

uSSD Test Adapter

User Manual



WILDER
TECHNOLOGIES

It's all about integrity

Table of Contents

Introduction.....	3
Product Inspection	5
The uSSD Test Adapter Care and Handling Precautions	6
General Test Adapter, Cable, and Connector.....	8
Handling and Storage	8
Visual Inspection.....	8
Cleaning	8
Making Connections	8
Electrostatic Discharge Information	9
User Model	10
Calibration Through De-Embedding	11
Mechanical and Environmental Specifications.....	12
Electrical Specifications	19
Wilder Technologies, LLC – Limited Warranty	36
Wilder Technologies, LLC – Terms & Conditions of Sale	37
Compliance with Environmental Legislation	38
WEEE Compliance Statement.....	38
Glossary of Terms	39
Index	40

Introduction

This user's guide documents the uSSD Host, Receptacle, and Device Test Adapters (uSSD-TPA-H, uSSD-TPA-R, and uSSD-TPA-DS) and the associated de-embedding files. The three test adapter types, shown in Figures 1 and 2, test uSSD hosts and devices against the SATA Specification. Calibration through de-embedding is presented on Page 11, and can be used to zero-out test adapter attributes.

The test adapter assemblies allow easy access, via SMA 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.

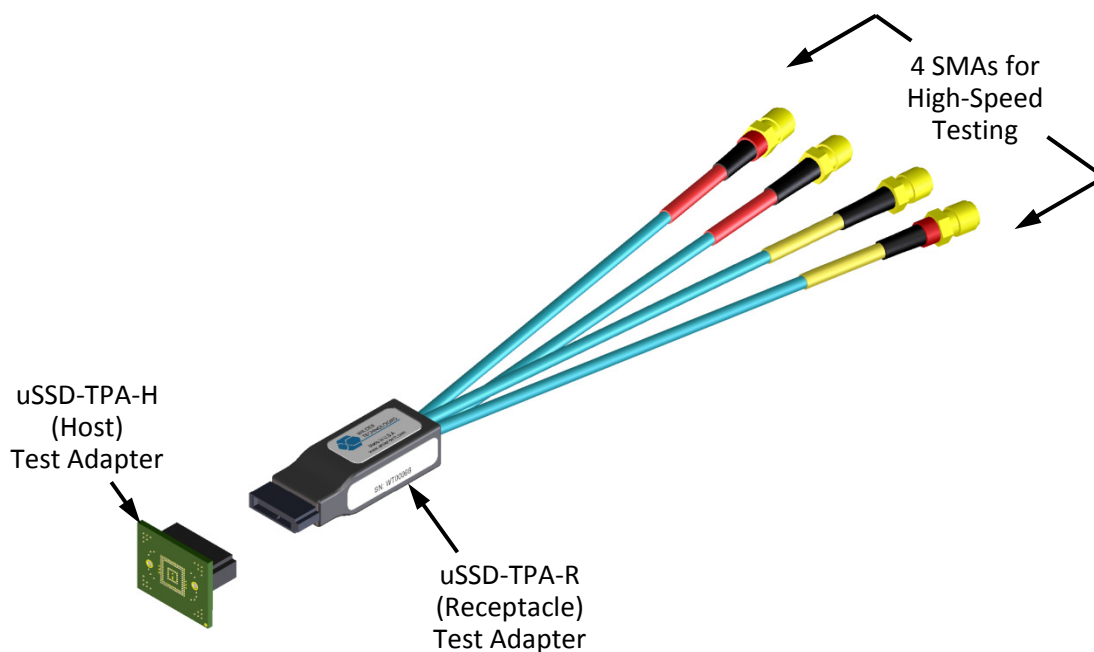


Figure 1. The uSSD Host and Receptacle Test Adapters

The uSSD Host Test Adapter connects to the host to be tested either through a socket or soldered directly to the UUT. The uSSD Receptacle adapter then connects to the Host test adapter converting the high-speed signals from SATA to SMAs.

The length, width, and ball pattern of the uSSD-TPA-H follows the requirements for a 156-position TFBGA device per JEDEC MO-276, variation CA, figure 11. Overall height, including SATA connector – 10.25 mm (0.40 inches)

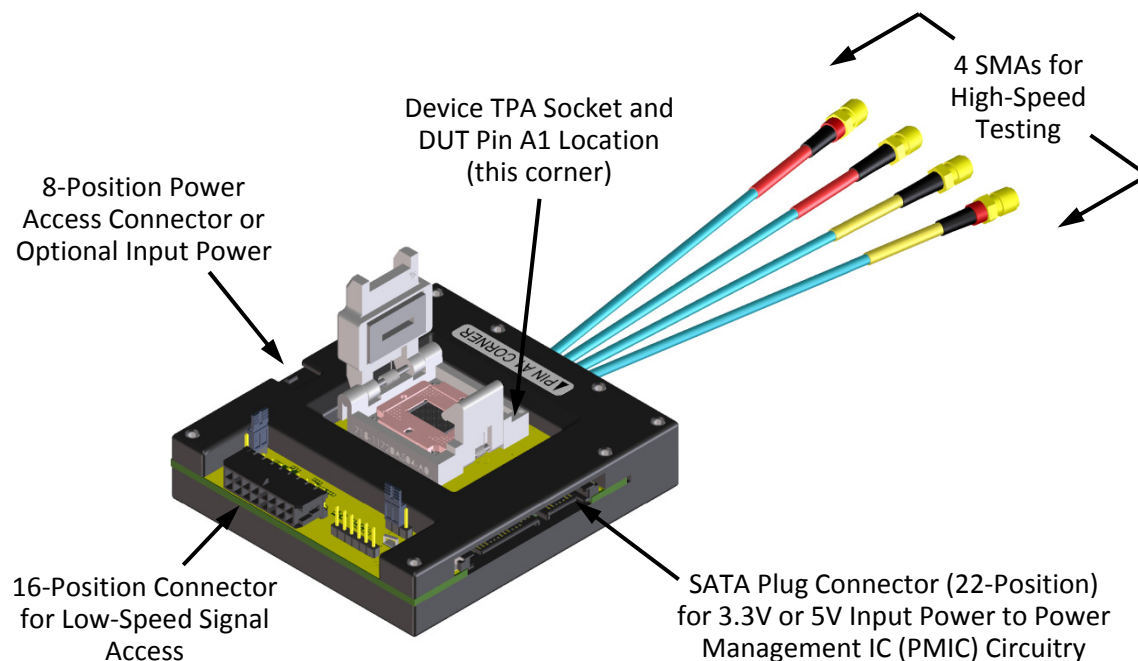


Figure 2. The uSSD Socketed (uSSD-TPA-DS) Device Test Adapter

The uSSD Device Test Adapter accepts the DUT via a 156-position TFBGA socket (standard configuration). An alternative option is available to directly solder the DUT to the uSSD Device Test Adapter (not shown).

The low-speed 8-position and 16-position receptacle connectors are keyed and latching (Molex part numbers 43650-0801 and 43045-1602, respectively). The mating plug connector housings and contact pins for 26-30awg wire are provided with each uSSD-TPA-DS assembly (Molex part numbers 43640-0801 and 43025-1600 for the 8-position and 16-position housings, respectively). Contact pins are Molex part number 43031-0011 for the 26-30awg pin contacts. Replacement plug parts can be purchased through Molex distributors.

Product Inspection

Upon receiving the uSSD-TPA from Wilder Technologies, perform the following product inspection:

- Inspect the outer shipping container, foam-lined storage container, 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 storage container for secure storage of the Wilder Technologies uSSD 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” section discusses how to contact Wilder Technologies for technical assistance and/or how to package the product for return.

The uSSD Test Adapter Care and Handling Precautions

The uSSD 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 uSSD-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 uSSD-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 uSSD-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 uSSD-TPA and cables. Use adjustable elevation stands or apparatus to accurately place and support the uSSD-TPA.
- **CAUTION 4: Connect the uSSD-TPA First**
To prevent twisting, bending, or applying tension to the coaxial cables when connecting a uSSD-TPA, always attach the uSSD-TPA to the device under test (DUT) or unit under test (UUT) before attaching any SMA connectors. Carefully align the SATA connectors of the Host and Receptacle TPAs and then gently push the connectors together until fully seated.

If the uSSD-TPA must be turned or twisted to make connection to the UUT, avoid using the uSSD-R-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 SMA connections at the uSSD-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 uSSD-TPA to or from the DUT. Pulling directly on the uSSD-TPA cables or using them to insert the uSSD-TPA may cause damage.

- **CAUTION 5: Carefully Make SMA Connections**
To connect the uSSD-TPA SMA connectors, follow these steps:
 1. Hold the cable stationary by grasping the cable at the black heat-shrink section near the SMA connector.
 2. Insert the mating SMA barrel and hand-tighten the free-spinning SMA nut onto the connector while avoiding pulling, bending, or twisting the uSSD-TPA coaxial cable.

3. The uSSD-TPA SMA connectors have flats that accept an open-end 1/4-inch or 6.5mm wrench. When attaching instrument cables to the uSSD-TPA, it is recommended that the uSSD-TPA SMA connectors be mechanically held and the test leads be tightened to the equipment manufacturer's torque recommendations, normally 5 in-lbs, using a 5/16-inch open-end wrench.

If the test set-up requires repositioning, first loosen or disconnect the SMA 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, the test adapter will need to be sent back to the factory for service.

- **CAUTION 6: Independently Support Instrument Cables or Accessories**
Excessive weight or stress from instrument cables and/or accessories connected to the uSSD-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: The uSSD Device Test Adapter is ESD Sensitive**
The uSSD Device Test Adapter incorporates electrostatic sensitive components to support the Power Management IC (PMIC) portion of the test adapter. Additionally, when a DUT is installed, that device also 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 uSSD-TPA, ensure that all connectors are clean. Handle all cables carefully and store the uSSD-TPA in the foam-lined storage container when not in use, if possible. Do not set connectors contact end down. Install the SMA protective end caps when the uSSD-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 or test adapter components.

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 the SMA 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, normally set to 5 in-lbs, 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 uSSD-TPA test adapter and connectors attached to a static-sensitive circuit (such as those found in test sets and the uSSD Device Test Adapter itself).

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

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

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

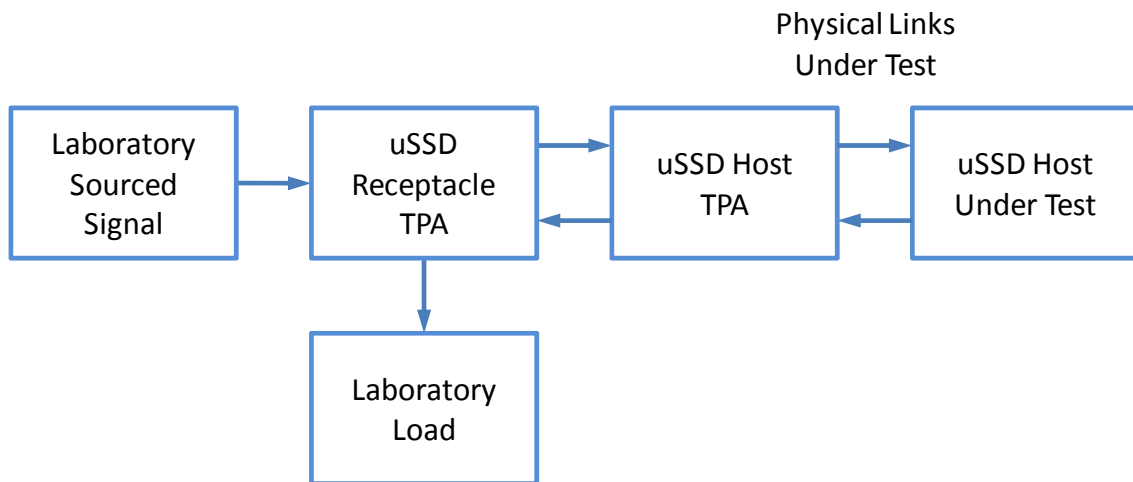
WARNING: These techniques for a static-safe work station should not be used when working on circuitry with a voltage potential greater than 500 volts.

