

USB 2.0, 1.1 & 1.0 Compliance Testing of NCN1154

Prepared by: Bertrand RENAUD
On Semiconductor



ON Semiconductor

<http://onsemi.com>

INTRODUCTION

The NCN1154 is a DP3T switch for combined true-ground audio, USB 2.0 high speed data, and UART applications. It allows portable systems to use a single port to pass either high speed data or audio signals from an external headset; the 3 channels being compliant to USB 2.0, USB 1.1 and USB 1.0.

The switch is capable of passing signals with negative voltages as low as 2 V below ground.

APPLICATION NOTE

The device features shunt resistors on the audio ports. These resistors are switched in when the audio channel is off and provide a safe path to ground for any charge that may build up on the audio lines. This reduces Pop & Click noise in the audio system.

The NCN1154 is housed in a spacesaving, ultra low profile 2.0x1.7x0.5mm, 12 pin UQFN package.

OBJECTIVE

As described in USB 2.0 specification, upstream and downstream ports must be capable of supporting data rates at low-speed (1.5 Mb/s), full-speed (12 Mb/s), and high-speed signaling (480 Mb/s). The eye diagram is the most relevant information for USB compliance testing, eye aperture, timings and voltage levels define the eye template defined in the specification. High speed signaling testing industry has developed automatic compliance testing which provides detailed performance reports.

This application note will provide NCN1154 USB compliance results for USB 2.0, USB 1.1 and USB 1.0 over power supply range.

TEST SUMMARY

Switch Position	USB Compliance Test	Vcc							
		2.7V	3.0V	3.3V	3.6V	3.9V	4.2V	5.0V	5.5V
D+ / D-	High Speed – 480 Mb/s	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
	Full Speed – 12 Mb/s	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
	Low Speed – 1.5 Mb/s	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Rx / Tx	High Speed – 480 Mb/s	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
	Full Speed – 12 Mb/s	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
	Low Speed – 1.5 Mb/s	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
L / R	High Speed – 480 Mb/s	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
	Full Speed – 12 Mb/s	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
	Low Speed – 1.5 Mb/s	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

AND8491/D

USB BOARD FIXTURE

The test board features USB Type B receptacles on each differential lines of the switch and a USB Type A connector on the common differential line of the switch. A pass through line connects directly a USB Type B to a USB Type A receptacles. This line serves as reference to validate test setup and board influence.

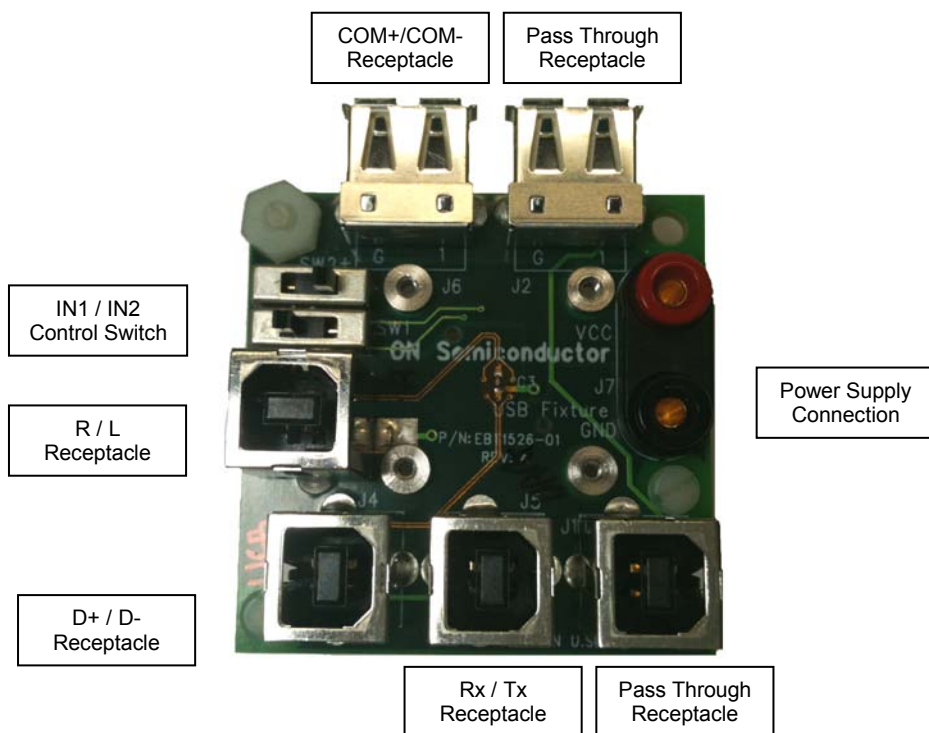


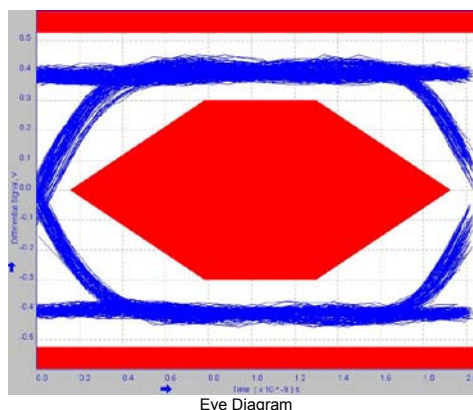
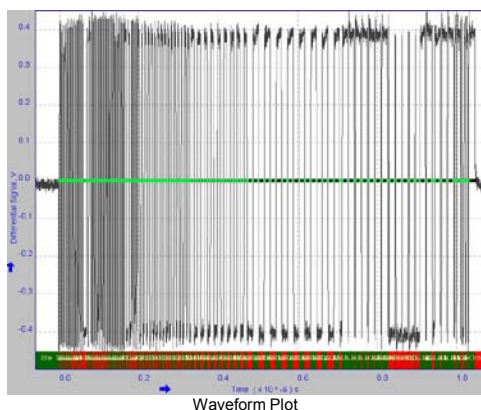
Figure 1: DP3T USB Board Fixture

TABLE OF CONTENT

1	Pass Through Path	3
2	D+ / D- Path At Vcc = 2.7 V	5
3	Rx / Tx Path At Vcc = 2.7 V	7
4	L / R Path At Vcc = 2.7 V	9
5	D+ / D- Path At Vcc = 3.0 V	11
6	Rx / Tx Path At Vcc = 3.0 V	13
7	L / R Path At Vcc = 3.0 V	15
8	D+ / D- Path At Vcc = 3.3 V	17
9	Rx / Tx Path At Vcc = 3.3 V	19
10	L / R Path At Vcc = 3.3 V	21
11	D+ / D- Path At Vcc = 3.6 V	23
12	Rx / Tx Path At Vcc = 3.6 V	25
13	L / R Path At Vcc = 3.6 V	27
14	D+ / D- Path At Vcc = 3.9 V	29
15	Rx / Tx Path At Vcc = 3.9 V	31
16	L / R Path At Vcc = 3.9 V	33
17	D+ / D- Path At Vcc = 4.2 V	35
18	Rx / Tx Path At Vcc = 4.2 V	37
19	L / R Path At Vcc = 4.2 V	39
20	D+ / D- Path At Vcc = 5.0 V	41
21	Rx / Tx Path At Vcc = 5.0 V	43
22	L / R Path At Vcc = 5.0 V	45
23	D+ / D- Path At Vcc = 5.5 V	47
24	Rx / Tx Path At Vcc = 5.5 V	49
25	L / R Path At Vcc = 5.5 V	51

1. Pass Trough

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	461.5482Mbps	504.5428Mbps	480.0561Mbps	0.0000bps	8.536579Mbps	480.3999Mbps	494	Pass
EOP Width	-	-	16.55740ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.948481	-	-	-	1	Pass
Falling Edge Rate	1.307373kV/us	1.587091kV/us	1.422236kV/us	279.7179 V/us	63.03532 V/us	1.423617kV/us	96	Pass
Rising Edge Rate	1.267139kV/us	1.569238kV/us	1.374000kV/us	302.0989 V/us	61.22889 V/us	1.375350kV/us	97	Pass

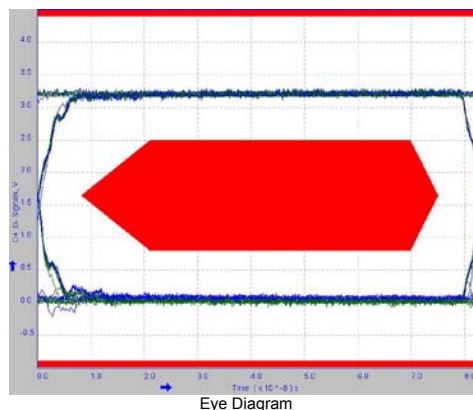
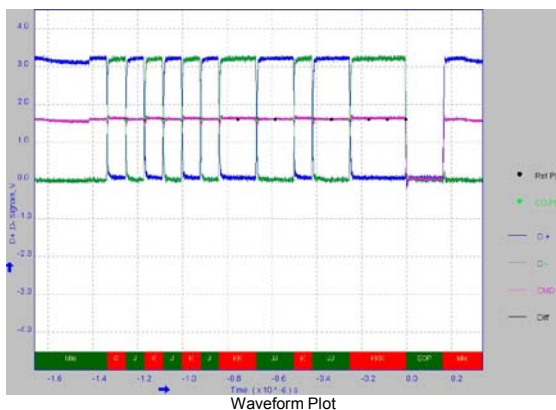
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -63.15ps to 85.48ps RMS Jitter 29.91ps
- KJ Paired Jitter range : -55.77ps to 47.81ps RMS Jitter 14.71ps
- JK Paired Jitter range : -60.03ps to 59.77ps RMS Jitter 17.10ps
- Rising Edge Rate:1.374000kV/us (Equivalent Rise Time = 465.79 ps)
- Falling Edge Rate:1.422236kV/us (Equivalent Fall Time = 450.00 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.98544Mbps	12.03390Mbps	12.00207Mbps	0.0000bps	15.84967kbps	12.00300Mbps	12	Pass
Crossover Voltage	1.569931 V	1.639448 V	1.603401 V	69.51724mV	22.83745mV	1.603549 V	11	Pass
EOP Width	-	-	167.5156ns	-	-	-	1	Pass
Consecutive Jitter	-101.1462ps	119.2390ps	-2.461860ps	220.3852ps	67.79028ps	64.35861ps	10	Pass
Paired JK Jitter	-65.50356ps	155.4256ps	28.90411ps	220.9291ps	104.0246ps	94.61126ps	4	Pass
Paired KJ Jitter	-115.1019ps	104.7687ps	16.56746ps	219.8707ps	100.4249ps	88.53443ps	4	Pass
Falling Edge Rate	502.1097 V/us	557.3770 V/us	522.2624 V/us	55.26734 V/us	15.79321 V/us	522.4813 V/us	12	Pass
Rising Edge Rate	396.6667 V/us	418.2613 V/us	410.7651 V/us	21.59468 V/us	5.897297 V/us	410.8035 V/us	11	Pass

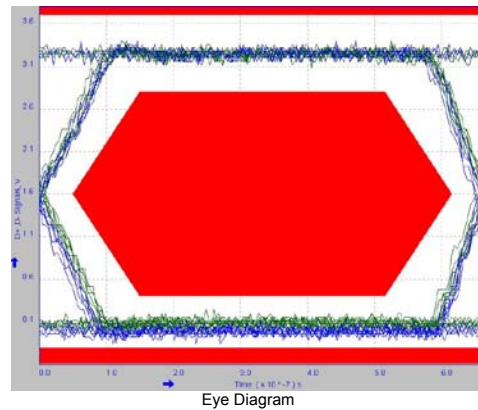
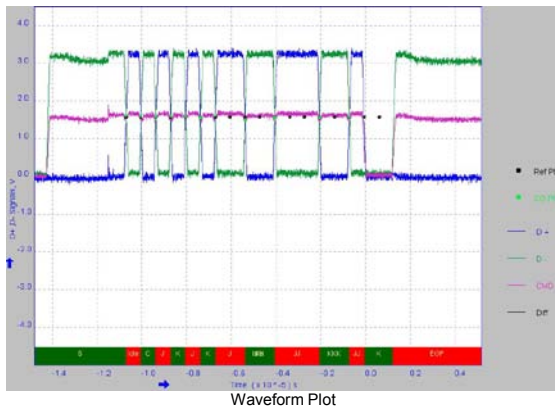
Additional Information :

- Rising Edge Rate:410.7651 V/us (Equivalent Rise Time = 6.4270 ns)
- Falling Edge Rate:522.2624 V/us (Equivalent Fall Time = 5.0549 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.474926Mbps	1.523926Mbps	1.501716Mbps	0.0000bps	17.91168kbps	1.500473Mbps	14	Pass
Crossover Voltage	1.504000 V	1.620000 V	1.580667 V	116.0000mV	33.40659mV	1.580988 V	11	Pass
EOP Width	-	-	1.332247us	-	-	-	1	Pass
Consecutive Jitter	-10.91472ns	8.704329ns	-884.7186ps	19.61905ns	5.683871ns	5.464292ns	10	Pass
Paired JK Jitter	-1.690476ns	5.476190ns	3.023810ns	7.166667ns	3.204129ns	4.104053ns	4	Pass
Paired KJ Jitter	-4.685714ns	9.123810ns	1.880952ns	13.80952ns	6.696484ns	6.096733ns	4	Pass
Falling Edge Rate	17.39130 V/us	20.00000 V/us	18.89277 V/us	2.608696 V/us	924.7640mV/us	18.91351 V/us	12	Pass
Rising Edge Rate	17.39130 V/us	25.80645 V/us	19.07545 V/us	8.415147 V/us	2.164189 V/us	19.18766 V/us	12	Pass

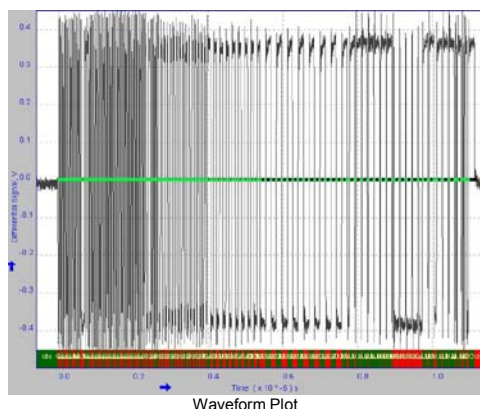
Additional Information :

- Rising Edge Rate:19.07545 V/us (Equivalent Rise Time = 138.40 ns)
- Falling Edge Rate:18.89277 V/us (Equivalent Fall Time = 139.74 ns)

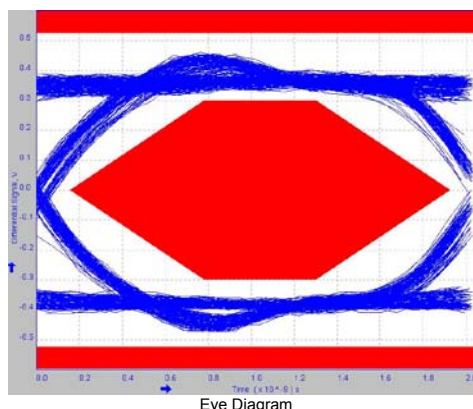
* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

2. D+ / D- Path At Vcc = 2.7 V

USB 2.0 Overall Result: **Pass***



Waveform Plot



Eye Diagram

Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	457.9271Mbps	517.2414Mbps	480.0381Mbps	0.0000bps	9.897494Mbps	480.9542Mbps	526	Pass
EOP Width	-	-	16.52308ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.931707	-	-	-	1	Pass
Falling Edge Rate	954.5455 V/us	1.111642kV/us	1.045222kV/us	157.0963 V/us	35.92939 V/us	1.045834kV/us	114	Pass
Rising Edge Rate	914.3687 V/us	1.102960kV/us	983.5264 V/us	188.5909 V/us	31.95278 V/us	984.0408 V/us	115	Pass

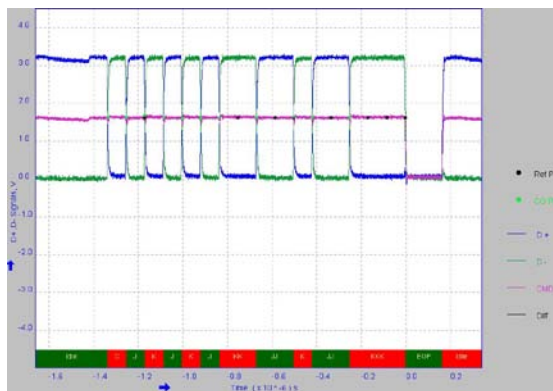
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

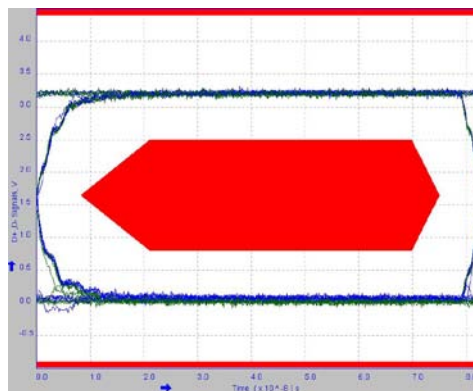
- Consecutive Jitter range : -81.26ps to 89.88ps RMS Jitter 31.98ps
- KJ Paired Jitter range : -68.65ps to 60.28ps RMS Jitter 13.55ps
- JK Paired Jitter range : -72.16ps to 68.44ps RMS Jitter 19.82ps
- Rising Edge Rate:983.5264 V/us (Equivalent Rise Time = 650.72 ps)
- Falling Edge Rate:1.045222kV/us (Equivalent Fall Time = 612.31 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Waveform Plot



Eye Diagram

Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.99300Mbps	12.00634Mbps	12.00031Mbps	0.0000bps	4.709872kbps	12.00020Mbps	12	Pass
Crossover Voltage	1.606258 V	1.673099 V	1.625434 V	66.84096mV	18.85878mV	1.625534 V	11	Pass
EOP Width	-	-	167.4708ns	-	-	-	1	Pass
Consecutive Jitter	-75.49731ps	57.26290ps	-3.850724ps	132.7602ps	35.61583ps	34.00686ps	10	Pass
Paired JK Jitter	-29.80651ps	46.86891ps	1.479787ps	76.67542ps	32.36558ps	28.06845ps	4	Pass
Paired KJ Jitter	-132.7602ps	75.80882ps	-10.95132ps	208.5690ps	90.74223ps	79.34447ps	4	Pass
Falling Edge Rate	419.3031 V/us	531.2500 V/us	473.2562 V/us	111.9469 V/us	29.29175 V/us	474.0864 V/us	12	Pass
Rising Edge Rate	377.2760 V/us	400.2616 V/us	387.0994 V/us	22.98557 V/us	6.394229 V/us	387.1474 V/us	11	Pass

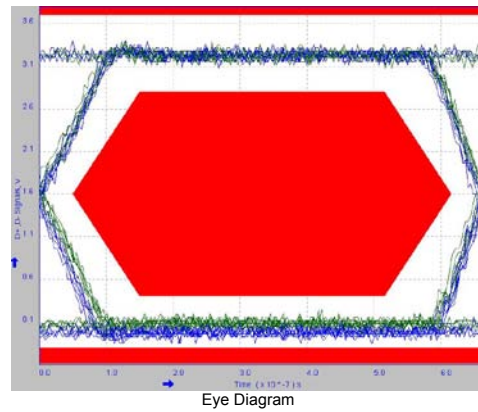
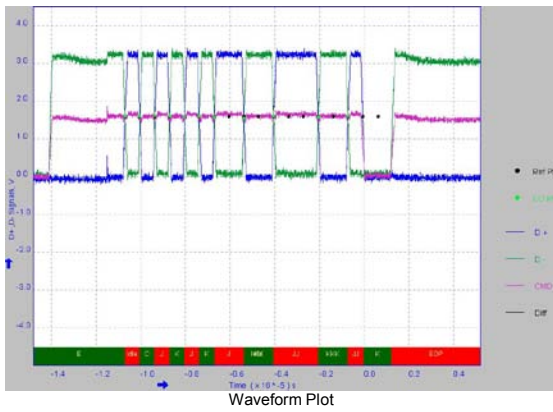
Additional Information :

- Rising Edge Rate:387.0994 V/us (Equivalent Rise Time = 6.8200 ns)
- Falling Edge Rate:473.2562 V/us (Equivalent Fall Time = 5.5784 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.482213Mbps	1.528384Mbps	1.502038Mbps	0.0000bps	16.76123kbps	1.501277Mbps	14	Pass
Crossover Voltage	1.544000 V	1.624000 V	1.592012 V	80.00000mV	21.54502mV	1.592144 V	11	Pass
EOP Width	-	-	1.330201us	-	-	-	1	Pass
Consecutive Jitter	-9.302742ns	5.811544ns	-871.3131ps	15.11429ns	4.889821ns	4.720010ns	10	Pass
Paired JK Jitter	209.5238ps	2.809524ns	1.826190ns	2.600000ns	1.175933ns	2.090953ns	4	Pass
Paired KJ Jitter	-1.914286ns	5.342857ns	1.952381ns	7.257143ns	3.168353ns	3.367586ns	4	Pass
Falling Edge Rate	17.64706 V/us	20.00000 V/us	18.59744 V/us	2.352941 V/us	759.3141mV/us	18.61152 V/us	11	Pass
Rising Edge Rate	1.000000 V/us	26.25000 V/us	17.78937 V/us	25.25000 V/us	5.744198 V/us	18.62009 V/us	12	Pass

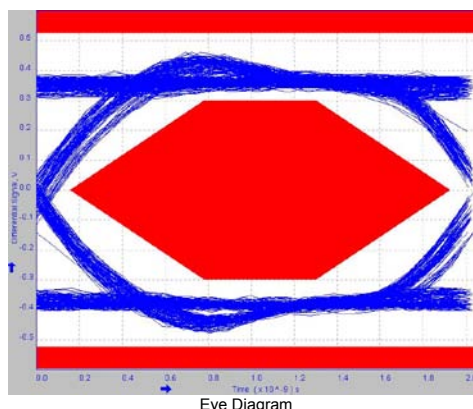
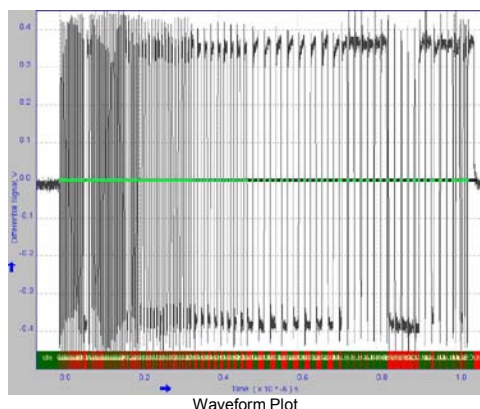
Additional Information :

- Rising Edge Rate:17.78937 V/us (Equivalent Rise Time = 148.40 ns)
- Falling Edge Rate:18.59744 V/us (Equivalent Fall Time = 141.96 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

3. Rx / Tx Path At Vcc = 2.7 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	459.1837Mbps	521.0029Mbps	480.0666Mbps	0.0000bps	10.14340Mbps	481.0009Mbps	494	Pass
EOP Width	-	-	16.44484ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.894619	-	-	-	1	Pass
Falling Edge Rate	959.5602 V/us	1.114197kV/us	1.028084kV/us	154.6371 V/us	38.27506 V/us	1.028789kV/us	98	Pass
Rising Edge Rate	898.3735 V/us	1.037282kV/us	976.3404 V/us	138.9089 V/us	31.43548 V/us	976.8412 V/us	99	Pass

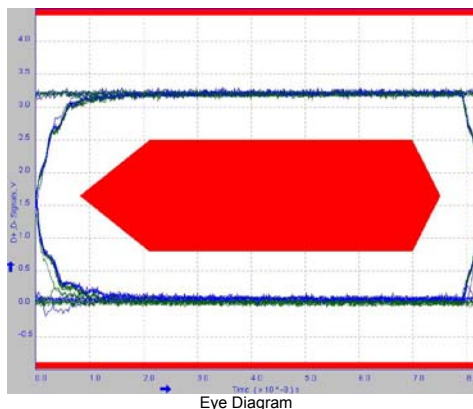
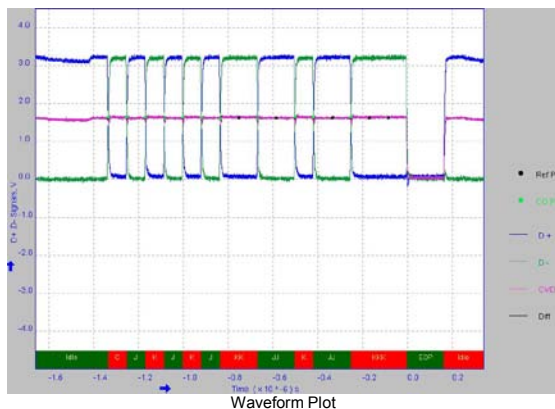
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -59.26ps to 104.4ps RMS Jitter 35.22ps
- KJ Paired Jitter range : -68.37ps to 50.30ps RMS Jitter 16.61ps
- JK Paired Jitter range : -75.65ps to 71.78ps RMS Jitter 21.76ps
- Rising Edge Rate:976.3404 V/us (Equivalent Rise Time = 655.51 ps)
- Falling Edge Rate:1.028084kV/us (Equivalent Fall Time = 622.52 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.97970Mbps	12.02073Mbps	12.00063Mbps	0.0000bps	11.00069kbps	11.99983Mbps	12	Pass
Crossover Voltage	1.600891 V	1.647635 V	1.627001 V	46.74380mV	17.86664mV	1.627090 V	11	Pass
EOP Width	-	-	167.5630ns	-	-	-	1	Pass
Consecutive Jitter	-50.79518ps	94.82923ps	-6.033934ps	145.6244ps	51.36409ps	49.10042ps	10	Pass
Paired JK Jitter	-79.64732ps	106.6180ps	36.40610ps	186.2654ps	85.74972ps	82.70529ps	4	Pass
Paired KJ Jitter	-63.50952ps	31.87973ps	-1.639573ps	95.38925ps	44.95811ps	38.96937ps	4	Pass
Falling Edge Rate	428.3820 V/us	526.9709 V/us	473.4253 V/us	98.58895 V/us	28.89357 V/us	474.2328 V/us	12	Pass
Rising Edge Rate	372.3922 V/us	398.4771 V/us	386.5758 V/us	26.08489 V/us	7.106779 V/us	386.6352 V/us	11	Pass

