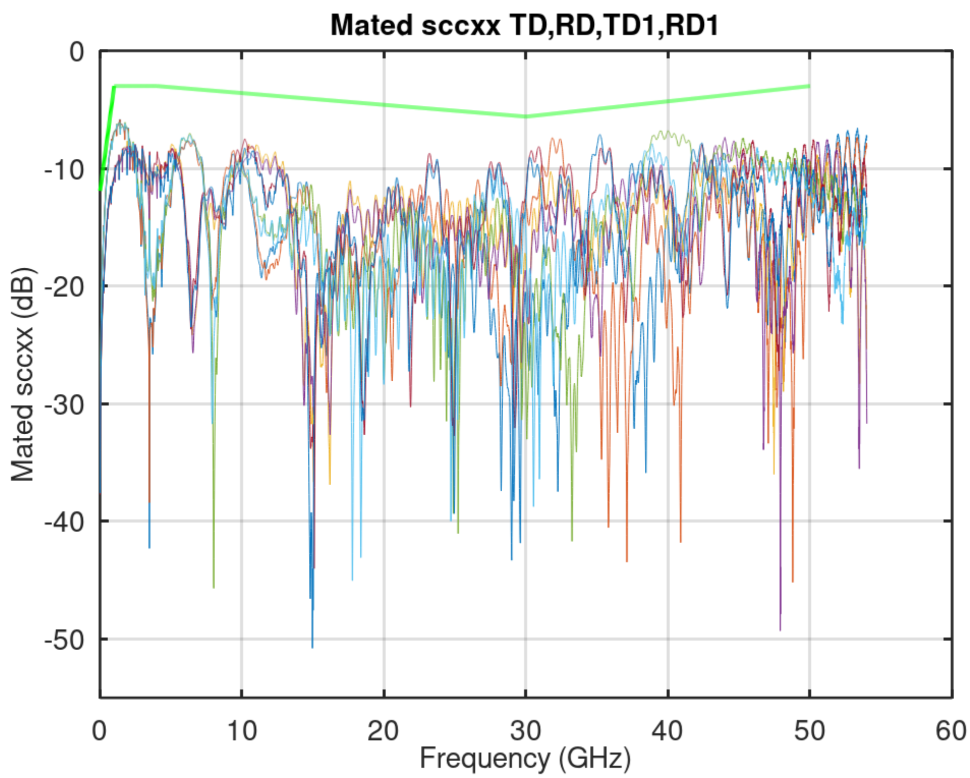


Figure 17. Plot of SFP-DD MTF Common Mode Return Loss with 802.3ck Limit

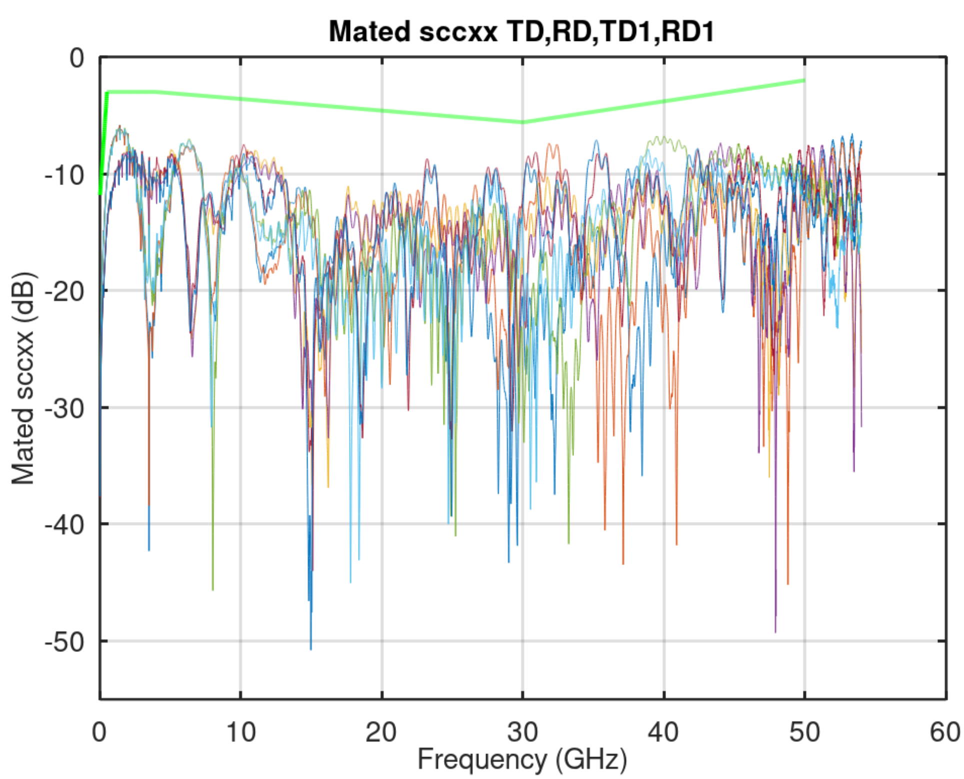


Figure 18. Plot of SFP-DD MTF Common Mode Return Loss with CEI VSR Limit

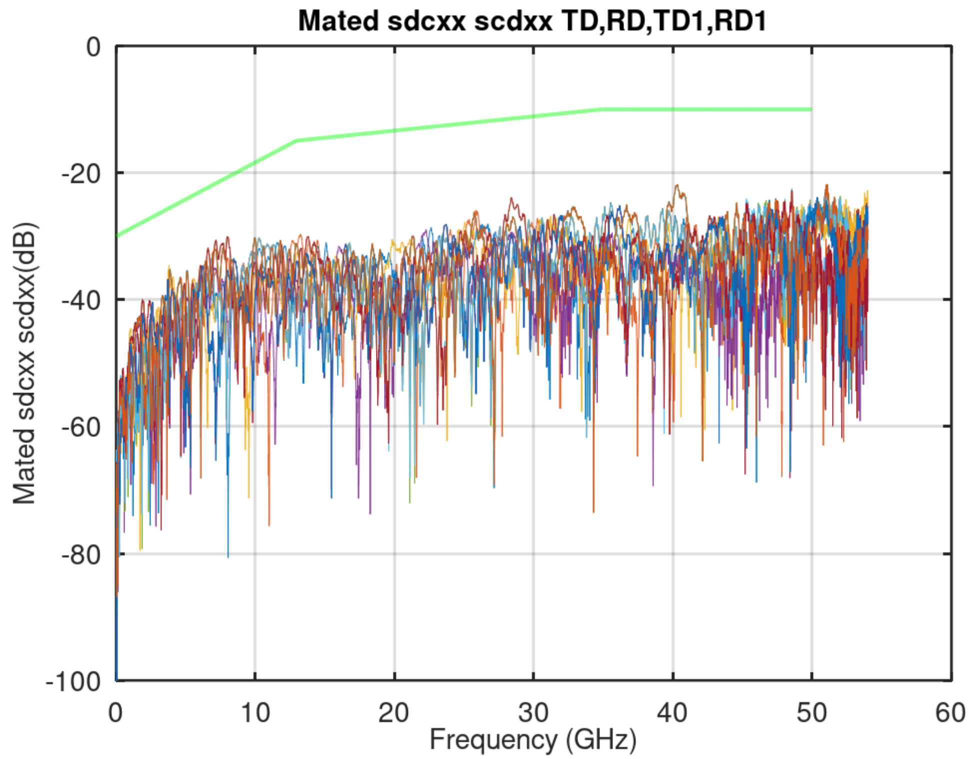