User Model

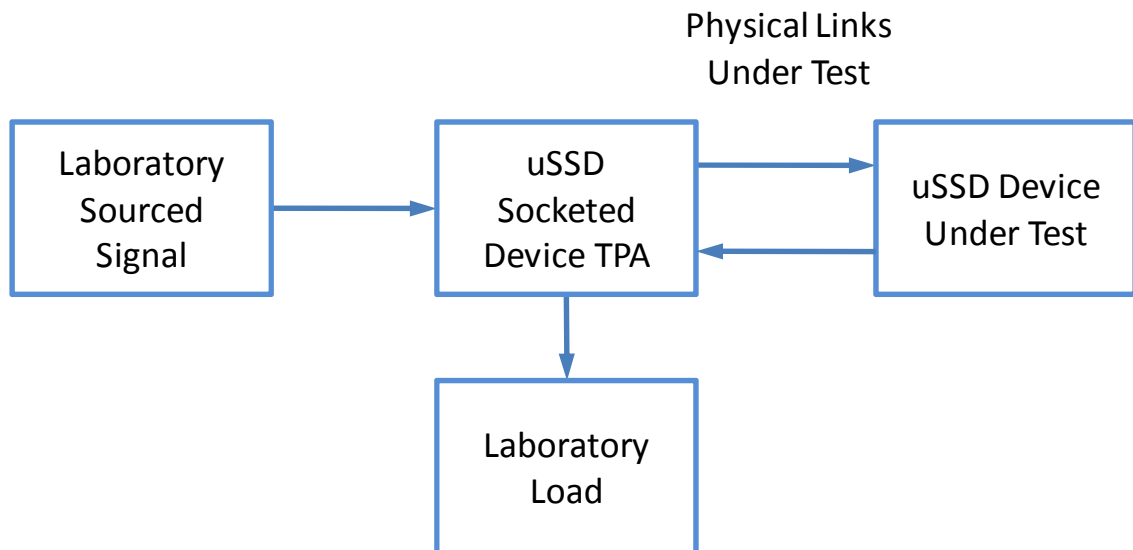
The uSSD TPA supports all testing of the SATA Specification. It is capable of performing well beyond the scope of measurements required, limited only by the specifications, environmental, care and handling as stated in this document.

The following examples are suggestions for possible testing setups.

In this first example, a uSSD Receptacle TPA in conjunction with a uSSD Host TPA is used to test a uSSD Host:



The second example shows a uSSD Socketed Device TPA used to test a DUT:



Calibration Through De-Embedding

The uSSD Host and Receptacle Test Adapters are fully passive components. The uSSD Device Test Adapter is passive for high and low-speed signal access, and has active Power Management IC (PMIC) circuitry. Therefore, calibration for the errors generated must occur within the test instrumentation that drives the SATA receiver device or looks at the response of the SATA transmitter device.

The uSSD-TPA's have Touchstone S4P files for de-embedding the electrical length and losses within the TPA through the uSSD TFBGA pad. (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 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 uSSD-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 1. General Specifications

ITEM	DESCRIPTION
Usage Environment	Controlled indoor environment
Receptacle Test Adapter Length	173.0 mm +/- 2 mm (6.81 inches +/- .08 inches) (Characteristic)
Host Test Adapter with 7-Position SATA Plug Connector Pre-Installed (Physical Dimensions)	Length, Width, and Ball Pattern Per JEDEC MO-276, Variation CA, Figure 11. Overall Height Including SATA Connector – 10.25 mm (0.40 inches)
Device Test Adapter Overall Dimensions (excluding TFBGA socket)	19.8 x 85.1 x 229.6 mm (0.78 x 3.35 x 9.04 inches) (Characteristic)
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)

uSSD-TPA-R Cable Pinout

The uSSD-TPA-R cables provide four SMA 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 host and receptacle connector.

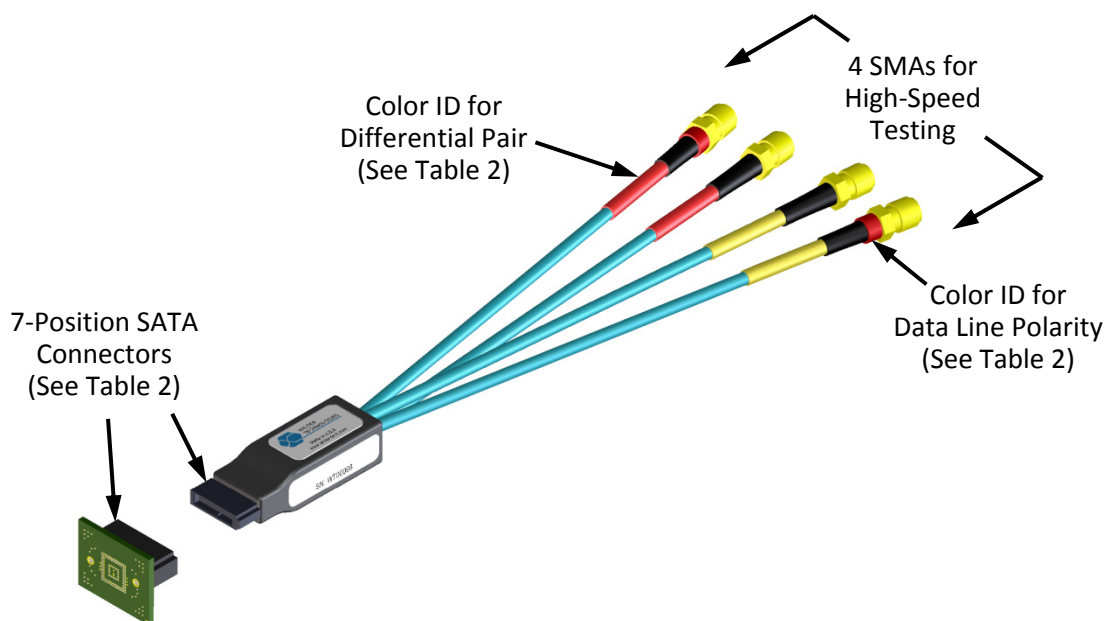


Figure 3. Cable Connectors (uSSD-TPA-H and uSSD-TPA-R shown)

Table 2. uSSD Host and Receptacle TPA Pin Assignments

Pin Description	Connector Pin Number	Destination Label	Color ID for Data Line Polarity (Receptacle)	Color ID for Differential Pair (Receptacle)
Signal Ground	S1	Signal Ground	N/A	N/A
Host TX Positive	S2	HOST TXP	Red	Yellow Label
Host TX Negative	S3	HOST TXN	Black	Yellow Label
Signal Ground	S4	Signal Ground	N/A	N/A
Host RX Negative	S5	HOST RXN	Black	Red Label
Host RX Positive	S6	HOST RXP	Red	Red Label
Signal Ground	S7	Signal Ground	N/A	N/A



uSSD-TPA-DS Cable and Connector Pinout

The uSSD-TPA-DS adapter provides four SMA connectors (one lane of differential TX and RX). Labels clearly mark each cable or connector. The following figure refers to the pin-description tables for the Device Test Adapter.

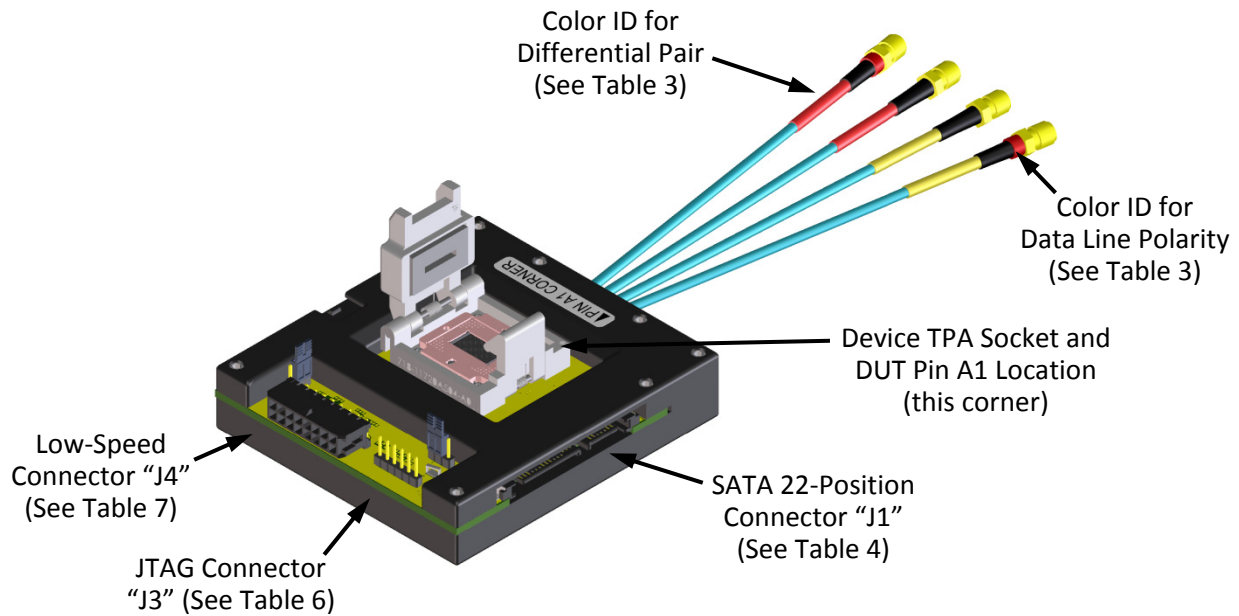


Figure 4. Cable Connectors (uSSD-TPA-DS shown)

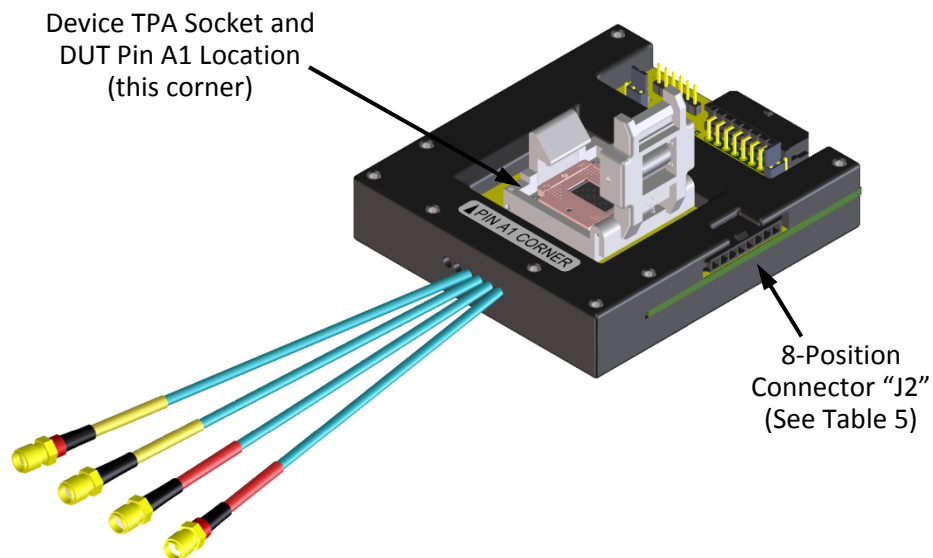


Figure 5. Cable Connectors (uSSD-TPA-DS shown)

Table 3. uSSD-TPA-DS High-Speed Pin Assignments

Pin Description	156 TFBGA Pin Assignment	Destination Label	Color ID for Data Line Polarity	Color ID for Differential Pair (Receptacle)
Crystal Out (Optional)	L9	XO	N/A	White Label
Crystal In (Optional)	M10	XI	N/A	White Label
Device RX Positive	P7	DEVICE RXP	Red	Yellow Label
Device RX Negative	R7	DEVICE RXN	Black	Yellow Label
Device TX Negative	U7	DEVICE TXN	Black	Red Label
Device TX Positive	V7	DEVICE TXP	Red	Red Label
Ground	L7, L8, L11, L19, L20, M7, M19, M20, N7, N8, N19, P19, P20, R12, T7, T8, U11, U19, U20, V19, W7, Y14, Y15, AB7, AC7, AC20, AD7, AD8, AD19, AD20	N/A	Black	N/A

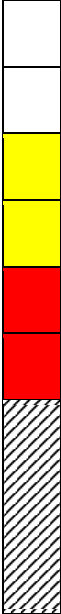


Table 4. uSSD-TPA-DS 22-Position SATA Connector “J1”

LABEL	J1 PIN NO.	DESCRIPTION
Unmarked	S1, S4, S7	Ground
Unmarked	S2, S3, S5, S6	No connect
Unmarked	P1, P2, P3	+3.3 Volts
Unmarked	P4, P5, P6, P10, P12	Ground
Unmarked	P7, P8, P9	+5.0 Volts
Unmarked	P11	DAS
Unmarked	P13, P14	No connect
Unmarked	P15	DEVSLP

Table 5. uSSD-TPA-DS 8-Position Power Access Connector “J2”

LABEL	J2 PIN NO.	156 TFBGA PIN ASSIGNMENT(S)	DESCRIPTION
1.2V	Pin 1	P8, R8, R11, T11, W11, Y11, Y12, Y13	+1.2 Volts (VDDC)
GND	Pin 2	L7, L8, L11, L19, L20, M7, M19, M20, N7, N8, N19, P19, P20, R12, T7, T8, U11, U19, U20, V19, W7, Y14, Y15, AB7, AC7, AC20, AD7, AD8, AD19, AD20	Ground
1.8V	Pin 3	V16, W16, Y16	+1.8 Volts (VCCQ)
GND	Pin 4	L7, L8, L11, L19, L20, M7, M19, M20, N7, N8, N19, P19, P20, R12, T7, T8, U11, U19, U20, V19, W7, Y14, Y15, AB7, AC7, AC20, AD7, AD8, AD19, AD20	Ground
33FL	Pin 5	L12, M11, R13, R14, R15, R16, R19, R20, T16, U8, U16, V8, Y20	+3.3 Volts (VCC_FLASH)
GND	Pin 6	L7, L8, L11, L19, L20, M7, M19, M20, N7, N8, N19, P19, P20, R12, T7, T8, U11, U19, U20, V19, W7, Y14, Y15, AB7, AC7, AC20, AD7, AD8, AD19, AD20	Ground
33IO	Pin 7	V11, Y19, AA19, AC8	+3.3 Volts (VCC_IO)
GND	Pin 8	L7, L8, L11, L19, L20, M7, M19, M20, N7, N8, N19, P19, P20, R12, T7, T8, U11, U19, U20, V19, W7, Y14, Y15, AB7, AC7, AC20, AD7, AD8, AD19, AD20	Ground

Table 6. uSSD-TPA-DS 6-Position JTAG Connector “J3”

LABEL	J3 PIN NO.	156 TFBGA PIN ASSIGNMENT(S)	TYPE	DESCRIPTION/COMMENT
33FL	Pin 1		POWER	VCC_FLASH
GND	Pin 2	GROUND	GROUND	GROUND
L15	Pin 3	L15	INPUT	JTAG_CLK (JTAG Clock.)
L16	Pin 4	L16	OUTPUT	JTAG_DO (JTAG Data Out Pin.)
L17	Pin 5	L17	INPUT	JTAG_DI (JTAG Data In Pin.)
L18	Pin 6	L18	INPUT	JTAG_TMS (JTAG Test Mode Select Pin.)

