UNH IOL PCIe Consortium

PCIe Gen 3 CEM Transmitter Testing

InterOperability Lab — 121 Technology Drive, Suite 2 — Durham, NH 03824 — (603) 862-0701

January 24, 2014

Mr. Vendor
Company Name
Address

Mr. Vendor:

Enclosed are the results from the PCIe Gen 3 CEM Receiver testing performed on the:

20140106 UNHID Company DUT PCIe Gen 3 Platform/AIC

The testing was performed according to Version 0.91 of the PCI Sig, PCI Express 3.0 CEM RX Physical Layer Test Method of Implementation for Agilent J-BERT N4903B High Performance Serial BERT, which is available online at:

http://www.pcisig.com/members/downloads/specifications/Agilent_PCIe_3.0_8G_RX_MOI_v0_91.pdf

Note that the tests defined in this test suite are based on:

PCI Express Base Specification Revision 3.0, version 1.0
PCI Express Card Electromechanical Specification Revision 3.0, version 0.9
PCI Express® Architecture PHY Test Specification Revision 3.0, Ver. 0.9

Please feel free to contact me at jbeaudet@iol.unh.edu if you have any questions regarding the test suite, or the results contained in this report.

Sincerely,

Joshua E. Beaudet

Joshua Beaudet

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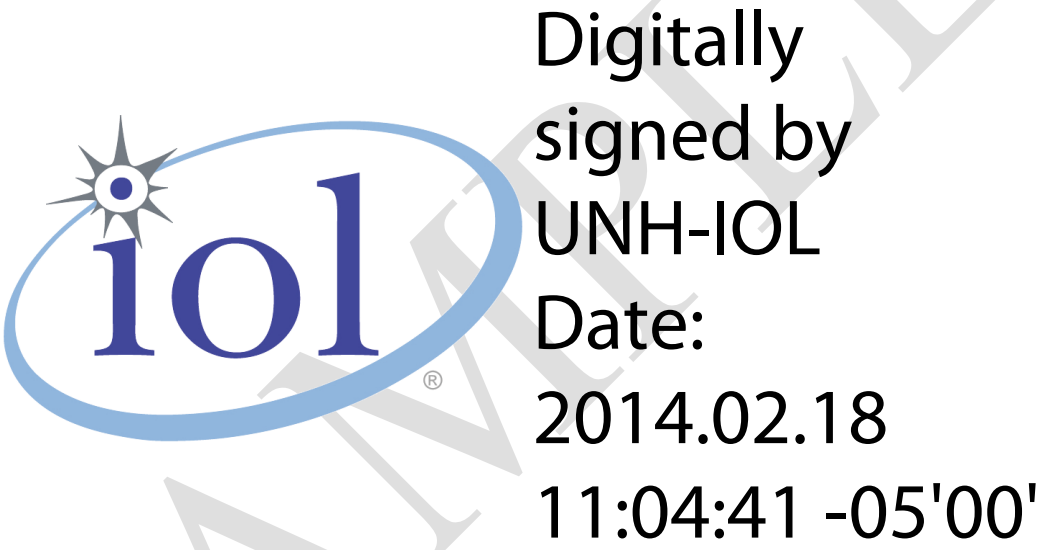
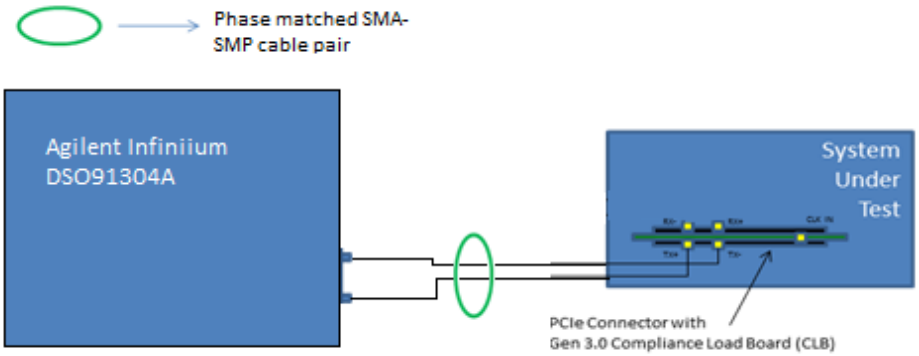