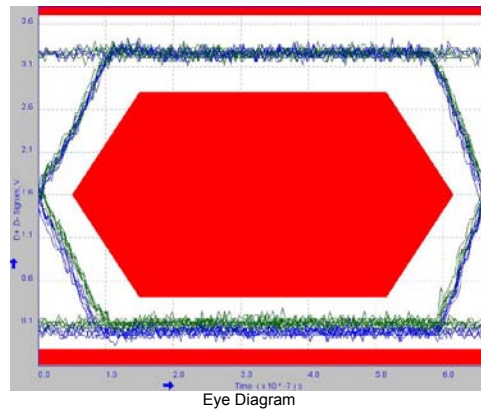
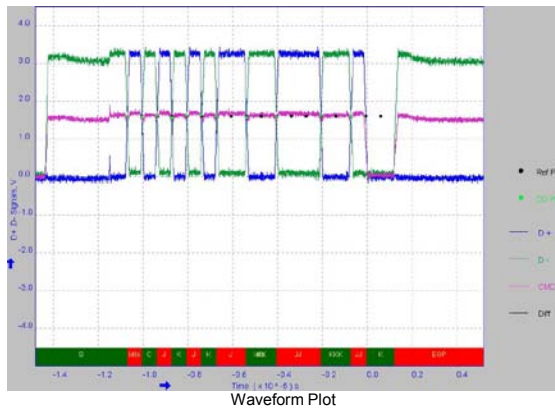
Additional Information :

- Rising Edge Rate:386.5758 V/us (Equivalent Rise Time = 6.8292 ns)
- Falling Edge Rate:473.4253 V/us (Equivalent Fall Time = 5.5764 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.481921Mbps	1.525320Mbps	1.502668Mbps	0.0000bps	16.46091kbps	1.501959Mbps	14	Pass
Crossover Voltage	1.560000 V	1.640000 V	1.604463 V	80.00000mV	23.08737mV	1.604614 V	11	Pass
EOP Width	-	-	1.344223us	-	-	-	1	Pass
Consecutive Jitter	-7.318429ns	7.394496ns	-436.0482ps	14.71293ns	4.729728ns	4.508152ns	10	Pass
Paired JK Jitter	-568.0272ps	4.486395ns	2.062585ns	5.054422ns	2.634157ns	3.075442ns	4	Pass
Paired KJ Jitter	-2.351020ns	3.765986ns	1.615646ns	6.117007ns	2.804535ns	2.917083ns	4	Pass
Falling Edge Rate	17.73399 V/us	19.76936 V/us	18.59273 V/us	2.035367 V/us	715.5759mV/us	18.60524 V/us	11	Pass
Rising Edge Rate	1.000000 V/us	25.71429 V/us	17.27953 V/us	24.71429 V/us	5.616654 V/us	18.09696 V/us	12	Pass

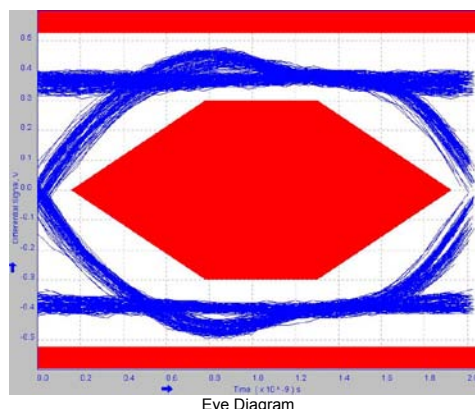
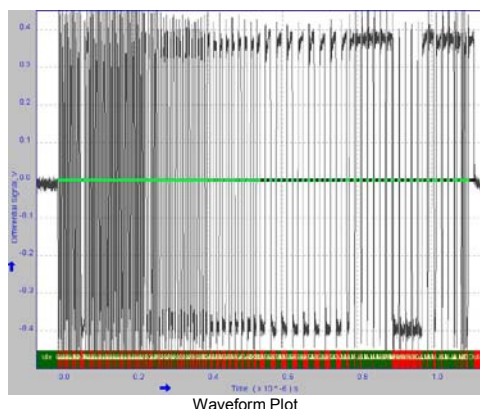
Additional Information :

- Rising Edge Rate:17.27953 V/us (Equivalent Rise Time = 152.78 ns)
- Falling Edge Rate:18.59273 V/us (Equivalent Fall Time = 141.99 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

4. L / R Path At Vcc = 2.7 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	459.4595Mbps	517.2971Mbps	480.0268Mbps	0.0000bps	10.14279Mbps	480.9644Mbps	526	Pass
EOP Width	-	-	16.53897ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.939150	-	-	-	1	Pass
Falling Edge Rate	956.1029 V/us	1.125215kV/us	1.035592kV/us	169.1123 V/us	37.01901 V/us	1.036248kV/us	114	Pass
Rising Edge Rate	929.6201 V/us	1.130277kV/us	1.001024kV/us	200.6569 V/us	33.51762 V/us	1.001580kV/us	115	Pass

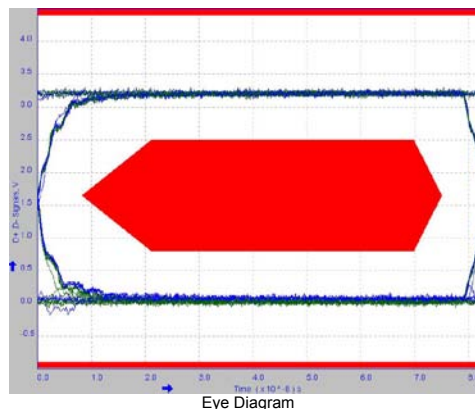
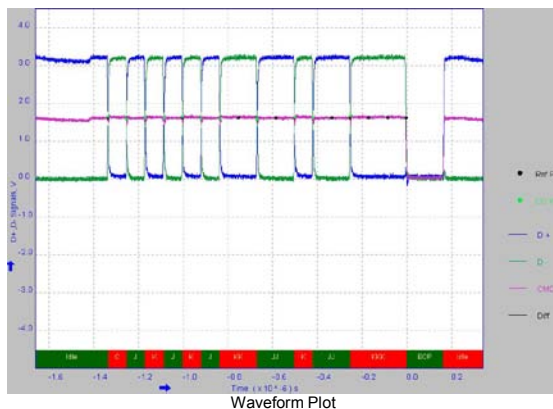
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -98.05ps to 84.18ps RMS Jitter 33.01ps
- KJ Paired Jitter range : -60.87ps to 71.76ps RMS Jitter 15.02ps
- JK Paired Jitter range : -67.39ps to 78.19ps RMS Jitter 20.14ps
- Rising Edge Rate:1.001024kV/us (Equivalent Rise Time = 639.35 ps)
- Falling Edge Rate:1.035592kV/us (Equivalent Fall Time = 618.00 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.99353Mbps	12.00578Mbps	12.00081Mbps	0.0000bps	4.795019kbps	12.00029Mbps	12	Pass
Crossover Voltage	1.597421 V	1.657443 V	1.622314 V	60.02119mV	20.88215mV	1.622436 V	11	Pass
EOP Width	-	-	167.4157ns	-	-	-	1	Pass
Consecutive Jitter	-49.42914ps	26.98743ps	-7.224855ps	76.41657ps	24.27800ps	24.13872ps	10	Pass
Paired JK Jitter	-61.47147ps	76.41657ps	-7.569095ps	137.8880ps	59.50704ps	52.08749ps	4	Pass
Paired KJ Jitter	-33.64353ps	31.33821ps	2.711995ps	64.98174ps	27.35867ps	23.84801ps	4	Pass
Falling Edge Rate	465.6042 V/us	524.2949 V/us	496.2440 V/us	58.69064 V/us	18.91600 V/us	496.5744 V/us	12	Pass
Rising Edge Rate	381.6839 V/us	406.4990 V/us	392.2193 V/us	24.81511 V/us	7.236309 V/us	392.2800 V/us	11	Pass

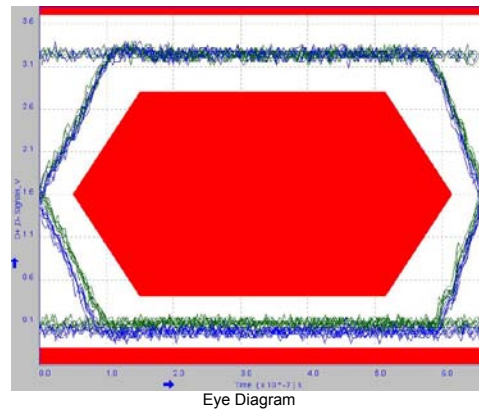
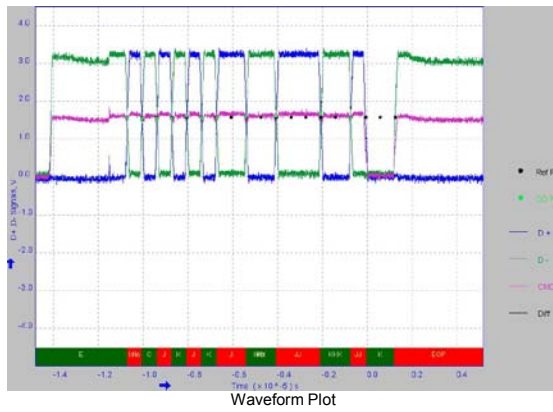
Additional Information :

- Rising Edge Rate:392.2193 V/us (Equivalent Rise Time = 6.7309 ns)
- Falling Edge Rate:496.2440 V/us (Equivalent Fall Time = 5.3200 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.479290Mbps	1.528117Mbps	1.502676Mbps	0.0000bps	16.24739kbps	1.501938Mbps	14	Pass
Crossover Voltage	1.540000 V	1.680000 V	1.577022 V	140.0000mV	41.00066mV	1.577506 V	11	Pass
EOP Width	-	-	1.329135us	-	-	-	1	Pass
Consecutive Jitter	-10.14385ns	5.331664ns	-509.0847ps	15.47551ns	5.222586ns	4.980666ns	10	Pass
Paired JK Jitter	559.1837ps	1.918367ns	1.180102ns	1.359184ns	723.3485ps	1.336063ns	4	Pass
Paired KJ Jitter	-894.5578ps	5.244898ns	2.688776ns	6.139456ns	2.862211ns	3.657008ns	4	Pass
Falling Edge Rate	17.47573 V/us	19.67213 V/us	18.72618 V/us	2.196403 V/us	753.8980mV/us	18.74009 V/us	12	Pass
Rising Edge Rate	17.14286 V/us	26.66667 V/us	19.08703 V/us	9.523810 V/us	2.530226 V/us	19.24015 V/us	12	Pass

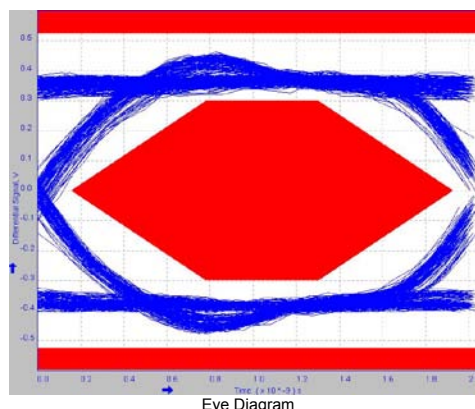
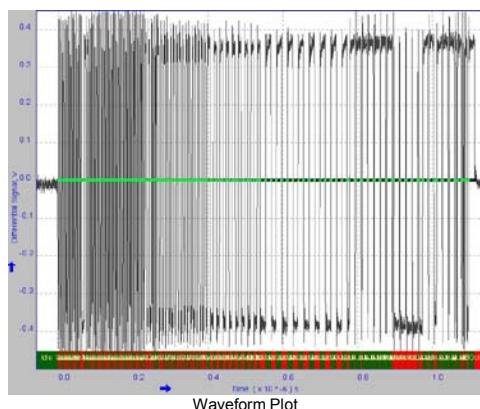
Additional Information :

- Rising Edge Rate:19.08703 V/us (Equivalent Rise Time = 138.31 ns)
- Falling Edge Rate:18.72618 V/us (Equivalent Fall Time = 140.98 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

5. D+ / D- Path At Vcc = 3.0 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	457.0539Mbps	519.1368Mbps	480.0545Mbps	0.0000bps	10.12170Mbps	480.9644Mbps	526	Pass
EOP Width	-	-	16.56875ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.953903	-	-	-	1	Pass
Falling Edge Rate	946.8599 V/us	1.138652kV/us	1.042601kV/us	191.7923 V/us	31.61707 V/us	1.043076kV/us	114	Pass
Rising Edge Rate	907.4074 V/us	1.055024kV/us	983.5165 V/us	147.6165 V/us	30.71875 V/us	983.9920 V/us	115	Pass

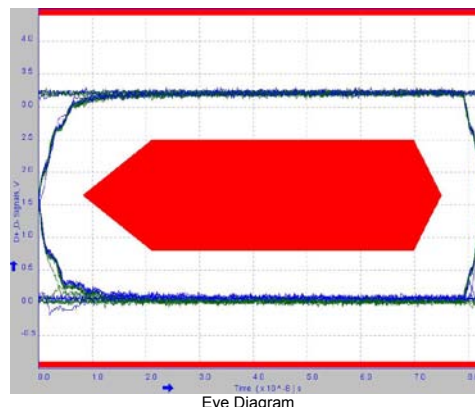
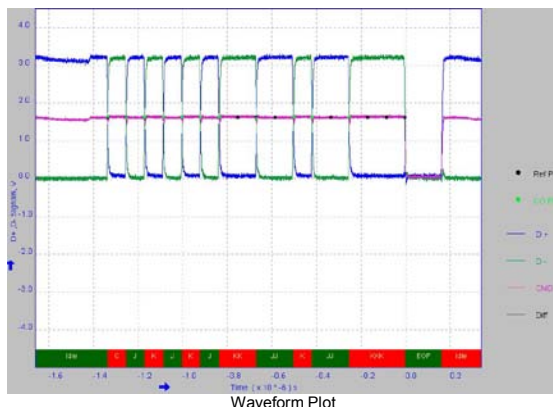
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -84.12ps to 119.1ps RMS Jitter 33.08ps
- KJ Paired Jitter range : -55.47ps to 42.64ps RMS Jitter 14.85ps
- JK Paired Jitter range : -68.10ps to 63.54ps RMS Jitter 21.14ps
- Rising Edge Rate:983.5165 V/us (Equivalent Rise Time = 650.73 ps)
- Falling Edge Rate:1.042601kV/us (Equivalent Fall Time = 613.85 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.99217Mbps	12.01457Mbps	12.00261Mbps	0.0000bps	8.510595kbps	12.00296Mbps	12	Pass
Crossover Voltage	1.595620 V	1.644524 V	1.625283 V	48.90402mV	15.32737mV	1.625348 V	11	Pass
EOP Width	-	-	167.3218ns	-	-	-	1	Pass
Consecutive Jitter	-75.19817ps	100.7692ps	10.49494ps	175.9673ps	54.57232ps	52.82488ps	10	Pass
Paired JK Jitter	-88.71681ps	51.70734ps	-20.73368ps	140.4241ps	57.46213ps	53.91018ps	4	Pass
Paired KJ Jitter	-93.81768ps	129.9941ps	-11.49332ps	223.8118ps	102.6823ps	89.66511ps	4	Pass
Falling Edge Rate	426.0745 V/us	529.3647 V/us	470.0701 V/us	103.2902 V/us	27.39783 V/us	470.8014 V/us	12	Pass
Rising Edge Rate	380.6169 V/us	392.9505 V/us	386.6789 V/us	12.33357 V/us	3.160439 V/us	386.6907 V/us	11	Pass

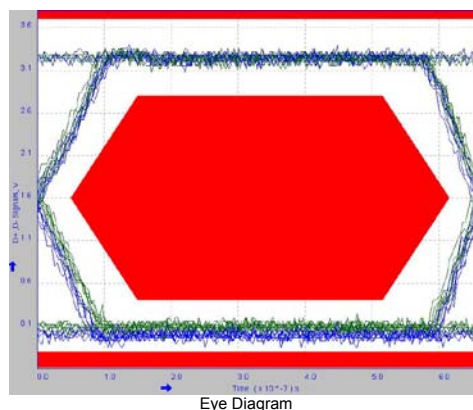
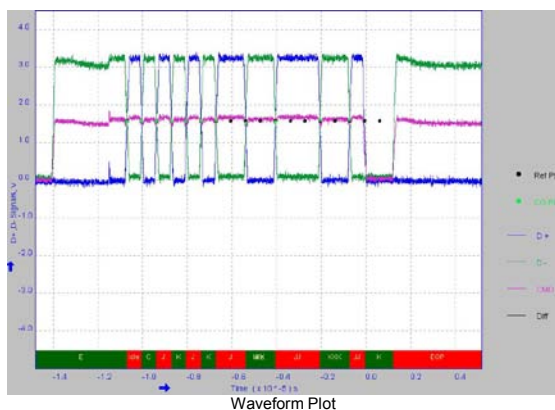
Additional Information :

- Rising Edge Rate:386.6789 V/us (Equivalent Rise Time = 6.8274 ns)
- Falling Edge Rate:470.0701 V/us (Equivalent Fall Time = 5.6162 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.483680Mbps	1.515152Mbps	1.501716Mbps	0.0000bps	11.39655kbps	1.500788Mbps	14	Pass
Crossover Voltage	1.520000 V	1.600000 V	1.571991 V	80.00000mV	22.90354mV	1.572143 V	11	Pass
EOP Width	-	-	1.330540us	-	-	-	1	Pass
Consecutive Jitter	-10.33766ns	5.948052ns	-842.4242ps	16.28571ns	4.498828ns	4.350309ns	10	Pass
Paired JK Jitter	190.4762ps	4.904762ns	2.023810ns	4.714286ns	2.169151ns	2.761289ns	4	Pass
Paired KJ Jitter	-2.190476ns	7.523810ns	2.047619ns	9.714286ns	4.071730ns	4.077620ns	4	Pass
Falling Edge Rate	17.51825 V/us	20.13423 V/us	18.75025 V/us	2.615980 V/us	950.1156mV/us	18.77212 V/us	11	Pass
Rising Edge Rate	1.000000 V/us	26.37363 V/us	17.65456 V/us	25.37363 V/us	5.735026 V/us	18.48873 V/us	12	Pass

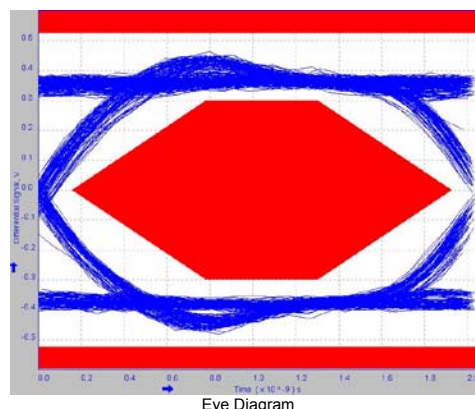
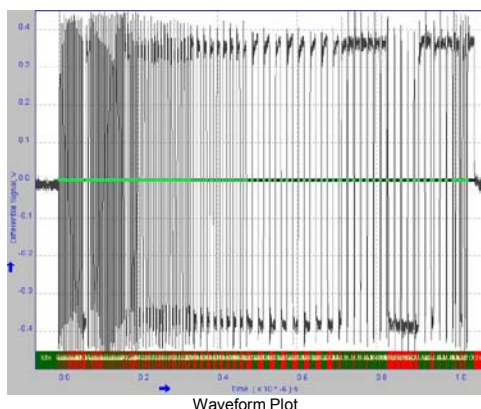
Additional Information :

- Rising Edge Rate:17.65456 V/us (Equivalent Rise Time = 149.54 ns)
- Falling Edge Rate:18.75025 V/us (Equivalent Fall Time = 140.80 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

6. Rx / Tx Path At Vcc = 3.0 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	460.2510Mbps	516.8913Mbps	480.0569Mbps	0.0000bps	9.706923Mbps	480.9229Mbps	494	Pass
EOP Width	-	-	16.59339ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.965773	-	-	-	1	Pass
Falling Edge Rate	953.8372 V/us	1.127979kV/us	1.028710kV/us	174.1422 V/us	34.95538 V/us	1.029297kV/us	98	Pass
Rising Edge Rate	911.7153 V/us	1.070226kV/us	986.2006 V/us	158.5107 V/us	34.83184 V/us	986.8093 V/us	99	Pass

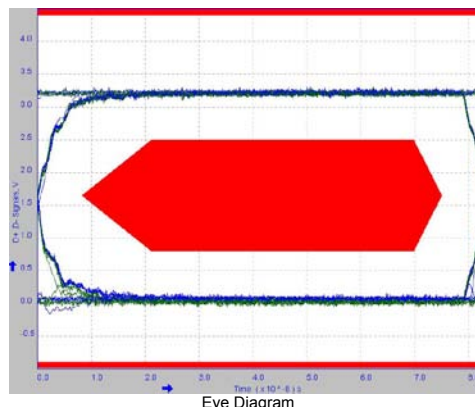
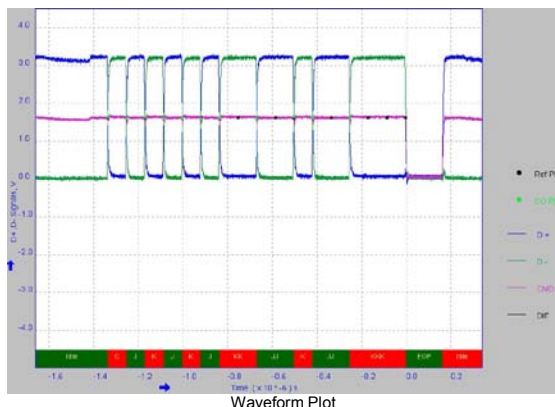
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -77.56ps to 91.75ps RMS Jitter 31.58ps
- KJ Paired Jitter range : -67.41ps to 49.23ps RMS Jitter 15.62ps
- JK Paired Jitter range : -67.87ps to 78.60ps RMS Jitter 21.59ps
- Rising Edge Rate:986.2006 V/us (Equivalent Rise Time = 648.96 ps)
- Falling Edge Rate:1.028710kV/us (Equivalent Fall Time = 622.14 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.99265Mbps	12.00823Mbps	12.00216Mbps	0.0000bps	5.811351kbps	12.00177Mbps	12	Pass
Crossover Voltage	1.592000 V	1.646400 V	1.617619 V	54.40000mV	17.69348mV	1.617707 V	11	Pass
EOP Width	-	-	167.4251ns	-	-	-	1	Pass
Consecutive Jitter	-64.77149ps	52.43547ps	-898.4614fs	117.2070ps	31.56894ps	29.96240ps	10	Pass
Paired JK Jitter	-23.96076ps	563.3256fs	-7.053190ps	24.52409ps	11.38528ps	12.12295ps	4	Pass
Paired KJ Jitter	-92.17491ps	77.12149ps	-12.07799ps	169.2964ps	69.65320ps	61.51873ps	4	Pass
Falling Edge Rate	433.5155 V/us	508.4384 V/us	466.7562 V/us	74.92289 V/us	27.73743 V/us	467.5110 V/us	12	Pass
Rising Edge Rate	379.5853 V/us	400.0384 V/us	387.4379 V/us	20.45309 V/us	6.001474 V/us	387.4801 V/us	11	Pass