Figure 19. Plot of SFP-DD MTF Conversion Return Loss with 802.3ck Limit

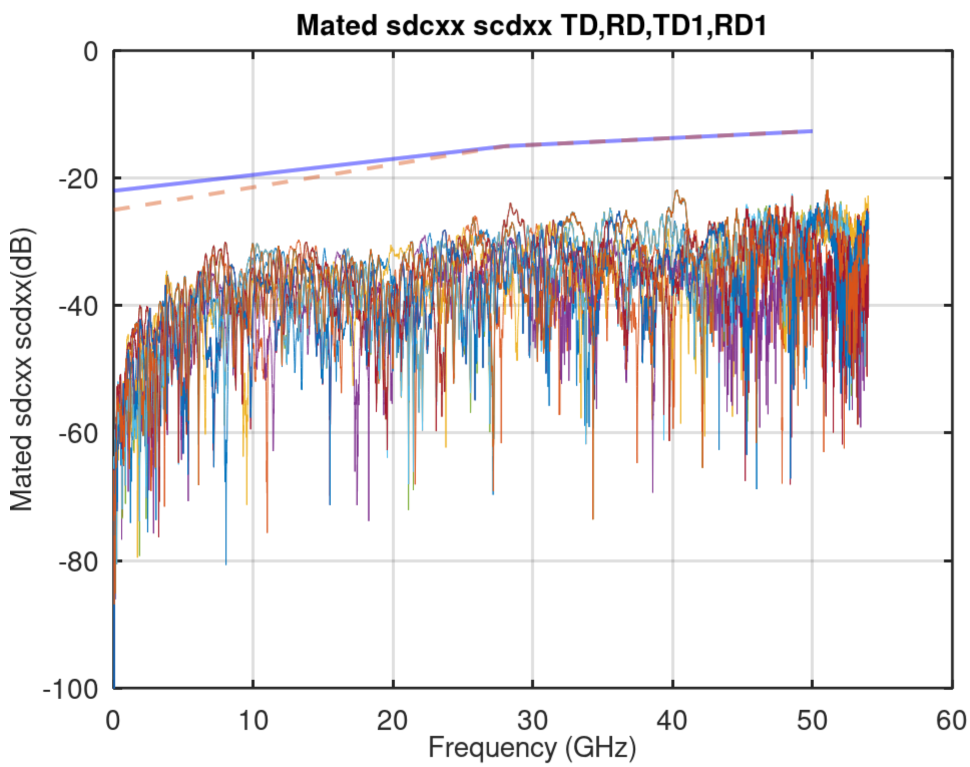


Figure 20. Plot of SFP-DD MTF Conversion Return Loss with CEI VSR Limit

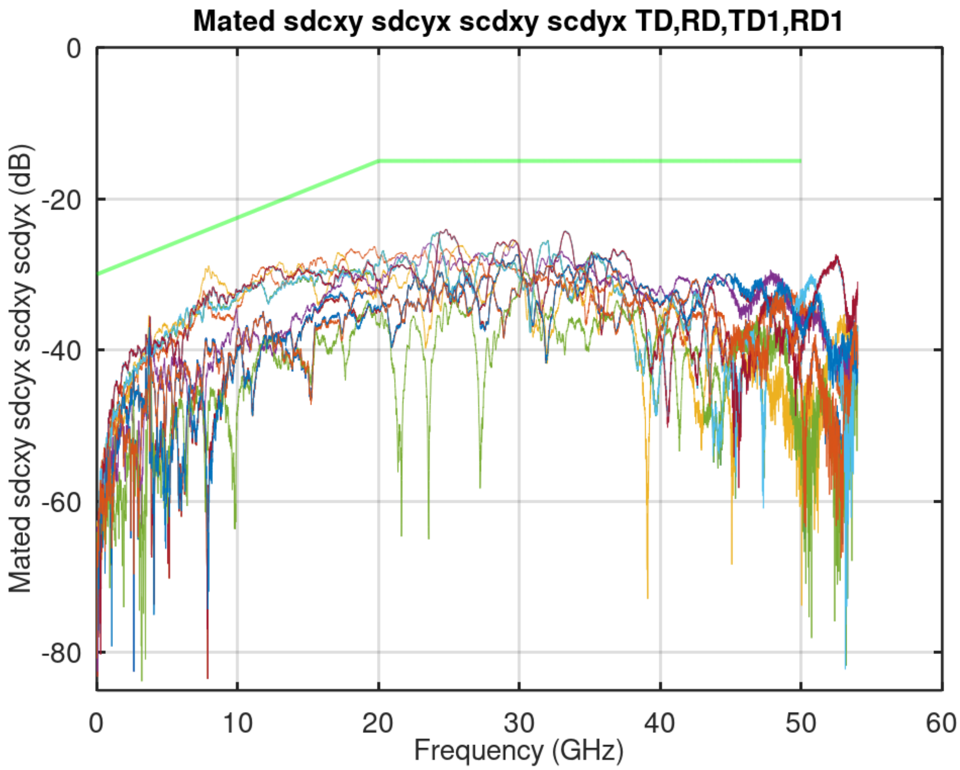


Figure 21. Plot of SFP-DD MTF Conversion Insertion Loss with 802.3ck and CEI VSR Limit

Wilder 112G SFP-DD 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 CK and OIF specification. Both single valued integrated noise levels are then added RSS to give the total ICN value.