Table 1: Test Equipment and DUT Configuration/Feature Information

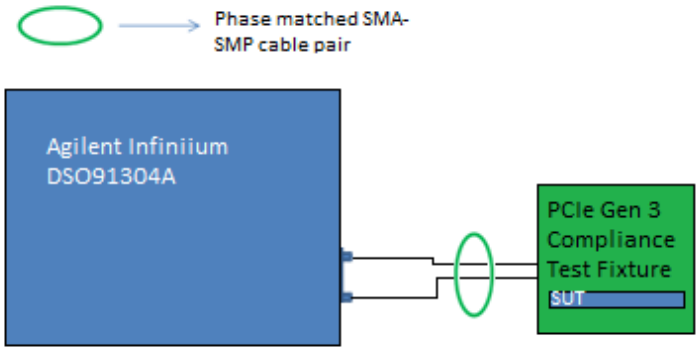
DUT Details	
Manufacturer	
Model	
Device Type (Platform/AIC)	
Mfr. Serial Number	
BIOS Version	
Hardware Version	
Software Version	
UNH-IOL ID Number	
Processor Details (If applicable)	
Spec	
Lot Information	
Manufacture Location	
Lot Numbers	
Test System Hardware	
Real-time DSO	Agilent Infiniium DSO91304A, 13GHz, 40GS/s Real-time DSO
Test Fixture	PCI Sig PCIe x16 Compliance Base Board
Additional Comments/Notes	
Table 3 and 4 results are gathered using the waveforms with the least amount of equalization. For Gen 1 this is the only one supported is used. For Gen 2 this is the -3.5 dB mode. For Gen 3 this is preset 4. All Eye Mask tests are done with at least 1E6 bits.	

Figure 1: Test Setup

Note: This setup was used for capturing the waveforms.



Setup for Platform



Setup for AIC

Table 2: TX Jitter and Eye Requirements

Slot x, Lane y

Test/Parameter	Valid Range	Measured	Units	Figure
Test 1.1: TX Jitter - Gen 1				
Median to Mean	-	**23.29**	ps	
Median to Maximum	125	**122.23**	mUI	
Median to Minimum	-	**14.54**	ps	
Test 1.2: TX Jitter - Gen 2				
Gen 2 (-3.5 dB)				
Deterministic jitter > 1.5MHz (DD)	<=150	**59.5**	mUI	
Random jitter < 1.5MHz (RMS)	<=3.00	**1.56**	ps	
Total jitter	-	**33.84**	ps	
Gen 2 (-6.0 dB)				
Deterministic jitter > 1.5MHz (DD)	<=150	**65**	mUI	
Random jitter < 1.5MHz (RMS)	<=3.00	**2.10**	ps	
Total jitter	-	**38.49**	ps	
Test 1.3: TX Jitter – Gen 3				
Gen 3 (P0)				
Uncorrelated deterministic jitter	<=12	**8.7**	ps	
Data dependent jitter	<=18	**12**	ps	
Total uncorrelated Jitter	<=31.25	**28.2**	ps	
Deterministic (DjDD) uncorrelated PWJ	<=10	**7.6**	ps	
Total uncorrelated PWJ	<=24	**23.5**	ps	
Gen 3 (P1)				
Uncorrelated deterministic jitter	<=12	**7.3**	ps	
Data dependent jitter	<=18	**11**	ps	
Total uncorrelated Jitter	<=31.25	**27.9**	ps	
Deterministic (DjDD) uncorrelated PWJ	<=10	**6.7**	ps	
Total uncorrelated PWJ	<=24	**23.9**	ps	
Gen 3 (P2)				
Uncorrelated deterministic jitter	<=12	**9.6**	ps	
Data dependent jitter	<=18	**13.2**	ps	
Total uncorrelated Jitter	<=31.25	**28.6**	ps	
Deterministic (DjDD) uncorrelated PWJ	<=10	**8.7**	ps	
Total uncorrelated PWJ	<=24	**21.3**	ps	
Gen 3 (P3)				
Uncorrelated deterministic jitter	<=12	**8.3**	ps	
Data dependent jitter	<=18	**15**	ps	
Total uncorrelated Jitter	<=31.25	**30.5**	ps	
Deterministic (DjDD) uncorrelated PWJ	<=10	**8.8**	ps	
Total uncorrelated PWJ	<=24	**22.2**	ps	
Gen 3 (P4)				
Uncorrelated deterministic jitter	<=12	**6.9**	ps	
Data dependent jitter	<=18	**9.0**	ps	
Total uncorrelated Jitter	<=31.25	**26.2**	ps	
Deterministic (DjDD) uncorrelated PWJ	<=10	**5.3**	ps	
Total uncorrelated PWJ	<=24	**20.6**	ps	

