Micro HDAS

1,27mm / .050” pitch connector

Phy Layer Qualification

Report No: BLP-ER-002-Ext

Revision 2, August 2022

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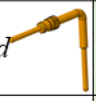
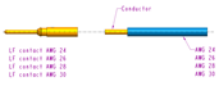
1. ETHERNET 1000BASE-T

The Micro HDAS connector has been tested according to the standard **IEEE Std 802.3™-2018 (Revision of IEEE Std 802.3-2015).**

1.1.ETHERNET 1000BASE-T Phy Layer Compatibility matrix

		Female connector	
	Contact type	*Straight PC tail standard* 	*Right angle PC tail standard* 
Male connector	*Straight PC tail standard* 	Pass	Pass
	Right angle PC tail standard 	Pass	Pass
	Crimp Contact 	Pass	Pass

1.2.Micro HDAS recommended Pin out

"1000BASE-T is designed to operate over a 4-pair Category 5 (as specified in ANSI/EIA/TIA-568-A-1995) / Class D (as specified in ISO/IEC 11801:1995) balanced cabling system. Each of the four pairs supports an effective data rate of 250 Mb/s in each direction simultaneously."

Female connector

Pin number	*Signal*	*AWG*
1	BI_DA+	24
2	BI_DA-	24
3	Ground	24
4	BI_DB+	24
5	BI_DC+	24
6	BI_DC-	24
7	BI_DB-	24
8	Ground	24
9	BI_DD+	24
10	BI_DD-	24

1.3.Compliant Network Standards

- 10BASE-T
- 1000BASE-TX
- 100BASE-T4
- 1000BASE-T
- ATM-25
- ATM-51
- ATM-155
- 100VG-AnyLan
- TR-4 TR-16 Active
- TR-16 Passive

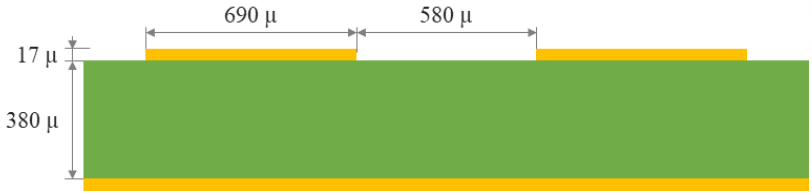
1.4. Tested configuration: **Female connector with straight PC tail VS Male connector with straight PC tails**

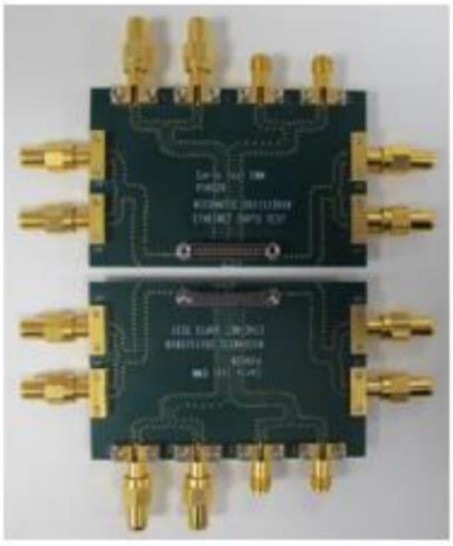
1.4.1. PCB recommendation

Total Thickness: 1600 µ

PCB Class: 4

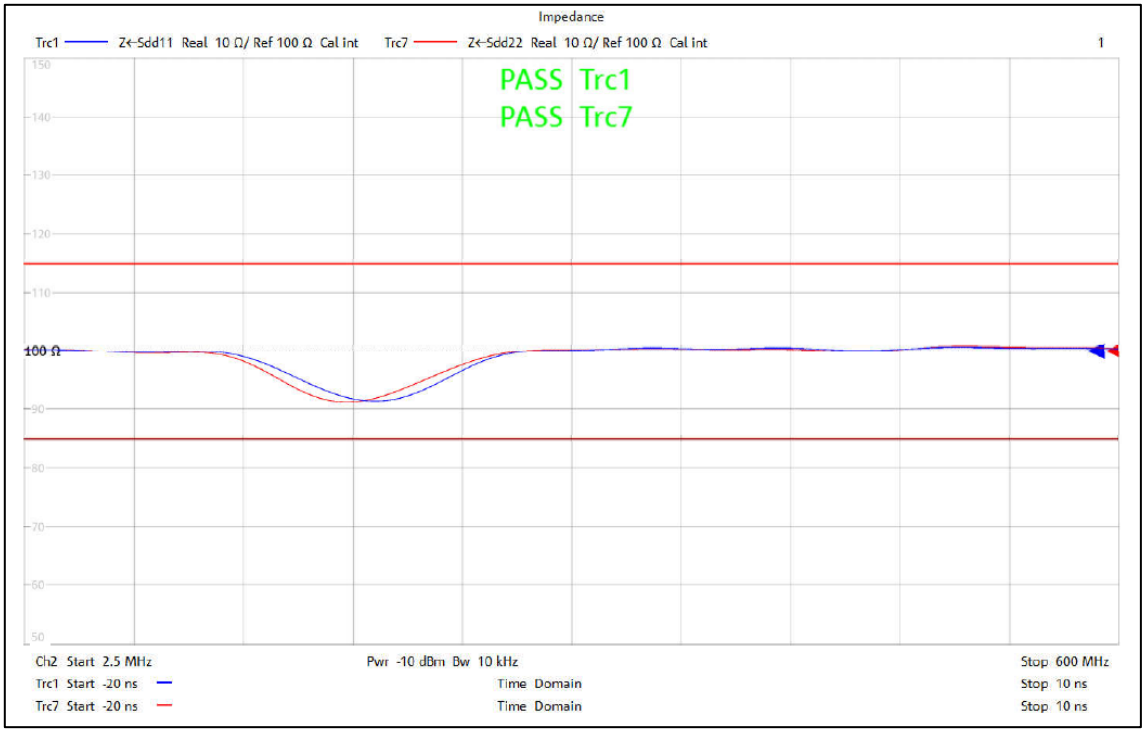
Plating: ENIG





1.4.2. Characteristic Impedance

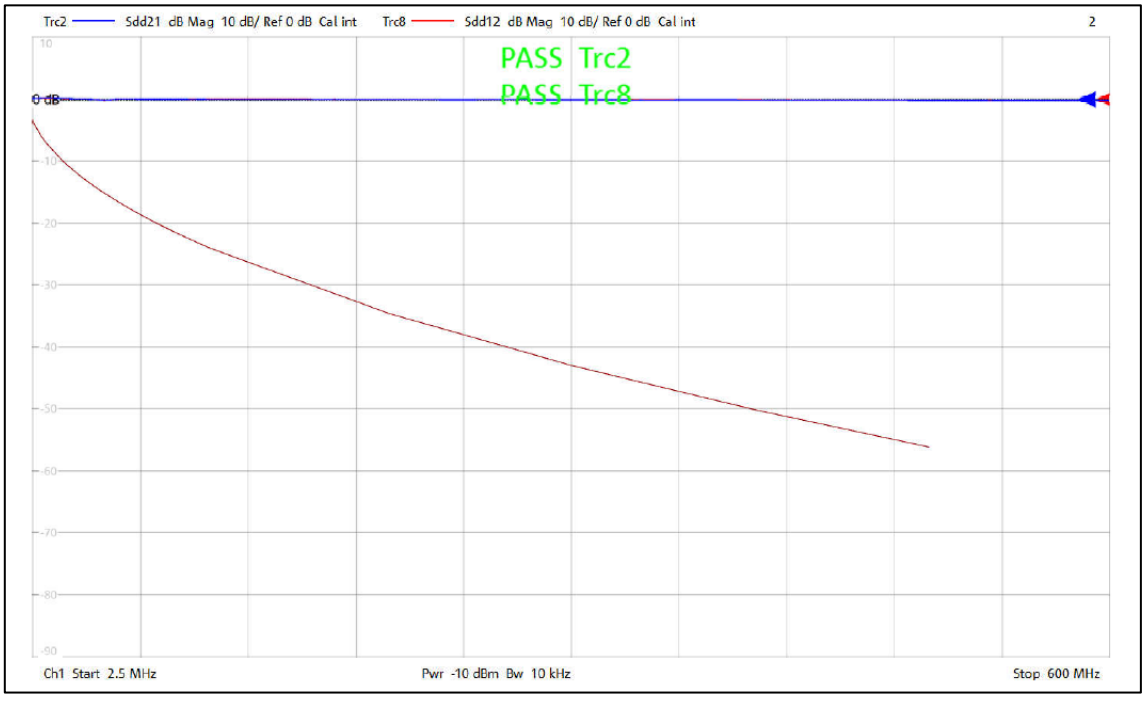
Measurement limit value (Ω): Min = 85
Max = 115
Measured Value (Ω): Min = 90,42
Max = 100,66