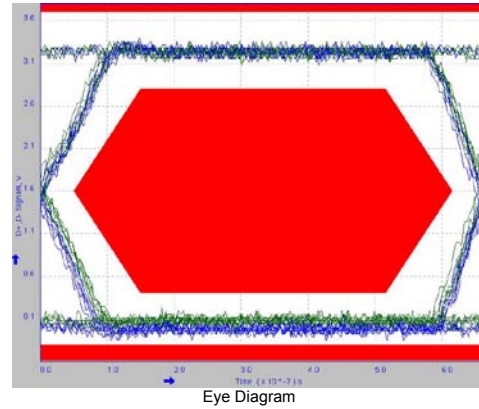
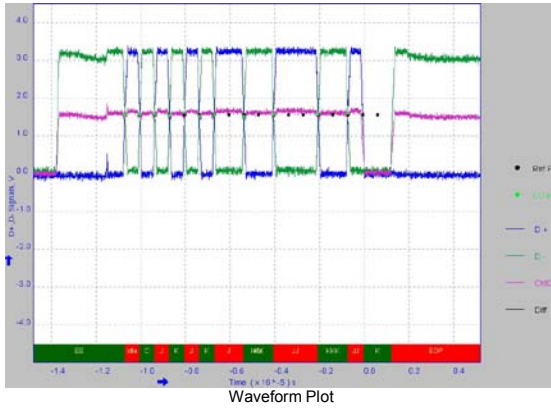
Additional Information :

- Rising Edge Rate:387.4379 V/us (Equivalent Rise Time = 6.8140 ns)
- Falling Edge Rate:466.7562 V/us (Equivalent Fall Time = 5.6561 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.478124Mbps	1.519449Mbps	1.501931Mbps	0.0000bps	14.12046kbps	1.500828Mbps	14	Pass
Crossover Voltage	1.520000 V	1.624000 V	1.567636 V	104.0000mV	30.96143mV	1.567914 V	11	Pass
EOP Width	-	-	1.331145us	-	-	-	1	Pass
Consecutive Jitter	-9.993074ns	7.511688ns	-633.0736ps	17.50476ns	5.311643ns	5.078679ns	10	Pass
Paired JK Jitter	-952.3810ps	9.238095ns	2.680952ns	10.19048ns	4.536943ns	4.756616ns	4	Pass
Paired KJ Jitter	-3.047619ns	7.447619ns	1.695238ns	10.49524ns	4.328492ns	4.114087ns	4	Pass
Falling Edge Rate	17.91045 V/us	19.78022 V/us	18.89754 V/us	1.869772 V/us	758.6671mV/us	18.91138 V/us	11	Pass
Rising Edge Rate	1.000000 V/us	26.08696 V/us	17.60194 V/us	25.08696 V/us	5.719772 V/us	18.43415 V/us	12	Pass

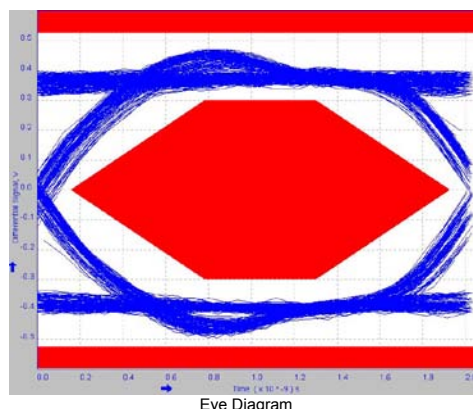
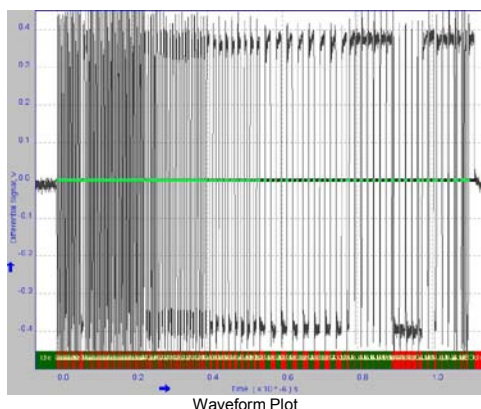
Additional Information :

- Rising Edge Rate:17.60194 V/us (Equivalent Rise Time = 149.98 ns)
- Falling Edge Rate:18.89754 V/us (Equivalent Fall Time = 139.70 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

7. L / R Path At Vcc = 3.0 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	459.6774Mbps	516.6475Mbps	480.0558Mbps	0.0000bps	10.03013Mbps	481.0069Mbps	526	Pass
EOP Width	-	-	16.53480ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.937629	-	-	-	1	Pass
Falling Edge Rate	938.6934 V/us	1.111989kV/us	1.033857kV/us	173.2953 V/us	35.20090 V/us	1.034451kV/us	114	Pass
Rising Edge Rate	914.0233 V/us	1.080165kV/us	996.2071 V/us	166.1420 V/us	34.16694 V/us	996.7878 V/us	115	Pass

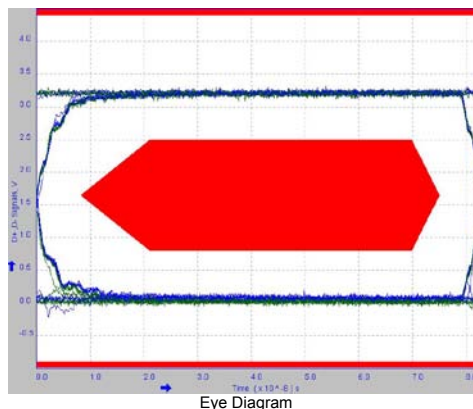
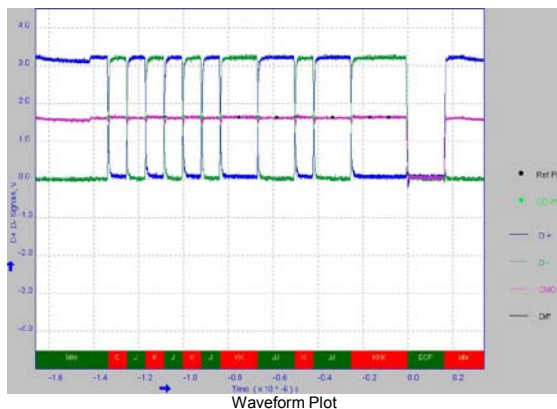
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -74.40ps to 107.3ps RMS Jitter 33.94ps
- KJ Paired Jitter range : -65.76ps to 58.25ps RMS Jitter 15.03ps
- JK Paired Jitter range : -70.27ps to 59.73ps RMS Jitter 19.69ps
- Rising Edge Rate:996.2071 V/us (Equivalent Rise Time = 642.44 ps)
- Falling Edge Rate:1.033857kV/us (Equivalent Fall Time = 619.04 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.99344Mbps	12.01056Mbps	12.00078Mbps	0.0000bps	4.787643kbps	12.00071Mbps	12	Pass
Crossover Voltage	1.602093 V	1.656004 V	1.629344 V	53.91109mV	15.74319mV	1.629413 V	11	Pass
EOP Width	-	-	167.5072ns	-	-	-	1	Pass
Consecutive Jitter	-29.62381ps	55.53233ps	-9.974666ps	85.15614ps	25.74142ps	26.37902ps	10	Pass
Paired JK Jitter	-5.484101ps	16.79712ps	6.807309ps	22.28122ps	9.518830ps	10.69091ps	4	Pass
Paired KJ Jitter	-74.04632ps	74.18788ps	352.7179fs	148.2342ps	61.10258ps	52.91756ps	4	Pass
Falling Edge Rate	468.5687 V/us	530.6829 V/us	500.5305 V/us	62.11425 V/us	18.10721 V/us	500.8306 V/us	12	Pass
Rising Edge Rate	380.6169 V/us	404.8041 V/us	393.2507 V/us	24.18715 V/us	6.512311 V/us	393.2997 V/us	11	Pass

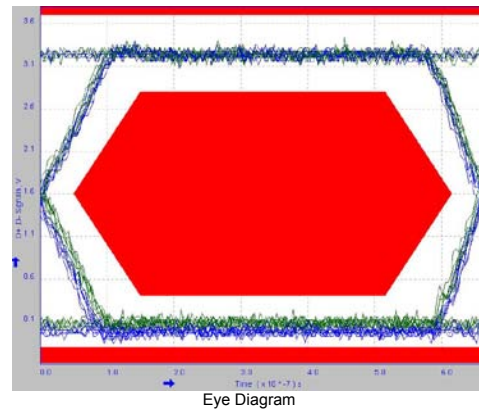
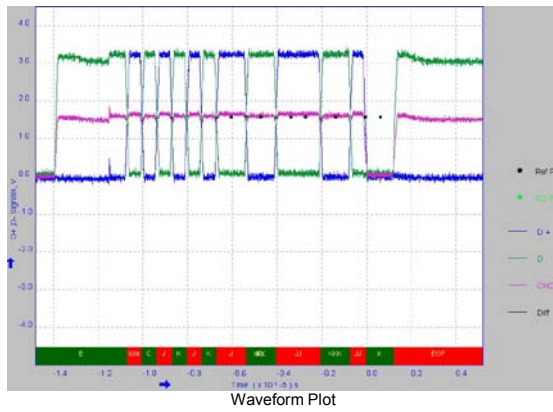
Additional Information :

- Rising Edge Rate:393.2507 V/us (Equivalent Rise Time = 6.7133 ns)
- Falling Edge Rate:500.5305 V/us (Equivalent Fall Time = 5.2744 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.479290Mbps	1.532176Mbps	1.502232Mbps	0.0000bps	17.78649kbps	1.501999Mbps	14	Pass
Crossover Voltage	1.531429 V	1.600000 V	1.578978 V	68.57143mV	20.63259mV	1.579101 V	11	Pass
EOP Width	-	-	1.332372us	-	-	-	1	Pass
Consecutive Jitter	-5.967100ns	8.204329ns	-702.3377ps	14.17143ns	5.003998ns	4.798883ns	10	Pass
Paired JK Jitter	685.7143ps	7.352381ns	2.580952ns	6.666667ns	3.208247ns	3.792223ns	4	Pass
Paired KJ Jitter	-914.2857ps	4.285714ns	961.9048ps	5.200000ns	2.291131ns	2.205045ns	4	Pass
Falling Edge Rate	17.64706 V/us	19.88950 V/us	18.57851 V/us	2.242444 V/us	839.4738mV/us	18.59575 V/us	11	Pass
Rising Edge Rate	1.000000 V/us	26.70623 V/us	17.68065 V/us	25.70623 V/us	5.791673 V/us	18.52980 V/us	12	Pass

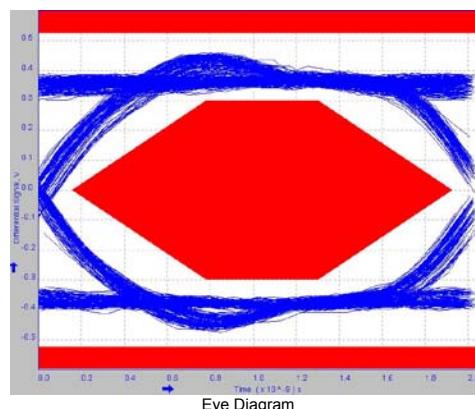
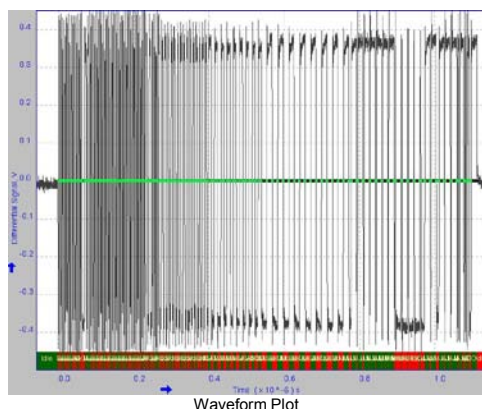
Additional Information :

- Rising Edge Rate:17.68065 V/us (Equivalent Rise Time = 149.32 ns)
- Falling Edge Rate:18.57851 V/us (Equivalent Fall Time = 142.10 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

8. D+ / D- Path At Vcc = 3.3 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	460.2992Mbps	516.9356Mbps	480.0279Mbps	0.0000bps	9.712870Mbps	480.9643Mbps	526	Pass
EOP Width	-	-	16.53110ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.935390	-	-	-	1	Pass
Falling Edge Rate	965.0926 V/us	1.100482kV/us	1.039089kV/us	135.3896 V/us	29.68533 V/us	1.039509kV/us	114	Pass
Rising Edge Rate	920.1390 V/us	1.061097kV/us	981.7377 V/us	140.9583 V/us	30.08754 V/us	982.1947 V/us	115	Pass

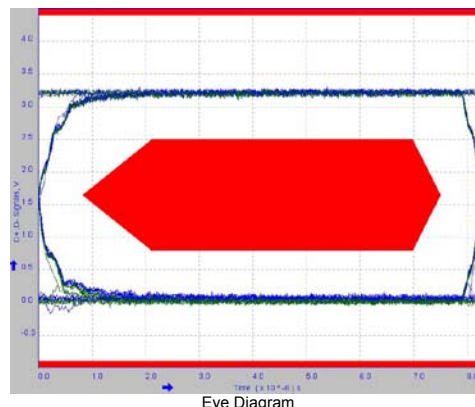
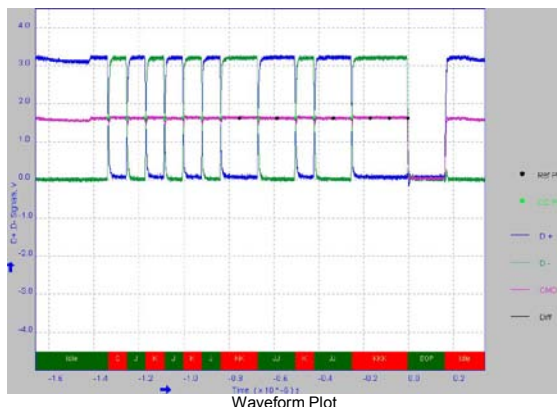
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -65.86ps to 93.21ps RMS Jitter 32.14ps
- KJ Paired Jitter range : -70.53ps to 48.05ps RMS Jitter 14.78ps
- JK Paired Jitter range : -65.65ps to 79.29ps RMS Jitter 19.58ps
- Rising Edge Rate:981.7377 V/us (Equivalent Rise Time = 651.91 ps)
- Falling Edge Rate:1.039089kV/us (Equivalent Fall Time = 615.92 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.98466Mbps	12.01373Mbps	12.00139Mbps	0.0000bps	8.691736kbps	12.00052Mbps	12	Pass
Crossover Voltage	1.610560 V	1.641920 V	1.626603 V	31.36000mV	11.22547mV	1.626638 V	11	Pass
EOP Width	-	-	167.3860ns	-	-	-	1	Pass
Consecutive Jitter	-77.57882ps	38.71748ps	-1.945822ps	116.2963ps	36.77567ps	34.94268ps	10	Pass
Paired JK Jitter	-93.33333ps	86.24339ps	-8.425926ps	179.5767ps	81.85267ps	71.38551ps	4	Pass
Paired KJ Jitter	-30.70707ps	35.97884ps	-5.740741ps	66.68591ps	29.45894ps	26.15010ps	4	Pass
Falling Edge Rate	449.3109 V/us	522.1207 V/us	472.4889 V/us	72.80973 V/us	20.52016 V/us	472.8972 V/us	12	Pass
Rising Edge Rate	378.5933 V/us	395.0863 V/us	387.6030 V/us	16.49298 V/us	5.914389 V/us	387.6440 V/us	11	Pass

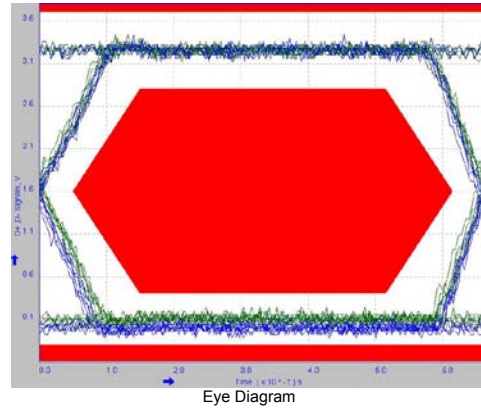
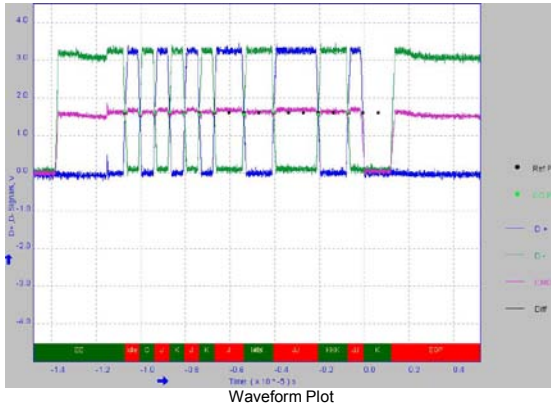
Additional Information :

- Rising Edge Rate:387.6030 V/us (Equivalent Rise Time = 6.8111 ns)
- Falling Edge Rate:472.4889 V/us (Equivalent Fall Time = 5.5874 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.485149Mbps	1.520527Mbps	1.502038Mbps	0.0000bps	12.38530kbps	1.501196Mbps	14	Pass
Crossover Voltage	1.560000 V	1.640000 V	1.598528 V	80.00000mV	30.04264mV	1.598785 V	11	Pass
EOP Width	-	-	1.327914us	-	-	-	1	Pass
Consecutive Jitter	-6.861472ns	4.519481ns	-604.3290ps	11.38095ns	3.834455ns	3.687541ns	10	Pass
Paired JK Jitter	523.8095ps	2.714286ns	1.559524ns	2.190476ns	1.199883ns	1.874008ns	4	Pass
Paired KJ Jitter	-1.142857ns	3.523810ns	1.285714ns	4.666667ns	2.236575ns	2.324814ns	4	Pass
Falling Edge Rate	17.54386 V/us	20.83333 V/us	18.87157 V/us	3.289474 V/us	988.7733mV/us	18.89530 V/us	12	Pass
Rising Edge Rate	17.64706 V/us	25.80645 V/us	19.09110 V/us	8.159393 V/us	2.211269 V/us	19.20813 V/us	12	Pass

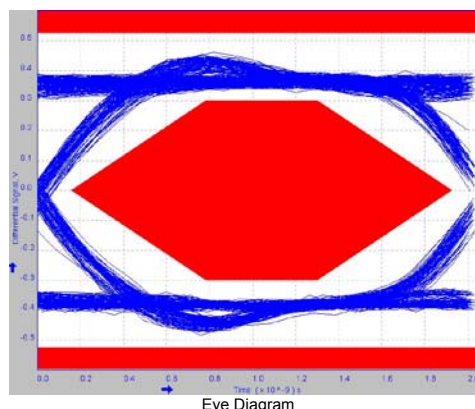
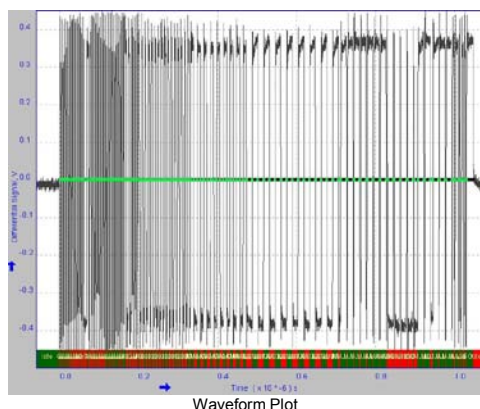
Additional Information :

- Rising Edge Rate:19.09110 V/us (Equivalent Rise Time = 138.28 ns)
- Falling Edge Rate:18.87157 V/us (Equivalent Fall Time = 139.89 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

9. Rx / Tx Path At Vcc = 3.3 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	458.9907Mbps	518.6573Mbps	480.0607Mbps	0.0000bps	9.953638Mbps	481.0022Mbps	494	Pass
EOP Width	-	-	16.53231ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.936513	-	-	-	1	Pass
Falling Edge Rate	951.8492 V/us	1.154082kV/us	1.029297kV/us	202.2333 V/us	40.85537 V/us	1.030099kV/us	98	Pass
Rising Edge Rate	878.5742 V/us	1.044669kV/us	976.1444 V/us	166.0952 V/us	32.97445 V/us	976.6955 V/us	99	Pass

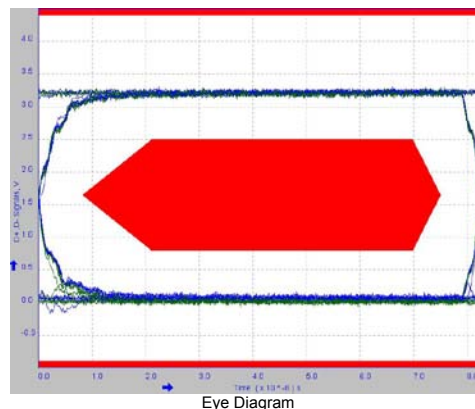
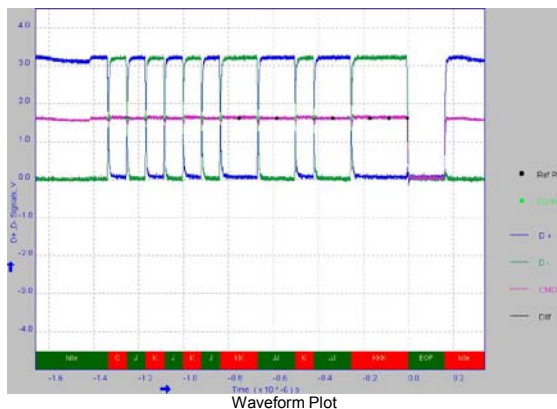
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -75.07ps to 79.94ps RMS Jitter 30.48ps
- KJ Paired Jitter range : -75.63ps to 50.48ps RMS Jitter 17.72ps
- JK Paired Jitter range : -72.38ps to 62.50ps RMS Jitter 21.07ps
- Rising Edge Rate:976.1444 V/us (Equivalent Rise Time = 655.64 ps)
- Falling Edge Rate:1.029297kV/us (Equivalent Fall Time = 621.78 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.99639Mbps	12.01100Mbps	12.00186Mbps	0.0000bps	4.239590kbps	12.00195Mbps	12	Pass
Crossover Voltage	1.592990 V	1.647313 V	1.624612 V	54.32320mV	14.08508mV	1.624668 V	11	Pass
EOP Width	-	-	167.3673ns	-	-	-	1	Pass
Consecutive Jitter	-41.66159ps	39.02150ps	2.721381ps	80.68309ps	24.22366ps	23.14116ps	10	Pass
Paired JK Jitter	-27.27671ps	2.013103ps	-15.83678ps	29.28981ps	12.52033ps	19.19303ps	4	Pass
Paired KJ Jitter	-47.49854ps	25.33728ps	-4.333996ps	72.83581ps	31.24005ps	27.39962ps	4	Pass
Falling Edge Rate	454.9056 V/us	511.5849 V/us	479.7834 V/us	56.67931 V/us	18.31930 V/us	480.1039 V/us	12	Pass
Rising Edge Rate	380.7188 V/us	397.2012 V/us	388.6150 V/us	16.48247 V/us	6.020048 V/us	388.6574 V/us	11	Pass

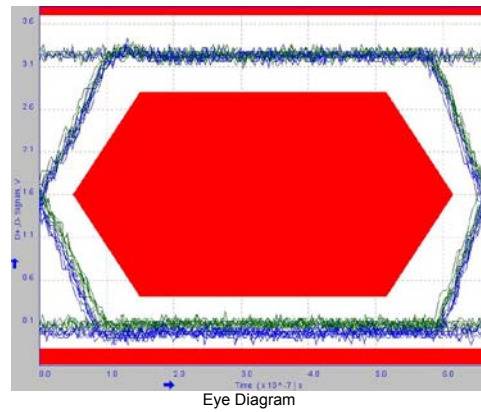
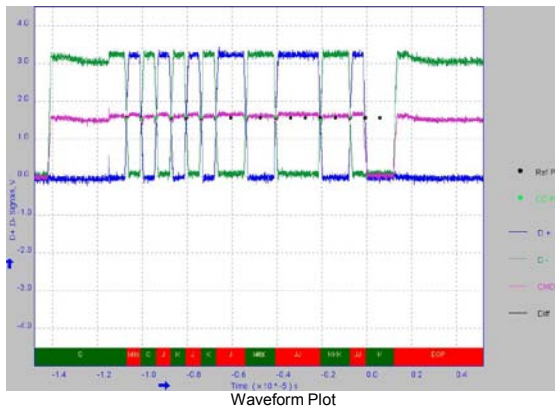
Additional Information :

- Rising Edge Rate:388.6150 V/us (Equivalent Rise Time = 6.7934 ns)
- Falling Edge Rate:479.7834 V/us (Equivalent Fall Time = 5.5025 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.480020Mbps	1.530612Mbps	1.502228Mbps	0.0000bps	17.86133kbps	1.501332Mbps	14	Pass
Crossover Voltage	1.500000 V	1.600000 V	1.560999 V	100.0000mV	32.04550mV	1.561298 V	11	Pass
EOP Width	-	-	1.330845us	-	-	-	1	Pass
Consecutive Jitter	-6.912101ns	6.189940ns	-718.7673ps	13.10204ns	4.819203ns	4.628053ns	10	Pass
Paired JK Jitter	-643.9909ps	4.834467ns	2.009070ns	5.478458ns	2.266540ns	2.808784ns	4	Pass
Paired KJ Jitter	-1.632653ns	3.622676ns	1.105442ns	5.255329ns	2.353386ns	2.318582ns	4	Pass
Falling Edge Rate	18.00000 V/us	19.35484 V/us	18.61970 V/us	1.354839 V/us	588.3575mV/us	18.62815 V/us	11	Pass
Rising Edge Rate	1.000000 V/us	25.53191 V/us	17.51795 V/us	24.53191 V/us	5.642871 V/us	18.33213 V/us	12	Pass