Table 7. uSSD-TPA-DS 16-Position Low-Speed Connector “J4”

LABEL	J4 PIN NO.	156 TFBGA PIN ASSIGNMENT(S)	TYPE	DESCRIPTION/COMMENT
GND	Pin 1	L7, L8, L11, L19, L20, M7, M19, M20, N7, N8, N19, P19, P20, R12, T7, T8, U11, U19, U20, V19, W7, Y14, Y15, AB7, AC7, AC20, AD7, AD8, AD19, AD20	GROUND	Ground
L13	Pin 2	L13	INPUT	POWER_LOSS_INT (Unexpected Power Loss Interrupt.)
M12	Pin 3	M12	INPUT	CLOCK_SEL (Clock Select.)
AC16	Pin 4	AC16	OUTPUT	SPI_CLK (SPI Clock.)
AD17	Pin 5	AD17	OUTPUT	SPI_MOSI (SPI Master-Out Slave-in.)
AD15	Pin 6	AD15	OUTPUT	SPI_CS0 (SPI Chip Select.)
AC9	Pin 7	AC9	INPUT	DEVSLP (Used to turn off the uSSD's SATA PHY for power saving.) Refer to SATA-IO specifications and ratified technical proposals for further details.
AA8	Pin 8	AA8	INPUT	TP0 (Diagnostic Test Pin.)
NC	Pin 9	NO CONNECT	Can be user definable	Can be user definable.
M9	Pin 10	M9	INPUT	PWR_RESETN (Hardware Reset, Active Low)
M13	Pin 11	M13	OUTPUT	DAS (Device Activity Signal.)
AA20	Pin 12	AA20	OUTPUT	VDDC_CTRL (VDDC Control)
AD18	Pin 13	AD18	OUTPUT	SPI_CS1 (SPI Chip Select.)
AD16	Pin 14	AD16	INPUT	SPI_MISO (SPI Master-In Slave-Out.)
AC11	Pin 15	AC11	OUTPUT	STANDBY (Asserted by uSSD to disable external power during low-power mode.)
AD9	Pin 16	AD9	OUTPUT	POWER_LOSS_EXT

uSSD-TPA-DS Power Management and TP0 Jumpers and Reference

The standard configuration uSSD-TPA-DS adapter incorporates active power management components and circuitry to transparently handle the power system requirements internally and ease the DUT testing requirements for users. The power management circuit utilizes a Texas Instruments LM10506-A PMIC device to accomplish this feature. For detailed descriptions of the PMIC device and its operation, refer to Texas Instruments LM10506-A data sheet. Specific information detailing how the uSSD-TPA-DS incorporates the PMIC components and circuitry can be found in the Schematic Addendum to this User Manual.

Primary input power to the uSSD-TPA-DS is made through the 22-position SATA connector “J1” as illustrated in Figure 5 and detailed in Table 4. The user has the option of setting the input power voltage to either 3.3V (if available) or 5V by setting jumper “VHOST” appropriately. See Figure 7, below.

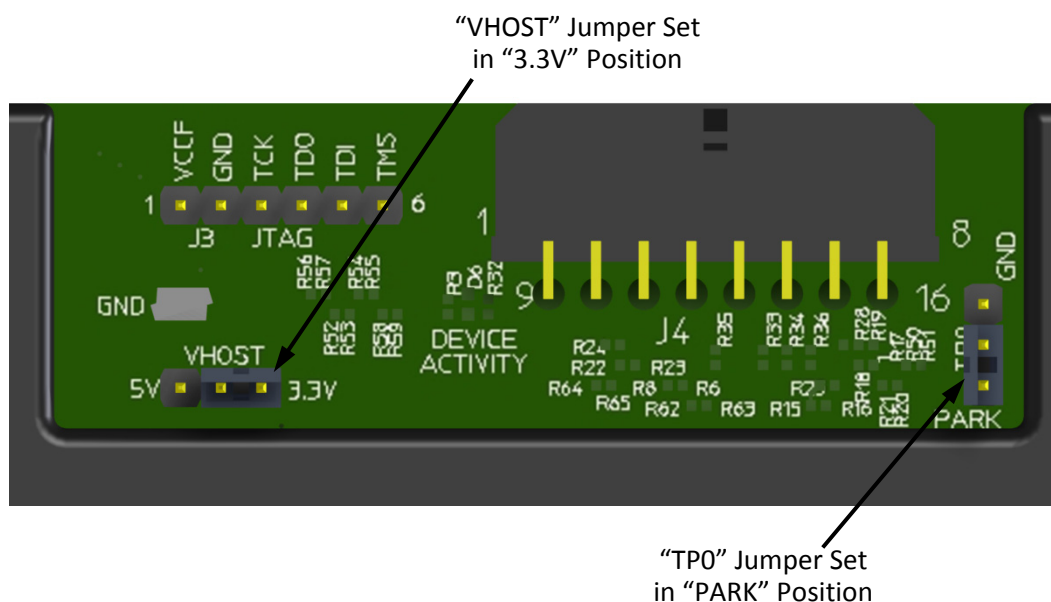


Figure 6. Jumper Positions (uSSD-TPA-DS shown, in part)

The diagnostic test pin “TP0” (refer to Table 7) is accessible through the 16-position low-speed connector “J4” and can be enabled or disabled by setting jumper “TP0” appropriately. See Figure 7, above.

As shown above, provisions are also made on the uSSD-TPA-DS for JTAG access to the DUT. Note, however, that the user is responsible for providing the mating connector and wiring to the stake-pins provided on the test adapter. Further details regarding the JTAG circuitry may be found in the Schematic Addendum to this User Manual.

Electrical Specifications

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

Table 8. Electrical Specifications

SPECIFICATION	MIN	TYP	MAX	NOTES
Differential Impedance (ohms), 70 ps Rise Time, 20 – 80%	95		105	All Differential Pairs, Host, Receptacle, and Device excluding Socket and SATA connectors.
Differential Impedance (ohms), 70 ps Rise Time, 20 – 80%	80		120	All Differential Pairs, Host, Receptacle, and Device with Socket, including SATA connectors.
Impedance (ohms), 70 ps Rise Time, 20 – 80%	47.5		52.5	All Differential Pairs, Host, Receptacle, and Device excluding Socket and SATA connectors.
Intra-pair Skew (ps)	-6		6	All Differential Pairs, Host, Receptacle, and Device with Socket.
Inter-pair Skew (ps)	-6		6	All Differential Pairs, Host, Receptacle, and Device with Socket.

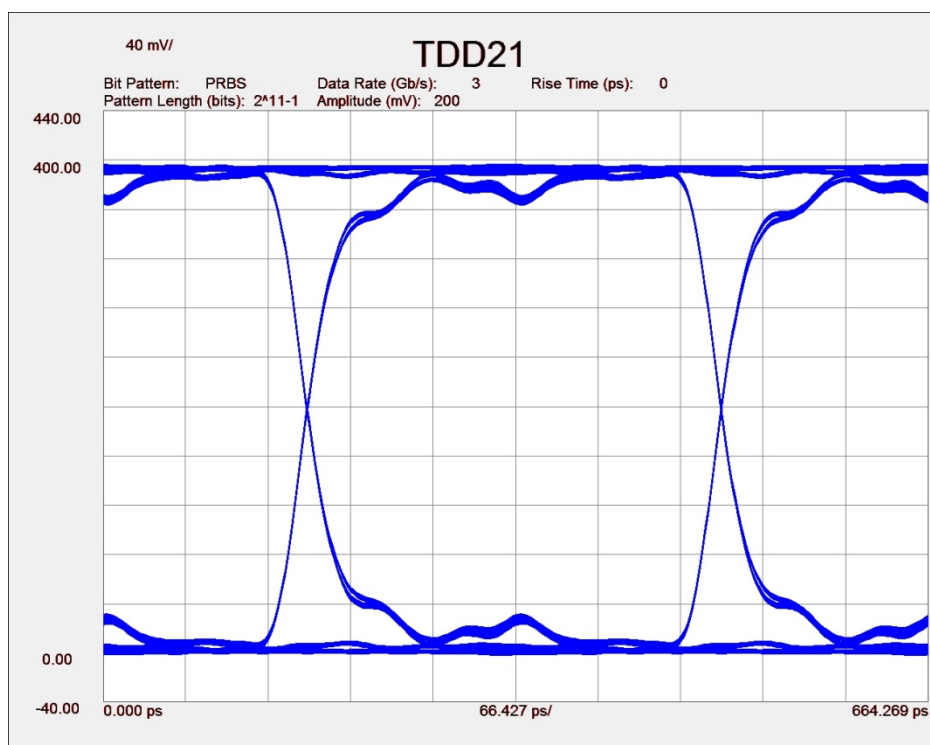
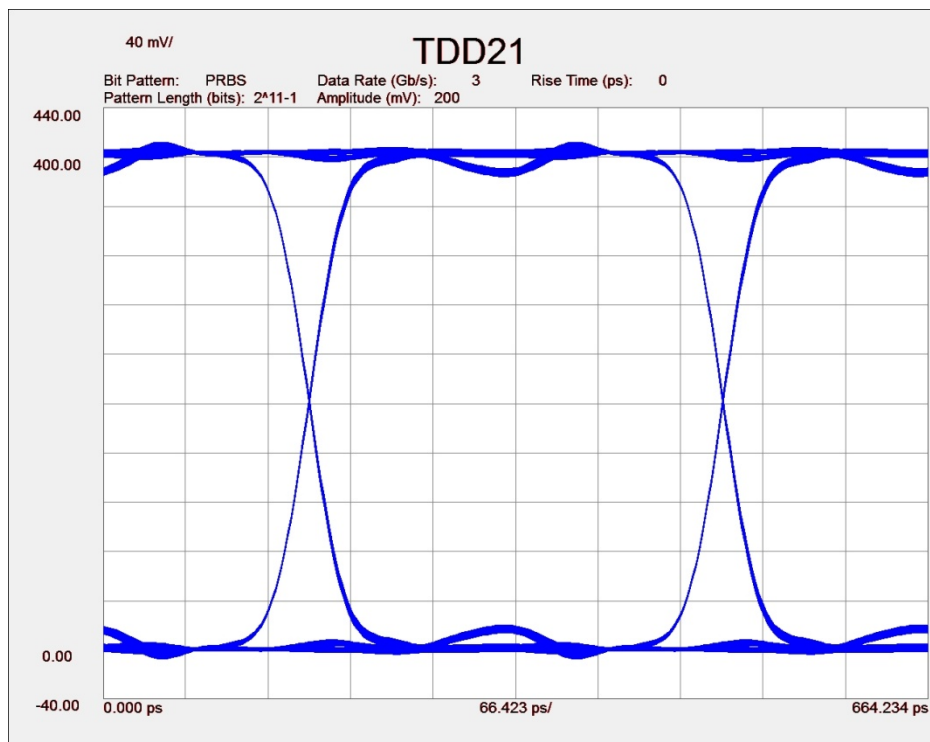


Figure 7. Typical socketed/mated pair 3 Gb/s eye diagram, with de-embedding (top) and without de-embedding (bottom).