1.4.3. Insertion Loss

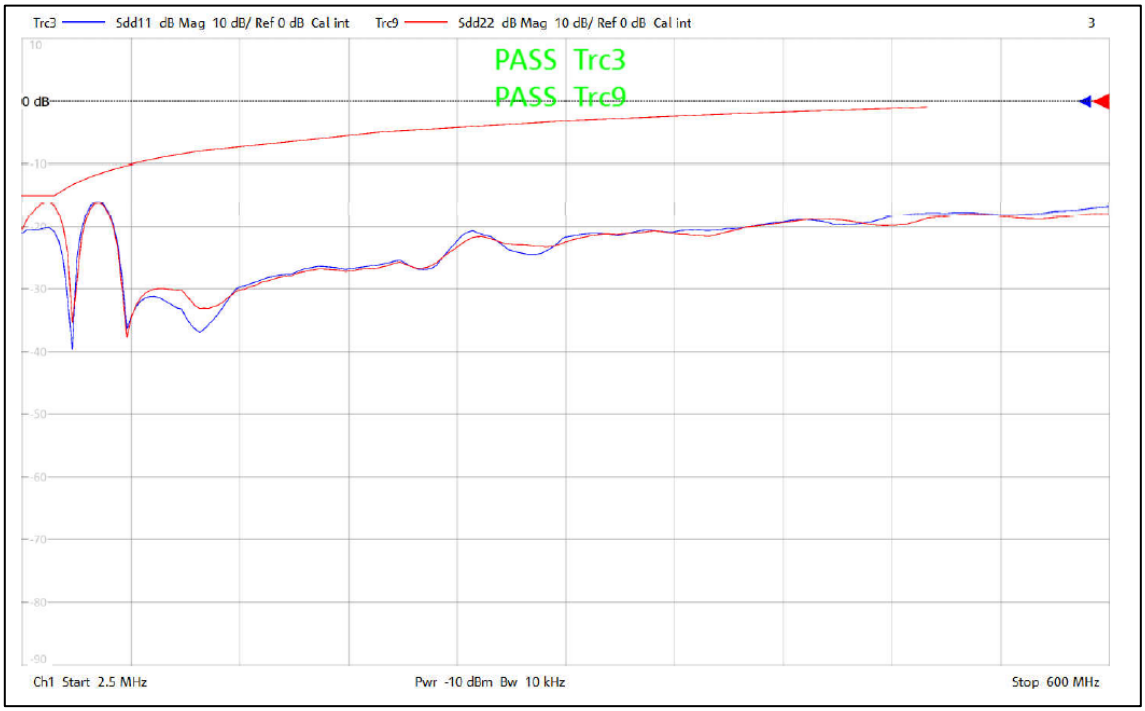
Measurement limit value (dB): $> - 2,1\ f^{0,529} - 0,4 / f$

Measured Value (dB): Min = -0,012 (@500 MHz)



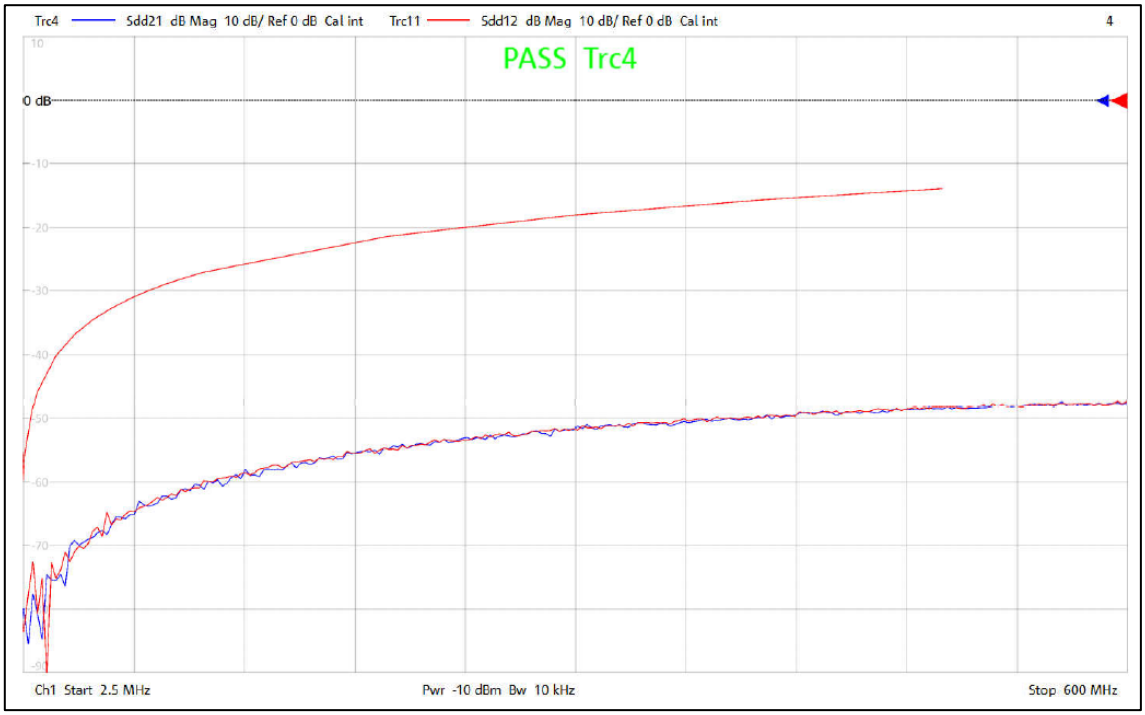
1.4.4. Return Loss

Measured Value (dB): Max = -15,8



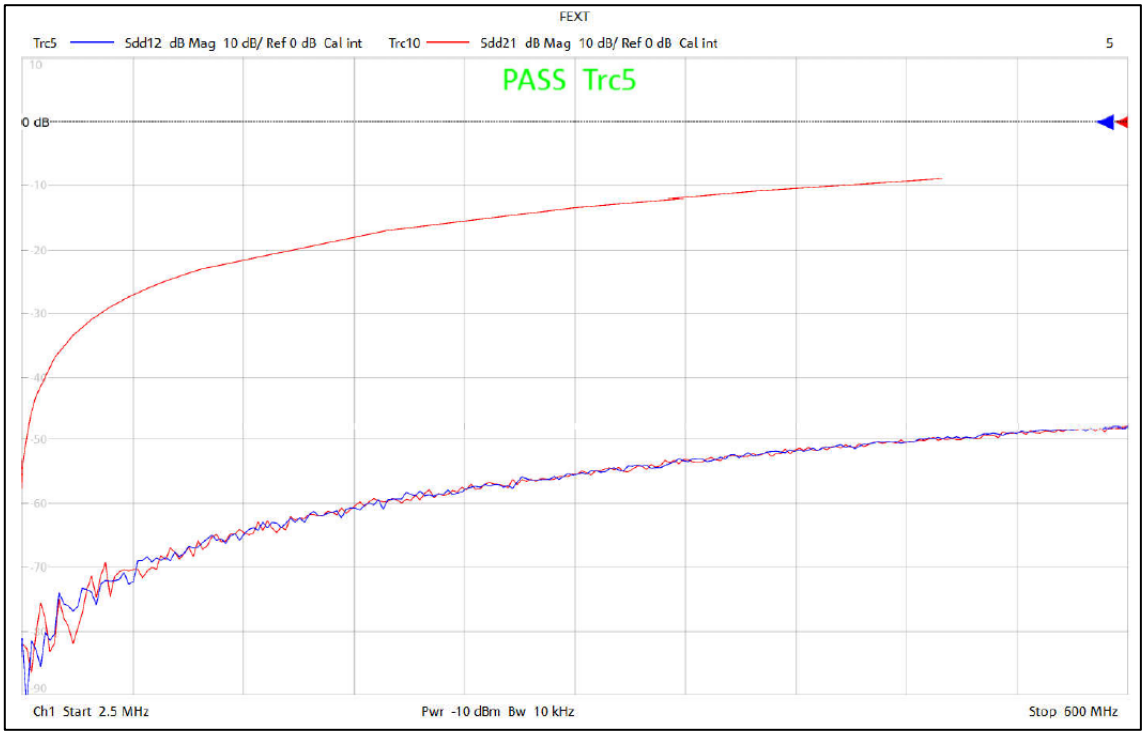
1.4.5. Near-End Crosstalk (NEXT)