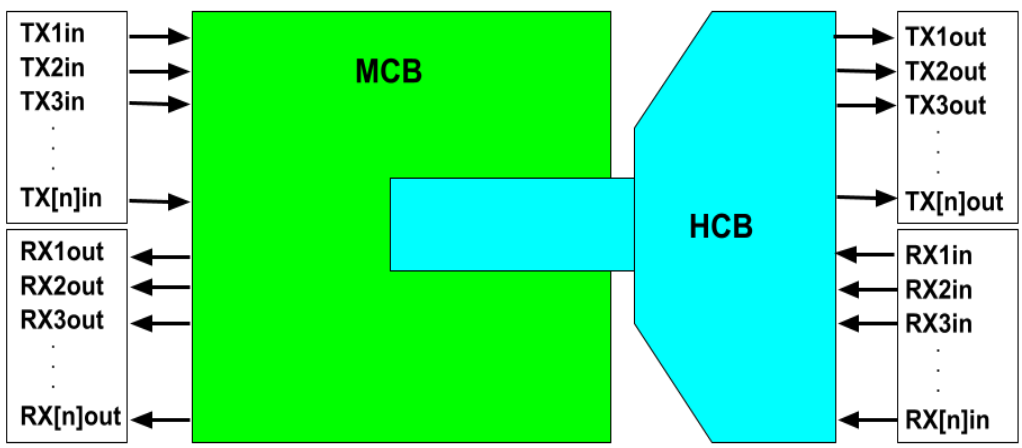


Figure 22. Diagram showing TX and RX Victim and Aggressors on SFP-DD

Table 12. TX ICN Data (802.3ck)

ICN (mV) from TX FEXT	Victim (HCB) p=port1, n=port3	
Aggressor (MCB) p=port2, n=port4	TD (mV)	TD1 (mV)
TD	NA	5.0097
TD1	6.8138	NA
TX MDFEXT	6.8138	5.0097
ICN (mV) from TX NEXT	Victim (HCB) p=port1, n=port3	
Aggressor (HCB) p=port1, n=port3	TD (mV)	TD1 (mV)
RD	1.9069	0.9658
RD1	0.801	1.975
TX MDNEXT	2.0683	2.1984
TX ICN total (mV)	7.1208	5.4709