Parameter Measurement Result	
Name	Measurement Result
Eye Level Zero(mV)	4.74
Eye Level One(mV)	399.75
Eye Level Mean(mV)	202.25
Eye Amplitude(mV)	395.01
Eye Height(mV)	366.36
Eye Height(db)	-4.36
Eye Width	3.31e-010
Eye Opening Factor	0.93
Eye Signal_to_Noise	31.43
Eye Duty Cycle Dist	-1.03e-014
Eye Duty Cycle Dist(%)	-0.00
Eye Rise Time (20-80)	3.76e-011
Eye Fall Time (80-20)	3.76e-011
Eye Jitter(PP)	2.22e-012
Eye Jitter(RMS)	7.05e-013

S₁₁ Param DUT Files Meas

Parameter Measurement Result	
Name	Measurement Result
Eye Level Zero(mV)	9.23
Eye Level One(mV)	385.85
Eye Level Mean(mV)	197.54
Eye Amplitude(mV)	376.62
Eye Height(mV)	336.45
Eye Height(db)	-4.73
Eye Width	3.31e-010
Eye Opening Factor	0.89
Eye Signal_to_Noise	23.31
Eye Duty Cycle Dist	-5.31e-014
Eye Duty Cycle Dist(%)	-0.02
Eye Rise Time (20-80)	3.51e-011
Eye Fall Time (80-20)	3.51e-011
Eye Jitter(PP)	2.22e-012
Eye Jitter(RMS)	7.34e-013

S₁₁ Param DUT Files Meas

Figure 8. Typical socketed/mated pair 3 Gb/s eye data, with de-embedding (top) and without de-embedding (bottom). Note: 0.00e+000 results are below the resolution of the calculation.

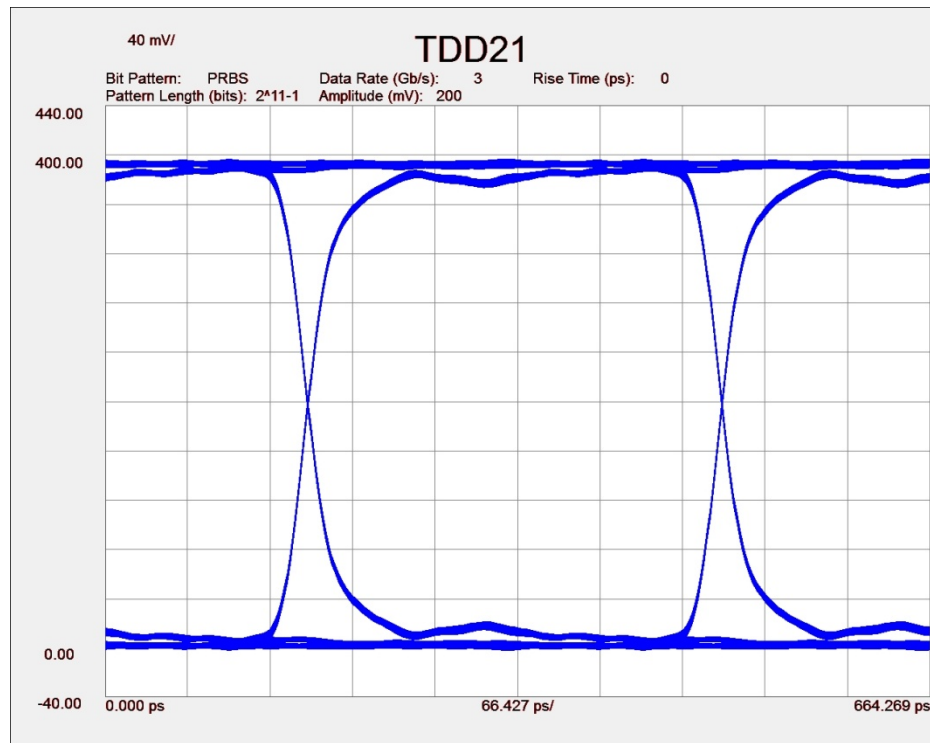
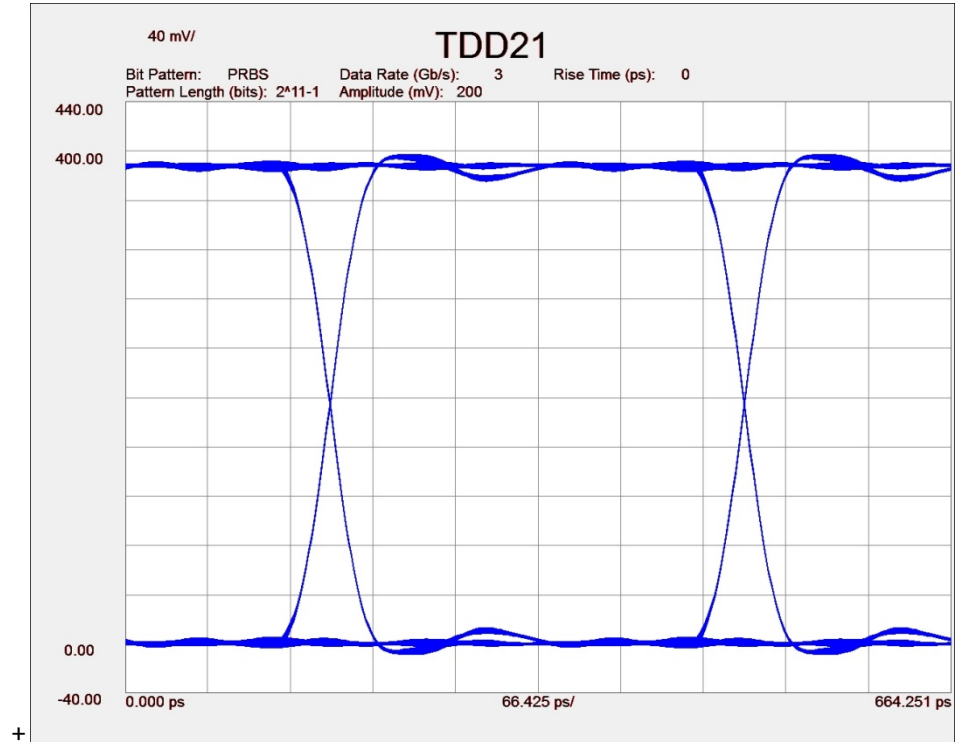


Figure 9. Typical TFBGA mounted/mated pair 3 Gb/s eye diagram, with de-embedding (top) and without de-embedding (bottom).

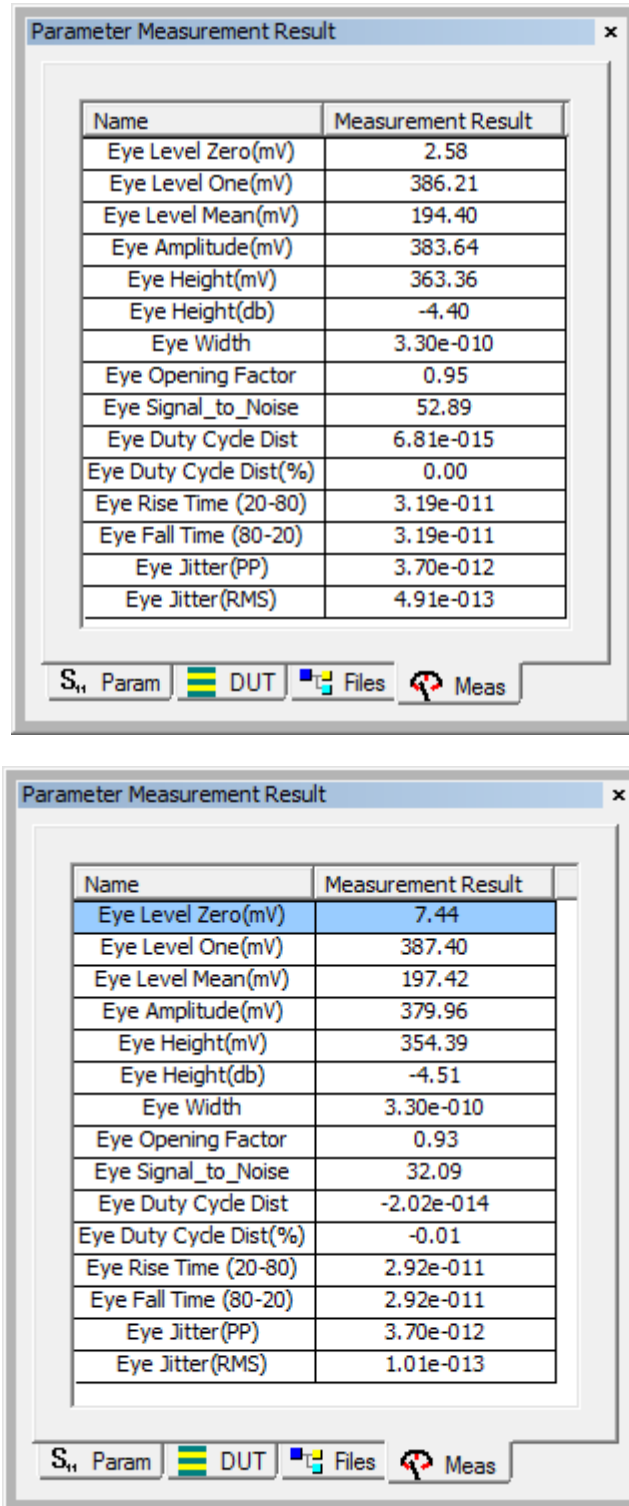


Figure 10. Typical TFBGA mounted/mated pair 3 Gb/s eye data, with de-embedding (top) and without de-embedding (bottom). Note: 0.00e+000 results are below the resolution of the calculation.

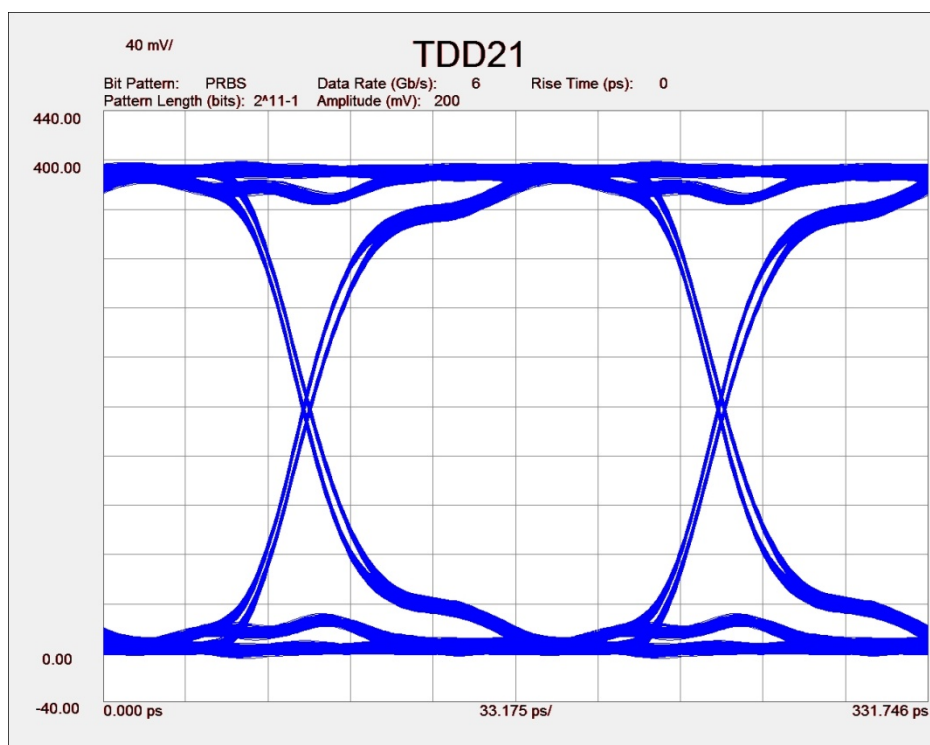
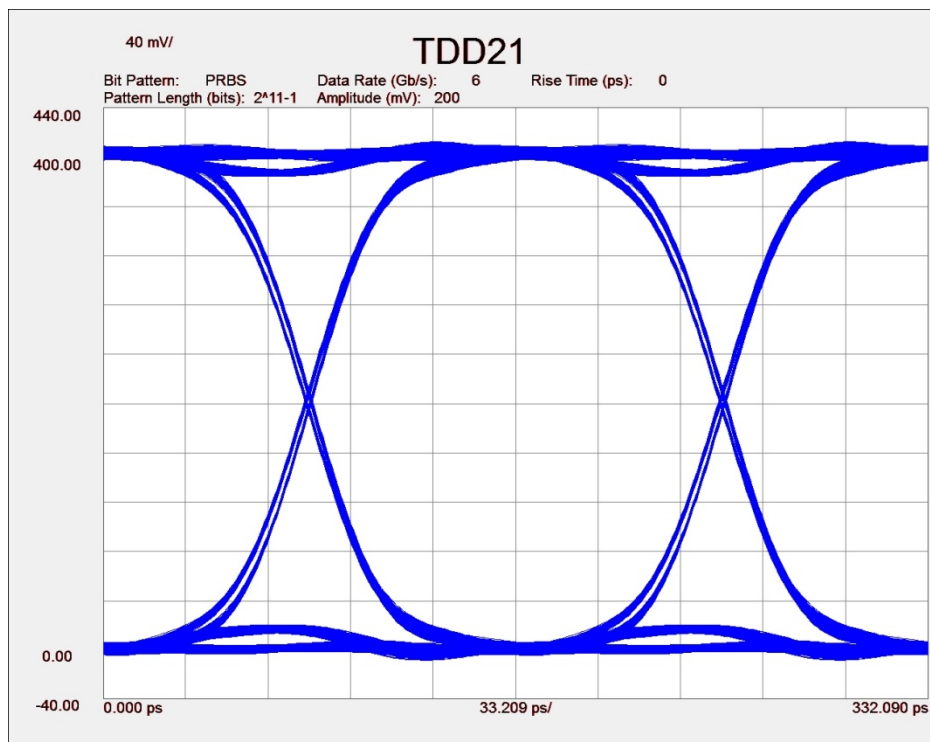


Figure 11. Typical socketed/mated pair 6 Gb/s eye diagram, with de-embedding (top) and without de-embedding (bottom).