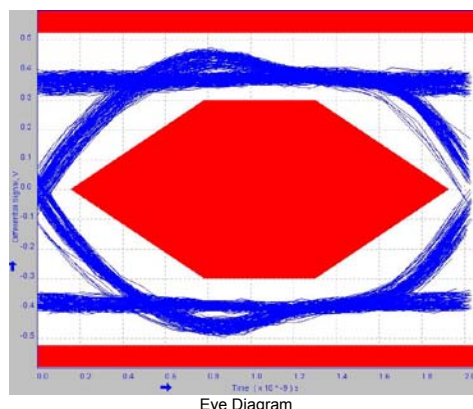
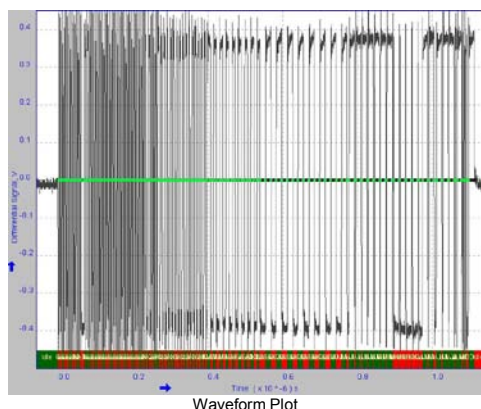
Additional Information :

- Rising Edge Rate:17.51795 V/us (Equivalent Rise Time = 150.70 ns)
- Falling Edge Rate:18.61970 V/us (Equivalent Fall Time = 141.79 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

10. L / R Path At Vcc = 3.3 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	458.2210Mbps	517.6328Mbps	480.0324Mbps	0.0000bps	10.24021Mbps	481.0458Mbps	526	Pass
EOP Width	-	-	16.53687ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.938234	-	-	-	1	Pass
Falling Edge Rate	933.9144 V/us	1.122096kV/us	1.026643kV/us	188.1816 V/us	32.89593 V/us	1.027166kV/us	114	Pass
Rising Edge Rate	919.2463 V/us	1.065098kV/us	996.1895 V/us	145.8516 V/us	30.93003 V/us	996.6654 V/us	115	Pass

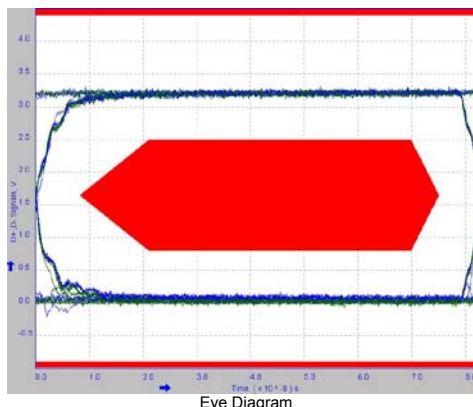
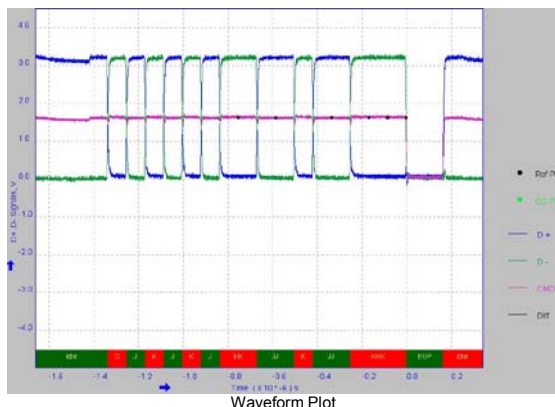
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -109.8ps to 74.60ps RMS Jitter 33.80ps
- KJ Paired Jitter range : -81.68ps to 65.67ps RMS Jitter 16.25ps
- JK Paired Jitter range : -64.05ps to 78.55ps RMS Jitter 20.67ps
- Rising Edge Rate:996.1895 V/us (Equivalent Rise Time = 642.45 ps)
- Falling Edge Rate:1.026643kV/us (Equivalent Fall Time = 623.39 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.99006Mbps	12.01106Mbps	12.00160Mbps	0.0000bps	6.579860kbps	12.00205Mbps	12	Pass
Crossover Voltage	1.611678 V	1.640169 V	1.625911 V	28.49050mV	8.730034mV	1.625933 V	11	Pass
EOP Width	-	-	167.2856ns	-	-	-	1	Pass
Consecutive Jitter	-91.86041ps	37.09532ps	-3.079025ps	128.9557ps	41.33064ps	39.33040ps	10	Pass
Paired JK Jitter	-37.61113ps	39.99752ps	-1.911255ps	77.60864ps	32.83638ps	28.50130ps	4	Pass
Paired KJ Jitter	-66.94704ps	115.6870ps	14.79048ps	182.6340ps	93.63062ps	82.42438ps	4	Pass
Falling Edge Rate	476.9539 V/us	538.9364 V/us	502.0647 V/us	61.98248 V/us	22.74250 V/us	502.5367 V/us	12	Pass
Rising Edge Rate	383.7678 V/us	396.5309 V/us	390.7428 V/us	12.76307 V/us	4.627552 V/us	390.7677 V/us	11	Pass

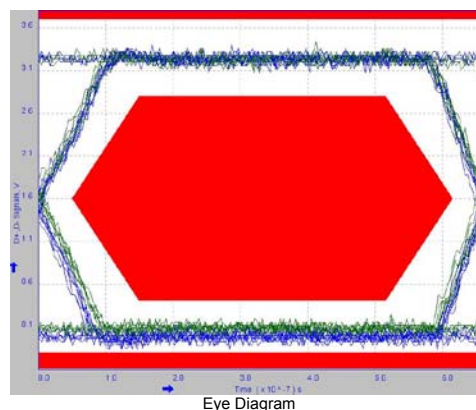
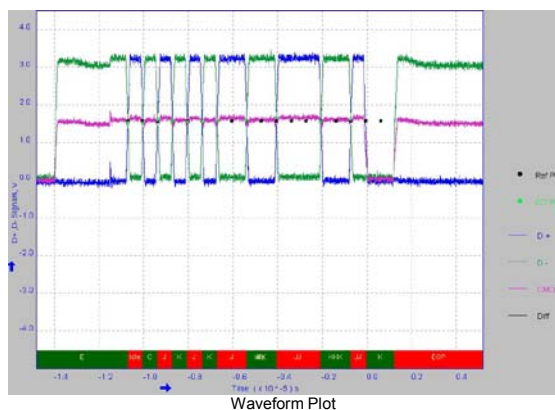
Additional Information :

- Rising Edge Rate:390.7428 V/us (Equivalent Rise Time = 6.7564 ns)
- Falling Edge Rate:502.0647 V/us (Equivalent Fall Time = 5.2583 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.483680Mbps	1.525719Mbps	1.502017Mbps	0.0000bps	16.92570kbps	1.501154Mbps	14	Pass
Crossover Voltage	1.520000 V	1.660000 V	1.576961 V	140.0000mV	41.03921mV	1.577446 V	11	Pass
EOP Width	-	-	1.332163us	-	-	-	1	Pass
Consecutive Jitter	-10.41818ns	7.067532ns	-701.0390ps	17.48571ns	5.511949ns	5.275877ns	10	Pass
Paired JK Jitter	971.4286ps	3.085714ns	2.057143ns	2.114286ns	864.0988ps	2.189026ns	4	Pass
Paired KJ Jitter	342.8571ps	3.857143ns	2.314286ns	3.514286ns	1.466357ns	2.639805ns	4	Pass
Falling Edge Rate	17.64706 V/us	19.93355 V/us	18.83395 V/us	2.286496 V/us	828.8937mV/us	18.85053 V/us	11	Pass
Rising Edge Rate	17.19198 V/us	19.09814 V/us	18.39665 V/us	1.906166 V/us	625.7422mV/us	18.40640 V/us	12	Pass

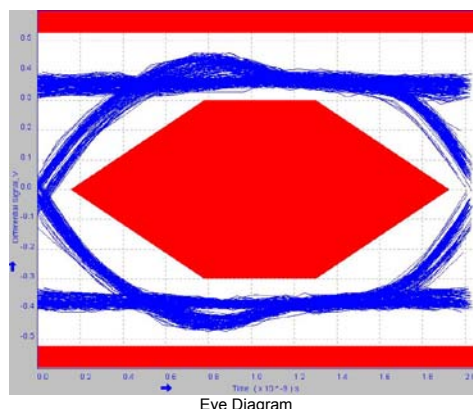
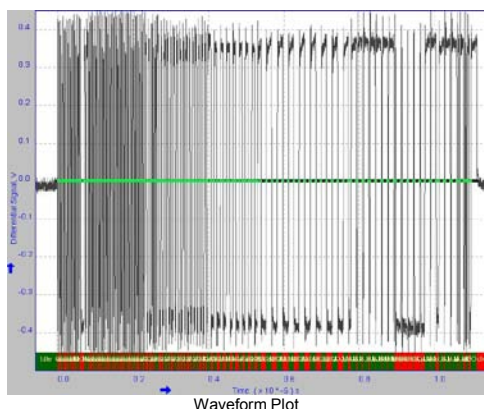
Additional Information :

- Rising Edge Rate:18.39665 V/us (Equivalent Rise Time = 143.50 ns)
- Falling Edge Rate:18.83395 V/us (Equivalent Fall Time = 140.17 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

11. D+ / D- Path At Vcc = 3.6 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	460.2403Mbps	517.0709Mbps	480.0299Mbps	0.0000bps	9.816113Mbps	480.9449Mbps	526	Pass
EOP Width	-	-	16.52378ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.931910	-	-	-	1	Pass
Falling Edge Rate	953.9752 V/us	1.138295kV/us	1.043237kV/us	184.3196 V/us	33.55914 V/us	1.043772kV/us	114	Pass
Rising Edge Rate	914.8441 V/us	1.066566kV/us	983.8931 V/us	151.7216 V/us	29.97329 V/us	984.3456 V/us	115	Pass

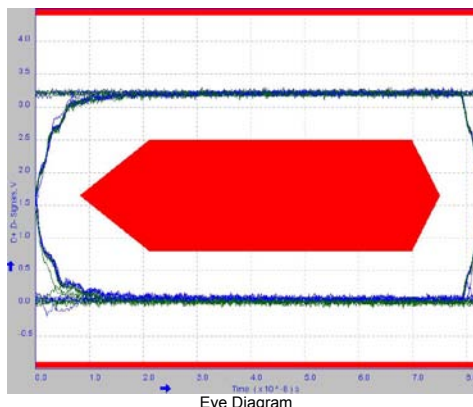
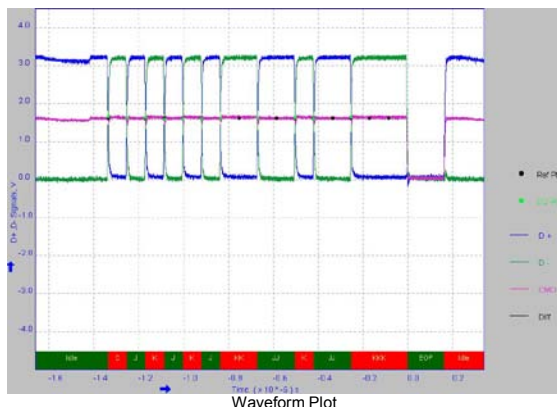
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -78.70ps to 86.55ps RMS Jitter 30.95ps
- KJ Paired Jitter range : -67.83ps to 48.32ps RMS Jitter 14.64ps
- JK Paired Jitter range : -71.32ps to 69.03ps RMS Jitter 20.41ps
- Rising Edge Rate:983.8931 V/us (Equivalent Rise Time = 650.48 ps)
- Falling Edge Rate:1.043237kV/us (Equivalent Fall Time = 613.48 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.98513Mbps	12.01505Mbps	12.00079Mbps	0.0000bps	7.754693kbps	12.00055Mbps	12	Pass
Crossover Voltage	1.589523 V	1.657831 V	1.621933 V	68.30778mV	21.48364mV	1.622062 V	11	Pass
EOP Width	-	-	167.3718ns	-	-	-	1	Pass
Consecutive Jitter	-29.04979ps	92.31403ps	-320.2186fs	121.3638ps	34.78715ps	33.00354ps	10	Pass
Paired JK Jitter	-15.57310ps	22.49508ps	1.771517ps	38.06818ps	17.71020ps	15.43945ps	4	Pass
Paired KJ Jitter	-114.3511ps	75.19784ps	-2.106337ps	189.5489ps	80.16195ps	69.45424ps	4	Pass
Falling Edge Rate	426.6060 V/us	504.1186 V/us	471.3632 V/us	77.51261 V/us	21.72301 V/us	471.8218 V/us	12	Pass
Rising Edge Rate	377.5717 V/us	394.8387 V/us	384.0820 V/us	17.26701 V/us	5.989005 V/us	384.1245 V/us	11	Pass

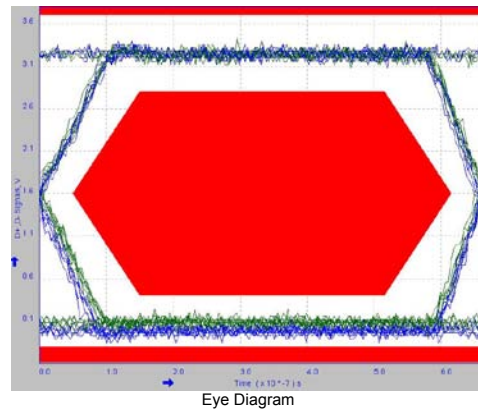
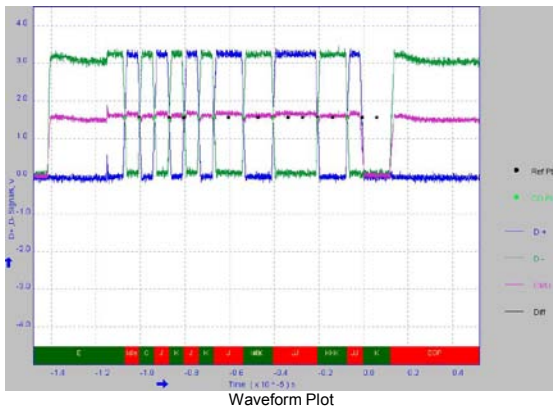
Additional Information :

- Rising Edge Rate:384.0820 V/us (Equivalent Rise Time = 6.8735 ns)
- Falling Edge Rate:471.3632 V/us (Equivalent Fall Time = 5.6008 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.483680Mbps	1.512859Mbps	1.502307Mbps	0.0000bps	9.767877kbps	1.501328Mbps	14	Pass
Crossover Voltage	1.506667 V	1.630000 V	1.554727 V	123.3333mV	34.17661mV	1.555069 V	11	Pass
EOP Width	-	-	1.328315us	-	-	-	1	Pass
Consecutive Jitter	-6.611255ns	5.460173ns	-274.5887ps	12.07143ns	4.055183ns	3.856871ns	10	Pass
Paired JK Jitter	285.7143ps	4.414286ns	2.089286ns	4.128571ns	1.752370ns	2.582289ns	4	Pass
Paired KJ Jitter	-6.047619ns	4.619048ns	928.5714ps	10.66667ns	4.822903ns	4.278731ns	4	Pass
Falling Edge Rate	17.56098 V/us	20.00000 V/us	18.78087 V/us	2.439024 V/us	925.7595mV/us	18.80160 V/us	11	Pass
Rising Edge Rate	1.000000 V/us	26.47059 V/us	17.53217 V/us	25.47059 V/us	5.748664 V/us	18.37581 V/us	12	Pass

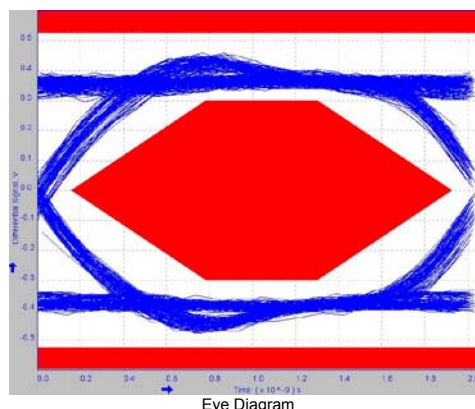
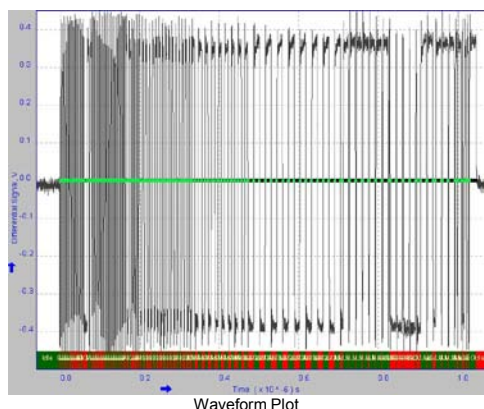
Additional Information :

- Rising Edge Rate:17.53217 V/us (Equivalent Rise Time = 150.58 ns)
- Falling Edge Rate:18.78087 V/us (Equivalent Fall Time = 140.57 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

12. Rx / Tx Path At Vcc = 3.6 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	459.7953Mbps	515.8096Mbps	480.0624Mbps	0.0000bps	9.759023Mbps	480.9237Mbps	494	Pass
EOP Width	-	-	16.56667ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.953033	-	-	-	1	Pass
Falling Edge Rate	957.2171 V/us	1.151709kV/us	1.033939kV/us	194.4923 V/us	38.56699 V/us	1.034651kV/us	98	Pass
Rising Edge Rate	896.2920 V/us	1.076014kV/us	982.5657 V/us	179.7215 V/us	35.93869 V/us	983.2161 V/us	99	Pass

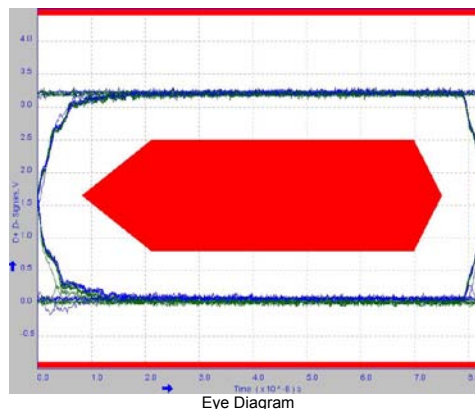
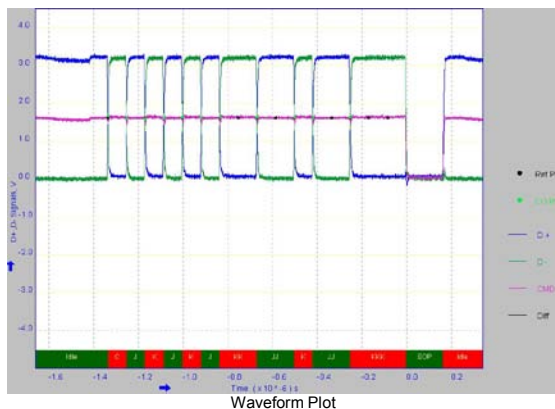
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -59.84ps to 87.95ps RMS Jitter 32.15ps
- KJ Paired Jitter range : -59.24ps to 47.21ps RMS Jitter 16.06ps
- JK Paired Jitter range : -66.30ps to 71.17ps RMS Jitter 21.72ps
- Rising Edge Rate:982.5657 V/us (Equivalent Rise Time = 651.36 ps)
- Falling Edge Rate:1.033939kV/us (Equivalent Fall Time = 618.99 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.99288Mbps	12.00909Mbps	12.00144Mbps	0.0000bps	4.766553kbps	12.00097Mbps	12	Pass
Crossover Voltage	1.593284 V	1.659080 V	1.625030 V	65.79635mV	18.92901mV	1.625130 V	11	Pass
EOP Width	-	-	167.4843ns	-	-	-	1	Pass
Consecutive Jitter	-55.79485ps	52.88672ps	597.1417fs	108.6816ps	30.74029ps	29.16892ps	10	Pass
Paired JK Jitter	-57.52015ps	74.72627ps	-13.27028ps	132.2464ps	61.02314ps	54.48824ps	4	Pass
Paired KJ Jitter	-37.56882ps	33.64323ps	3.858904ps	71.21205ps	32.60209ps	28.49672ps	4	Pass
Falling Edge Rate	409.9914 V/us	515.4517 V/us	467.6740 V/us	105.4603 V/us	26.38043 V/us	468.3555 V/us	12	Pass
Rising Edge Rate	377.3385 V/us	398.2100 V/us	387.8192 V/us	20.87148 V/us	8.052764 V/us	387.8952 V/us	11	Pass

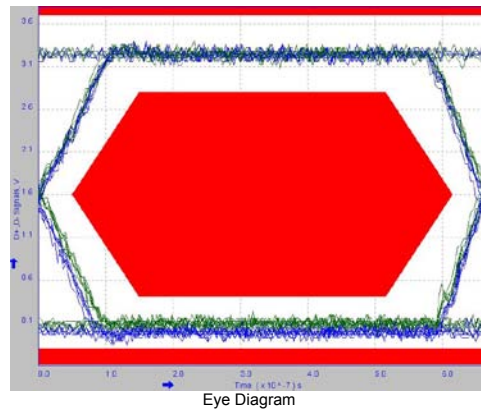
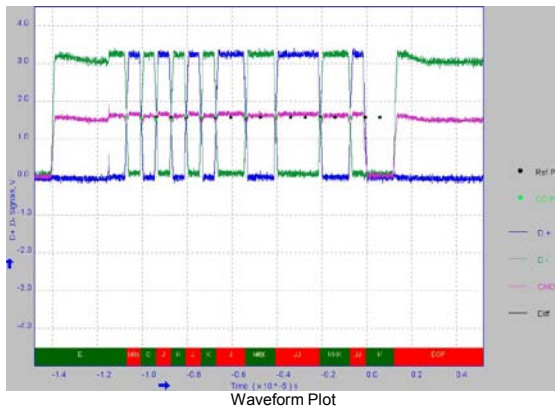
Additional Information :

- Rising Edge Rate:387.8192 V/us (Equivalent Rise Time = 6.8073 ns)
- Falling Edge Rate:467.6740 V/us (Equivalent Fall Time = 5.6450 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.486620Mbps	1.521298Mbps	1.502699Mbps	0.0000bps	12.77279kbps	1.501923Mbps	14	Pass
Crossover Voltage	1.520000 V	1.600000 V	1.570364 V	80.00000mV	28.21642mV	1.570594 V	11	Pass
EOP Width	-	-	1.333244us	-	-	-	1	Pass
Consecutive Jitter	-6.835498ns	4.609400ns	-478.6271ps	11.44490ns	4.099773ns	3.918726ns	10	Pass
Paired JK Jitter	367.3469ps	3.775510ns	1.489796ns	3.408163ns	1.545191ns	2.002549ns	4	Pass
Paired KJ Jitter	-1.186395ns	3.605442ns	1.074830ns	4.791837ns	2.553710ns	2.458930ns	4	Pass
Falling Edge Rate	17.34104 V/us	19.73684 V/us	18.56403 V/us	2.395802 V/us	822.4009mV/us	18.58072 V/us	12	Pass
Rising Edge Rate	17.47573 V/us	25.35211 V/us	19.24514 V/us	7.876385 V/us	1.992919 V/us	19.33949 V/us	12	Pass

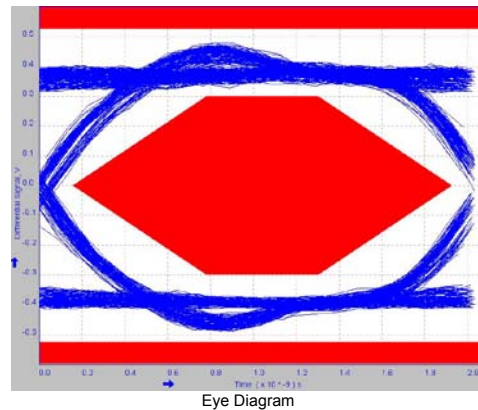
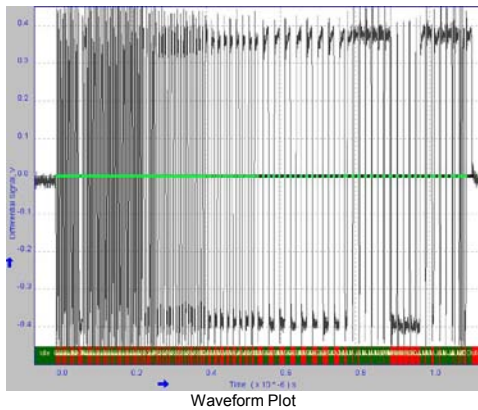
Additional Information :