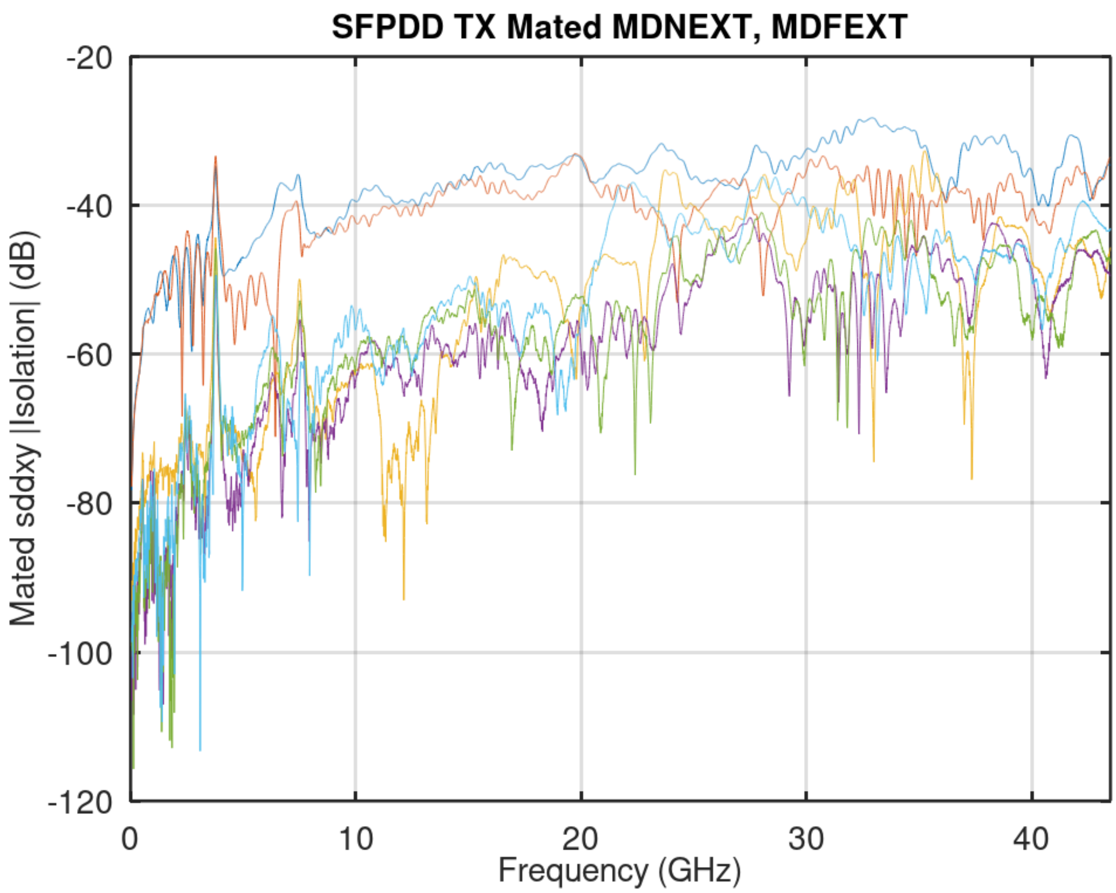


Figure 23. Plot of TX Victim Response to NEXT and FEXT

The table above is ICN data calculated as outlined in 802.3CK for the TX victim responses.

Note that each row represents an ICN value as each aggressor is added to the power sum.

Table 13. RX ICN Data (802.3ck)

ICN (mV) from RX FEXT	Victim (MCB) p=port2, n=port4	
Aggressor (HCB) p=port1, n=port3	RD (mV)	RD1 (mV)
RD	NA	6.8773
RD1	4.1758	NA
RX MDFEXT	4.1758	6.8773
ICN (mV) from RX NEXT	Victim (HCB) p=port1, n=port2	
Aggressor (HCB) p=port1, n=port2	RD (mV)	RD1 (mV)
TD	1.5294	1.1573
TD1	0.9234	1.2699
RX MDNEXT	1.7865	1.7181
RX ICN total (mV)	4.5419	7.0886