Parameter Measurement Result	
Name	Measurement Result
Eye Level Zero(mV)	3.12
Eye Level One(mV)	400.91
Eye Level Mean(mV)	202.01
Eye Amplitude(mV)	397.79
Eye Height(mV)	373.83
Eye Height(db)	-4.27
Eye Width	1.63e-010
Eye Opening Factor	0.94
Eye Signal_to_Noise	48.64
Eye Duty Cycle Dist	-8.57e-015
Eye Duty Cycle Dist(%)	-0.01
Eye Rise Time (20-80)	3.91e-011
Eye Fall Time (80-20)	3.91e-011
Eye Jitter(PP)	4.07e-012
Eye Jitter(RMS)	1.10e-012

S_n Param DUT Files Meas

Parameter Measurement Result	
Name	Measurement Result
Eye Level Zero(mV)	11.80
Eye Level One(mV)	382.75
Eye Level Mean(mV)	197.28
Eye Amplitude(mV)	370.95
Eye Height(mV)	311.03
Eye Height(db)	-5.07
Eye Width	1.62e-010
Eye Opening Factor	0.84
Eye Signal_to_Noise	16.81
Eye Duty Cycle Dist	-2.92e-014
Eye Duty Cycle Dist(%)	-0.02
Eye Rise Time (20-80)	3.31e-011
Eye Fall Time (80-20)	3.31e-011
Eye Jitter(PP)	4.80e-012
Eye Jitter(RMS)	1.38e-012

S_n Param DUT Files Meas

Figure 12. Typical socketed/mated pair 6 Gb/s eye data, with de-embedding (top) and without de-embedding (bottom).

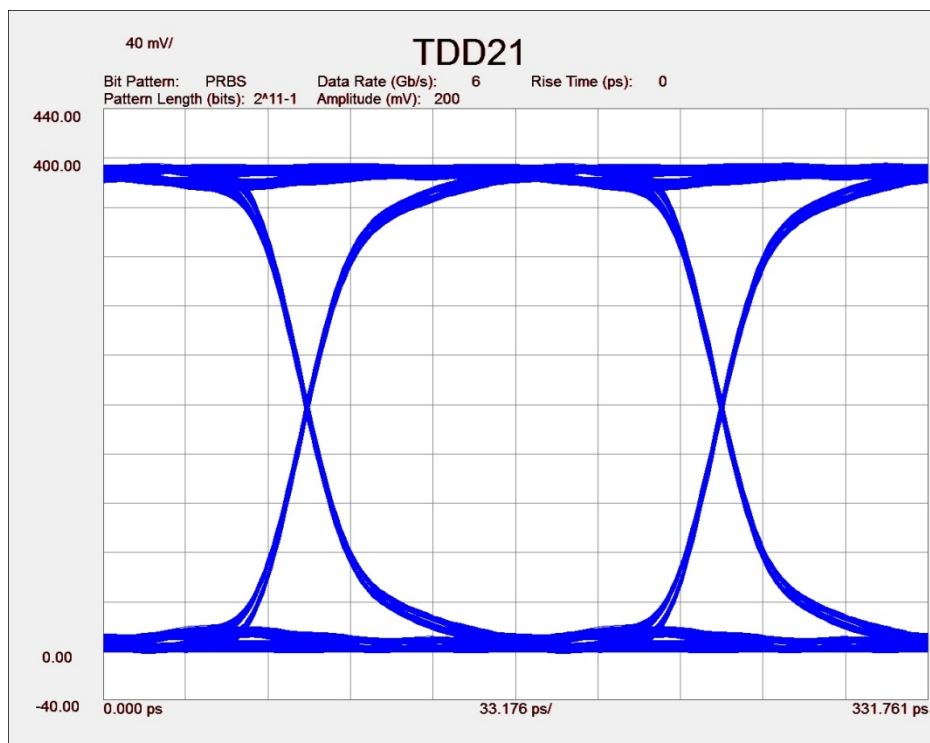
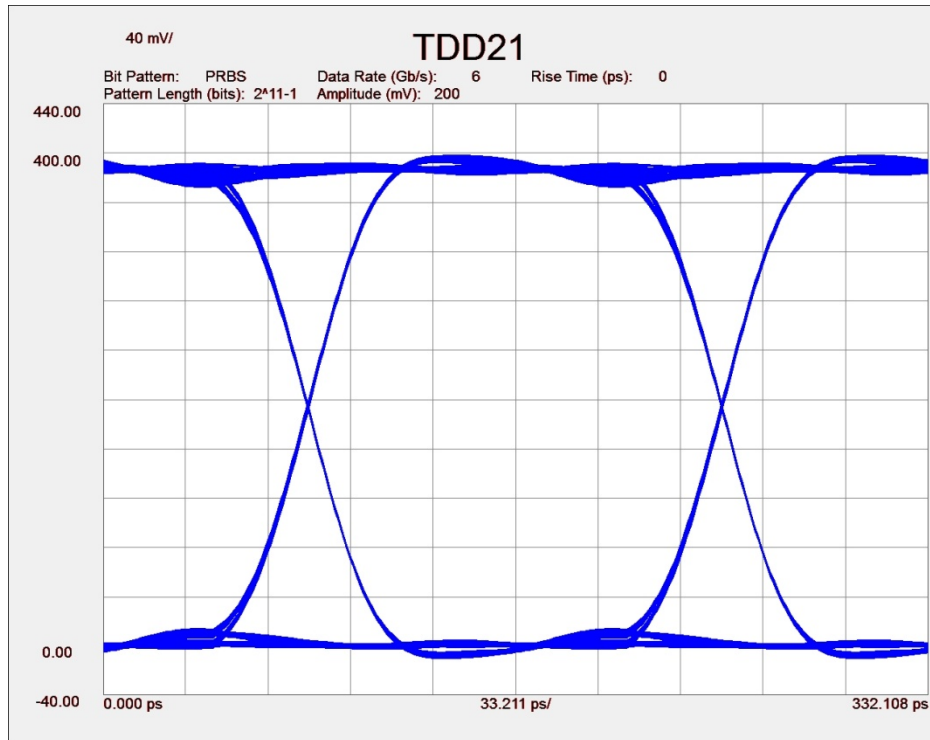


Figure 13. Typical TFBGA mounted/mated pair 6 Gb/s eye diagram, with de-embedding (top) and without de-embedding (bottom).

Parameter Measurement Result	
Name	Measurement Result
Eye Level Zero(mV)	0.05
Eye Level One(mV)	387.75
Eye Level Mean(mV)	193.90
Eye Amplitude(mV)	387.70
Eye Height(mV)	364.86
Eye Height(db)	-4.38
Eye Width	1.65e-010
Eye Opening Factor	0.94
Eye Signal_to_Noise	43.73
Eye Duty Cycle Dist	1.91e-014
Eye Duty Cycle Dist(%)	0.01
Eye Rise Time (20-80)	3.28e-011
Eye Fall Time (80-20)	3.27e-011
Eye Jitter(PP)	1.85e-012
Eye Jitter(RMS)	5.34e-013

S₁₁ Param DUT Files Meas

Parameter Measurement Result	
Name	Measurement Result
Eye Level Zero(mV)	8.29
Eye Level One(mV)	385.77
Eye Level Mean(mV)	197.03
Eye Amplitude(mV)	377.48
Eye Height(mV)	343.93
Eye Height(db)	-4.64
Eye Width	1.64e-010
Eye Opening Factor	0.91
Eye Signal_to_Noise	33.77
Eye Duty Cycle Dist	-1.08e-014
Eye Duty Cycle Dist(%)	-0.01
Eye Rise Time (20-80)	2.90e-011
Eye Fall Time (80-20)	2.89e-011
Eye Jitter(PP)	2.59e-012
Eye Jitter(RMS)	6.17e-013

S₁₁ Param DUT Files Meas

Figure 14. Typical TFBGA mounted/mated pair 6 Gb/s eye data, with de-embedding (top) and without de-embedding (bottom).

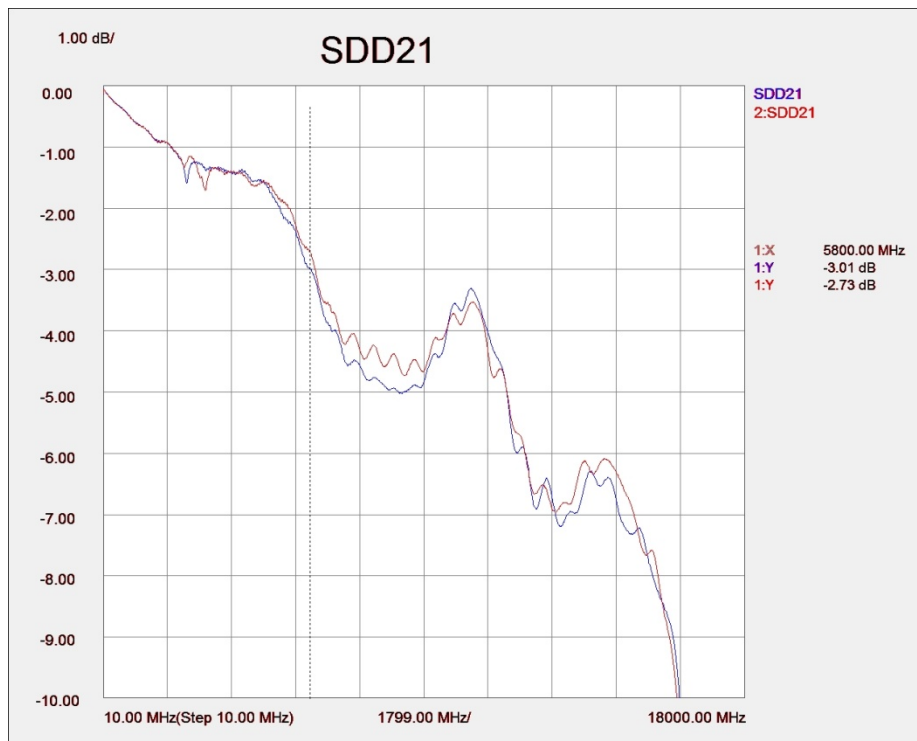


Figure 15. Typical socketed/mated pair balanced insertion loss, with de-embedding (top) and without de-embedding (bottom).