- Rising Edge Rate:19.24514 V/us (Equivalent Rise Time = 137.18 ns)
- Falling Edge Rate:18.56403 V/us (Equivalent Fall Time = 142.21 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

13. L / R Path At Vcc = 3.6 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	456.8106Mbps	521.4680Mbps	480.0345Mbps	0.0000bps	10.12528Mbps	481.0083Mbps	526	Pass
EOP Width	-	-	16.47370ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.907944	-	-	-	1	Pass
Falling Edge Rate	965.4162 V/us	1.119546kV/us	1.034724kV/us	154.1299 V/us	28.71249 V/us	1.035118kV/us	114	Pass
Rising Edge Rate	927.3158 V/us	1.079850kV/us	998.4012 V/us	152.5339 V/us	31.41796 V/us	998.8911 V/us	115	Pass

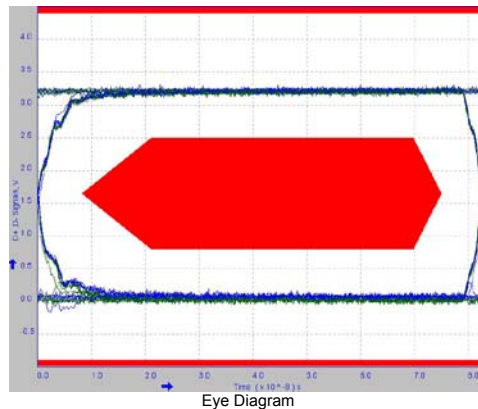
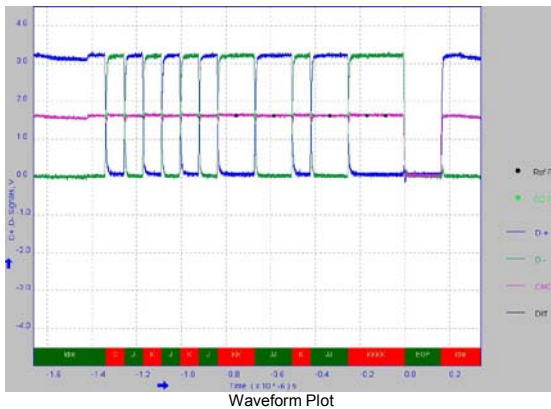
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -73.81ps to 91.71ps RMS Jitter 31.85ps
- KJ Paired Jitter range : -74.02ps to 67.65ps RMS Jitter 15.50ps
- JK Paired Jitter range : -67.87ps to 77.47ps RMS Jitter 20.97ps
- Rising Edge Rate:998.4012 V/us (Equivalent Rise Time = 641.02 ps)
- Falling Edge Rate:1.034724kV/us (Equivalent Fall Time = 618.52 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.98461Mbps	12.01284Mbps	12.00026Mbps	0.0000bps	7.841804kbps	12.00001Mbps	12	Pass
Crossover Voltage	1.598570 V	1.639527 V	1.622926 V	40.95722mV	13.03455mV	1.622974 V	11	Pass
EOP Width	-	-	167.4316ns	-	-	-	1	Pass
Consecutive Jitter	-54.68783ps	71.65597ps	-9.034008ps	126.3438ps	41.62011ps	40.50461ps	10	Pass
Paired JK Jitter	-9.995442ps	65.11640ps	27.20220ps	75.11184ps	32.25973ps	38.99330ps	4	Pass
Paired KJ Jitter	-65.26424ps	82.79925ps	-4.535793ps	148.0635ps	71.13763ps	61.77374ps	4	Pass
Falling Edge Rate	469.2429 V/us	546.0180 V/us	497.4683 V/us	76.77513 V/us	23.44961 V/us	497.9746 V/us	12	Pass
Rising Edge Rate	379.7367 V/us	410.3541 V/us	394.7292 V/us	30.61740 V/us	8.325067 V/us	394.8090 V/us	11	Pass

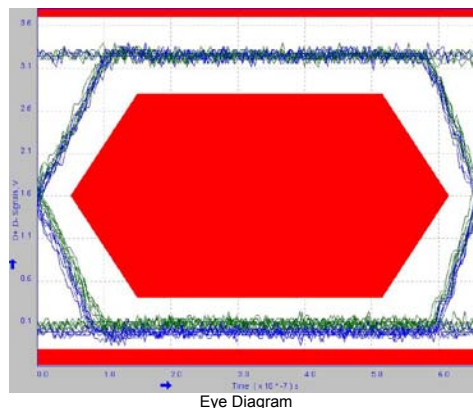
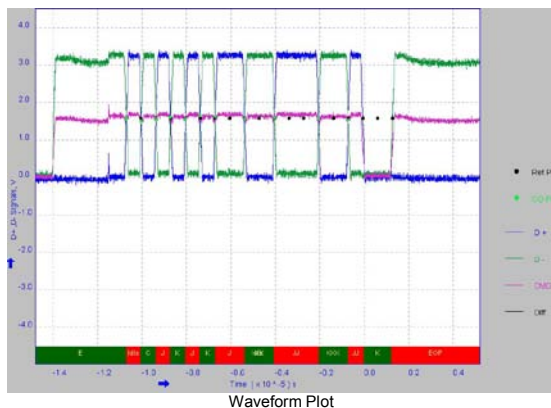
Additional Information :

- Rising Edge Rate:394.7292 V/us (Equivalent Rise Time = 6.6881 ns)
- Falling Edge Rate:497.4683 V/us (Equivalent Fall Time = 5.3069 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.475586Mbps	1.531465Mbps	1.502146Mbps	0.0000bps	17.72129kbps	1.501558Mbps	14	Pass
Crossover Voltage	1.504000 V	1.647273 V	1.574133 V	143.2727mV	39.58887mV	1.574586 V	11	Pass
EOP Width	-	-	1.325178us	-	-	-	1	Pass
Consecutive Jitter	-7.766076ns	4.978512ns	-716.8989ps	12.74459ns	4.589696ns	4.412791ns	10	Pass
Paired JK Jitter	-1.523810ns	2.476190ns	800.0000ps	4.00000ns	1.701113ns	1.676407ns	4	Pass
Paired KJ Jitter	-4.554113ns	4.228571ns	1.842857ns	8.782684ns	4.268656ns	4.130640ns	4	Pass
Falling Edge Rate	17.14286 V/us	19.67213 V/us	18.43455 V/us	2.529274 V/us	752.3962mV/us	18.44836 V/us	10	Pass
Rising Edge Rate	1.000000 V/us	19.51220 V/us	16.97404 V/us	18.51220 V/us	5.076875 V/us	17.65629 V/us	12	Pass

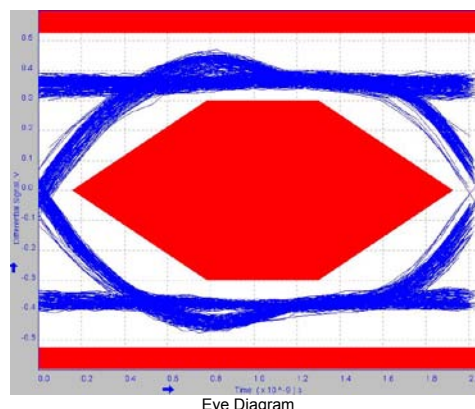
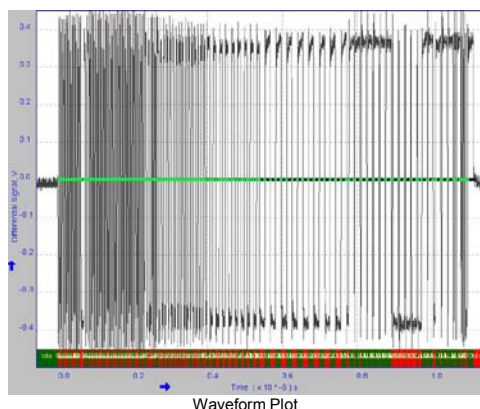
Additional Information :

- Rising Edge Rate:16.97404 V/us (Equivalent Rise Time = 155.53 ns)
- Falling Edge Rate:18.43455 V/us (Equivalent Fall Time = 143.21 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

14. D+ / D- Path At Vcc = 3.9 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	459.7701Mbps	514.7059Mbps	480.0351Mbps	0.0000bps	9.702701Mbps	480.9297Mbps	526	Pass
EOP Width	-	-	16.41535ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.879946	-	-	-	1	Pass
Falling Edge Rate	947.7928 V/us	1.131050kV/us	1.042638kV/us	183.2576 V/us	33.86425 V/us	1.043183kV/us	114	Pass
Rising Edge Rate	905.0035 V/us	1.040828kV/us	981.8530 V/us	135.8241 V/us	28.84621 V/us	982.2730 V/us	115	Pass

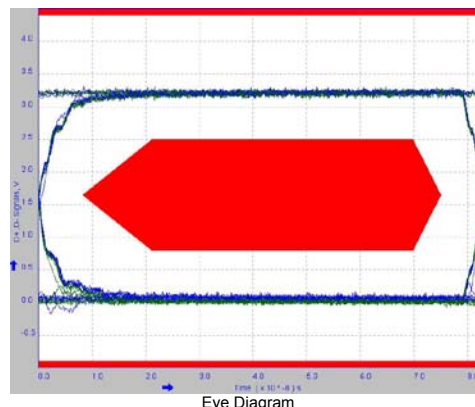
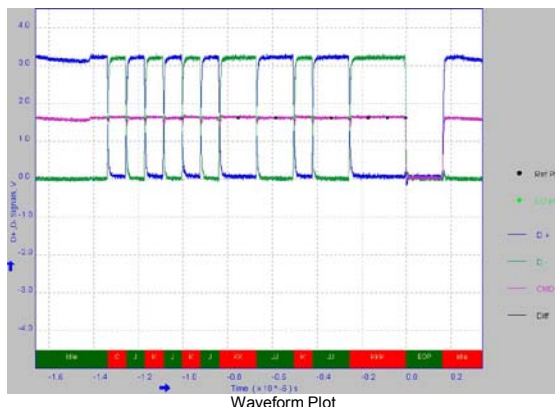
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -92.47ps to 80.42ps RMS Jitter 30.48ps
- KJ Paired Jitter range : -57.97ps to 52.87ps RMS Jitter 13.22ps
- JK Paired Jitter range : -71.77ps to 68.09ps RMS Jitter 20.07ps
- Rising Edge Rate:981.8530 V/us (Equivalent Rise Time = 651.83 ps)
- Falling Edge Rate:1.042638kV/us (Equivalent Fall Time = 613.83 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.99676Mbps	12.01248Mbps	12.00150Mbps	0.0000bps	5.151322kbps	12.00275Mbps	12	Pass
Crossover Voltage	1.605327 V	1.657275 V	1.625466 V	51.94773mV	14.49291mV	1.625525 V	11	Pass
EOP Width	-	-	167.4245ns	-	-	-	1	Pass
Consecutive Jitter	-50.68005ps	58.35674ps	-1.486690ps	109.0368ps	39.50424ps	37.50649ps	10	Pass
Paired JK Jitter	-90.72511ps	20.88745ps	-19.04762ps	111.6126ps	50.64391ps	47.81648ps	4	Pass
Paired KJ Jitter	-21.44661ps	90.20563ps	16.45022ps	111.6522ps	50.10928ps	46.40921ps	4	Pass
Falling Edge Rate	445.2784 V/us	521.2199 V/us	479.0839 V/us	75.94155 V/us	21.44795 V/us	479.5238 V/us	12	Pass
Rising Edge Rate	383.9144 V/us	394.7047 V/us	389.3829 V/us	10.79026 V/us	3.583661 V/us	389.3979 V/us	11	Pass

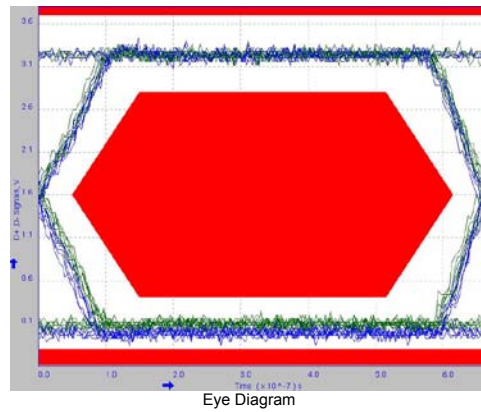
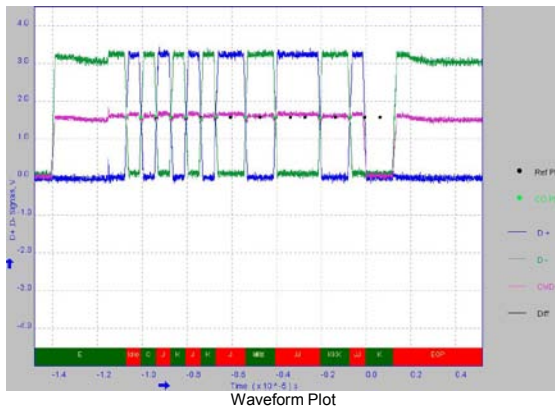
Additional Information :

- Rising Edge Rate:389.3829 V/us (Equivalent Rise Time = 6.7800 ns)
- Falling Edge Rate:479.0839 V/us (Equivalent Fall Time = 5.5105 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.484169Mbps	1.522843Mbps	1.501967Mbps	0.0000bps	15.58528kbps	1.500994Mbps	14	Pass
Crossover Voltage	1.533333 V	1.600000 V	1.576089 V	66.66667mV	17.91701mV	1.576182 V	11	Pass
EOP Width	-	-	1.329272us	-	-	-	1	Pass
Consecutive Jitter	-9.178932ns	5.884560ns	-756.7100ps	15.06349ns	4.851337ns	4.664175ns	10	Pass
Paired JK Jitter	253.9683ps	3.174603ns	1.996032ns	2.920635ns	1.358442ns	2.316930ns	4	Pass
Paired KJ Jitter	142.8571ps	4.301587ns	1.769841ns	4.158730ns	1.777093ns	2.345396ns	4	Pass
Falling Edge Rate	17.34940 V/us	19.60784 V/us	18.53407 V/us	2.258446 V/us	825.8659mV/us	18.55093 V/us	12	Pass
Rising Edge Rate	16.66667 V/us	24.16107 V/us	18.93757 V/us	7.494407 V/us	1.822045 V/us	19.01775 V/us	12	Pass

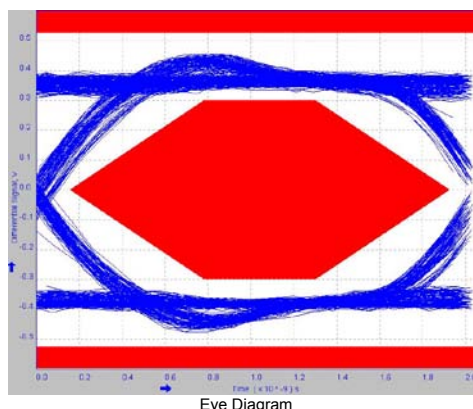
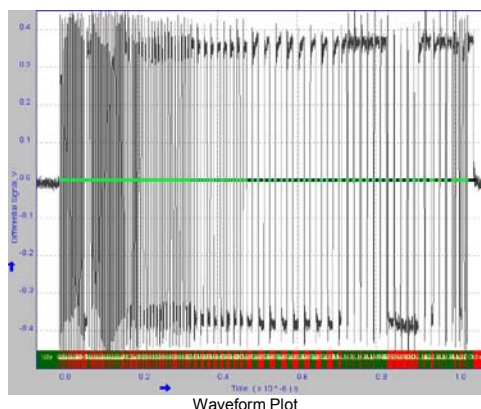
Additional Information :

- Rising Edge Rate:18.93757 V/us (Equivalent Rise Time = 139.41 ns)
- Falling Edge Rate:18.53407 V/us (Equivalent Fall Time = 142.44 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

15. Rx / Tx Path At Vcc = 3.9 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	461.1650Mbps	520.3323Mbps	480.0802Mbps	0.0000bps	9.915365Mbps	481.1054Mbps	494	Pass
EOP Width	-	-	16.55674ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.948564	-	-	-	1	Pass
Falling Edge Rate	948.9142 V/us	1.112762kV/us	1.030363kV/us	163.8482 V/us	38.96743 V/us	1.031092kV/us	98	Pass
Rising Edge Rate	908.6244 V/us	1.068655kV/us	981.9571 V/us	160.0310 V/us	32.74495 V/us	982.4974 V/us	99	Pass

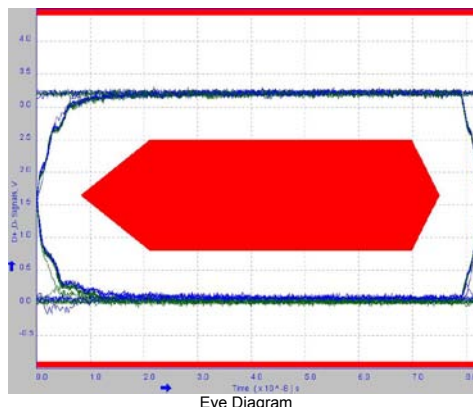
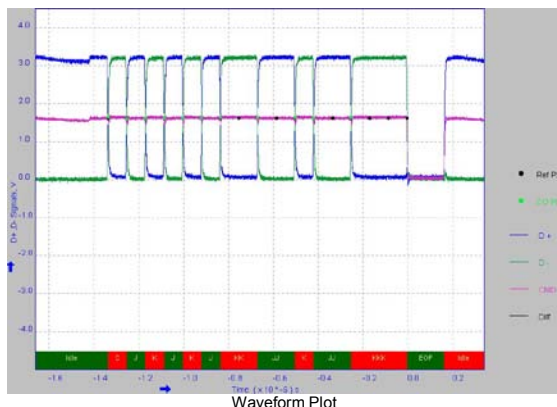
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -77.01ps to 104.3ps RMS Jitter 35.71ps
- KJ Paired Jitter range : -61.40ps to 60.42ps RMS Jitter 16.71ps
- JK Paired Jitter range : -72.07ps to 74.41ps RMS Jitter 22.43ps
- Rising Edge Rate:981.9571 V/us (Equivalent Rise Time = 651.76 ps)
- Falling Edge Rate:1.030363kV/us (Equivalent Fall Time = 621.14 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.99202Mbps	12.01286Mbps	12.00015Mbps	0.0000bps	8.081555kbps	12.00090Mbps	12	Pass
Crossover Voltage	1.599257 V	1.653000 V	1.625582 V	53.74286mV	12.74771mV	1.625628 V	11	Pass
EOP Width	-	-	167.3514ns	-	-	-	1	Pass
Consecutive Jitter	-54.43511ps	66.40905ps	-44.58420fs	120.8442ps	38.10665ps	36.15117ps	10	Pass
Paired JK Jitter	-26.79654ps	36.06227ps	8.720238ps	62.85881ps	30.25174ps	27.61193ps	4	Pass
Paired KJ Jitter	-99.11255ps	107.3918ps	16.36905ps	206.5043ps	86.36949ps	76.56835ps	4	Pass
Falling Edge Rate	412.8382 V/us	523.1859 V/us	464.6256 V/us	110.3477 V/us	29.05481 V/us	465.4576 V/us	12	Pass
Rising Edge Rate	378.7992 V/us	393.6144 V/us	386.9934 V/us	14.81520 V/us	4.052917 V/us	387.0127 V/us	11	Pass

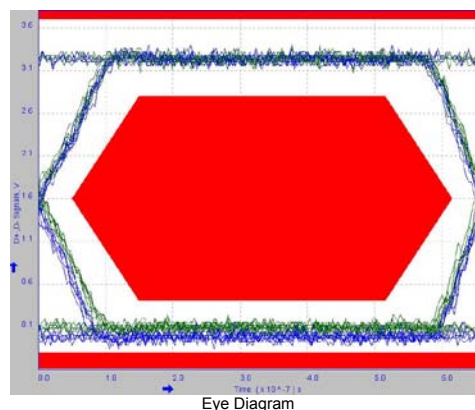
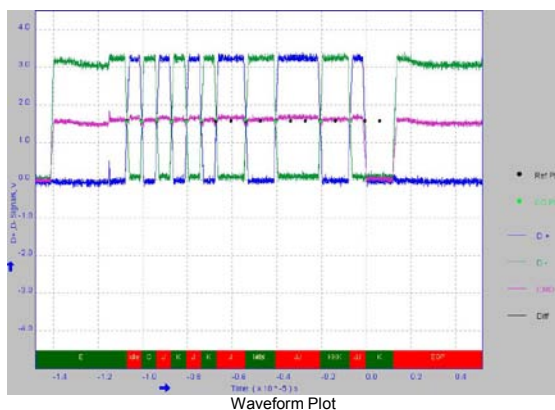
Additional Information :

- Rising Edge Rate:386.9934 V/us (Equivalent Rise Time = 6.8218 ns)
- Falling Edge Rate:464.6256 V/us (Equivalent Fall Time = 5.6820 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.477978Mbps	1.524390Mbps	1.502307Mbps	0.0000bps	17.19582kbps	1.501382Mbps	14	Pass
Crossover Voltage	1.540000 V	1.620000 V	1.575463 V	80.00000mV	22.73807mV	1.575612 V	11	Pass
EOP Width	-	-	1.330062us	-	-	-	1	Pass
Consecutive Jitter	-7.032035ns	6.372727ns	-632.5108ps	13.40476ns	4.724224ns	4.526205ns	10	Pass
Paired JK Jitter	-1.428571ns	4.428571ns	1.922619ns	5.857143ns	2.440476ns	2.857168ns	4	Pass
Paired KJ Jitter	-671.4286ps	2.219048ns	1.428571ns	2.890476ns	1.405534ns	1.876822ns	4	Pass
Falling Edge Rate	17.26619 V/us	19.69981 V/us	18.59335 V/us	2.433625 V/us	905.7755mV/us	18.61356 V/us	12	Pass
Rising Edge Rate	17.30769 V/us	25.87269 V/us	19.32977 V/us	8.564998 V/us	2.172001 V/us	19.44131 V/us	12	Pass

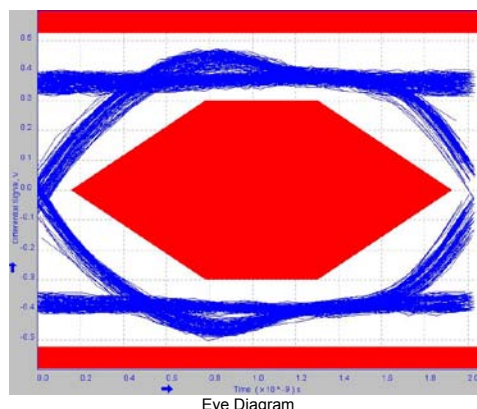
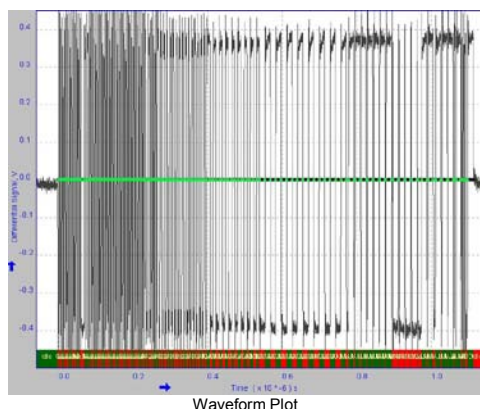
Additional Information :

- Rising Edge Rate:19.32977 V/us (Equivalent Rise Time = 136.58 ns)
- Falling Edge Rate:18.59335 V/us (Equivalent Fall Time = 141.99 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

16. L / R Path At Vcc = 3.9 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	458.3333Mbps	517.1241Mbps	480.0453Mbps	0.0000bps	10.10313Mbps	481.0180Mbps	526	Pass
EOP Width	-	-	16.56455ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.951734	-	-	-	1	Pass
Falling Edge Rate	942.2481 V/us	1.120822kV/us	1.033168kV/us	178.5734 V/us	31.84955 V/us	1.033655kV/us	114	Pass
Rising Edge Rate	897.6348 V/us	1.105840kV/us	998.0087 V/us	208.2054 V/us	32.78195 V/us	998.5423 V/us	115	Pass