Test/Parameter	Valid Range	Measured	Units	Figure
Test 1.3: TX Jitter – Gen 3 (Continued)				
Gen 3 (P5)				
Uncorrelated deterministic jitter	<=12	**9.3**	ps	
Data dependent jitter	<=18	**13**	ps	
Total uncorrelated Jitter	<=31.25	**27.6**	ps	
Deterministic (DjDD) uncorrelated PWJ	<=10	**9.7**	ps	
Total uncorrelated PWJ	<=24	**23.6**	ps	
Gen 3 (P6)				
Uncorrelated deterministic jitter	<=12	**8.3**	ps	
Data dependent jitter	<=18	**13**	ps	
Total uncorrelated Jitter	<=31.25	**26.9**	ps	
Deterministic (DjDD) uncorrelated PWJ	<=10	**7.7**	ps	
Total uncorrelated PWJ	<=24	**21.9**	ps	
Gen 3 (P7)				
Uncorrelated deterministic jitter	<=12	**8.2**	ps	
Data dependent jitter	<=18	**15**	ps	
Total uncorrelated Jitter	<=31.25	**24.9**	ps	
Deterministic (DjDD) uncorrelated PWJ	<=10	**5.7**	ps	
Total uncorrelated PWJ	<=24	**20.9**	ps	
Gen 3 (P8)				
Uncorrelated deterministic jitter	<=12	**(12.1)**	ps	
Data dependent jitter	<=18	**14**	ps	
Total uncorrelated Jitter	<=31.25	**29.3**	ps	
Deterministic (DjDD) uncorrelated PWJ	<=10	**9.8**	ps	
Total uncorrelated PWJ	<=24	**24**	ps	
Gen 3 (P9)				
Uncorrelated deterministic jitter	<=12	**6.3**	ps	
Data dependent jitter	<=18	**10.5**	ps	
Total uncorrelated Jitter	<=31.25	**25.9**	ps	
Deterministic (DjDD) uncorrelated PWJ	<=10	**6.6**	ps	
Total uncorrelated PWJ	<=24	**22.9**	ps	
Gen 3 (P10)				
Uncorrelated deterministic jitter	<=12	**9.3**	ps	
Data dependent jitter	<=18	**17**	ps	
Total uncorrelated Jitter	<=31.25	**30.2**	ps	
Deterministic (DjDD) uncorrelated PWJ	<=10	**9.4**	ps	
Total uncorrelated PWJ	<=24	**23.9**	ps	

Test/Parameter	Valid Range	Measured	Units	Figure
Test 1.5: Eye Width (Gen 2 and 3 only)				
Gen 2 (-3.5 dB)	>=750	**802**	mUI	
Gen 2 (-6.0 dB)	>=750	**795**	mUI	
Gen 3 (P0)	>=41.25	**50.2**	ps	
Gen 3 (P1)	>=41.25	**49.6**	ps	
Gen 3 (P2)	>=41.25	**43.4**	ps	
Gen 3 (P3)	>=41.25	**42.3**	ps	
Gen 3 (P4)	>=41.25	**40.7**	ps	
Gen 3 (P5)	>=41.25	**41.75**	ps	
Gen 3 (P6)	>=41.25	**44.9**	ps	
Gen 3 (P7)	>=41.25	**48.6**	ps	
Gen 3 (P8)	>=41.25	**51.2**	ps	
Gen 3 (P9)	>=41.25	**53.8**	ps	
Gen 3 (P10)	>=41.25	**47.6**	ps	
Test 1.6: Eye Height (Gen 2 and 3 only)				
Gen 2 (-3.5 dB)	-	**200.4**	mV	
Gen 2 (-6.0 dB)	-	**198.6**	mV	
Gen 3 (P0)	-	**194.3**	mV	
Gen 3 (P1)	-	**195.2**	mV	
Gen 3 (P2)	-	**197.8**	mV	
Gen 3 (P3)	-	**194.9**	mV	
Gen 3 (P4)	-	**188.7**	mV	
Gen 3 (P5)	-	**190.2**	mV	
Gen 3 (P6)	-	**193.8**	mV	
Gen 3 (P7)	-	**194.8**	mV	
Gen 3 (P8)	-	**197.6**	mV	
Gen 3 (P9)	-	**199.9**	mV	
Gen 3 (P10)	-	**202.3**	mV	
Test 1.6 Eye Mask				
Gen 1	-	**Pass**		2
Gen 2 (-3.5 dB)	-	**Pass**		3
Gen 2 (-6.0 dB)	-	**Pass**		4
Gen 3 (P0)	-	**Pass**		5
Gen 3 (P1)	-	**Pass**		6
Gen 3 (P2)	-	**Pass**		7
Gen 3 (P3)	-	**Pass**		8
Gen 3 (P4)	-	**Pass**		9
Gen 3 (P5)	-	**Pass**		10
Gen 3 (P6)	-	**Pass**		11
Gen 3 (P7)	-	**Pass**		12
Gen 3 (P8)	-	**Pass**		13
Gen 3 (P9)	-	**Pass**		14
Gen 3 (P10)	-	**Pass**		15

Table 3: Clocking and SSC Test Results

Slot x, Lane y

Test/Parameter	Valid Range	Measured	Units	Figure
Test 2.1: TX UI Period				
UI Period at 2.5 GT/s	399.88/400.12	**400**	ps	
UI Period at 5.0 GT/s	199.94/200.06	**200**	ps	
UI Period at 8.0 GT/s	124.9625/ 125.0375	**125**	ps	
Test 2.2: Reference Clock Frequency (Platform only)				
Reference Clock Frequency (No SSC)	99.97/100.03	**100.02**	MHz	
Test 2.3: TX SSC Modulation Frequency				
Frequency of SSC modulation at 5 GT/s	30/33	**31.2**	kHz	16
Frequency of SSC modulation at 8 GT/s	30/33	**31.3**	kHz	17
Test 2.4: TX SSC Modulation Deviation and Balance				
5GT/s				
Average upper SSC peak value:	< 0	**(34.8)**	ppm	16
Average lower SSC peak value:	> -5000	**-1931.6**	ppm	16
8GT/s				
Average upper SSC peak value:	< 0	**(25.1)**	ppm	17
Average lower SSC peak value:	> -5000	**-1930.5**	ppm	17
Test 2.5: TX SSC dF/dt (Informative)				
Peak dF/dt at 5 GT/s	1250	**194**	ppm/us	18
Peak dF/dt at 8 GT/s	1250	**186**	ppm/us	19