Measured Value (dB): Max = -47,3 (@600 MHz)



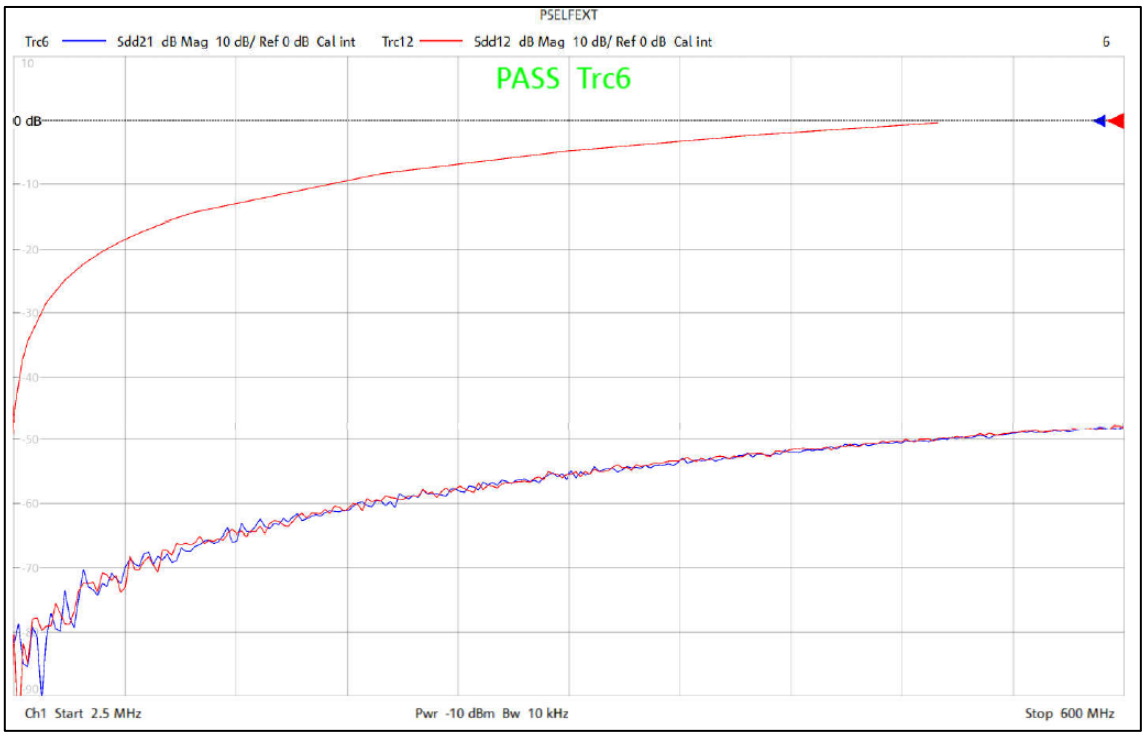
1.4.6. Far-End Crosstalk (FEXT)

Measurement limit value (dB): $< -23 + 20log_{10}(f/100)$
Measured Value (dB): Max = - 48,31 (@600 MHz)



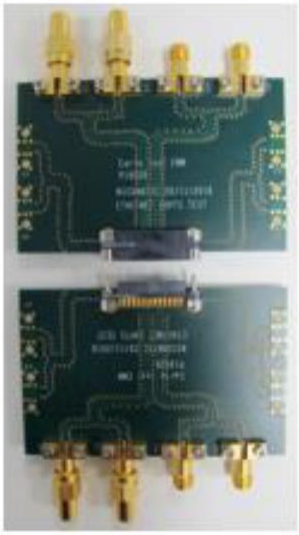
1.4.7. Power Sum Equal Level Far-End Crosstalk (PSELFEXT)

Measurement limit value (dB): $< -14,4 + 20log_{10}(f/100)$
Measured Value (dB): Max = - 49,12 (@600 MHz)