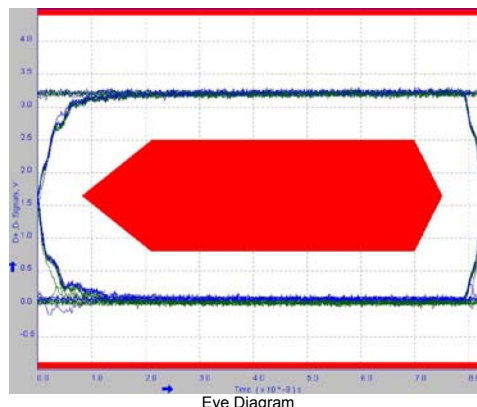
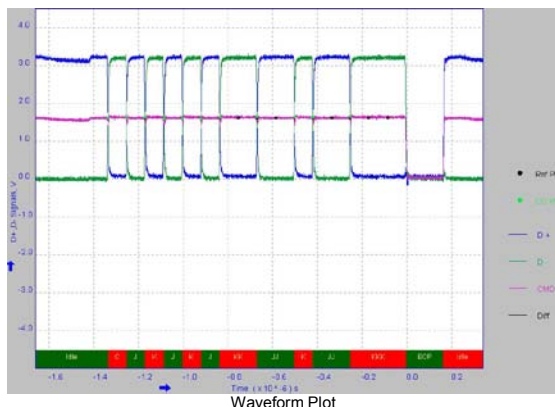
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -83.27ps to 78.57ps RMS Jitter 31.23ps
- KJ Paired Jitter range : -71.48ps to 66.72ps RMS Jitter 14.07ps
- JK Paired Jitter range : -61.87ps to 79.85ps RMS Jitter 21.10ps
- Rising Edge Rate:998.0087 V/us (Equivalent Rise Time = 641.28 ps)
- Falling Edge Rate:1.033168kV/us (Equivalent Fall Time = 619.45 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.98559Mbps	12.01401Mbps	12.00028Mbps	0.0000bps	9.690616kpbs	12.00066Mbps	12	Pass
Crossover Voltage	1.598588 V	1.649694 V	1.625785 V	51.10558mV	16.91890mV	1.625865 V	11	Pass
EOP Width	-	-	167.4012ns	-	-	-	1	Pass
Consecutive Jitter	-82.13900ps	55.78057ps	-5.472945ps	137.9196ps	45.96947ps	43.95254ps	10	Pass
Paired JK Jitter	-13.84776ps	45.43644ps	19.87295ps	59.28420ps	26.81267ps	30.56344ps	4	Pass
Paired KJ Jitter	-112.3154ps	116.5750ps	14.60694ps	228.8904ps	108.6707ps	95.23844ps	4	Pass
Falling Edge Rate	474.8254 V/us	535.5000 V/us	501.5098 V/us	60.67457 V/us	17.27263 V/us	501.7824 V/us	12	Pass
Rising Edge Rate	377.8293 V/us	402.6093 V/us	390.5893 V/us	24.78001 V/us	6.440171 V/us	390.6376 V/us	11	Pass

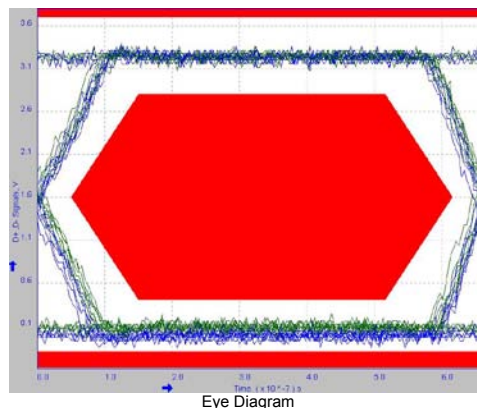
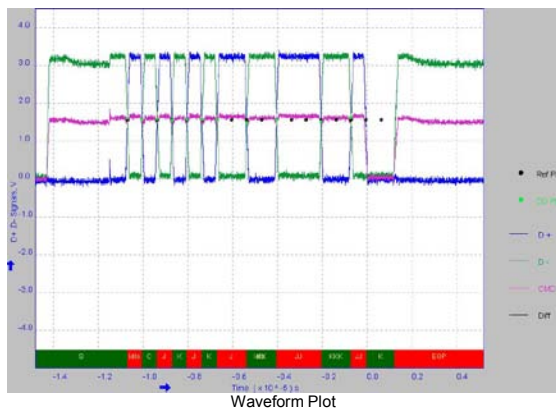
Additional Information :

- Rising Edge Rate:390.5893 V/us (Equivalent Rise Time = 6.7590 ns)
- Falling Edge Rate:501.5098 V/us (Equivalent Fall Time = 5.2641 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.476378Mbps	1.522567Mbps	1.501179Mbps	0.0000bps	14.49240kbps	1.500076Mbps	14	Pass
Crossover Voltage	1.493333 V	1.620000 V	1.563948 V	126.6667mV	35.18339mV	1.564308 V	11	Pass
EOP Width	-	-	1.326874us	-	-	-	1	Pass
Consecutive Jitter	-10.32511ns	6.579654ns	-953.2035ps	16.90476ns	5.247348ns	5.068509ns	10	Pass
Paired JK Jitter	119.0476ps	3.904762ns	2.797619ns	3.785714ns	1.799733ns	3.202492ns	4	Pass
Paired KJ Jitter	-5.314286ns	8.047619ns	1.428571ns	13.36190ns	5.720890ns	5.156283ns	4	Pass
Falling Edge Rate	17.47573 V/us	20.33898 V/us	18.68208 V/us	2.863255 V/us	860.5788mV/us	18.70024 V/us	12	Pass
Rising Edge Rate	17.14286 V/us	25.21008 V/us	19.03200 V/us	8.067227 V/us	2.074823 V/us	19.13539 V/us	12	Pass

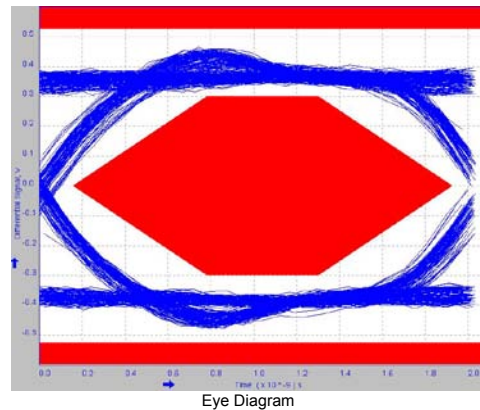
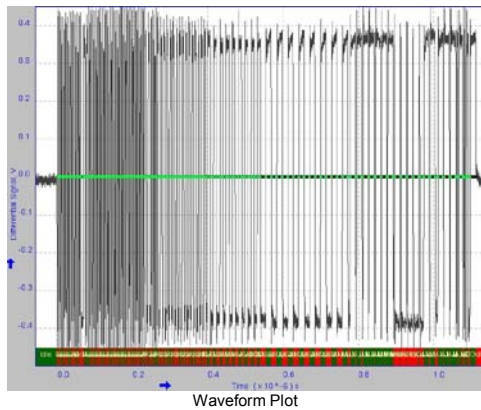
Additional Information :

- Rising Edge Rate:19.03200 V/us (Equivalent Rise Time = 138.71 ns)
- Falling Edge Rate:18.68208 V/us (Equivalent Fall Time = 141.31 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

17. D+ / D- Path At Vcc = 4.2 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	459.3996Mbps	518.8815Mbps	480.0572Mbps	0.0000bps	10.27107Mbps	480.9890Mbps	526	Pass
EOP Width	-	-	16.51563ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.928444	-	-	-	1	Pass
Falling Edge Rate	937.8284 V/us	1.133333kV/us	1.044124kV/us	195.5050 V/us	34.31745 V/us	1.044683kV/us	114	Pass
Rising Edge Rate	894.8864 V/us	1.056213kV/us	982.7308 V/us	161.3267 V/us	31.75691 V/us	983.2394 V/us	115	Pass

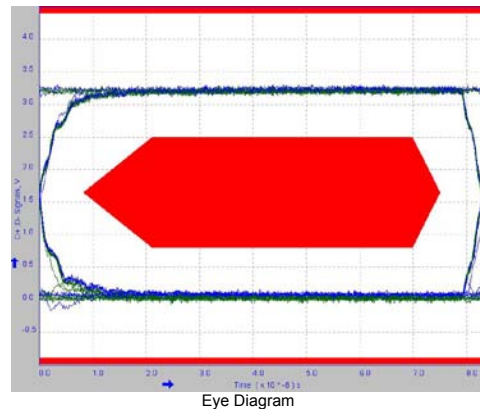
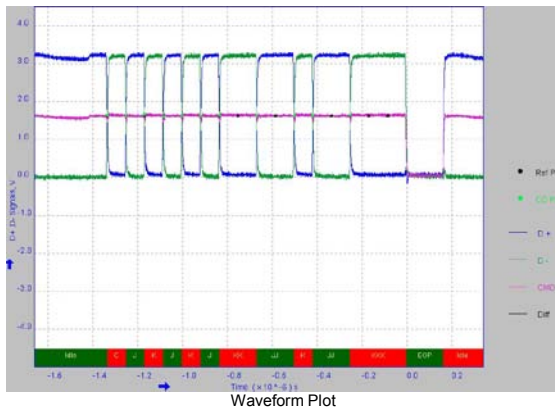
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -80.13ps to 100.0ps RMS Jitter 33.52ps
- KJ Paired Jitter range : -63.36ps to 50.74ps RMS Jitter 14.95ps
- JK Paired Jitter range : -69.40ps to 78.42ps RMS Jitter 20.41ps
- Rising Edge Rate:982.7308 V/us (Equivalent Rise Time = 651.25 ps)
- Falling Edge Rate:1.044124kV/us (Equivalent Fall Time = 612.95 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.98382Mbps	12.00907Mbps	12.00114Mbps	0.0000bps	7.907504kbps	12.00034Mbps	12	Pass
Crossover Voltage	1.600809 V	1.664662 V	1.625901 V	63.85274mV	17.46452mV	1.625987 V	11	Pass
EOP Width	-	-	167.6030ns	-	-	-	1	Pass
Consecutive Jitter	-40.91508ps	79.57150ps	-1.019555ps	120.4866ps	35.63727ps	33.82385ps	10	Pass
Paired JK Jitter	-21.01992ps	21.60089ps	4.607456ps	42.62081ps	18.99648ps	17.08444ps	4	Pass
Paired KJ Jitter	-60.47615ps	-2.055048ps	-24.86666ps	58.42110ps	27.92224ps	34.68559ps	4	Pass
Falling Edge Rate	448.0753 V/us	520.5169 V/us	476.9659 V/us	72.44153 V/us	18.20350 V/us	477.2842 V/us	12	Pass
Rising Edge Rate	374.2571 V/us	400.6309 V/us	387.5292 V/us	26.37374 V/us	6.960676 V/us	387.5860 V/us	11	Pass

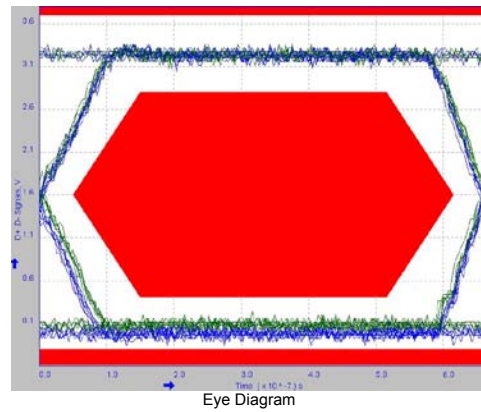
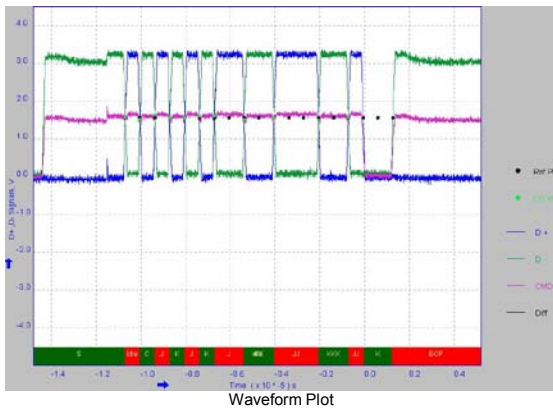
Additional Information :

- Rising Edge Rate:387.5292 V/us (Equivalent Rise Time = 6.8124 ns)
- Falling Edge Rate:476.9659 V/us (Equivalent Fall Time = 5.5350 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.481481Mbps	1.520681Mbps	1.502630Mbps	0.0000bps	12.64874kbps	1.502200Mbps	14	Pass
Crossover Voltage	1.506667 V	1.640000 V	1.566190 V	133.3333mV	40.80872mV	1.566674 V	11	Pass
EOP Width	-	-	1.332619us	-	-	-	1	Pass
Consecutive Jitter	-5.938961ns	4.061039ns	-548.9610ps	10.0000ns	3.466953ns	3.334539ns	10	Pass
Paired JK Jitter	-1.600000ns	3.666667ns	625.0000ps	5.266667ns	2.223340ns	2.024365ns	4	Pass
Paired KJ Jitter	-3.166667ns	3.000000ns	833.3333ps	6.166667ns	2.915476ns	2.658843ns	4	Pass
Falling Edge Rate	17.39130 V/us	20.13423 V/us	18.87207 V/us	2.742924 V/us	904.9557mV/us	18.89178 V/us	11	Pass
Rising Edge Rate	1.000000 V/us	26.66667 V/us	17.46692 V/us	25.66667 V/us	5.775163 V/us	18.32120 V/us	12	Pass

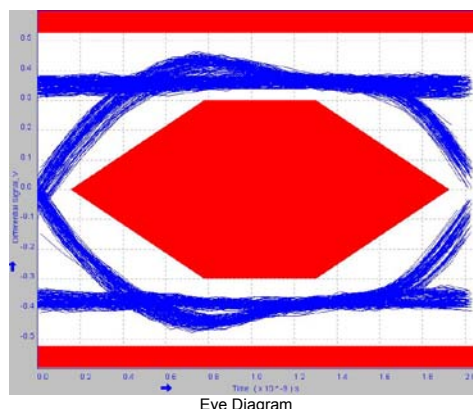
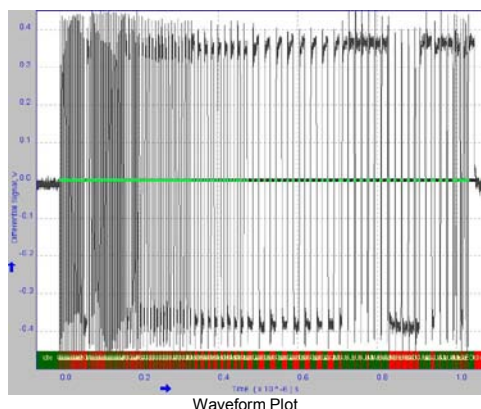
Additional Information :

- Rising Edge Rate:17.46692 V/us (Equivalent Rise Time = 151.14 ns)
- Falling Edge Rate:18.87207 V/us (Equivalent Fall Time = 139.89 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

18. Rx / Tx Path At Vcc = 4.2 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	459.1837Mbps	519.2932Mbps	480.0613Mbps	0.0000bps	9.831304Mbps	480.9832Mbps	494	Pass
EOP Width	-	-	16.40438ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.875107	-	-	-	1	Pass
Falling Edge Rate	943.4230 V/us	1.121082kV/us	1.027745kV/us	177.6587 V/us	37.34135 V/us	1.028416kV/us	98	Pass
Rising Edge Rate	896.7148 V/us	1.054176kV/us	979.8911 V/us	157.4617 V/us	35.29247 V/us	980.5200 V/us	99	Pass

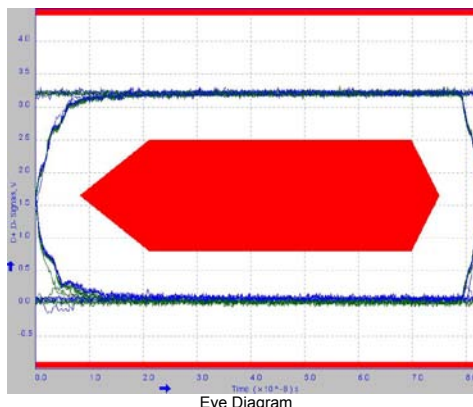
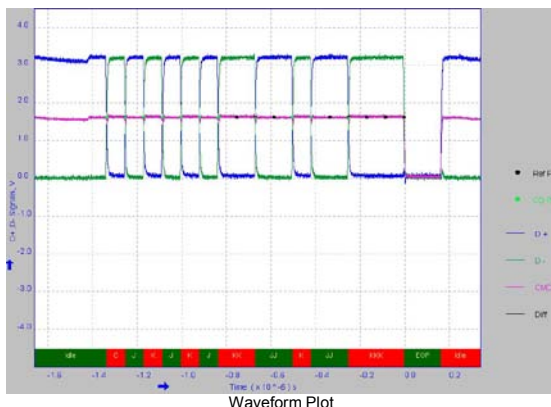
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -72.59ps to 89.55ps RMS Jitter 30.71ps
- KJ Paired Jitter range : -58.05ps to 46.29ps RMS Jitter 15.45ps
- JK Paired Jitter range : -64.04ps to 63.98ps RMS Jitter 20.99ps
- Rising Edge Rate:979.8911 V/us (Equivalent Rise Time = 653.13 ps)
- Falling Edge Rate:1.027745kV/us (Equivalent Fall Time = 622.72 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.99549Mbps	12.00822Mbps	12.00150Mbps	0.0000bps	4.895381kbps	12.00208Mbps	12	Pass
Crossover Voltage	1.588727 V	1.633486 V	1.616259 V	44.75903mV	14.25203mV	1.616316 V	11	Pass
EOP Width	-	-	167.3964ns	-	-	-	1	Pass
Consecutive Jitter	-47.70907ps	35.65321ps	-1.719477ps	83.36228ps	29.49719ps	28.03627ps	10	Pass
Paired JK Jitter	-41.63116ps	3.384234ps	-11.65233ps	45.01540ps	21.07822ps	21.65630ps	4	Pass
Paired KJ Jitter	-45.83731ps	44.39701ps	7.691366ps	90.23432ps	41.28328ps	36.57033ps	4	Pass
Falling Edge Rate	424.8292 V/us	513.9464 V/us	475.0241 V/us	89.11718 V/us	28.35339 V/us	475.7991 V/us	12	Pass
Rising Edge Rate	378.8904 V/us	394.4207 V/us	384.6871 V/us	15.53027 V/us	4.552231 V/us	384.7116 V/us	11	Pass

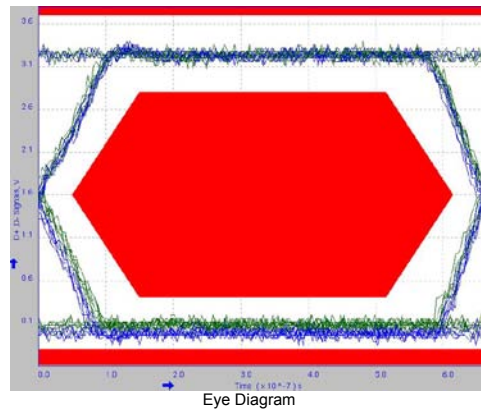
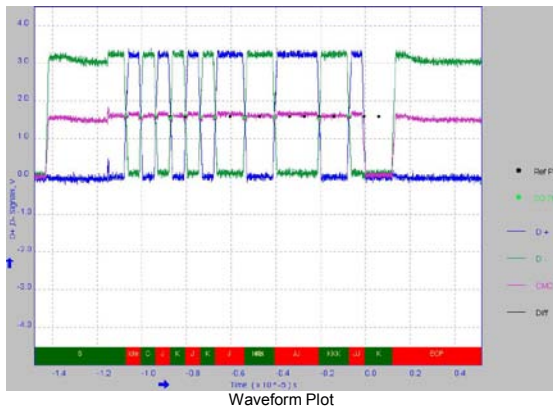
Additional Information :

- Rising Edge Rate:384.6871 V/us (Equivalent Rise Time = 6.8627 ns)
- Falling Edge Rate:475.0241 V/us (Equivalent Fall Time = 5.5576 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.482109Mbps	1.520087Mbps	1.502232Mbps	0.0000bps	13.97608kbps	1.501412Mbps	14	Pass
Crossover Voltage	1.530000 V	1.630000 V	1.585381 V	100.0000mV	29.20065mV	1.585625 V	11	Pass
EOP Width	-	-	1.330173us	-	-	-	1	Pass
Consecutive Jitter	-5.822078ns	5.882684ns	-758.7446ps	11.70476ns	4.056630ns	3.922539ns	10	Pass
Paired JK Jitter	-1.647619ns	4.214286ns	1.780952ns	5.861905ns	2.534303ns	2.826448ns	4	Pass
Paired KJ Jitter	-1.219048ns	3.885714ns	578.5714ps	5.104762ns	2.287663ns	2.063927ns	4	Pass
Falling Edge Rate	16.98113 V/us	19.83471 V/us	18.67595 V/us	2.853579 V/us	828.7476mV/us	18.69280 V/us	12	Pass
Rising Edge Rate	17.14286 V/us	26.84564 V/us	18.69817 V/us	9.702780 V/us	2.639480 V/us	18.86817 V/us	12	Pass

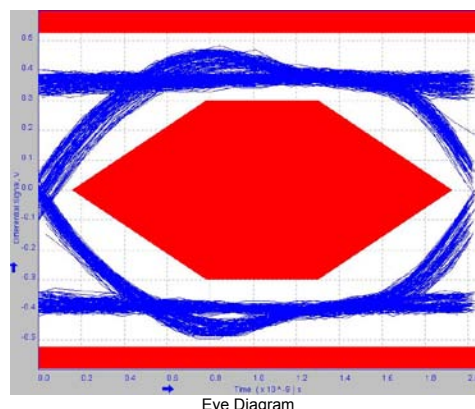
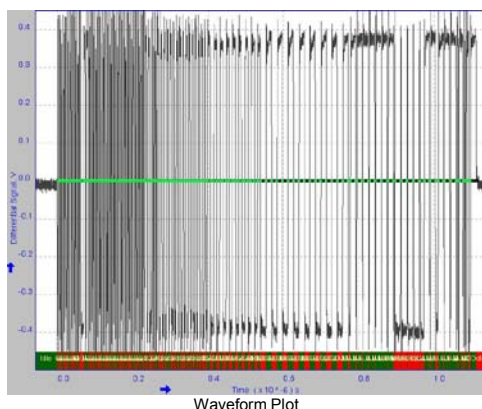
Additional Information :

- Rising Edge Rate:18.69817 V/us (Equivalent Rise Time = 141.19 ns)
- Falling Edge Rate:18.67595 V/us (Equivalent Fall Time = 141.36 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

19. L / R Path At Vcc = 4.2 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	460.3581Mbps	517.9283Mbps	480.0338Mbps	0.0000bps	9.894713Mbps	481.0285Mbps	526	Pass
EOP Width	-	-	16.56824ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.953317	-	-	-	1	Pass
Falling Edge Rate	964.8275 V/us	1.097903kV/us	1.035488kV/us	133.0751 V/us	31.23955 V/us	1.035955kV/us	114	Pass
Rising Edge Rate	899.8834 V/us	1.145447kV/us	998.4833 V/us	245.5635 V/us	36.33579 V/us	999.1385 V/us	115	Pass

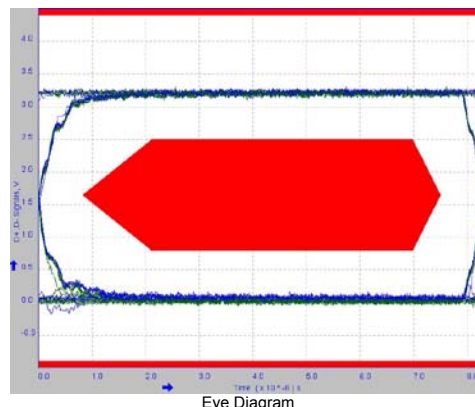
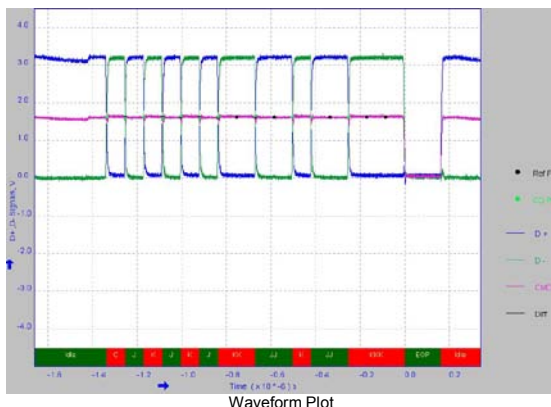
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -68.88ps to 101.7ps RMS Jitter 34.22ps
- KJ Paired Jitter range : -85.79ps to 70.82ps RMS Jitter 16.58ps
- JK Paired Jitter range : -75.10ps to 64.56ps RMS Jitter 20.02ps
- Rising Edge Rate:998.4833 V/us (Equivalent Rise Time = 640.97 ps)
- Falling Edge Rate:1.035488kV/us (Equivalent Fall Time = 618.07 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.98326Mbps	12.01034Mbps	12.00072Mbps	0.0000bps	7.715477kbps	11.99987Mbps	12	Pass
Crossover Voltage	1.587526 V	1.651913 V	1.619354 V	64.38742mV	19.98147mV	1.619466 V	11	Pass
EOP Width	-	-	167.6829ns	-	-	-	1	Pass
Consecutive Jitter	-86.66386ps	83.41782ps	-3.845869ps	170.0817ps	58.93161ps	56.03956ps	10	Pass
Paired JK Jitter	-48.70454ps	73.94357ps	30.34428ps	122.6481ps	54.18858ps	55.88450ps	4	Pass
Paired KJ Jitter	-123.1516ps	83.64134ps	-8.058572ps	206.7929ps	86.51715ps	75.35817ps	4	Pass
Falling Edge Rate	480.0807 V/us	533.5064 V/us	500.1584 V/us	53.42569 V/us	15.86287 V/us	500.3889 V/us	12	Pass
Rising Edge Rate	384.1365 V/us	403.2579 V/us	392.6413 V/us	19.12143 V/us	5.275567 V/us	392.6736 V/us	11	Pass