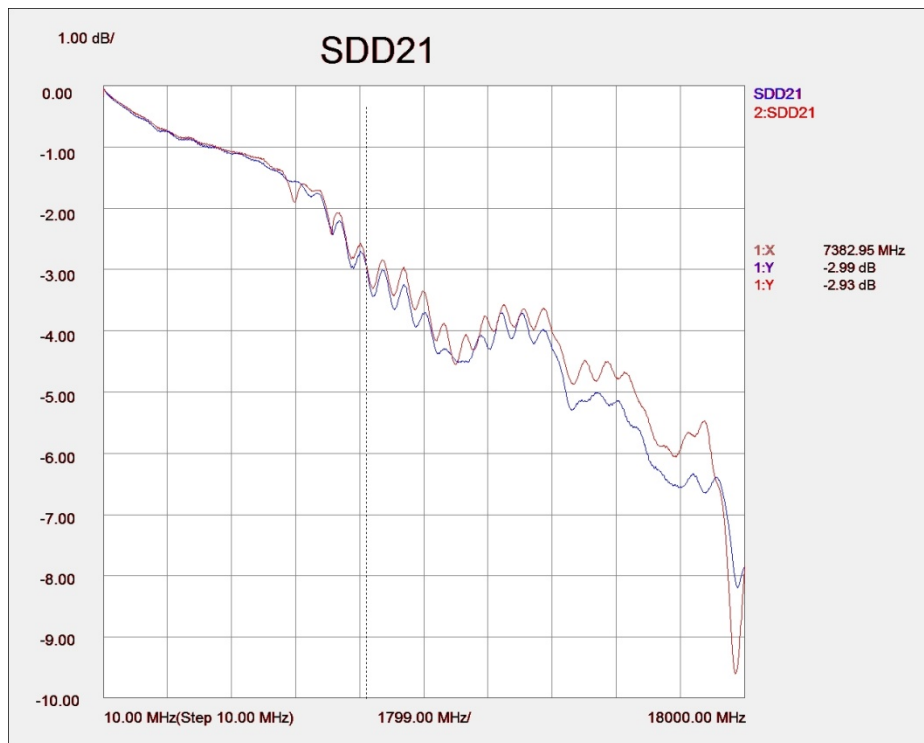
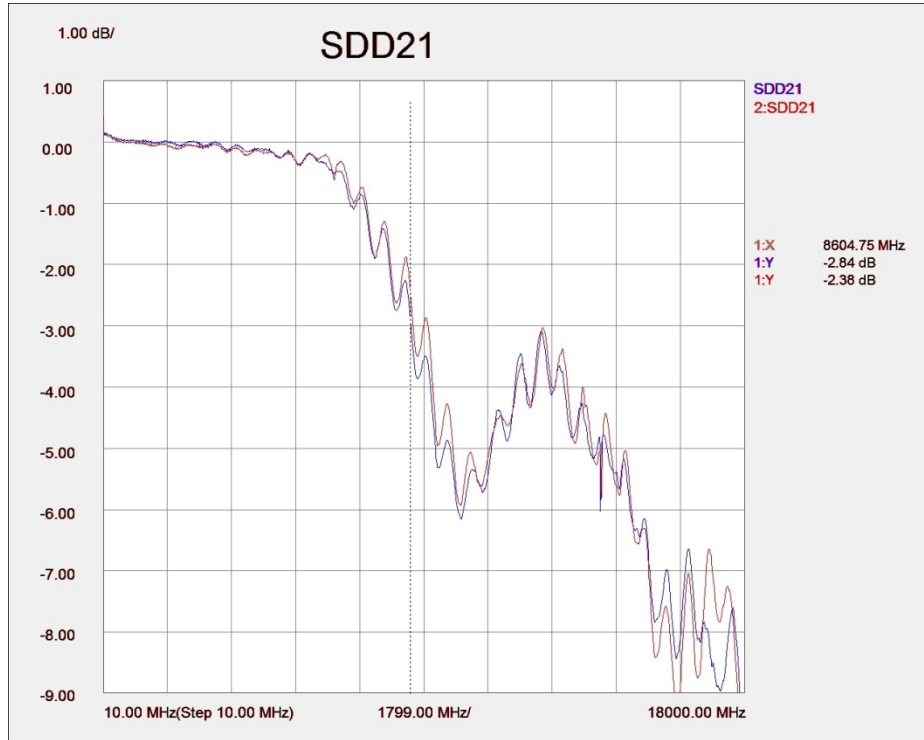


Figure 16. Typical TFBGA mounted/mated pair balanced insertion loss, with de-embedding (top) and without de-embedding (bottom).

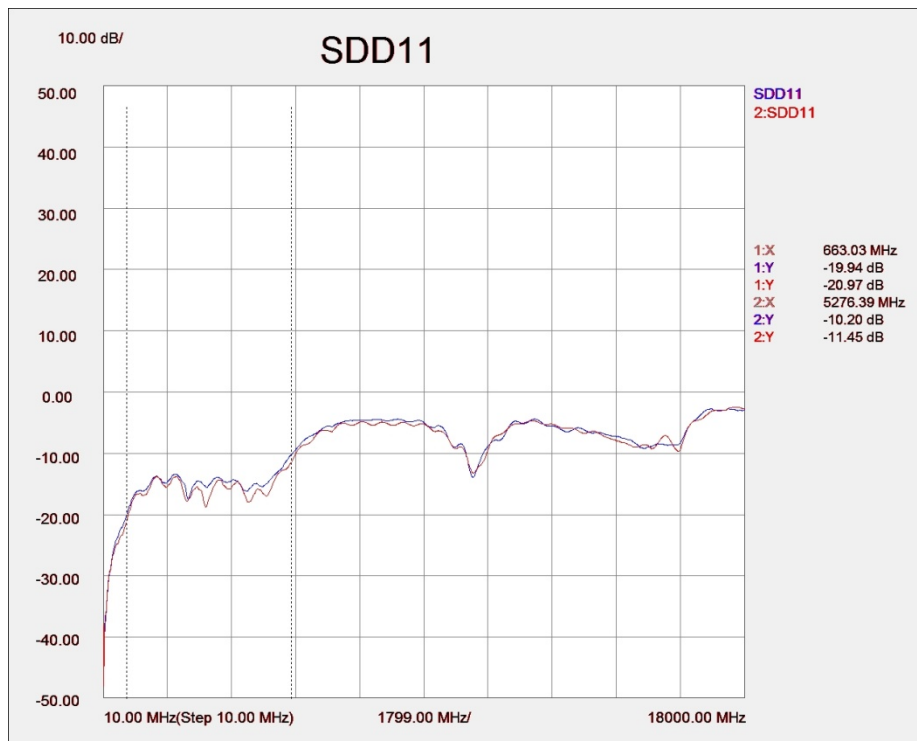
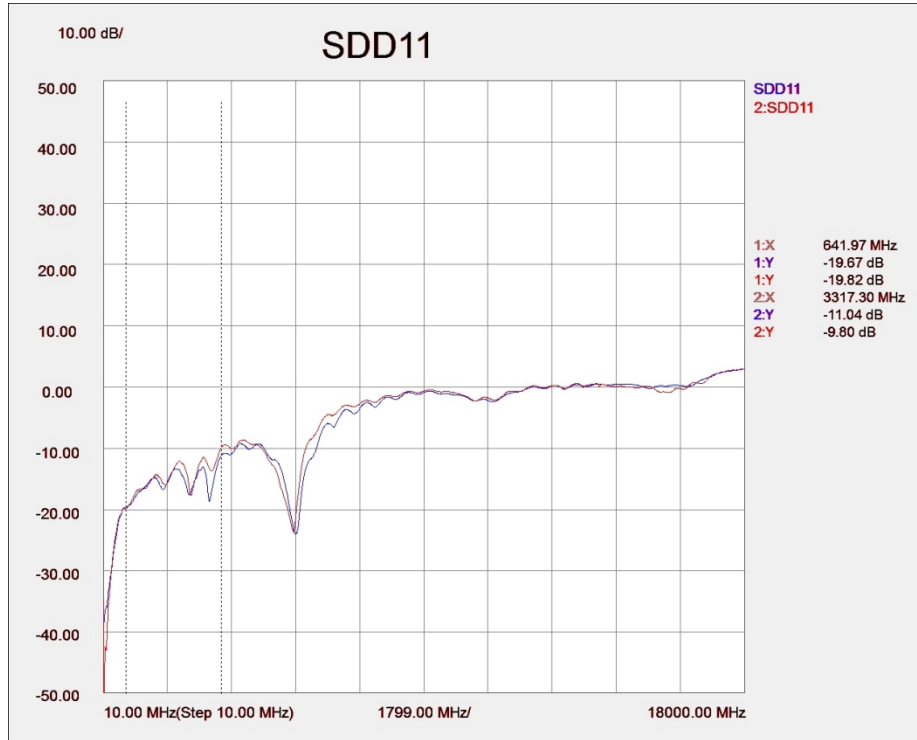


Figure 17. Typical socketed/mated pair balanced return loss, with de-embedding (top) and without de-embedding (bottom).

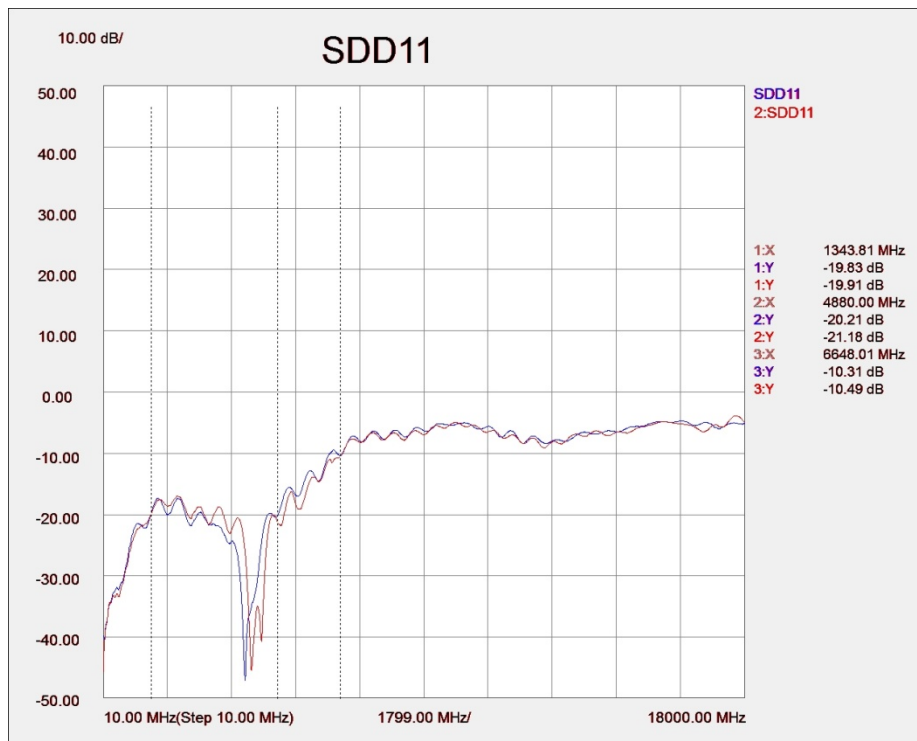
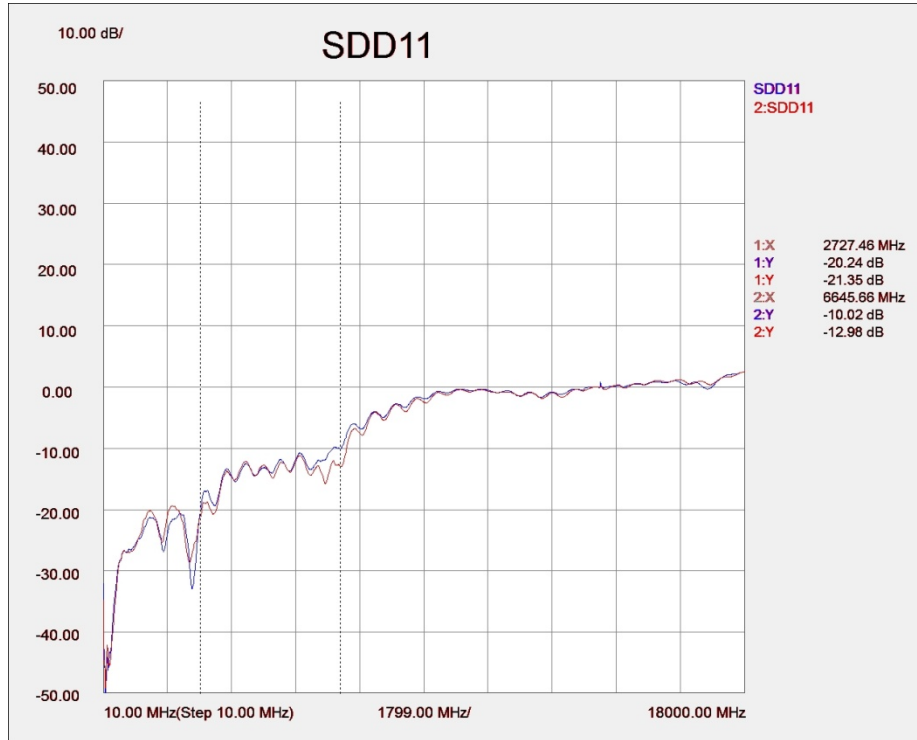


Figure 18. Typical TFBGA mounted/mated pair balanced return loss, with de-embedding (top) and without de-embedding (bottom).