Table 4: TX NRZ Data Signaling Test Results

Slot x, Lane y

Test/Parameter	Valid Range	Measured	Units	Figure
Test 2.1: TX Differential Voltage (p-p) (Informative)				
Differential Swing at 2.5 GT/s	800/1200	**1154**	mV_{pp}	2
Differential Swing at 5.0 GT/s	800/1200	**1194**	mV_{pp}	3
Differential Swing at 8.0 GT/s	800/1300	**1202**	mV_{pp}	9
Test 2.2: TX AC Common Mode Voltage (p-p) (Informative)				
AC Common Mode Voltage at 2.5 GT/s	0/20*	**7.9**	mV_{pp}	
AC Common Mode Voltage at 5.0 GT/s	0/150	**5.3**	mV_{pp}	
AC Common Mode Voltage at 8.0 GT/s	0/150	**6.9**	mV_{pp}	
Test 2.3: TX DC Common Mode Voltage				
DC Common Mode Voltage at 2.5 GT/s	0/3.6	**1.2E-6**	V	
DC Common Mode Voltage at 5.0 GT/s	0/3.6	**0.2E-6**	V	
DC Common Mode Voltage at 8.0 GT/s	0/3.6	**1.3E-6**	V	
Test 2.4: TX Intra Pair Skew (Informative)				
Skew at 2.5 GT/s	-	**3**	ps	
Skew at 5.0 GT/s	-	**3.1**	ps	
Skew at 8.0 GT/s	-	**2.9**	ps	

*This test is defined to the peak, not peak to peak (p-p)

Table 5: Gen 3 Equalization Results

Slot x, Lane y

Preset	Vb (mV)	De-emphasis (dB)	Preshoot (dB)	CP
P0	414.09	0.00	-6.73	0
P1	593.33	0.00	-3.60	1
P2	514.21	0.00	-4.85	2
P3	671.25	0.00	-2.53	3
P4	898.56	0.00	0.00	4
P5	748.32	1.59	0.00	5
P6	703.16	2.13	0.00	6
P7	333.10	3.77	-7.03	7
P8	448.79	3.50	-3.90	8
P9	625.61	3.14	0.00	9
P10	273.90	0.00	-10.32	10