1.5. Tested configuration: **Female connector with Right angle PC tail VS Male connector with Right angle PC tails**

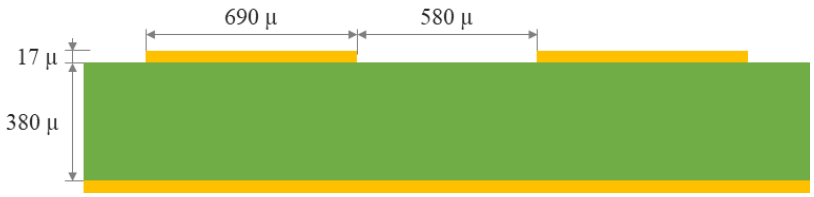
1.5.1. PCB recommendation



Total Thickness: 1600 µ

PCB Class: 4

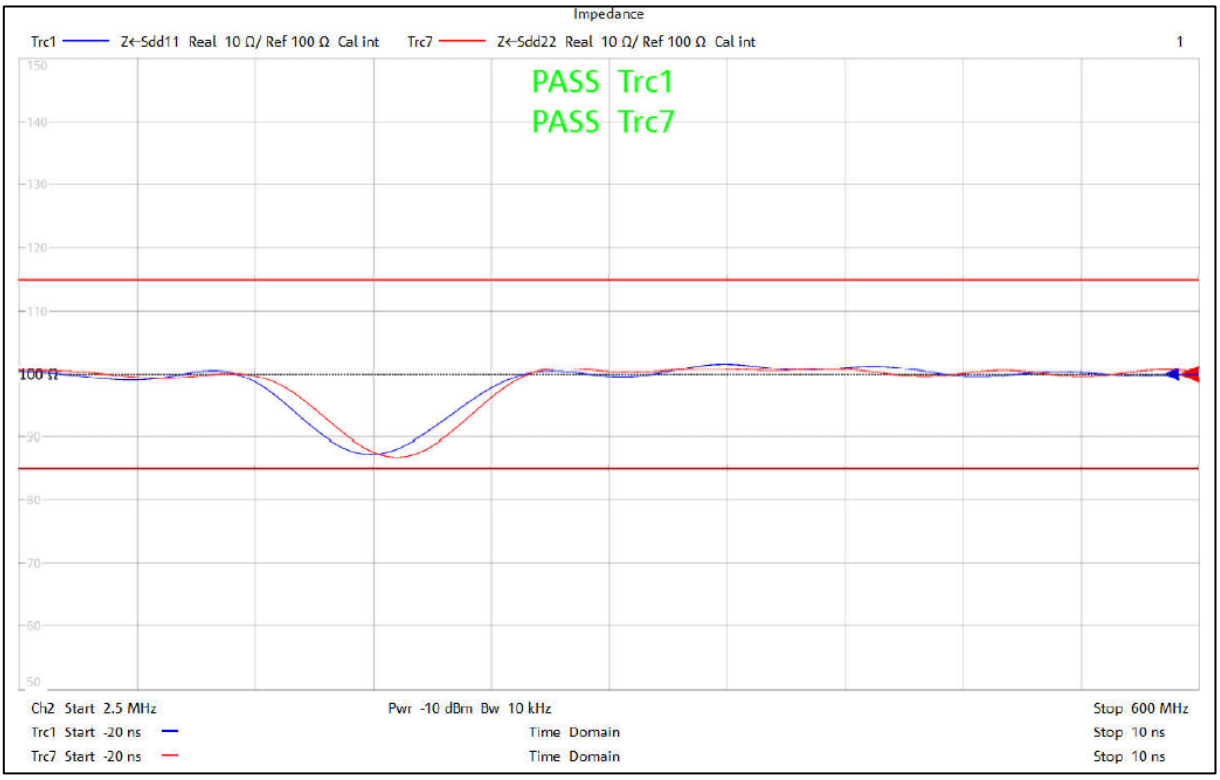
Plating: ENIG



1.5.2. Characteristic Impedance

Measurement limit value (Ω): Min = 85
Max = 115

Measured Value (Ω): Min = 91,5
Max = 103,77



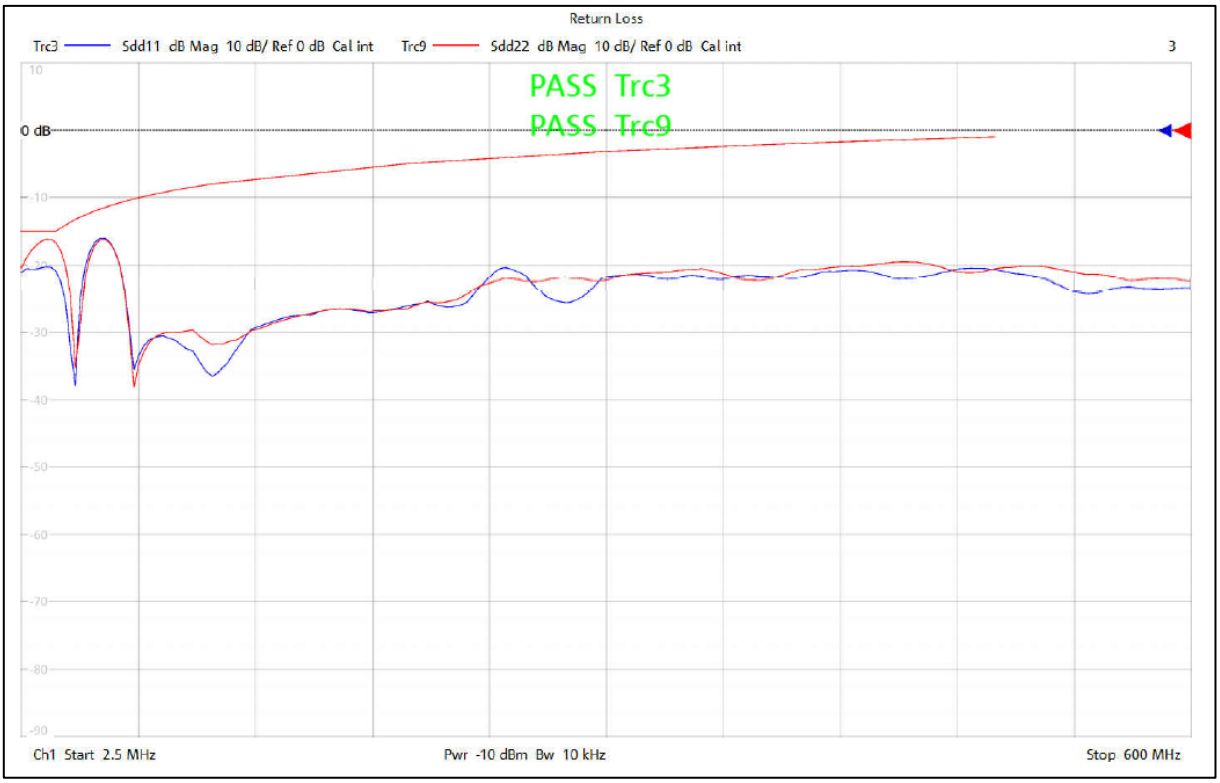
1.5.3. Insertion Loss

Measurement limit value (dB): > - 2,1 f ^{0,529} - 0,4 / f

Measured Value (dB): Min = -0,0133 (@500 MHz)

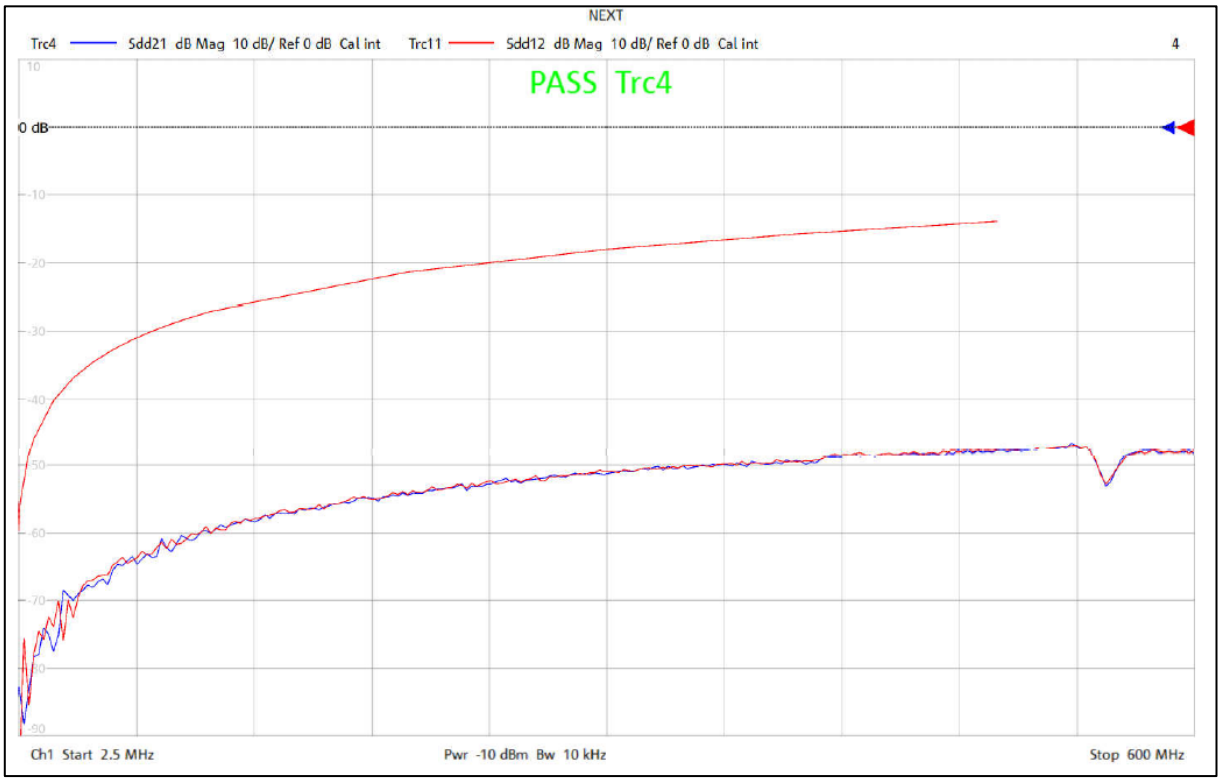
1.5.4. Return Loss

Measured Value (dB): Max = -15,8



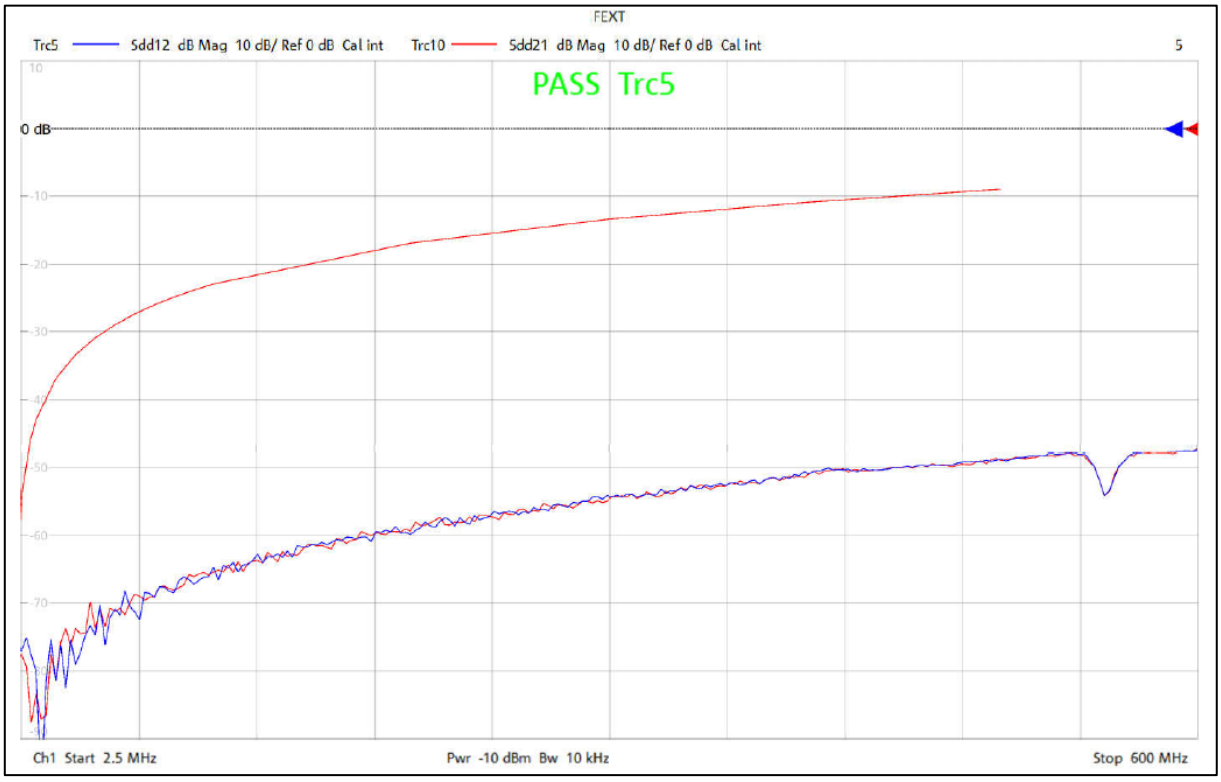
1.5.5. Near-End Crosstalk (NEXT)