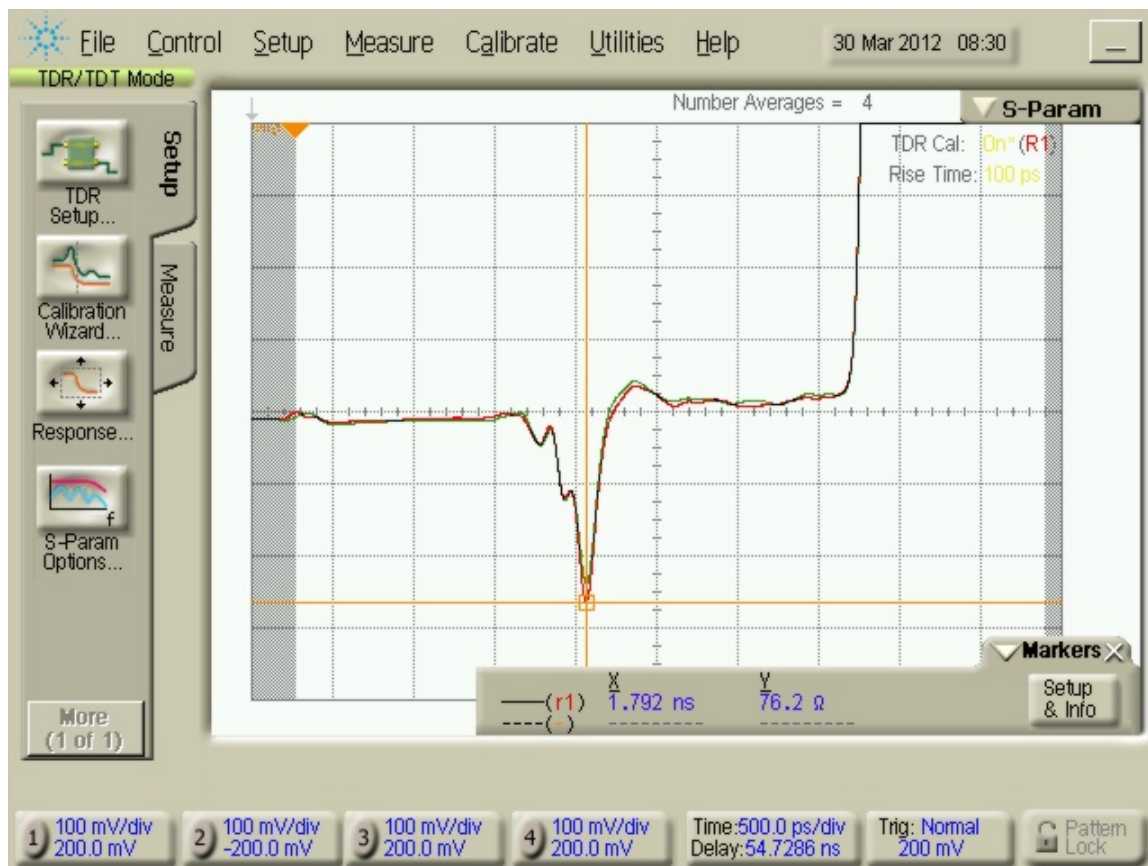


Figure 19. Typical differential TDR of TPA-H and TPA-R connected to TPA-DS (socketed) at 100ps Rise Time (Equivalent to 70ps, 20% to 80%).

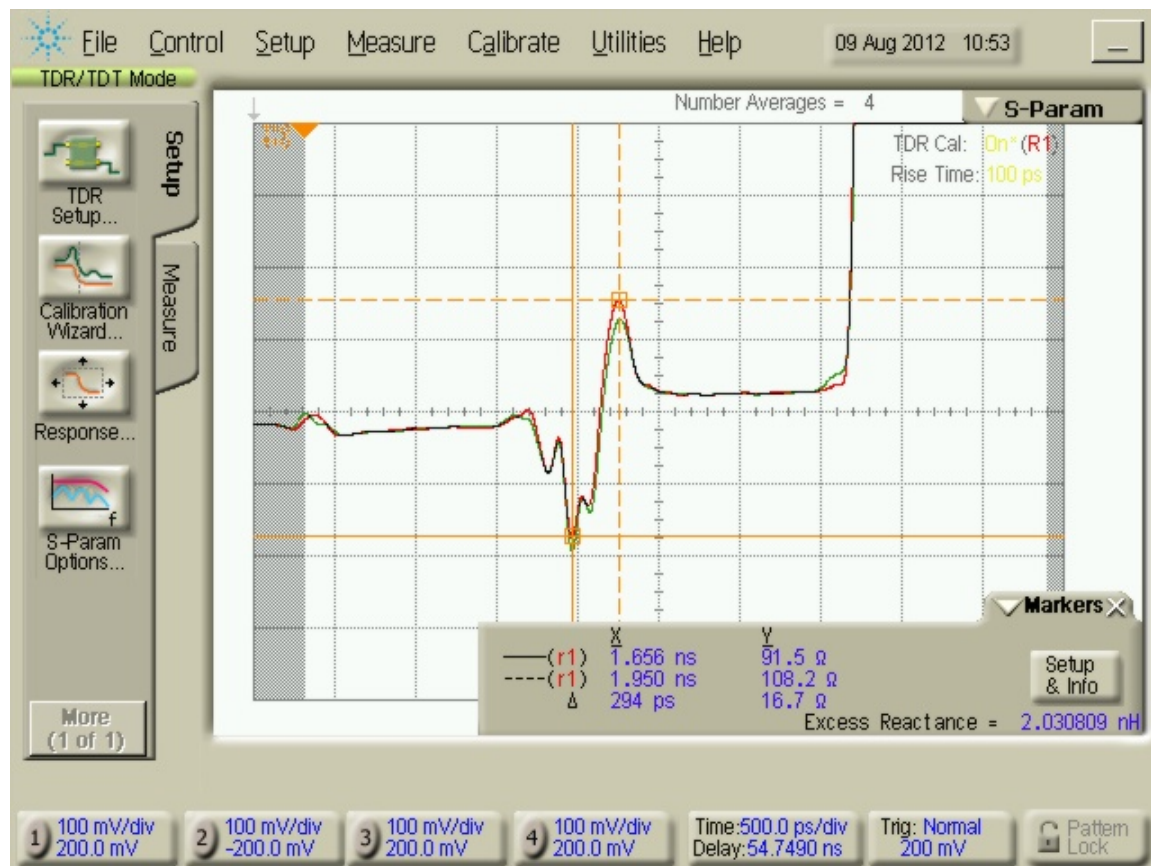


Figure 20. Typical differential TDR of TPA-H and TPA-R connected to TPA-D (TFBGA mounted) at 100ps Rise Time (Equivalent to 70ps, 20% to 80%).

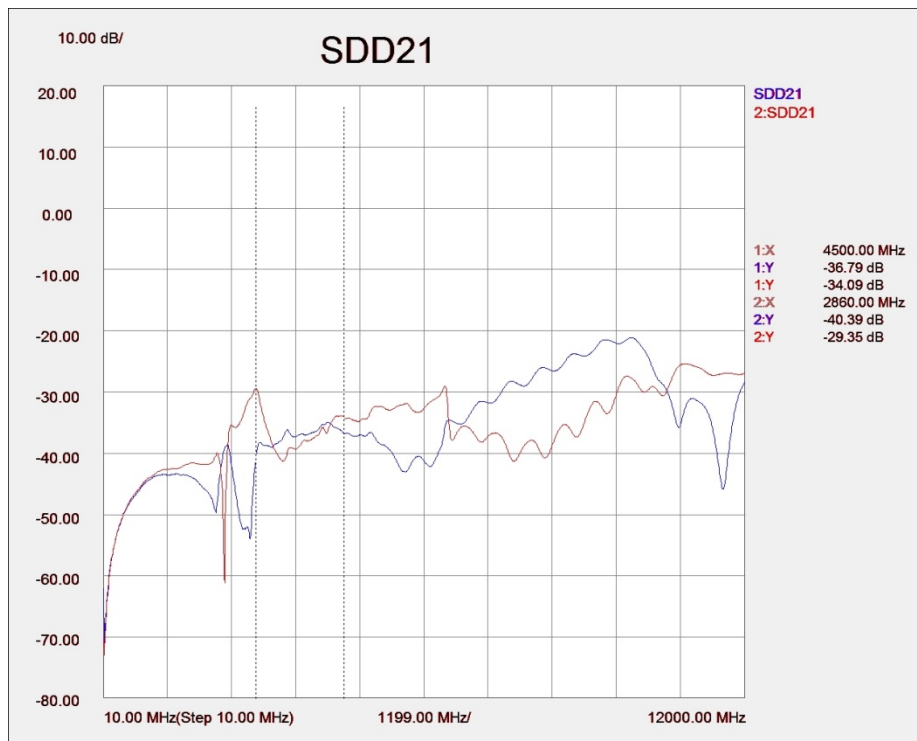
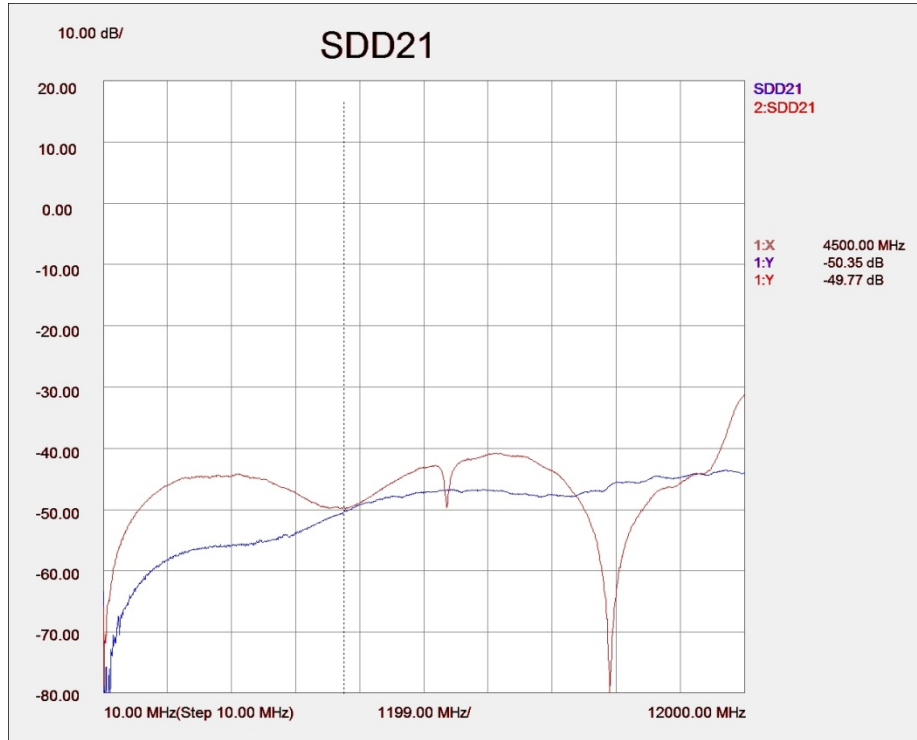


Figure 21. Typical Differential NEXT, without connector (top) and with socketed/mated connectors (bottom), adjacent differential pairs, both transmit and receive terminated at both ends.

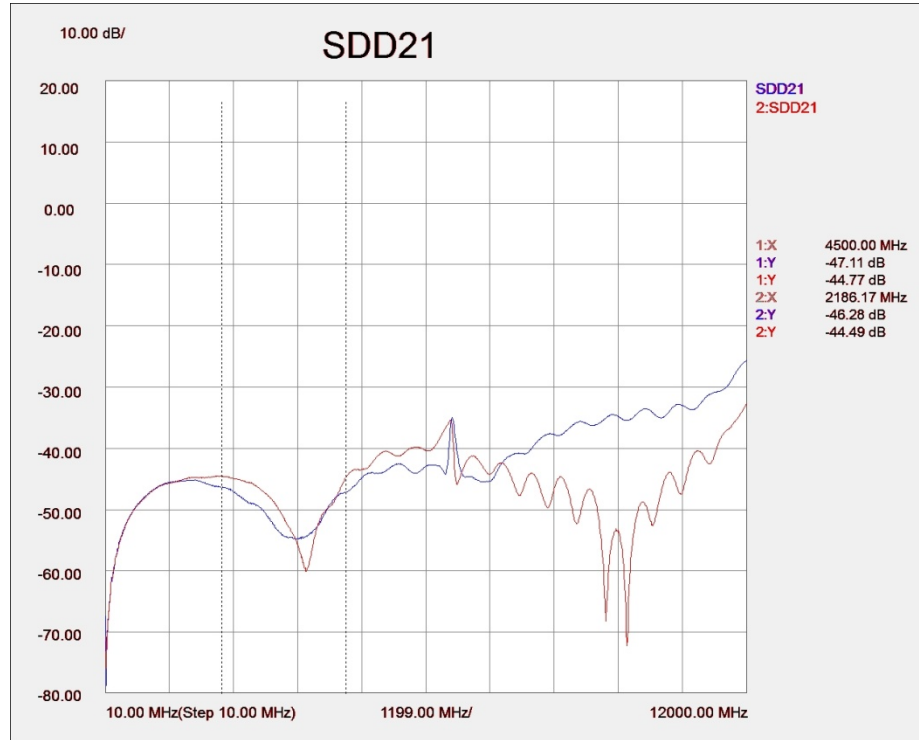


Figure 22. Typical Differential NEXT, without connector (top) and with TFBGA mounted/mated connectors (bottom), adjacent differential pairs, both transmit and receive terminated at both ends.