Figure 2: Gen 1 Eye Diagram

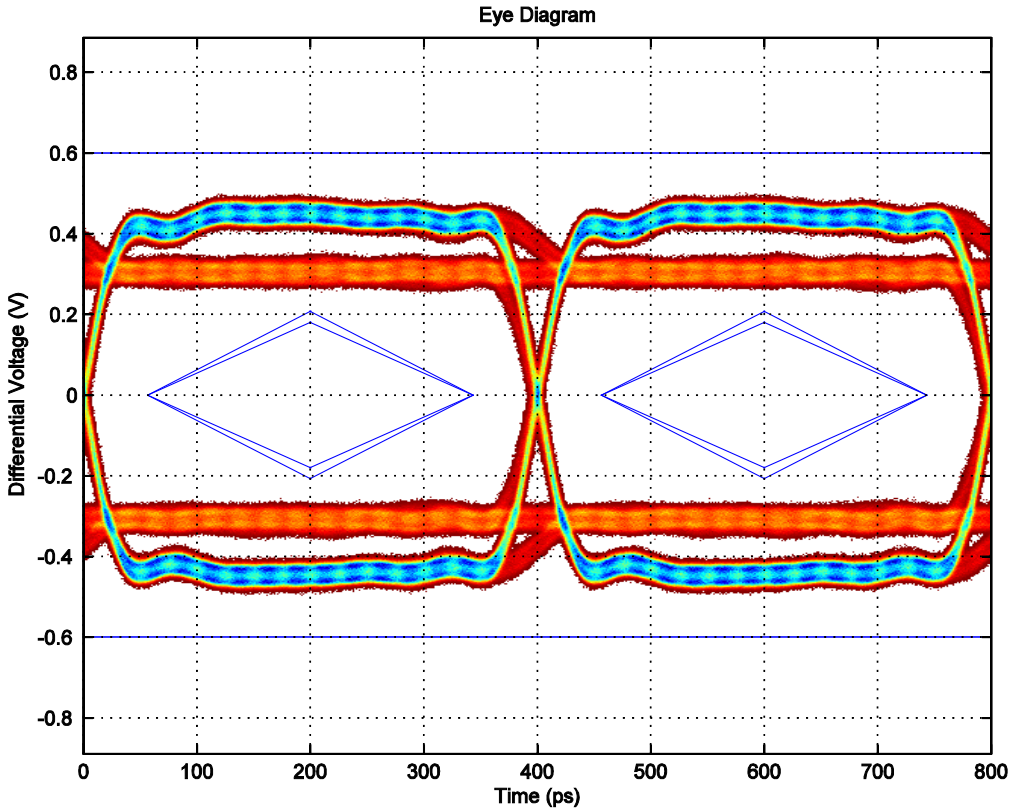


Figure 3: Gen 2 (-3.5 dB) Eye Diagram

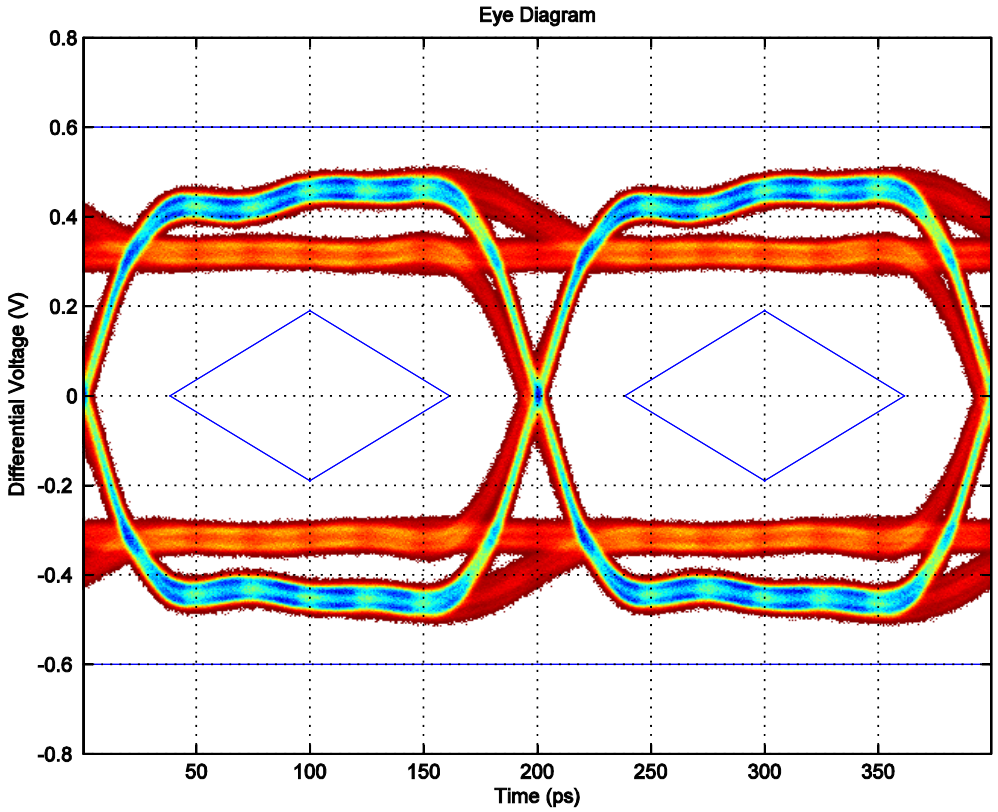