Measured Value (dB): Max = -50,98 (@452,51 MHz)



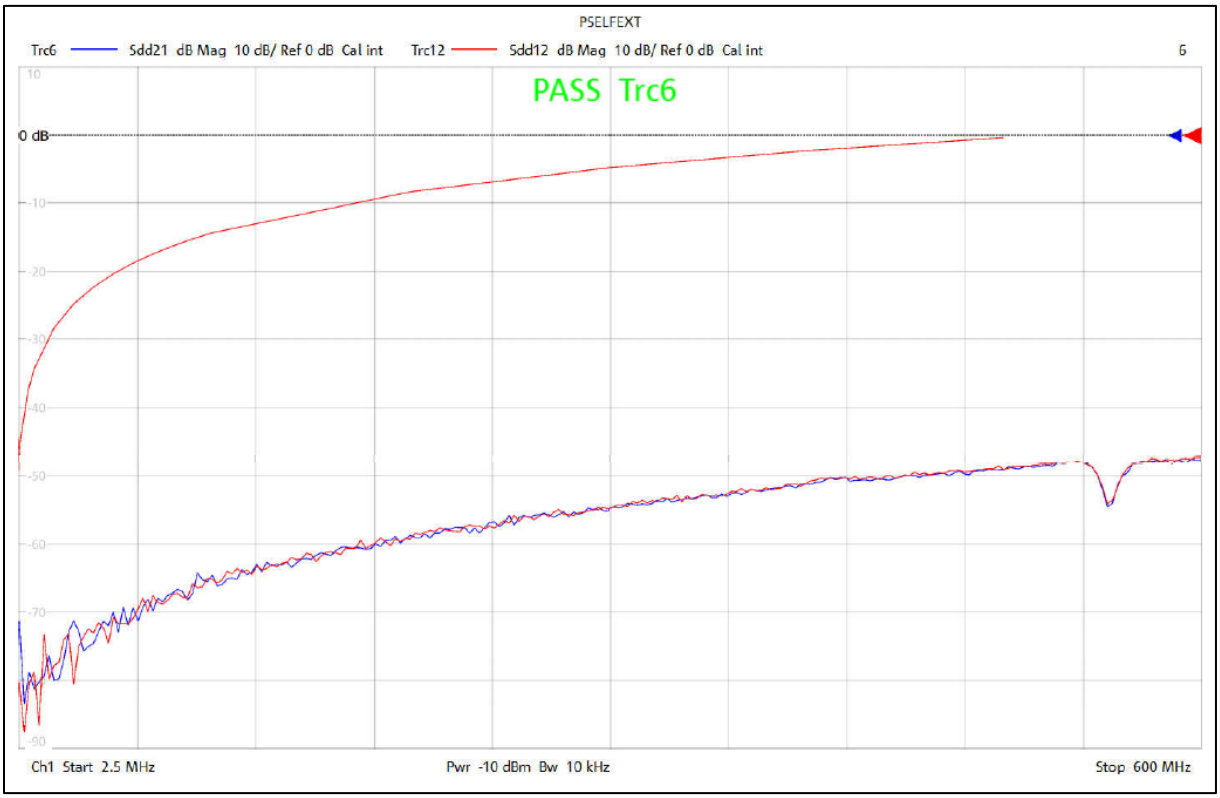
1.5.6. Far-End Crosstalk (FEXT)

Measurement limit value (dB): $< -23 + 20log_{10}(f/100)$
Measured Value (dB): Max = - 54,27 (@497,51 MHz)



1.5.7. Power Sum Equal Level Far-End Crosstalk (PSELFEXT)

Measurement limit value (dB): $< -14{,}4 + 20\log_{10}(f/100)$
Measured Value (dB): Max = - 49,12 (@600 MHz)



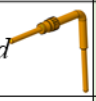
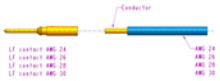
2. Universal Serial Bus 3.0

The Micro HDAS connector has been tested according to the standard **Universal Serial Bus 3.0 Specification (Revision 1.0).**

2.1. Used instrument

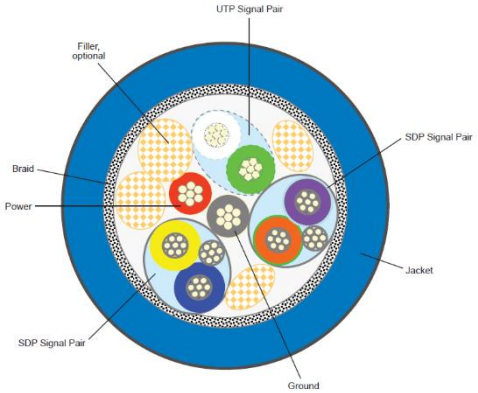
- VNA N°00651 R&S Model ZNB20
- Calibration Method: SOLT and Deembbeding

2.2. USB 3.0 Phy Layer Compatibility matrix

		Female connector	
	Contact type	*Straight PC tail standard* 	*Right angle PC tail standard* 
Male connector	*Straight PC tail standard* 	Pass	Pass
	Right angle PC tail standard 	Pass	Pass
	Crimp Contact 	Pass	Pass

2.3. Micro HDAS recommended Pin out

Female connector



Pin number	*Signal*	*AWG*
1	Ground	24
2	USB2_P1	28
3	USB2_P2	28
4	Ground	24
5	Ground	-
6	USB3_TX_N	28
7	USB3_TX_P	28
8	Ground	-
9	USB3_RX_N	28
10	USB3_RX_P	28

2.4.General characteristics of USB 3.0

The USB 3.0 is a physical SuperSpeed bus combined in parallel with a physical USB 2.0 bus, that can transfer data at up to 5 Gbit/s (640 MB/s).

2.4.1. D+/D- Pair Attenuation

The D+/D- Pair of a cable assembly provide an adequate signal strength to the receiver in order to maintain a low error rate. The D+/D- Pair Attenuation must not exceed:

- -0,67 dB maximum @12 MHz
- -0,95 dB maximum @24 MHz
- -1,35 dB maximum @48 MHz
- -1,90 dB maximum @96 MHz
- -3,20 dB maximum @200 MHz
- -5,87 dB maximum @400MHz

2.4.2. Mated connector impedance

The mated connector impedance requirement is needed to maintain signal integrity. The differential impedance of a mated connector shall be within 90 Ω +/-15 Ω.

2.4.3. Differential Insertion Loss of SS pairs

The differential insertion loss, SDD12, measures the differential signal energy transmitted through the mated cable assembly. The limit of the SDD12 is defined by the following values: (100 MHz, -1.5 dB), (1.25 GHz, -5.0 dB), (2.5 GHz, -7.5 dB), and (7.5 GHz, -25 dB). The measured differential insertion loss of a mated cable assembly must not exceed the differential insertion loss limit.

2.4.4. Differential-to-Common-Mode Conversion

Since the common mode current is directly responsible for EMI, limiting the differential-to-common-mode conversion, SCD12, will limit EMI generation within the connector and cable assembly. A mated cable assembly passes the differential-to-common-mode conversion requirement if its differential-to-common-mode conversion is less than or equal to -20 dB across the frequency over the range of 1 MHz to 7.5 GHz.

2.4.5. Differential Near-End Crosstalk Between SuperSpeed Pairs

The differential crosstalk measures must not exceed the limit defined below:

- USB 3.0 Standard-A connector: 0,9%
- USB 3.0 Standard-B connector: 1,8%
- USB 3.0 Micro connector family: 1,2%

2.4.6. Intra-Pair Skew / Propagation Delay

The intra-pair skew for the SDP pairs is recommended to be less than 15 ps/m. The progation delay shall be less than 10.000 ps.