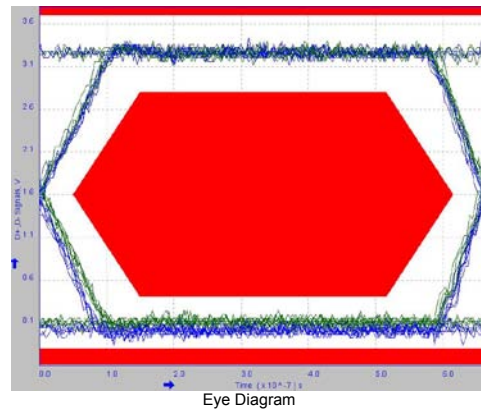
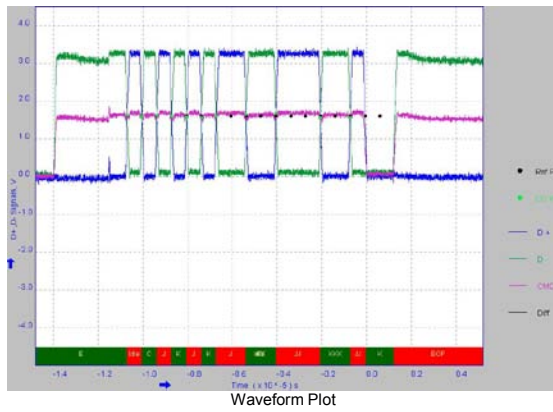
Additional Information :

- Rising Edge Rate:392.6413 V/us (Equivalent Rise Time = 6.7237 ns)
- Falling Edge Rate:500.1584 V/us (Equivalent Fall Time = 5.2783 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.477105Mbps	1.526718Mbps	1.502307Mbps	0.0000bps	17.05067kbps	1.501602Mbps	14	Pass
Crossover Voltage	1.560000 V	1.680000 V	1.602833 V	120.0000mV	38.22623mV	1.603247 V	11	Pass
EOP Width	-	-	1.327540us	-	-	-	1	Pass
Consecutive Jitter	-7.468543ns	6.094949ns	-616.6378ps	13.56349ns	4.980267ns	4.764766ns	10	Pass
Paired JK Jitter	-714.2857ps	4.214286ns	1.589286ns	4.928571ns	2.372953ns	2.597885ns	4	Pass
Paired KJ Jitter	-3.000000ns	4.814286ns	1.623016ns	7.814286ns	3.658856ns	3.560141ns	4	Pass
Falling Edge Rate	17.59531 V/us	19.45946 V/us	18.53100 V/us	1.864152 V/us	742.3411mV/us	18.54451 V/us	11	Pass
Rising Edge Rate	16.94915 V/us	19.53488 V/us	18.11665 V/us	2.585731 V/us	905.9428mV/us	18.13741 V/us	12	Pass

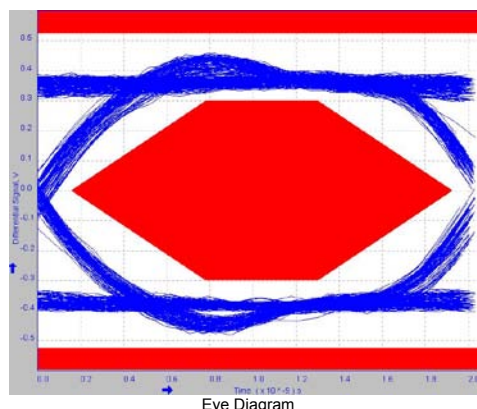
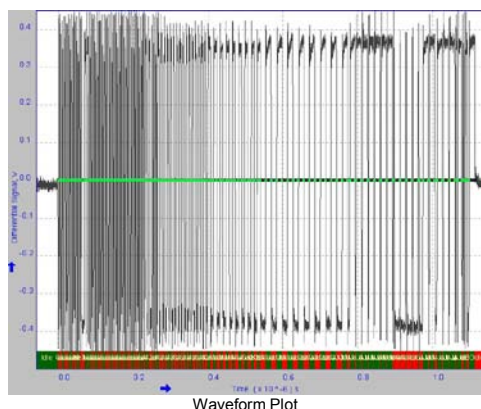
Additional Information :

- Rising Edge Rate:18.11665 V/us (Equivalent Rise Time = 145.72 ns)
- Falling Edge Rate:18.53100 V/us (Equivalent Fall Time = 142.46 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

20. D+ / D- Path At Vcc = 5.0 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	459.8540Mbps	517.6877Mbps	480.0497Mbps	0.0000bps	9.687460Mbps	480.8896Mbps	526	Pass
EOP Width	-	-	16.53563ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.937923	-	-	-	1	Pass
Falling Edge Rate	953.2099 V/us	1.154396kV/us	1.045006kV/us	201.1863 V/us	35.72747 V/us	1.045611kV/us	114	Pass
Rising Edge Rate	904.1545 V/us	1.075644kV/us	986.6923 V/us	171.4897 V/us	31.86715 V/us	987.2023 V/us	115	Pass

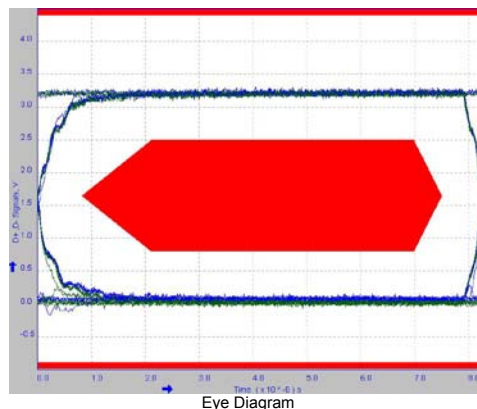
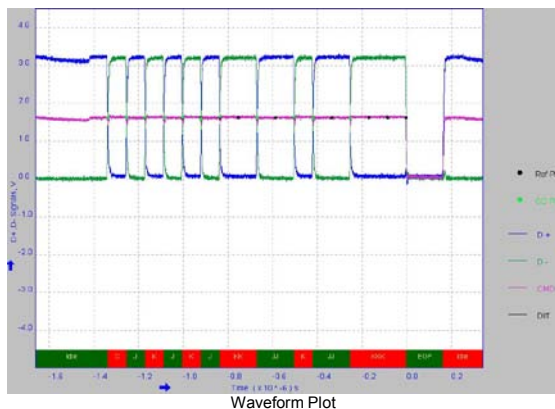
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -71.93ps to 89.14ps RMS Jitter 31.29ps
- KJ Paired Jitter range : -57.45ps to 53.91ps RMS Jitter 14.07ps
- JK Paired Jitter range : -72.64ps to 56.34ps RMS Jitter 17.48ps
- Rising Edge Rate:986.6923 V/us (Equivalent Rise Time = 648.63 ps)
- Falling Edge Rate:1.045006kV/us (Equivalent Fall Time = 612.44 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.99531Mbps	12.00896Mbps	12.00196Mbps	0.0000bps	4.678513kbps	12.00176Mbps	12	Pass
Crossover Voltage	1.590300 V	1.646862 V	1.620634 V	56.56154mV	16.19993mV	1.620707 V	11	Pass
EOP Width	-	-	167.5594ns	-	-	-	1	Pass
Consecutive Jitter	-81.93183ps	54.43181ps	6.324496ps	136.3636ps	37.36292ps	36.00539ps	10	Pass
Paired JK Jitter	-37.52914ps	37.19614ps	-4.599567ps	74.72527ps	32.89188ps	28.85417ps	4	Pass
Paired KJ Jitter	-136.3636ps	84.09091ps	-5.303030ps	220.4545ps	93.82273ps	81.42574ps	4	Pass
Falling Edge Rate	425.1398 V/us	515.3159 V/us	472.1642 V/us	90.17604 V/us	26.99798 V/us	472.8712 V/us	12	Pass
Rising Edge Rate	384.4018 V/us	400.3471 V/us	390.6708 V/us	15.94527 V/us	5.771646 V/us	390.7096 V/us	11	Pass

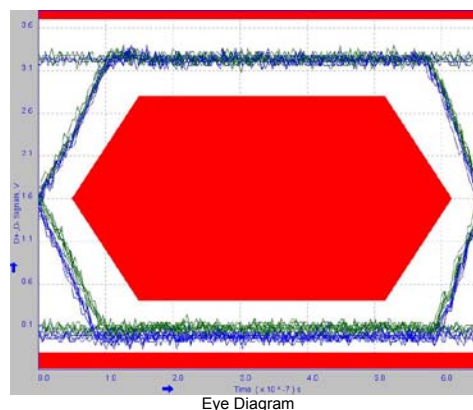
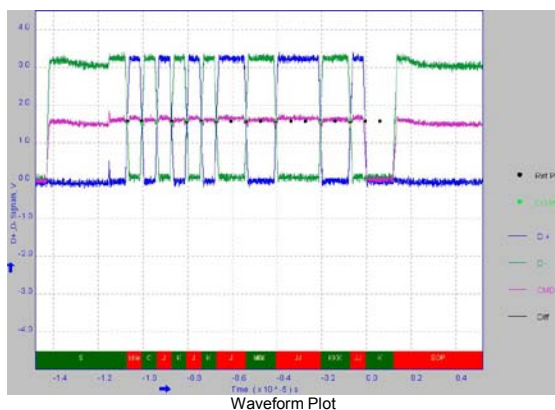
Additional Information :

- Rising Edge Rate:390.6708 V/us (Equivalent Rise Time = 6.7576 ns)
- Falling Edge Rate:472.1642 V/us (Equivalent Fall Time = 5.5913 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.482946Mbps	1.525165Mbps	1.502791Mbps	0.0000bps	15.59853kbps	1.502093Mbps	14	Pass
Crossover Voltage	1.520000 V	1.620000 V	1.570303 V	100.0000mV	40.67362mV	1.570782 V	11	Pass
EOP Width	-	-	1.327354us	-	-	-	1	Pass
Consecutive Jitter	-8.287879ns	6.283550ns	-364.0693ps	14.57143ns	4.573974ns	4.354499ns	10	Pass
Paired JK Jitter	857.1429ps	3.142857ns	2.017857ns	2.285714ns	1.085424ns	2.226063ns	4	Pass
Paired KJ Jitter	-5.357143ns	4.190476ns	285.7143ps	9.547619ns	4.440630ns	3.856298ns	4	Pass
Falling Edge Rate	16.90141 V/us	19.69365 V/us	18.54746 V/us	2.792246 V/us	858.2134mV/us	18.56565 V/us	12	Pass
Rising Edge Rate	17.06161 V/us	25.53191 V/us	18.68659 V/us	8.470304 V/us	2.264702 V/us	18.81196 V/us	12	Pass

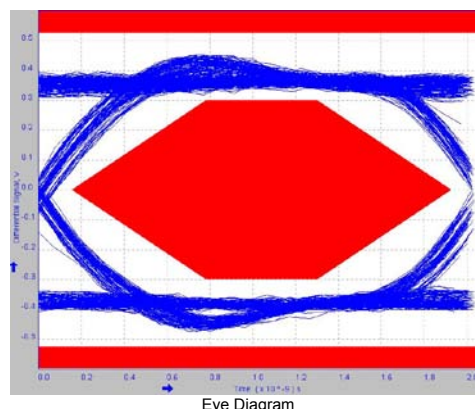
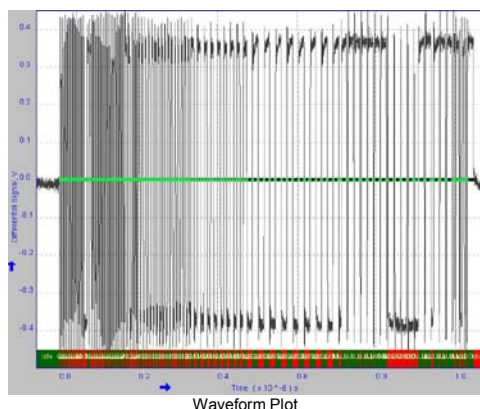
Additional Information :

- Rising Edge Rate:18.68659 V/us (Equivalent Rise Time = 141.28 ns)
- Falling Edge Rate:18.54746 V/us (Equivalent Fall Time = 142.34 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

21. Rx / Tx Path At Vcc = 5.0 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	458.5219Mbps	514.7059Mbps	480.0552Mbps	0.0000bps	9.830477Mbps	480.9613Mbps	494	Pass
EOP Width	-	-	16.59219ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.965165	-	-	-	1	Pass
Falling Edge Rate	951.3359 V/us	1.157062kV/us	1.033831kV/us	205.7265 V/us	43.54550 V/us	1.034738kV/us	98	Pass
Rising Edge Rate	903.9484 V/us	1.090175kV/us	987.5966 V/us	186.2269 V/us	37.10981 V/us	988.2865 V/us	99	Pass

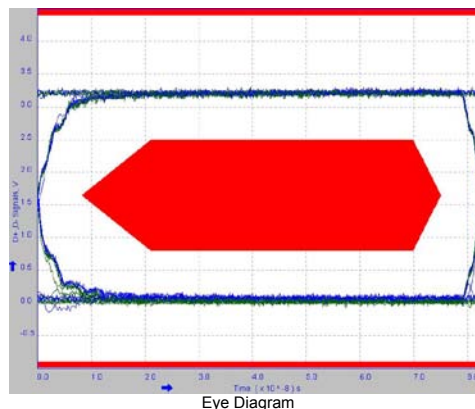
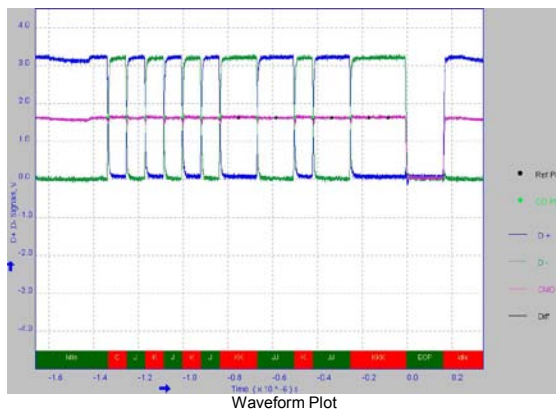
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -64.95ps to 82.39ps RMS Jitter 31.23ps
- KJ Paired Jitter range : -58.91ps to 42.02ps RMS Jitter 14.96ps
- JK Paired Jitter range : -58.41ps to 87.89ps RMS Jitter 20.62ps
- Rising Edge Rate:987.5966 V/us (Equivalent Rise Time = 648.04 ps)
- Falling Edge Rate:1.033831kV/us (Equivalent Fall Time = 619.06 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.99301Mbps	12.00914Mbps	12.00055Mbps	0.0000bps	4.535203kbps	12.00072Mbps	12	Pass
Crossover Voltage	1.599405 V	1.639462 V	1.623963 V	40.05720mV	12.02282mV	1.624004 V	11	Pass
EOP Width	-	-	167.3563ns	-	-	-	1	Pass
Consecutive Jitter	-65.28009ps	39.05917ps	-5.959245ps	104.3393ps	30.69274ps	29.72124ps	10	Pass
Paired JK Jitter	2.305585ps	29.26993ps	13.09008ps	26.96435ps	11.56584ps	16.48262ps	4	Pass
Paired KJ Jitter	-35.58500ps	104.3393ps	7.595663ps	139.9243ps	65.92944ps	57.59959ps	4	Pass
Falling Edge Rate	415.9334 V/us	517.9010 V/us	465.0768 V/us	101.9676 V/us	28.93200 V/us	465.9010 V/us	12	Pass
Rising Edge Rate	373.3025 V/us	397.7203 V/us	388.8254 V/us	24.41774 V/us	6.821928 V/us	388.8798 V/us	11	Pass

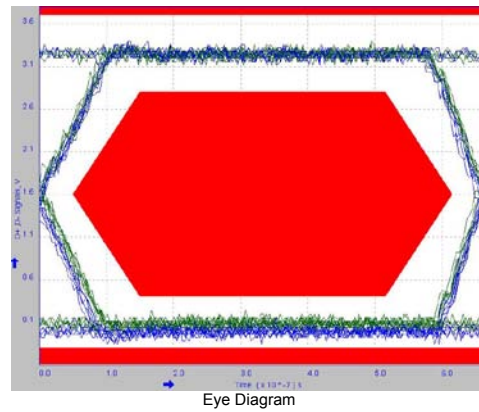
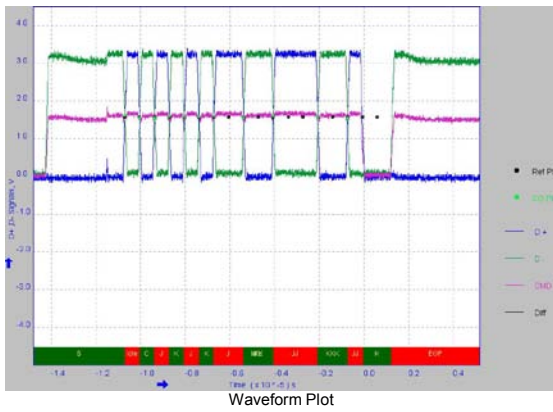
Additional Information :

- Rising Edge Rate:388.8254 V/us (Equivalent Rise Time = 6.7897 ns)
- Falling Edge Rate:465.0768 V/us (Equivalent Fall Time = 5.6765 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.484414Mbps	1.525424Mbps	1.502273Mbps	0.0000bps	15.15903kbps	1.501585Mbps	14	Pass
Crossover Voltage	1.545000 V	1.620000 V	1.578680 V	75.00000mV	25.80525mV	1.578871 V	11	Pass
EOP Width	-	-	1.331040us	-	-	-	1	Pass
Consecutive Jitter	-8.985549ns	6.016151ns	-790.3906ps	15.00170ns	4.570320ns	4.407240ns	10	Pass
Paired JK Jitter	967.1202ps	3.232653ns	1.817602ns	2.265533ns	1.081595ns	2.044765ns	4	Pass
Paired KJ Jitter	-1.692177ns	5.624150ns	1.932823ns	7.316327ns	3.203259ns	3.381044ns	4	Pass
Falling Edge Rate	17.44186 V/us	20.45455 V/us	18.59580 V/us	3.012685 V/us	907.1048mV/us	18.61591 V/us	11	Pass
Rising Edge Rate	1.000000 V/us	26.16279 V/us	17.54102 V/us	25.16279 V/us	5.721780 V/us	18.37656 V/us	12	Pass

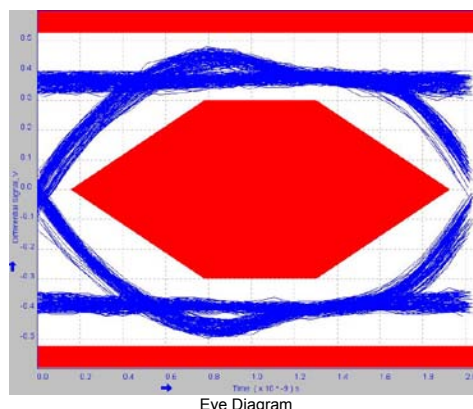
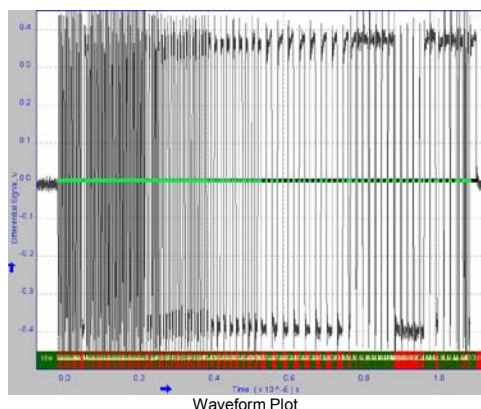
Additional Information :

- Rising Edge Rate:17.54102 V/us (Equivalent Rise Time = 150.50 ns)
- Falling Edge Rate:18.59580 V/us (Equivalent Fall Time = 141.97 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

22. L / R Path At Vcc = 5.0 V

USB 2.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	460.0812Mbps	517.7994Mbps	480.0348Mbps	0.0000bps	9.849224Mbps	480.8995Mbps	526	Pass
EOP Width	-	-	16.52060ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.930466	-	-	-	1	Pass
Falling Edge Rate	961.5215 V/us	1.110229kV/us	1.038457kV/us	148.7075 V/us	34.30125 V/us	1.039019kV/us	114	Pass
Rising Edge Rate	919.3259 V/us	1.153174kV/us	1.003512kV/us	233.8478 V/us	33.89689 V/us	1.004079kV/us	115	Pass

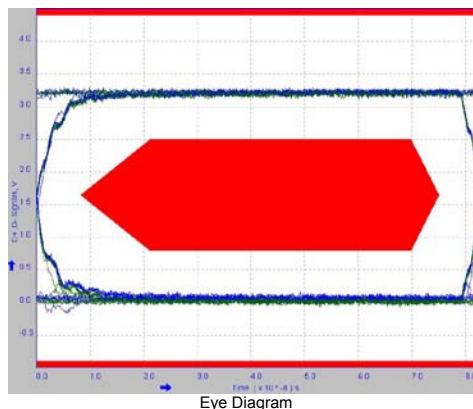
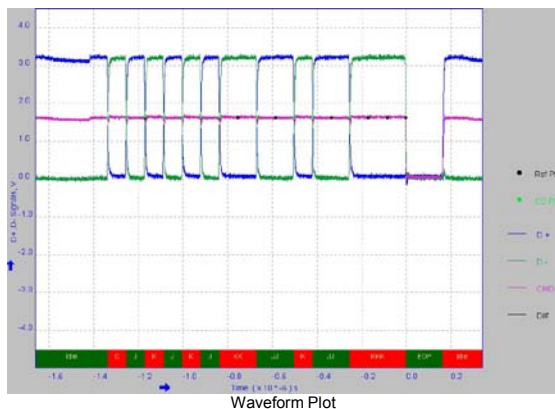
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -90.09ps to 81.21ps RMS Jitter 30.78ps
- KJ Paired Jitter range : -61.81ps to 49.37ps RMS Jitter 14.01ps
- JK Paired Jitter range : -64.40ps to 70.56ps RMS Jitter 19.40ps
- Rising Edge Rate:1.003512kV/us (Equivalent Rise Time = 637.76 ps)
- Falling Edge Rate:1.038457kV/us (Equivalent Fall Time = 616.30 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.98724Mbps	12.00597Mbps	12.00149Mbps	0.0000bps	6.830948kbps	12.00061Mbps	12	Pass
Crossover Voltage	1.611215 V	1.646181 V	1.624700 V	34.96592mV	11.76885mV	1.624739 V	11	Pass
EOP Width	-	-	167.4288ns	-	-	-	1	Pass
Consecutive Jitter	-52.39868ps	46.63387ps	479.9168fs	99.03255ps	30.72870ps	29.15575ps	10	Pass
Paired JK Jitter	-69.90947ps	69.27132ps	-5.137555ps	139.1808ps	59.07760ps	51.42000ps	4	Pass
Paired KJ Jitter	-57.40591ps	60.23440ps	-10.12681ps	117.6403ps	52.38524ps	46.48347ps	4	Pass
Falling Edge Rate	482.1067 V/us	543.1700 V/us	502.0060 V/us	61.06334 V/us	17.15517 V/us	502.2746 V/us	12	Pass
Rising Edge Rate	383.6132 V/us	397.5954 V/us	391.0148 V/us	13.98225 V/us	5.120481 V/us	391.0453 V/us	11	Pass

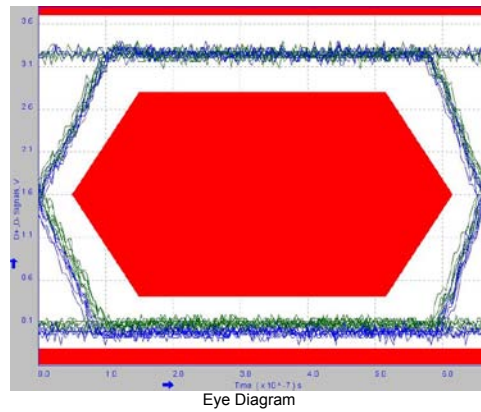
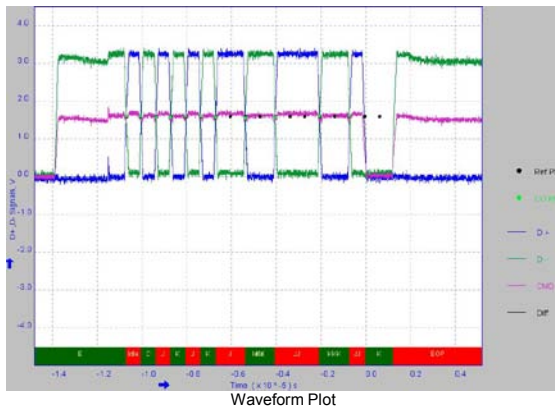
Additional Information :