Figure 4: Gen 2 (-5 dB) Eye Diagram

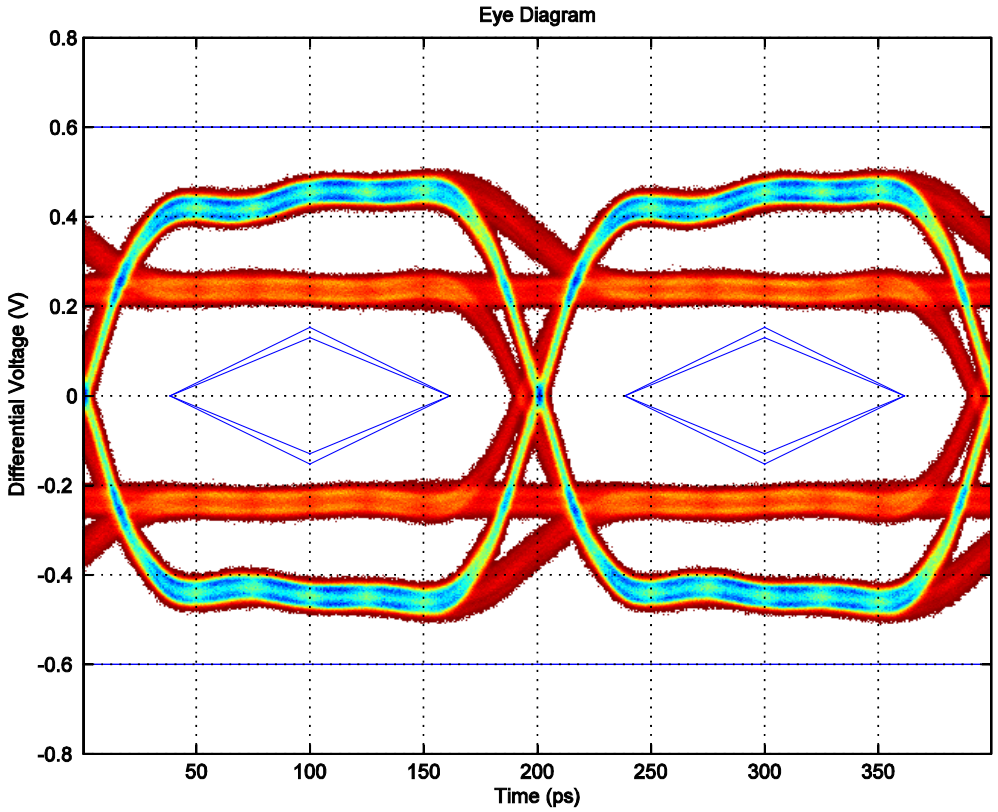


Figure 5: Gen 3 P0 Eye Diagram

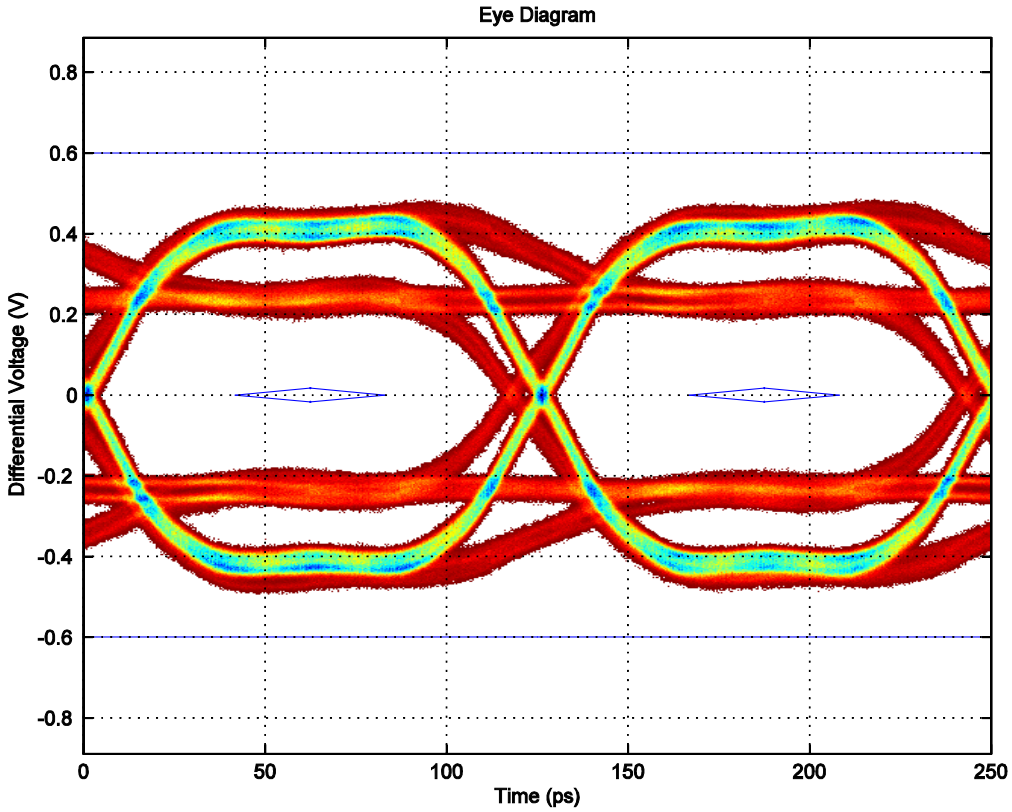