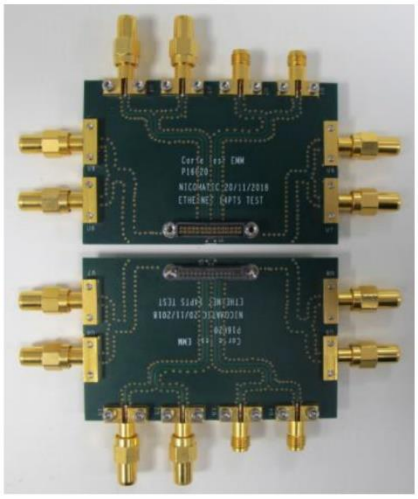
2.5. Tested configuration: **Female connector with straight PC tails VS Male connector with straight PC tails**

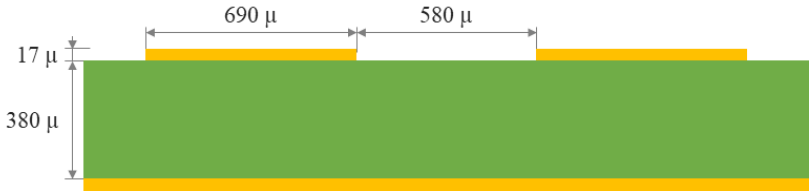
2.5.1. PCB recommendation

Total Thickness: 1600 µ

PCB Class: 4

Plating: ENIG

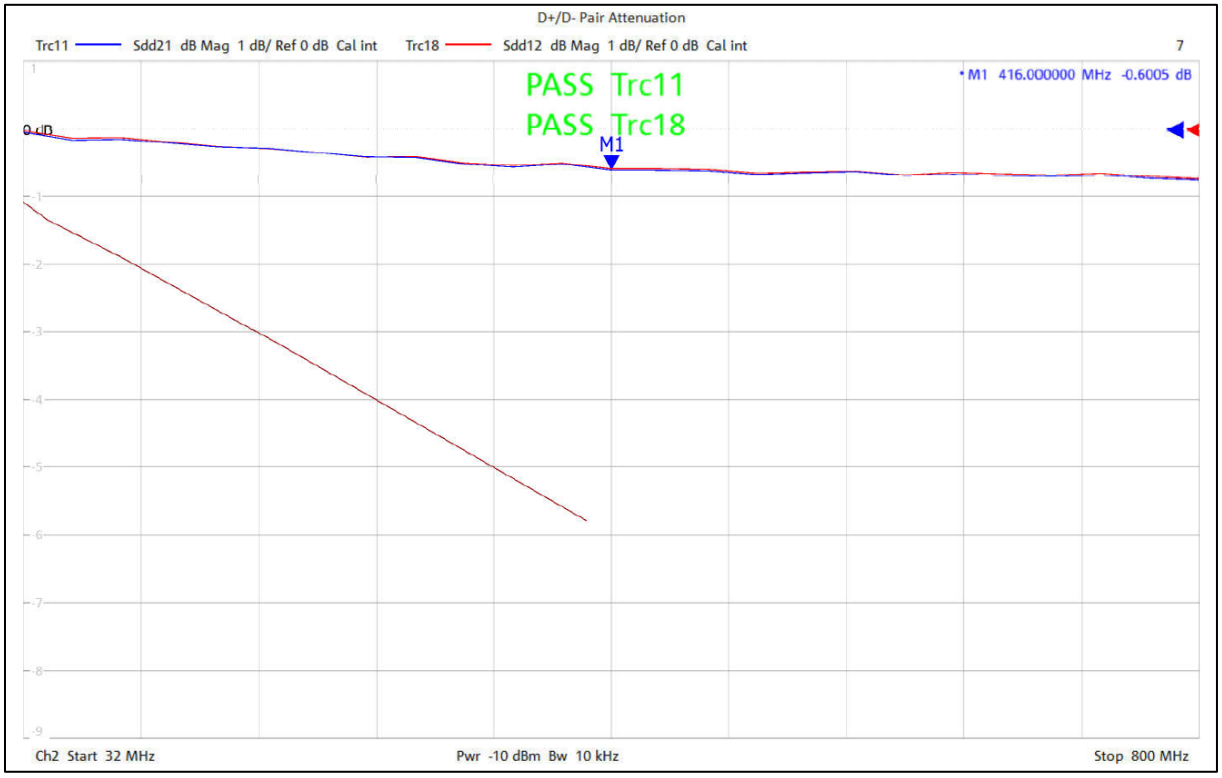




2.5.2. D+/D- Pair Attenuation

Measurement limit value (dB): Min = -0,67 @12 MHz
Max = -5,80 @400 MHz

Measured Value (dB): -0,21 @400 MHz



2.5.3. Mated connector impedance

Measurement limit value (Ω): Min = 75
Max = 105
Measured Value (Ω): Min = 83,28
Max = 103,22

2.5.4. Differential Insertion Loss of SS pairs

Measurement limit value (dB): Min = -1,5 @ 100 MHz
Max = -25 @ 7,5 GHz
Measured Value (Ω): Min = -9,64 @7,5 GHz

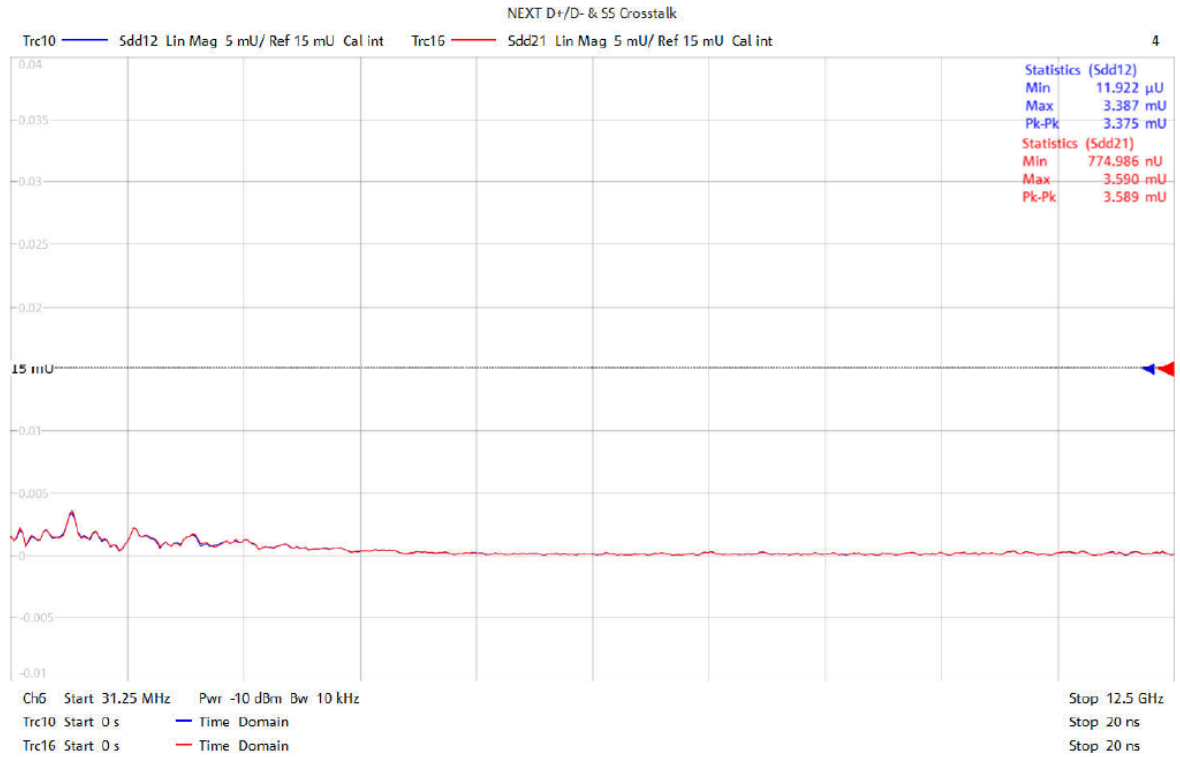
2.5.5. Differential-to-Common-Mode Conversion