Wilder Technologies, LLC – Limited Warranty

Wilder Technologies, LLC warrants that each Test Adapter, 1) is free from defects in materials and workmanship and, 2) conforms to Wilder Technologies specifications for a period of 12 months. **See Consumable and Fragile Material Warranty for exceptions to the 12 month warranty**

The warranty period for a Test Adapter is a specified, fixed period commencing on the date of ship from Wilder Technologies, LLC. If you did not purchase your Test Adapter directly from Wilder Technologies, LLC, the serial number and a valid proof of purchase will be required to establish your purchase date. If you do not have a valid proof of purchase, the warranty period will be measured from the date of ship from Wilder Technologies, LLC.

If, during the warranty period, the Test Adapter is not in good working order, Wilder Technologies, LLC will, at its option, repair or replace it at no additional charge, except as is set forth below. In some cases, the replacement Test Adapter may not be new and may have been previously installed. Regardless of the Test Adapter's production status, Wilder Technologies, LLC appropriate warranty terms apply.

Consumable and Fragile Material Warranty

Wilder Technologies, LLC warrants that consumable materials and all fragile materials supplied by Wilder Technologies, LLC either as part of an instrument or system, or supplied separately, will be free from defects in material and workmanship at the time of shipment.

Extent of Warranty

The warranty does not cover the repair or exchange of a Test Adapter resulting from misuse, accident, modification, unsuitable physical or operating environment, improper maintenance by you, or failure caused by a product for which Wilder Technologies, LLC is not responsible. The warranty is voided by removal or alteration of Test Adapter or parts identification labels. The initial three months are unconditional; the remaining months excludes plugs, receptacles and SMA connectors. Connectors are wear items and excluded from the warranty after the initial three months.

These warranties are your exclusive warranties and replace all other warranties or conditions, express or implied, including but not limited to, the implied warranties or conditions or merchantability and fitness for a particular purpose. These warranties give you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction. Some jurisdictions do not allow the exclusion or limitation of express or implied warranties, so the above exclusion or limitation may not apply to you. In that event, such warranties are limited in duration to the warranty period. No warranties apply after that period.

Items Not Covered by Warranty

Wilder Technologies, LLC does not warrant uninterrupted or error-free operation of a Test Adapter.

Any technical or other support provided for a Test Adapter under warranty, such as assistance via telephone with "how-to" questions and those regarding Test Adapter set-up and installation, will be provided **WITHOUT WARRANTIES OF ANY KIND**.

Warranty Service

Warranty service may be obtained from Wilder Technologies, LLC by returning a Wilder Technologies, LLC Returns Material Authorization and the Test Adapter to Wilder Technologies, LLC during the warranty period. To obtain RMA number, contact support@wilder-tech.com.

You may be required to present proof of purchase or other similar proof of warranty entitlement. You are responsible for any associated transportation charges, duties and insurance between you and Wilder Technologies, LLC. In all instances, you must ship Test Adapters in Wilder Technologies, LLC approved packaging. Information on packaging guidelines can be found at: www.wilder-tech.com. Wilder Technologies, LLC will ship repaired or replacement Test Adapter Delivery Duty Prepaid (DDP) and will pay for return shipment. You will receive title to the repaired or replacement Test Adapter and you will be the importer of record.

Wilder Technologies, LLC – Terms & Conditions of Sale

1. **Other Documents:** This Agreement may NOT be altered, supplemented, or amended by the use of any other document(s) unless otherwise agreed to in a written agreement signed by both you and Wilder Technologies, LLC. If you do not receive an invoice or acknowledgement in the mail, via e-mail, or with your Product, information about your purchase may be obtained at support@wilder-tech.com or by contacting your sales representative.
2. **Payment Terms, Orders, Quotes, Interest:** Terms of payment are within Wilder Technologies, LLC's sole discretion, and unless otherwise agreed to by Wilder Technologies, LLC, payment must be received by Wilder Technologies, LLC prior to Wilder Technologies, LLC's acceptance of an order. Payment for the products will be made by credit card, wire transfer, or some other prearranged payment method unless credit terms have been agreed to by Wilder Technologies, LLC. Invoices are due and payable within the time period noted on your invoice, measured from the date of the invoice. Wilder Technologies, LLC may invoice parts of an order separately. Your order is subject to cancellation by Wilder Technologies, LLC, in Wilder Technologies, LLC's sole discretion. Unless you and Wilder Technologies, LLC have agreed to a different discount, Wilder Technologies, LLC's standard pricing policy for Wilder Technologies, LLC-branded systems, which includes hardware, software and services in one discounted price, allocates the discount off list price applicable to the service portion of the system to be equal to the overall calculated percentage discount off list price on the entire system. Wilder Technologies, LLC is not responsible for pricing, typographical, or other errors in any offer by Wilder Technologies, LLC and reserves the right to cancel any orders resulting from such errors.
3. **Shipping Charges; Taxes; Title; Risk of Loss:** Shipping, handling, duties and tariffs are additional unless otherwise expressly indicated at the time of sale. Title to products passes from Wilder Technologies, LLC to Customer on shipment from Wilder Technologies, LLC's facility. Loss or damage that occurs during shipping by a carrier selected by Wilder Technologies, LLC is Wilder Technologies, LLC's responsibility. Loss or damage that occurs during shipping by a carrier selected by you is your responsibility. You must notify Wilder Technologies, LLC within 7 days of the date of your invoice or acknowledgement if you believe any part of your purchase is missing, wrong or damaged. Unless you provide Wilder Technologies, LLC with a valid and correct tax exemption certificate applicable to your purchase of Product and the Product ship-to location, you are responsible for sales and other taxes associated with the order. **Shipping dates are estimates only.**
4. **WARRANTY:** WILDER TECHNOLOGIES, LLC, warrants that the item(s) manufactured under the Buyer's contract shall be free from defects in materials and workmanship furnished by WILDER TECHNOLOGIES, LLC, and shall conform to the applicable drawings and specifications. WILDER TECHNOLOGIES, LLC'S liability herein, for breach of warranty, contract or negligence in manufacturing, shall be limited to repair or replacement. Repair or replacement of defective items will be applicable only if the Buyer notifies WILDER TECHNOLOGIES, LLC, by written notice within 30-days of delivery. All claims shall be addressed to: support@wilder-tech.com or WILDER TECHNOLOGIES, LLC, 6101A East 18th Street, Vancouver, Washington 98661 U.S.A.; ATTENTION: Customer Service Manager. WILDER TECHNOLOGIES, LLC, reserves the right to inspect at the Buyer's plant all items claimed to be defective or nonconforming prior to authorizing their return. WILDER TECHNOLOGIES, LLC, assumes no liability for the results of the use of its components in conjunction with other electric, electronic or mechanical components, circuits and/or systems. The foregoing constitutes the sole and exclusive remedy of the Buyer and the exclusive liability of WILDER TECHNOLOGIES, LLC, and is IN LIEU OF ANY AND ALL OTHER WARRANTIES, STATUTORY, IMPLIED OR EXPRESSED AS TO MERCHANTABILITY, FITNESS FOR THE PURPOSE SOLD, DESCRIPTION, QUALITY, and PRODUCTIVENESS OR ANY OTHER MATTER. Without limiting the foregoing, in no event shall WILDER TECHNOLOGIES, LLC, be liable for loss of use, profit or other collateral, or for special and/or consequential damages.
5. **RETURNED GOODS:** WILDER TECHNOLOGIES, LLC, will accept only those goods for return that have been authorized for return. All goods authorized for return shall be assigned a Returned Material Authorization (RMA) Number. The RMA Number shall be clearly marked on the shipping container(s) and all documentation accompanying the goods authorized for return. The RMA Number shall be assigned by WILDER TECHNOLOGIES, LLC pursuant to the conditions set forth in Paragraph 4, WARRANTY.
6. **UNITED STATES GOVERNMENT CONTRACTS:** In the event this offer is accepted under Government contract, WILDER TECHNOLOGIES, LLC, agrees to accept clauses required by Government regulations and to waive WILDER TECHNOLOGIES, LLC conditions inconsistent therewith. WILDER TECHNOLOGIES, LLC, certifies that it is a regular manufacturer or dealer of the goods and/or services offered herein and that the prices offered do not exceed those charged to any customer for like quantities, services or materials under the same conditions.

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.

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.
Informative	The designation of a test that is not required for compliance but is considered important from a characterization standpoint. It is provided for informational purposes only.
Insertion loss	The ratio, expressed in dB, of incident power to delivered power.
Near-end crosstalk	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.
SATA Initiator Device	A device containing SSP, STP, and /or SMP initiating ports in a SATA domain.
SATA Link	The SATA link is a full duplex point to point link as continuous data activity exists on each direction. For purposes of compliance testing of Hosts and Devices, the full duplex link is broken into two simplex links, one for the Host transmitting to the Device and the other for the Device transmitting to the Host. Each link is tested for compliance separately.
SATA Target Device	A device containing SSP, STP, and /or SMP target ports in a SATA domain.
uSSD-TPA	uSSD Test Point Access. A specialized assembly that interfaces to a SATA receptacle or plug and enables access of signals for measurement or stimulation.
Serial ATA (SATA)	The protocol defined by SATA (see ATA8-AAM)
Serial Attached SCSI (SAS)	The set of protocols defined in SPL and the interconnect defined by the SAS-2.1 standard.
Victim	A signal carrier on a system that has a response imposed on it by other signals in the system.

Index

- 156-position TFBGA, 3, 4
- Cable Bend Limits, 6
- Cable Tension (Pull Forces), 6
- Cable Twisting (Torque), 6
- Calibration Through De-Embedding, 11
- Care and Handling, 6
- Cleaning, 8
- Compliance
 - WEEE, 38
- Connections
 - SMA, 6, 7
 - uSSD-TPA to DUT, 6
- Connector Part Numbers, 4
- Crosstalk Errors, 11
- Device and Socket Pin A1 Location, 4, 14
- Directivity Errors, 11
- Drift Errors, 11
- DUT, 11
- Electrical Specifications, 19
- Electrostatic Discharge Information (ESD), 9
- Environmental Changes, 11
- Errors
 - Crosstalk*, 11
 - Directivity*, 11
 - Drift*, 11
 - Load Impedance Mismatching*, 11
 - Random*, 11
 - Receiver Reflection-tracking in Test Equipment*, 11
 - Receiver Transmission in Test Equipment*, 11
 - Source Impedance Mismatching*, 11
- ESD protection, 9
- ESD Sensitivity, 7
- Figures
 - Cable Connectors, 12, 14
 - Jumper Positions, 18
 - The uSSD Device Test Adapter, 4
 - The uSSD Host and Receptacle Test Adapters, 3
- Glossary, 39
- Handling and Storage, 8
- JTAG Access, 18
- Load Impedance Mismatching Errors, 11
- Low-Speed Connector, 4
- Making Connections, 8
- Mechanical and Environmental Specifications, 12
- Molex Part Numbers, 4
- Power Access Connector, 4
- Power Management IC (PMIC), 4, 7, 11
- Product Inspection, 5
- Product Return, 5
- Pull Force, 6, 7
- Random Errors, 11
- Receiver Reflection-Tracking in Test Equip. Errors, 11
- Receiver Transmission in Test Equipment Errors, 11
- SATA Specification, 3
- Secure Storage, 5
- SMA cables, 12, 14
- Source Impedance Mismatching Errors, 11
- Support, 37
- Supporting Instrument Cables or Accessories, 7
- Tables
 - 8-Position Power Access Pin Assignments, 16
 - Electrical Specifications, 19
 - General Specifications, 12
 - Host and Receptacle Pin Assignments, 13
 - uSSD-TPA-DS 16-Position Low-Speed Connector, 17
 - uSSD-TPA-DS 22-Position Connector Pin Assignments, 15
 - uSSD-TPA-DS 6-Position JTAG Connector, 16
 - uSSD-TPA-DS SMA Pin Assignments, 15
- Terms and Conditions of Sale, 37
- Test Instrument Noise, 11
- Test Repeatability Problems, 11
- TP0 Jumper, 18
- User Model Examples, 10
- uSSD Device TPA Testing a DUT, 10
- uSSD Host and Receptacle TPA testing a Host, 10
- uSSD-TPA-DS Cable and Connector Pinout, 14
- uSSD-TPA-DS Power Management and TP0 Jumpers and Reference, 18
- uSSD-TPA-R Cable Pinout, 12
- VHOST Jumper, 18
- Visual Inspection, 8
- Warranty, 36
- Web Sites
 - support@wilder-tech.com, 36, 37
 - www.egmetalrecycling.com, 38
 - www.wilder-tech.com, 36
- WEEE, 38

Visit our website at www.wilder-tech.com



Wilder Technologies, LLC
6101A East 18th Street
Vancouver, WA 98661
Phone: 360-859-3041
Fax: 360-859-3105
www.wilder-tech.com

©2012, 2013 Wilder Technologies, LLC
Document No. 910-0023-000 Rev. B
Created: 8/9/2012 Revised: 10/25/2013