Figure 6: Gen 3 P1 Eye Diagram

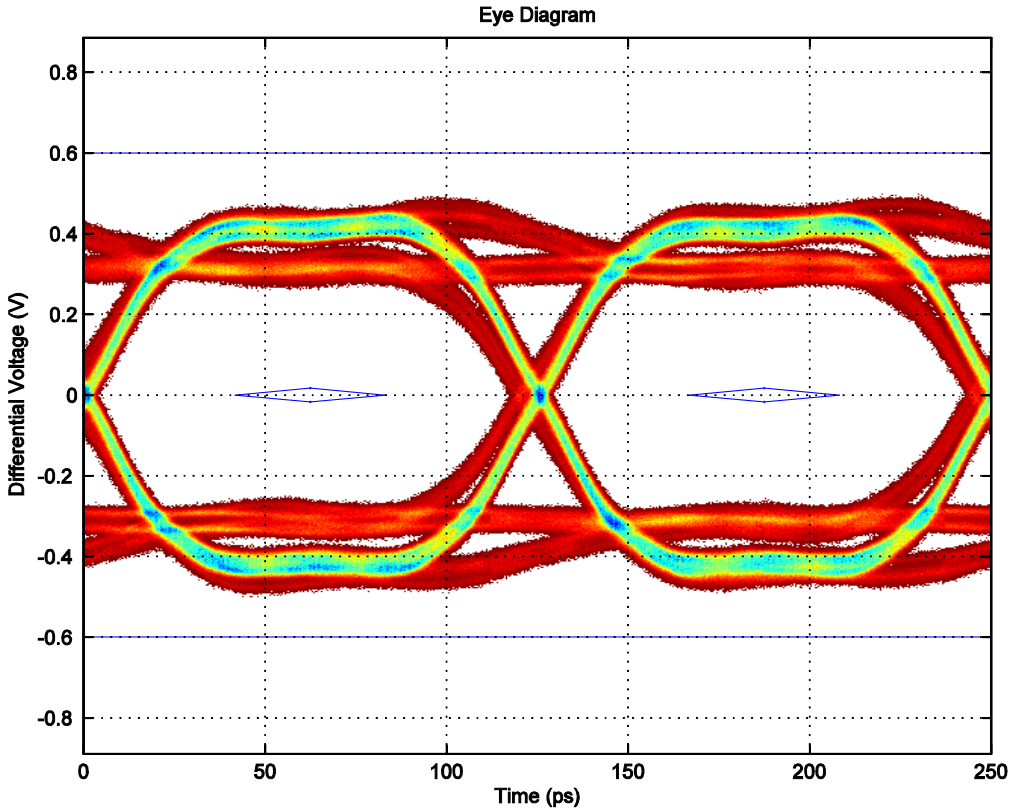


Figure 7: Gen 3 P2 Eye Diagram

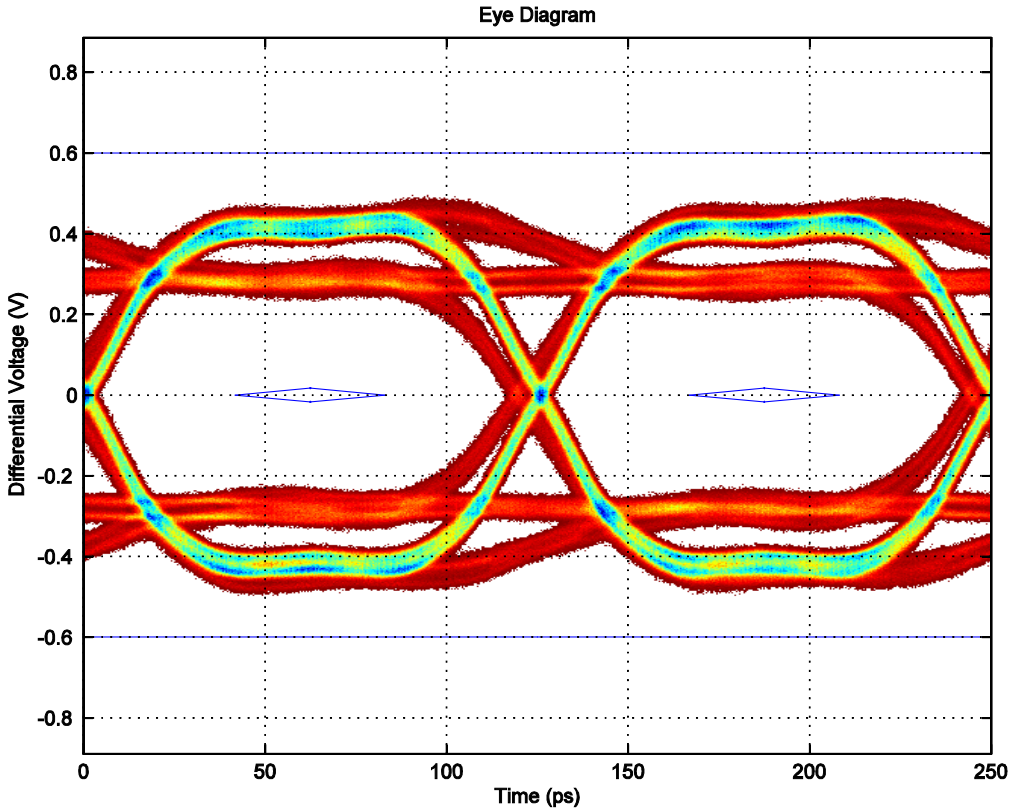


Figure 8: Gen 3 P3 Eye Diagram