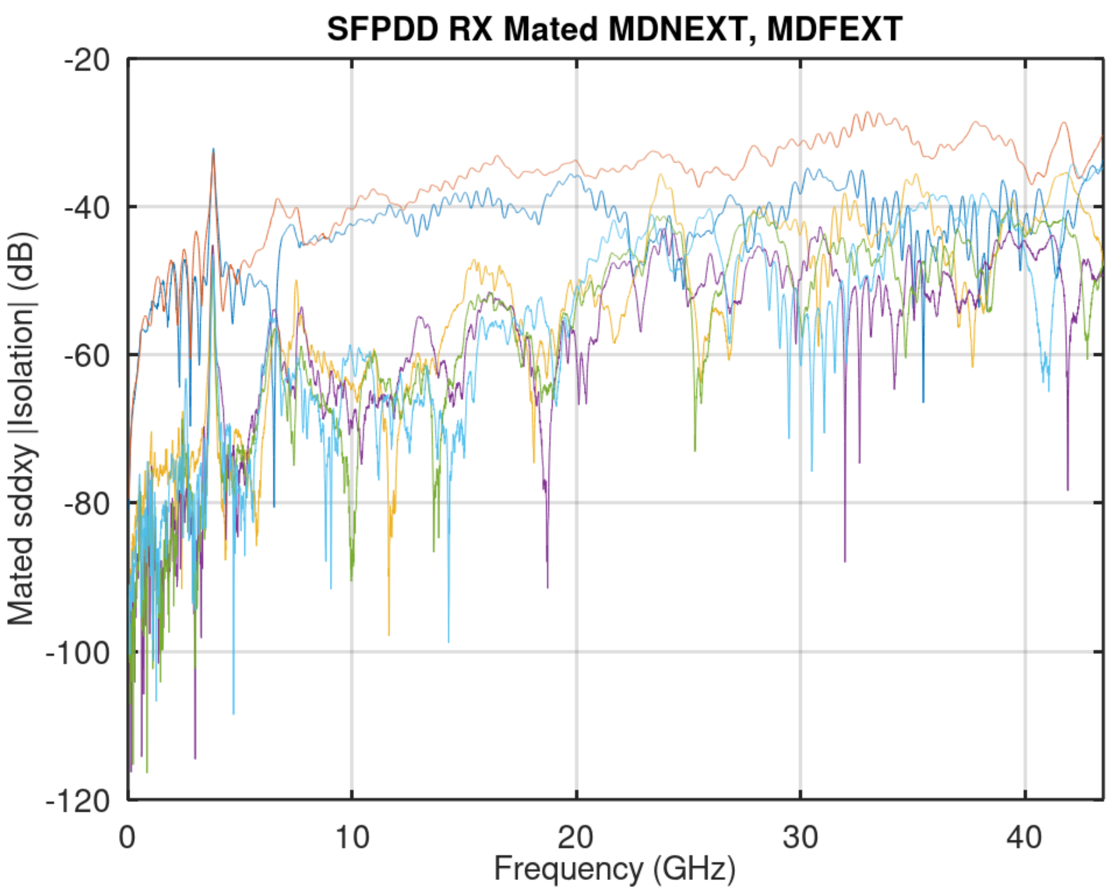


Figure 24. Plot of RX Victim Response to NEXT and FEXT

The table above is ICN data calculated as outlined in 802.3CK for the RX victim responses.

Note that each row represents an ICN value as each aggressor is added to the power sum.

Table 14. TX ICN Data (CEI VSR)

ICN (mV) from TX FEXT	Victim (HCB) p=port1, n=port3	
Aggressor (MCB) p=port2, n=port4	TD (mV)	TD1 (mV)
TD	NA	3.7533
TD1	5.1887	NA
TX MDFEXT	5.1887	3.7533

ICN (mV) from TX NEXT	Victim (HCB) p=port1, n=port3	
Aggressor (HCB) p=port1, n=port3	TD (mV)	TD1 (mV)
RD	1.5034	0.756
RD1	0.6331	1.5339
TX MDNEXT	1.6313	1.71
TX ICN total (mV)	5.4391	4.1245

The table above is ICN data calculated as outlined in CEI VSR for the TX victim responses.

Note that each row represents an ICN value as each aggressor is added to the power sum.

Table 15. RX ICN Data (CEI VSR)

ICN (mV) from RX FEXT	Victim (MCB) p=port2, n=port4	
Aggressor (HCB) p=port1, n=port3	RD (mV)	RD1 (mV)
RD	NA	5.2749
RD1	3.1184	NA
RX MDFEXT	3.1184	5.2749

ICN (mV) from RX NEXT	Victim (HCB) p=port1, n=port2	
Aggressor (HCB) p=port1, n=port2	RD (mV)	RD1 (mV)
TD	1.2153	0.9103
TD1	0.7165	1.0155
RX MDNEXT	1.4108	1.3638
RX ICN total (mV)	3.4227	5.4483

The table above is ICN data calculated as outlined in CEI VSR for the RX victim responses.

Note that each row represents an ICN value as each aggressor is added to the power sum.

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 and Amendment Directive (EU) 2015/863 of the European Parliament, and of the Council of 8 June, 2011 and 31 March, 2015 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.
SFPDD	Enhanced Small Form Factor Pluggable connection. (SFP+ 1X 28 Gb/s)
SFP-DD Host	The SFP-DD Host is the fixed end of the connection supporting IEEE 802.3 (clauses 38, 49, 52, 59, or 68), 8 GFC, 10 GFC, and 10GSFP+Cu serial protocols.
SFP-DD Module	The SFP-DD Module is the moveable end of the connection supporting IEEE 802.3 (clauses 38, 49, 52, 59, or 68), 8 GFC, 10 GFC, and 10GSFP+Cu serial protocols.
SFP-DD TPA	SFP-DD Test Point Access. A specialized assembly that interfaces to a SFP-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.

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