Measurement limit value (dB): < -20
Measured Value (Ω): -21,87

2.5.6. Differential Near-End Crosstalk Between SuperSpeed Pairs

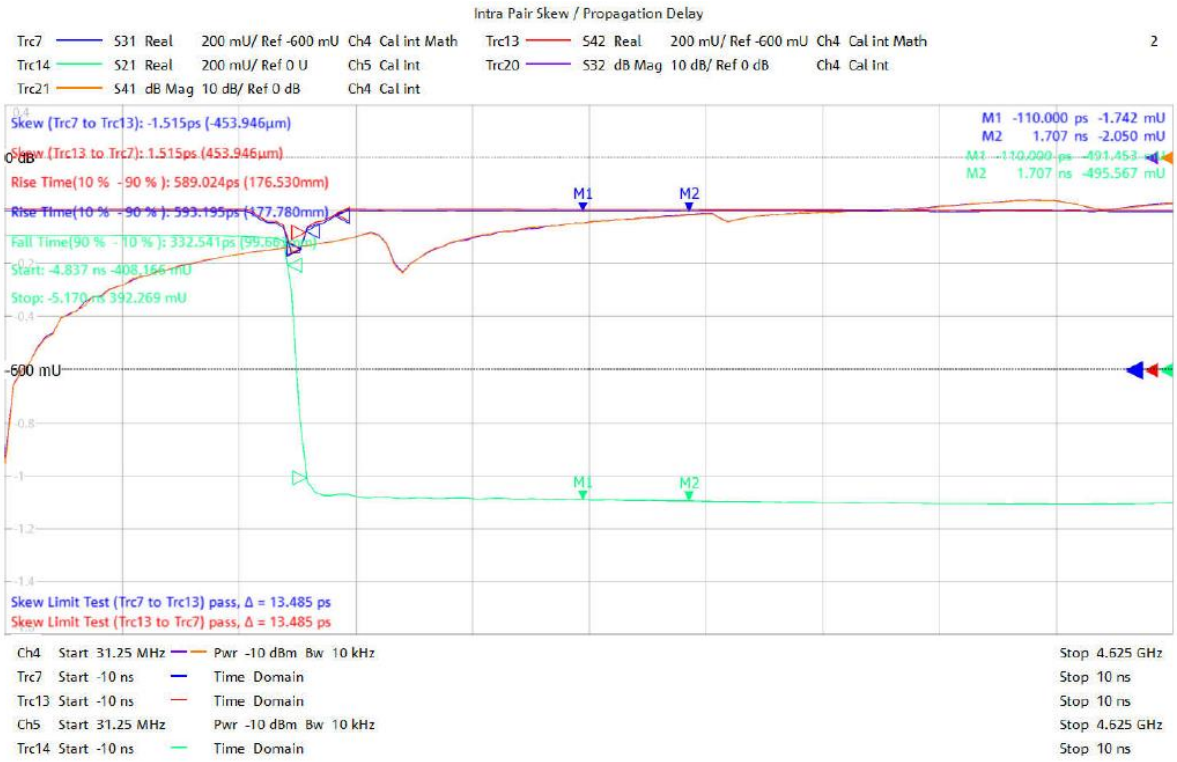
Measurement limit value (mV): USB 3.0 Standard-A connector: peak-to-peak = 3,6
USB 3.0 Standard-B connector: peak-to-peak = 7,2
USB 3.0 Micro connector family: peak-to-peak = 4,2

Measured Value (mV): 3,59



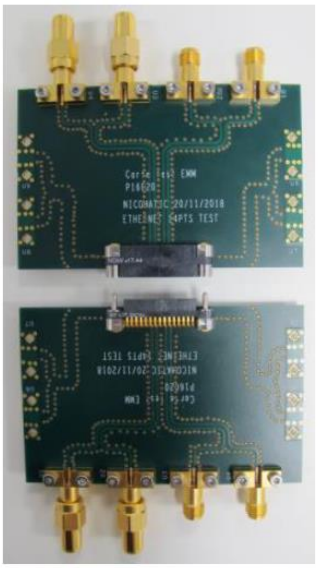
2.5.7. Intra-Pair Skew / Propagation Delay

Measured Value for the intra-pair skew (ps): 14,95
Measured Value for the progation delay (ps): 248,27



2.6. Tested configuration: **Female connector with Right angle PC tail VS Male connector with Right angle PC tails**

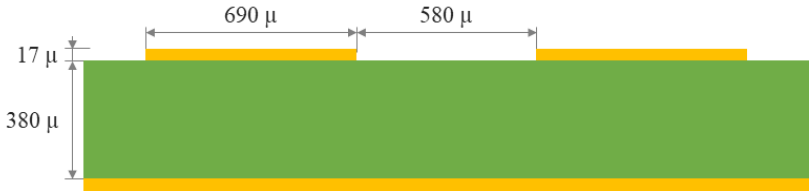
2.6.1. PCB recommendation



Total Thickness: 1600 µ

PCB Class: 4

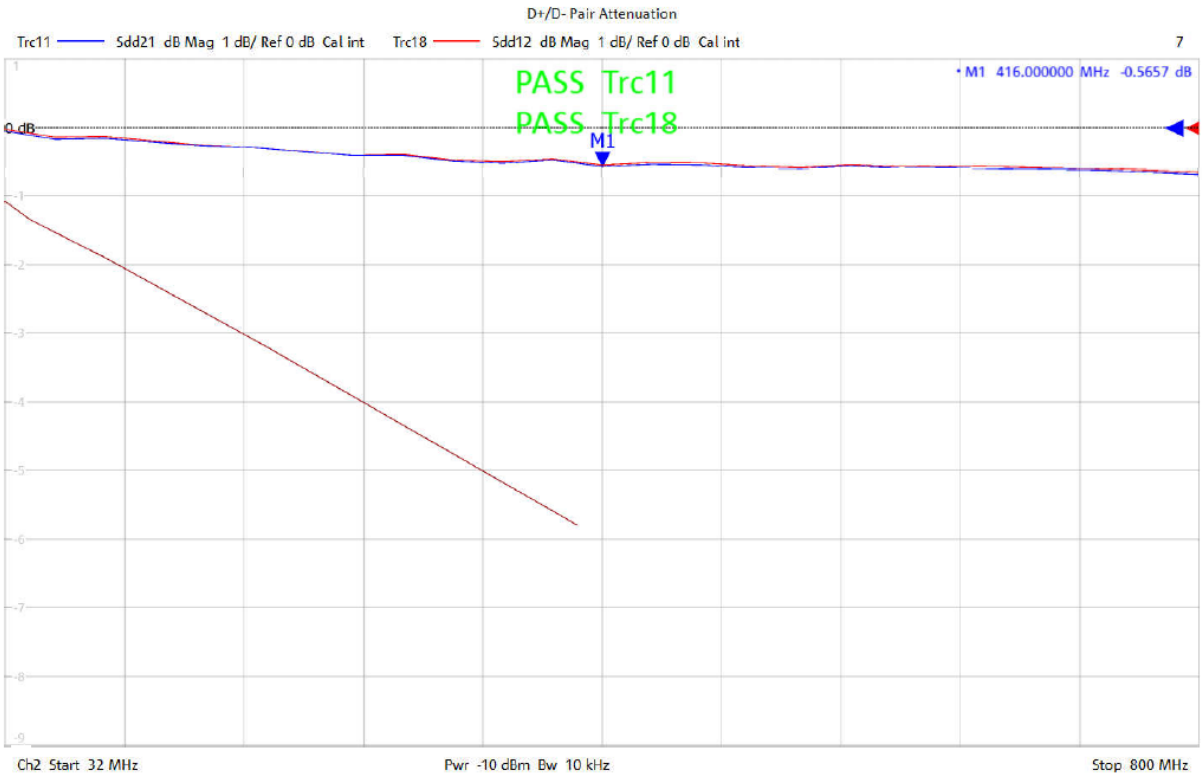
Plating: ENIG



2.6.1. D+/D- Pair Attenuation

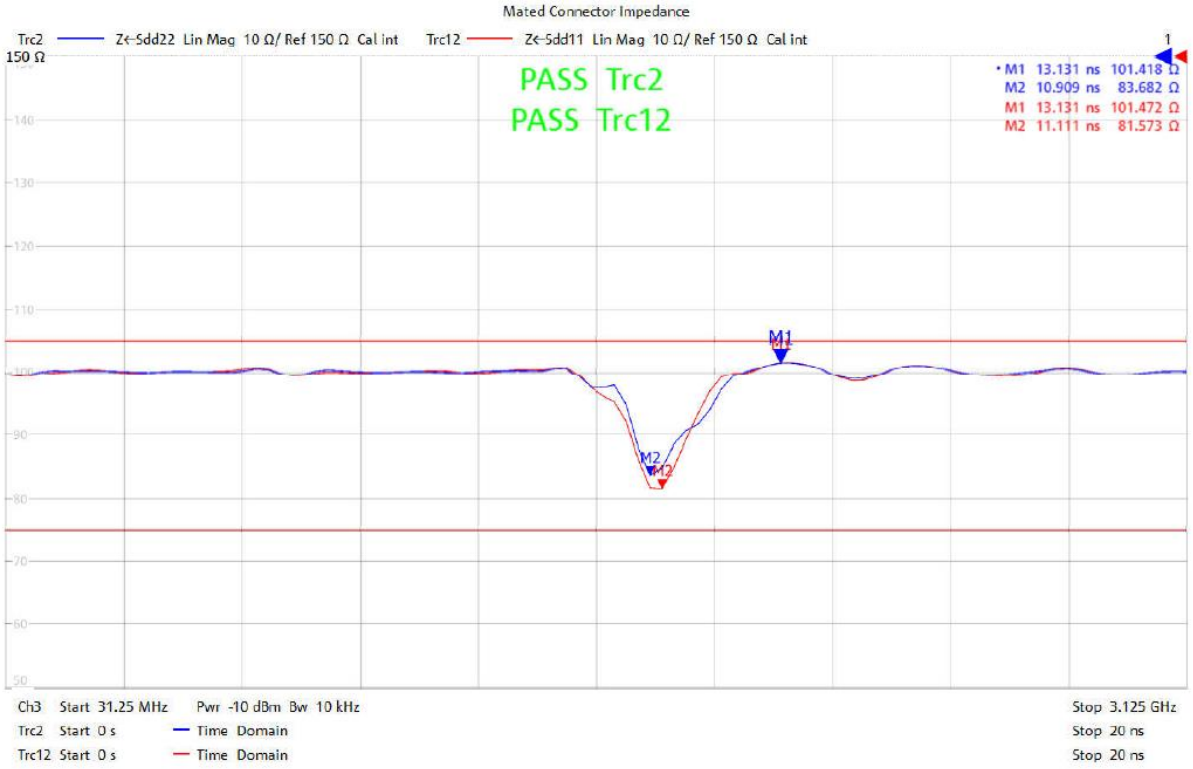
Measurement limit value (dB): Min = -0,67 @12 MHz
Max = -5,80 @400 MHz