- Rising Edge Rate:391.0148 V/us (Equivalent Rise Time = 6.7517 ns)
- Falling Edge Rate:502.0060 V/us (Equivalent Fall Time = 5.2589 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.483680Mbps	1.522843Mbps	1.501985Mbps	0.0000bps	14.26159kbps	1.500906Mbps	14	Pass
Crossover Voltage	1.560000 V	1.610000 V	1.589550 V	50.00000mV	16.18174mV	1.589625 V	11	Pass
EOP Width	-	-	1.332432us	-	-	-	1	Pass
Consecutive Jitter	-11.28225ns	6.360606ns	-793.2035ps	17.64286ns	4.941006ns	4.754089ns	10	Pass
Paired JK Jitter	-771.4286ps	4.342857ns	2.053571ns	5.114286ns	2.134918ns	2.763252ns	4	Pass
Paired KJ Jitter	-428.5714ps	8.928571ns	2.357143ns	9.357143ns	4.415795ns	4.492277ns	4	Pass
Falling Edge Rate	17.95511 V/us	19.67213 V/us	18.69269 V/us	1.717019 V/us	620.0953mV/us	18.70211 V/us	12	Pass
Rising Edge Rate	17.18494 V/us	26.27737 V/us	19.30314 V/us	9.092430 V/us	2.264208 V/us	19.42449 V/us	12	Pass

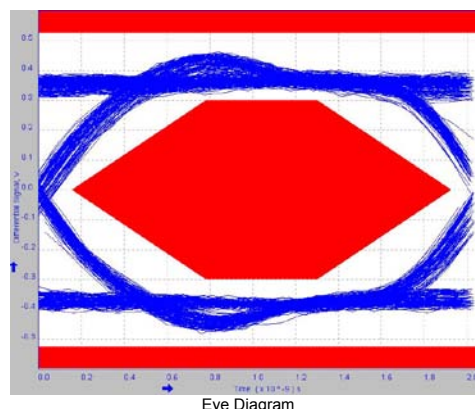
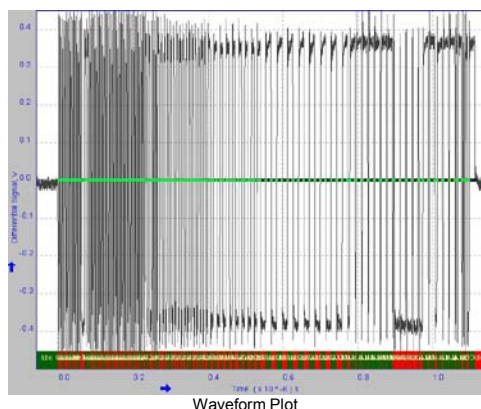
Additional Information :

- Rising Edge Rate:19.30314 V/us (Equivalent Rise Time = 136.77 ns)
- Falling Edge Rate:18.69269 V/us (Equivalent Fall Time = 141.23 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

23. D+ / D- Path At Vcc = 5.5 V

USB 2.0 Overall Result: Pass*



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	460.9743Mbps	517.0537Mbps	480.0348Mbps	0.0000bps	9.757130Mbps	480.9677Mbps	526	Pass
EOP Width	-	-	16.54069ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.940109	-	-	-	1	Pass
Falling Edge Rate	986.4220 V/us	1.133589kV/us	1.049095kV/us	147.1671 V/us	29.61831 V/us	1.049509kV/us	114	Pass
Rising Edge Rate	906.8761 V/us	1.114954kV/us	993.0981 V/us	208.0778 V/us	29.91937 V/us	993.5448 V/us	115	Pass

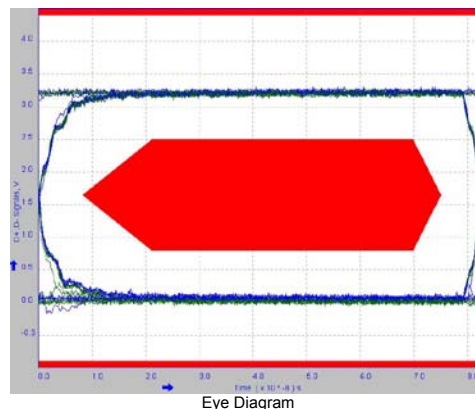
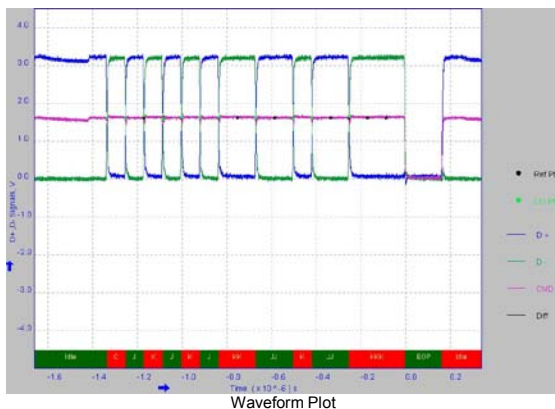
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -73.91ps to 87.20ps RMS Jitter 31.00ps
- KJ Paired Jitter range : -67.29ps to 56.36ps RMS Jitter 13.73ps
- JK Paired Jitter range : -73.12ps to 59.43ps RMS Jitter 19.28ps
- Rising Edge Rate:993.0981 V/us (Equivalent Rise Time = 644.45 ps)
- Falling Edge Rate:1.049095kV/us (Equivalent Fall Time = 610.05 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: Pass*



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.98298Mbps	12.00917Mbps	11.99958Mbps	0.0000bps	8.985241kbps	12.00011Mbps	12	Pass
Crossover Voltage	1.589001 V	1.658723 V	1.623252 V	69.72105mV	20.36928mV	1.623369 V	11	Pass
EOP Width	-	-	167.2706ns	-	-	-	1	Pass
Consecutive Jitter	-104.2299ps	82.22342ps	-3.988481ps	186.4533ps	61.87852ps	58.83845ps	10	Pass
Paired JK Jitter	-22.93631ps	71.84116ps	28.87123ps	94.77747ps	45.02694ps	48.51925ps	4	Pass
Paired KJ Jitter	-110.1533ps	157.6141ps	17.74209ps	267.7674ps	117.0504ps	102.9096ps	4	Pass
Falling Edge Rate	442.1737 V/us	506.5711 V/us	470.2993 V/us	64.39741 V/us	20.96710 V/us	470.7275 V/us	12	Pass
Rising Edge Rate	375.1478 V/us	395.6520 V/us	388.1812 V/us	20.50423 V/us	5.952089 V/us	388.2227 V/us	11	Pass

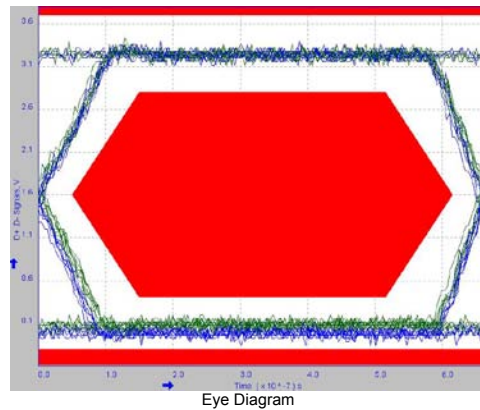
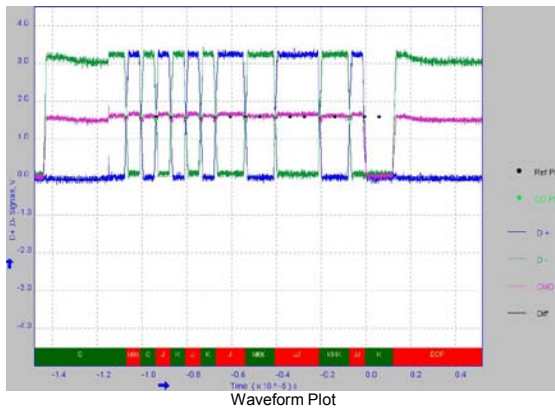
Additional Information :

- Rising Edge Rate:388.1812 V/us (Equivalent Rise Time = 6.8009 ns)
- Falling Edge Rate:470.2993 V/us (Equivalent Fall Time = 5.6134 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.482213Mbps	1.530612Mbps	1.502146Mbps	0.0000bps	17.65247kbps	1.501277Mbps	14	Pass
Crossover Voltage	1.533333 V	1.640000 V	1.589939 V	106.6667mV	33.20703mV	1.590255 V	11	Pass
EOP Width	-	-	1.333147us	-	-	-	1	Pass
Consecutive Jitter	-9.704762ns	7.819048ns	-758.0952ps	17.52381ns	5.185860ns	4.977805ns	10	Pass
Paired JK Jitter	-571.4286ps	4.095238ns	2.238095ns	4.666667ns	1.986348ns	2.822810ns	4	Pass
Paired KJ Jitter	-571.4286ps	5.371429ns	2.142857ns	5.942857ns	2.749793ns	3.203569ns	4	Pass
Falling Edge Rate	17.64706 V/us	19.63993 V/us	18.60100 V/us	1.992876 V/us	756.6015mV/us	18.61510 V/us	12	Pass
Rising Edge Rate	16.98113 V/us	26.47059 V/us	18.93526 V/us	9.489456 V/us	2.459648 V/us	19.08114 V/us	12	Pass

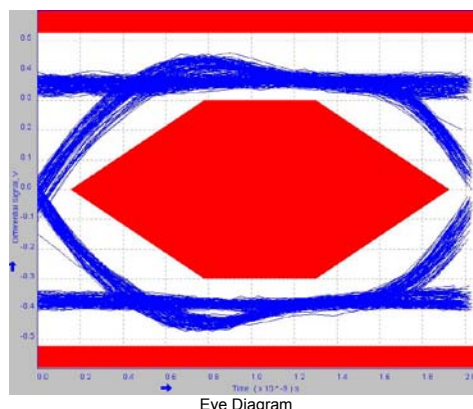
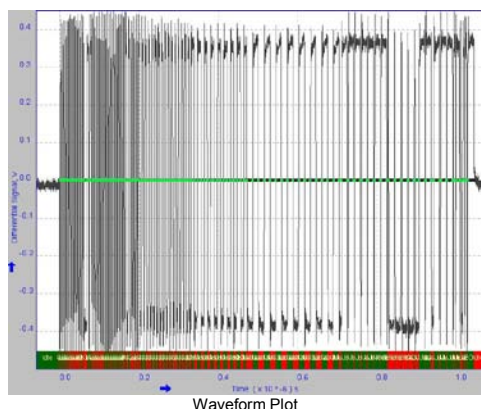
Additional Information :

- Rising Edge Rate:18.93526 V/us (Equivalent Rise Time = 139.42 ns)
- Falling Edge Rate:18.60100 V/us (Equivalent Fall Time = 141.93 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

24. Rx / Tx Path At Vcc = 5.5 V

USB 2.0 Overall Result: Pass*



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	458.3858Mbps	519.7894Mbps	480.0496Mbps	0.0000bps	9.781482Mbps	480.9442Mbps	494	Pass
EOP Width	-	-	16.58953ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.963796	-	-	-	1	Pass
Falling Edge Rate	928.3262 V/us	1.124598kV/us	1.037269kV/us	196.2721 V/us	36.37016 V/us	1.037900kV/us	98	Pass
Rising Edge Rate	893.0784 V/us	1.064958kV/us	988.6345 V/us	171.8792 V/us	33.41060 V/us	989.1932 V/us	99	Pass

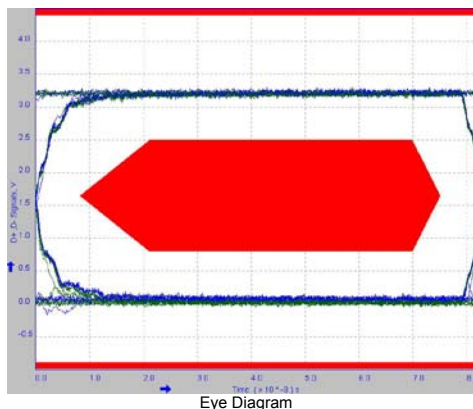
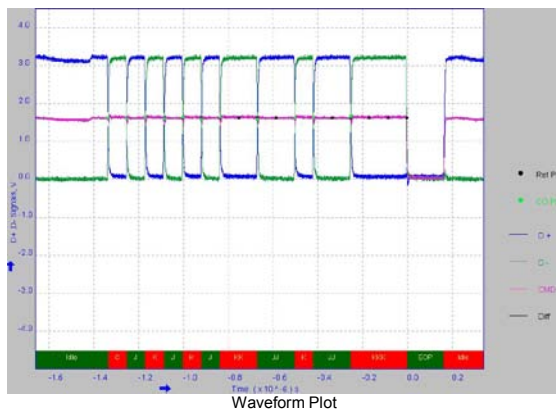
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

- Consecutive Jitter range : -58.76ps to 100.5ps RMS Jitter 31.69ps
- KJ Paired Jitter range : -66.99ps to 62.48ps RMS Jitter 16.01ps
- JK Paired Jitter range : -66.95ps to 66.02ps RMS Jitter 21.05ps
- Rising Edge Rate:988.6345 V/us (Equivalent Rise Time = 647.36 ps)
- Falling Edge Rate:1.037269kV/us (Equivalent Fall Time = 617.00 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: Pass*



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.99012Mbps	12.01547Mbps	12.00121Mbps	0.0000bps	7.814299kbps	12.00207Mbps	12	Pass
Crossover Voltage	1.584073 V	1.658830 V	1.617780 V	74.75702mV	21.55619mV	1.617910 V	11	Pass
EOP Width	-	-	167.4929ns	-	-	-	1	Pass
Consecutive Jitter	-34.95175ps	67.18348ps	1.846911ps	102.1352ps	32.61837ps	30.99957ps	10	Pass
Paired JK Jitter	-72.28577ps	37.21132ps	-435.5300fs	109.4971ps	49.05495ps	42.48507ps	4	Pass
Paired KJ Jitter	-102.1352ps	56.58468ps	8.691294ps	158.7199ps	74.30510ps	64.93439ps	4	Pass
Falling Edge Rate	457.4940 V/us	517.1905 V/us	476.6272 V/us	59.69655 V/us	17.31035 V/us	476.9153 V/us	12	Pass
Rising Edge Rate	379.1361 V/us	396.9265 V/us	389.9559 V/us	17.79032 V/us	5.301128 V/us	389.9887 V/us	11	Pass

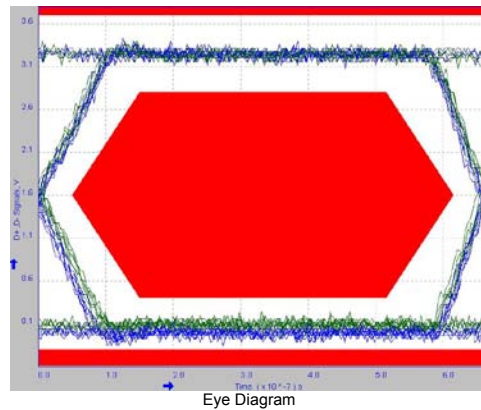
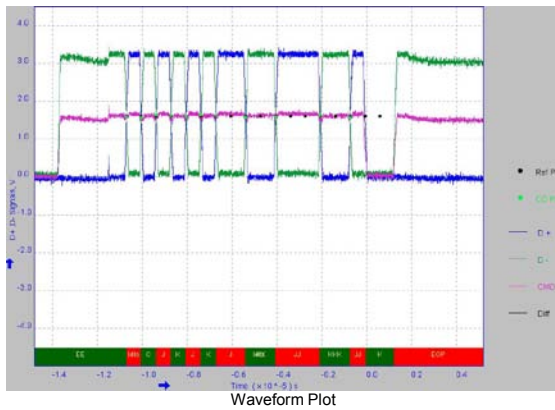
Additional Information :

- Rising Edge Rate:389.9559 V/us (Equivalent Rise Time = 6.7700 ns)
- Falling Edge Rate:476.6272 V/us (Equivalent Fall Time = 5.5389 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***



Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.476378Mbps	1.529052Mbps	1.502146Mbps	0.0000bps	17.72911kbps	1.501367Mbps	14	Pass
Crossover Voltage	1.560000 V	1.640000 V	1.600762 V	80.00000mV	28.92982mV	1.601000 V	11	Pass
EOP Width	-	-	1.328076us	-	-	-	1	Pass
Consecutive Jitter	-10.05887ns	6.131602ns	-822.6840ps	16.19048ns	5.349262ns	5.141007ns	10	Pass
Paired JK Jitter	95.23810ps	3.619048ns	1.571429ns	3.523810ns	1.480536ns	2.028147ns	4	Pass
Paired KJ Jitter	-1.714286ns	5.028571ns	2.476190ns	6.742857ns	3.147414ns	3.682551ns	4	Pass
Falling Edge Rate	17.68173 V/us	19.56522 V/us	18.63784 V/us	1.883489 V/us	669.8959mV/us	18.64887 V/us	12	Pass
Rising Edge Rate	17.02128 V/us	26.08696 V/us	18.78364 V/us	9.065680 V/us	2.390229 V/us	18.92253 V/us	12	Pass

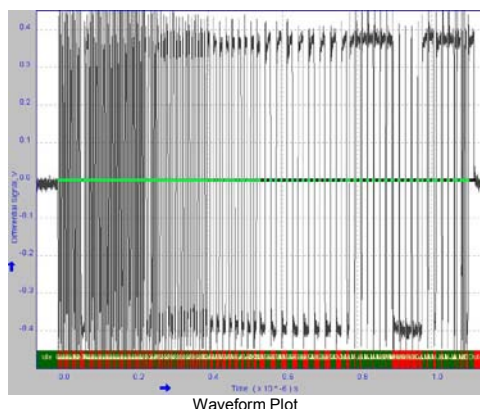
Additional Information :

- Rising Edge Rate:18.78364 V/us (Equivalent Rise Time = 140.55 ns)
- Falling Edge Rate:18.63784 V/us (Equivalent Fall Time = 141.65 ns)

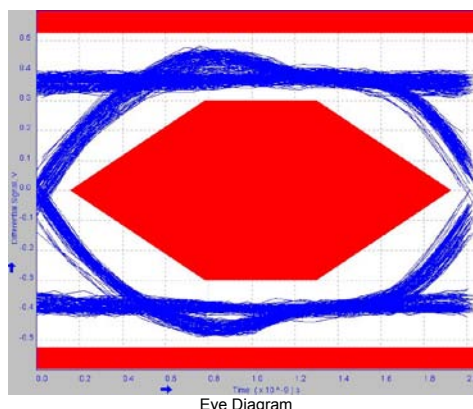
* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

25. L / R Path At Vcc = 5.5 V

USB 2.0 Overall Result: **Pass***



Waveform Plot



Eye Diagram

Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	460.5053Mbps	522.8758Mbps	480.0368Mbps	0.0000bps	10.09255Mbps	480.9852Mbps	526	Pass
EOP Width	-	-	16.49721ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.919266	-	-	-	1	Pass
Falling Edge Rate	961.5137 V/us	1.175028kV/us	1.042501kV/us	213.5142 V/us	34.52731 V/us	1.043068kV/us	114	Pass
Rising Edge Rate	925.2108 V/us	1.087960kV/us	1.005330kV/us	162.7490 V/us	34.25058 V/us	1.005908kV/us	115	Pass

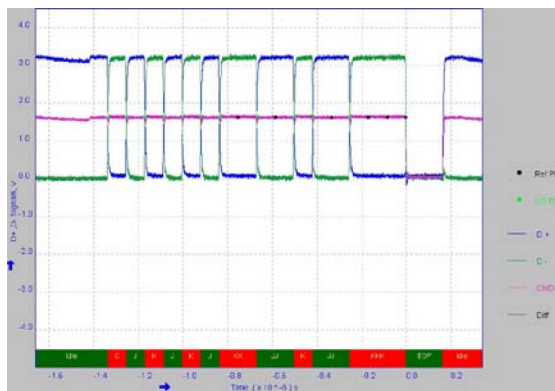
Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information:

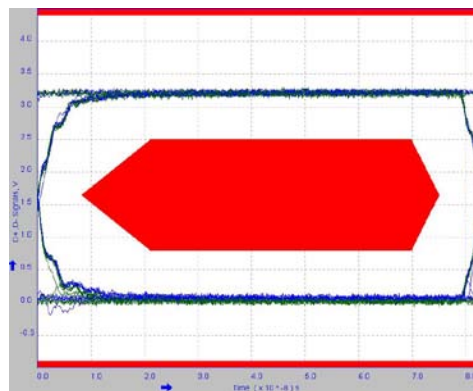
- Consecutive Jitter range : -103.3ps to 82.67ps RMS Jitter 32.02ps
- KJ Paired Jitter range : -83.53ps to 44.12ps RMS Jitter 14.74ps
- JK Paired Jitter range : -80.17ps to 64.22ps RMS Jitter 19.42ps
- Rising Edge Rate:1.005330kV/us (Equivalent Rise Time = 636.61 ps)
- Falling Edge Rate:1.042501kV/us (Equivalent Fall Time = 613.91 ps)

*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.

USB 1.1 Overall Result: **Pass***



Waveform Plot



Eye Diagram

Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.99281Mbps	12.01202Mbps	12.00213Mbps	0.0000bps	6.285221kbps	12.00295Mbps	12	Pass
Crossover Voltage	1.600271 V	1.635961 V	1.622115 V	35.68998mV	10.61869mV	1.622147 V	11	Pass
EOP Width	-	-	167.3934ns	-	-	-	1	Pass
Consecutive Jitter	-59.40198ps	66.68623ps	892.3685fs	126.0882ps	42.57774ps	40.40265ps	10	Pass
Paired JK Jitter	-46.17212ps	17.93579ps	-15.37799ps	64.10791ps	29.80281ps	30.04393ps	4	Pass
Paired KJ Jitter	-126.0882ps	95.98421ps	16.97644ps	222.0724ps	98.87092ps	87.29143ps	4	Pass
Falling Edge Rate	469.2429 V/us	549.8652 V/us	496.0797 V/us	80.62233 V/us	21.69283 V/us	496.5142 V/us	12	Pass
Rising Edge Rate	380.3132 V/us	397.5009 V/us	392.9068 V/us	17.18773 V/us	5.128196 V/us	392.9373 V/us	11	Pass

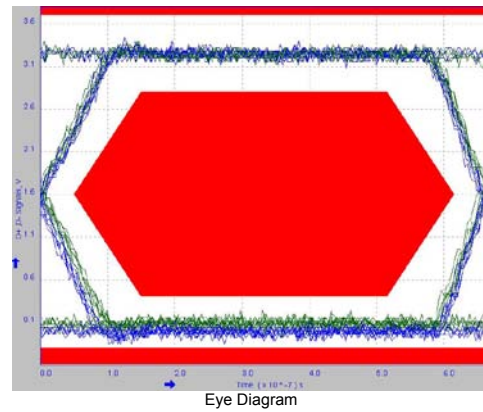
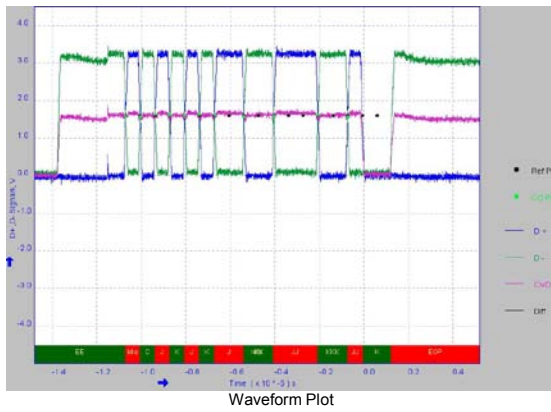
Additional Information :

- Rising Edge Rate:392.9068 V/us (Equivalent Rise Time = 6.7191 ns)
- Falling Edge Rate:496.0797 V/us (Equivalent Fall Time = 5.3217 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

AND8491/D

USB 1.0 Overall Result: **Pass***




Results based on USB-IF / Waiver Limits:

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.476378Mbps	1.529052Mbps	1.502146Mbps	0.0000bps	17.72911kbps	1.501367Mbps	14	Pass
Crossover Voltage	1.560000 V	1.640000 V	1.600762 V	80.00000mV	28.92982mV	1.601000 V	11	Pass
EOP Width	-	-	1.328076us	-	-	-	1	Pass
Consecutive Jitter	-10.05887ns	6.131602ns	-822.6840ps	16.19048ns	5.349262ns	5.141007ns	10	Pass
Paired JK Jitter	95.23810ps	3.619048ns	1.571429ns	3.523810ns	1.480536ns	2.028147ns	4	Pass
Paired KJ Jitter	-1.714286ns	5.028571ns	2.476190ns	6.742857ns	3.147414ns	3.682551ns	4	Pass
Falling Edge Rate	17.68173 V/us	19.56522 V/us	18.63784 V/us	1.883489 V/us	669.8959mV/us	18.64887 V/us	12	Pass
Rising Edge Rate	17.02128 V/us	26.08696 V/us	18.78364 V/us	9.065680 V/us	2.390229 V/us	18.92253 V/us	12	Pass

Additional Information :

- Rising Edge Rate:18.78364 V/us (Equivalent Rise Time = 140.55 ns)
- Falling Edge Rate:18.63784 V/us (Equivalent Fall Time = 141.65 ns)

* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).

ON Semiconductor and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5773-3850

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local
Sales Representative