Measured Value (dB): -0,57 @400 MHz



2.6.2. Mated connector impedance

Measurement limit value (Ω): Min = 75
Max = 105
Measured Value (Ω): Min = 81,57
Max = 101,47

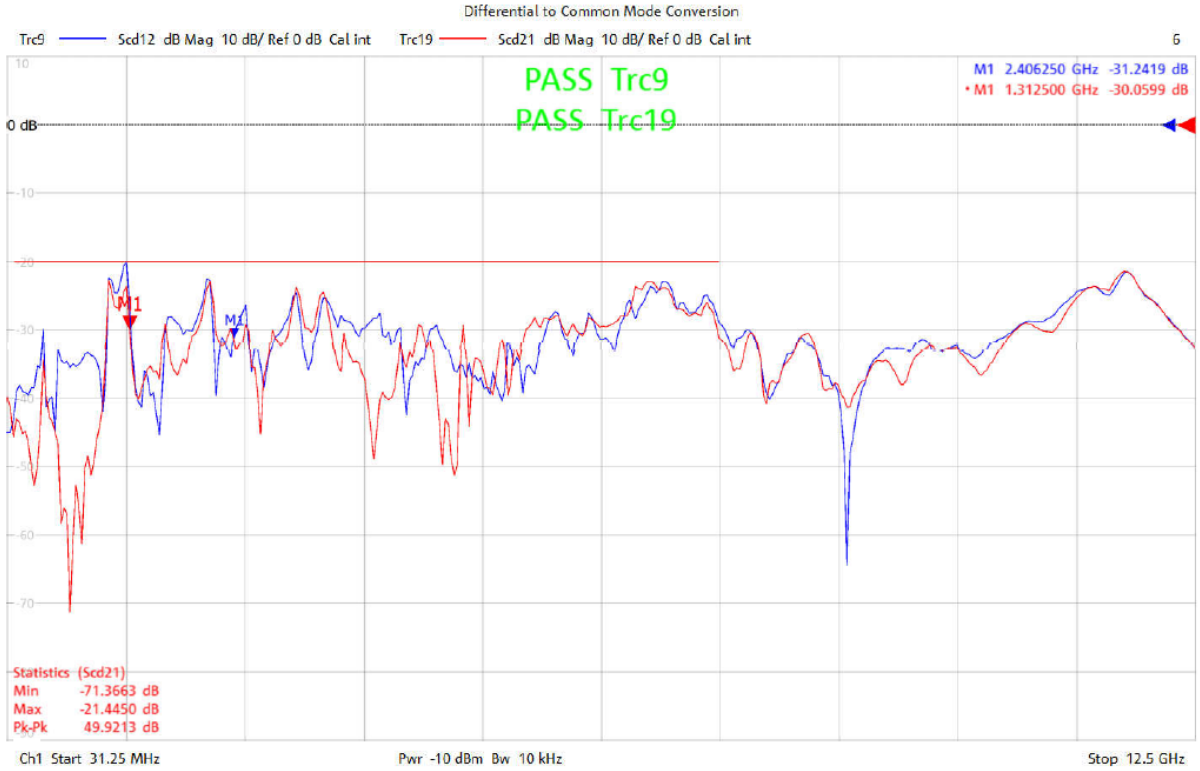


2.6.3. Differential Insertion Loss of SS pairs

Measurement limit value (dB): Min = -1,5 @ 100 MHz
Max = -25 @ 7,5 GHz
Measured Value (Ω): Min = -11,41 @7,5 GHz

2.6.4. Differential-to-Common-Mode Conversion

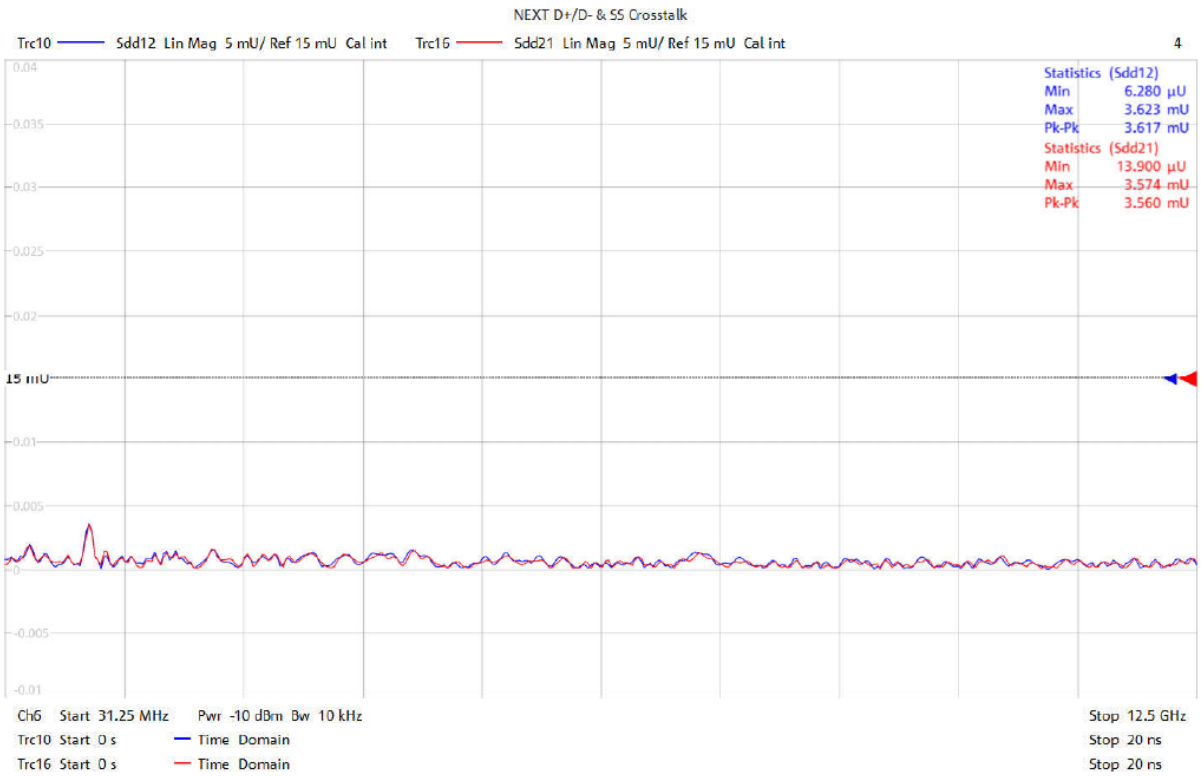
Measurement limit value (dB): < -20
Measured Value (Ω): -20,21



2.6.5. Differential Near-End Crosstalk Between SuperSpeed Pairs

Measurement limit value (mV): USB 3.0 Standard-A connector: peak-to-peak = 3,6
USB 3.0 Standard-B connector: peak-to-peak = 7,2
USB 3.0 Micro connector family: peak-to-peak = 4,2

Measured Value (mV): 3,6



2.6.6. Intra-Pair Skew / Propagation Delay

Measured Value for the intra-pair skew (ps): 0,541
Measured Value for the progation delay (ps): 766,77