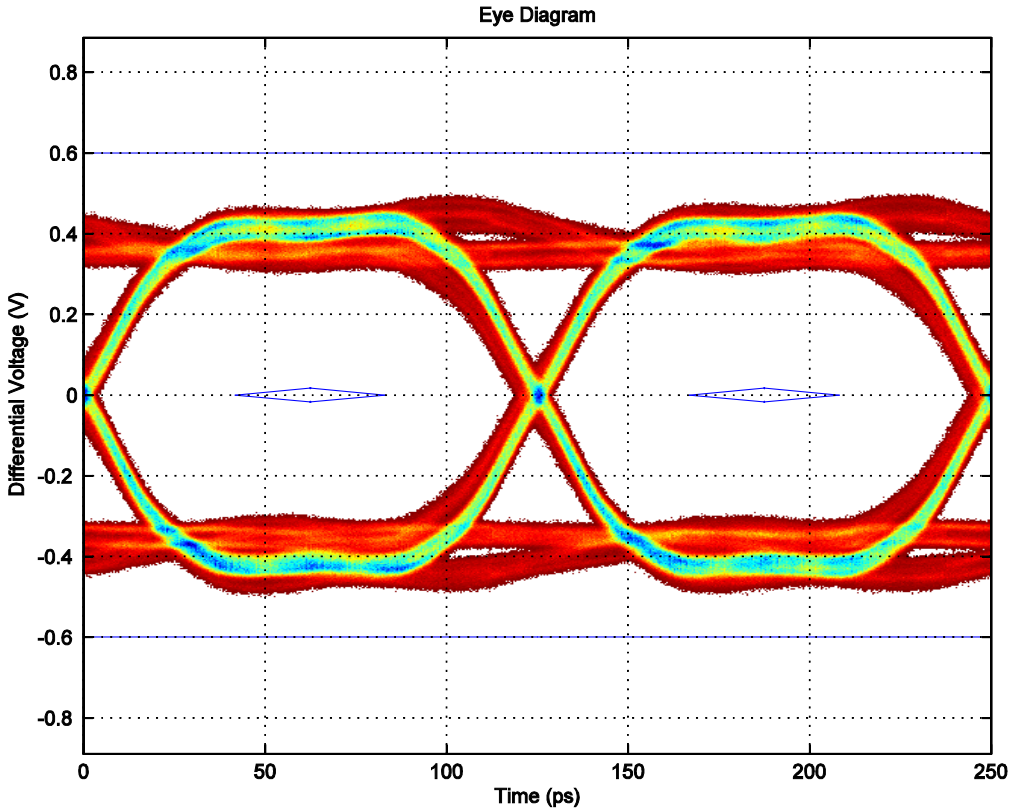


Figure 9: Gen 3 P4 Eye Diagram

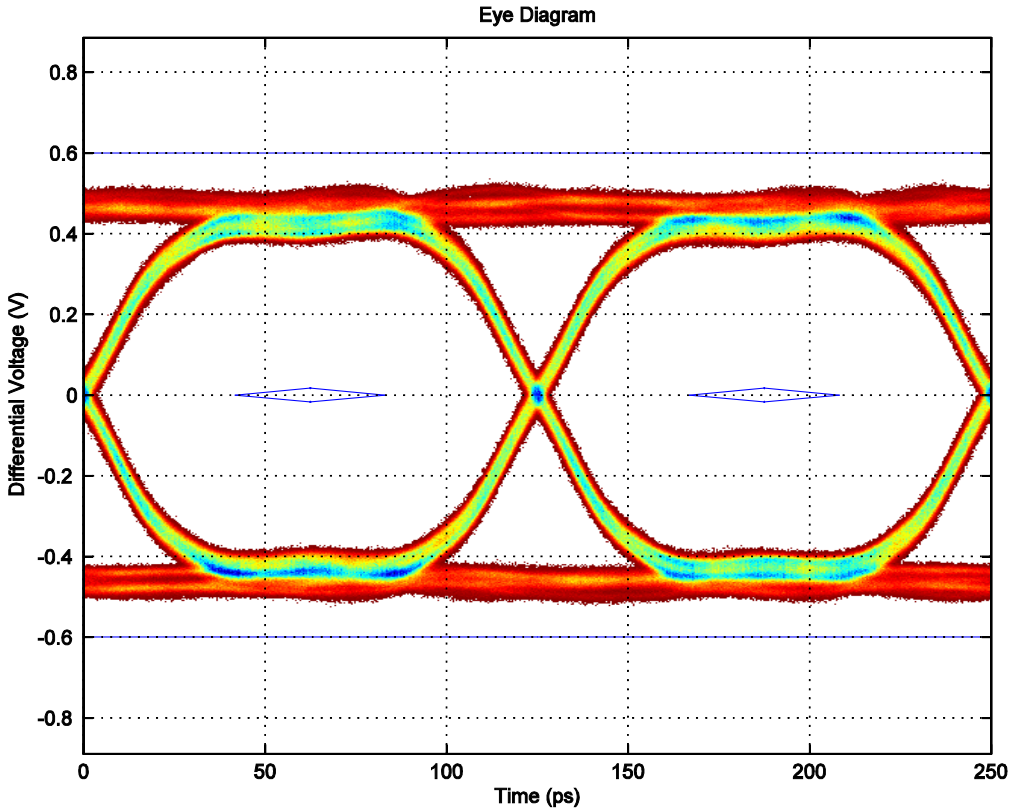


Figure 10: Gen 3 P5 Eye Diagram

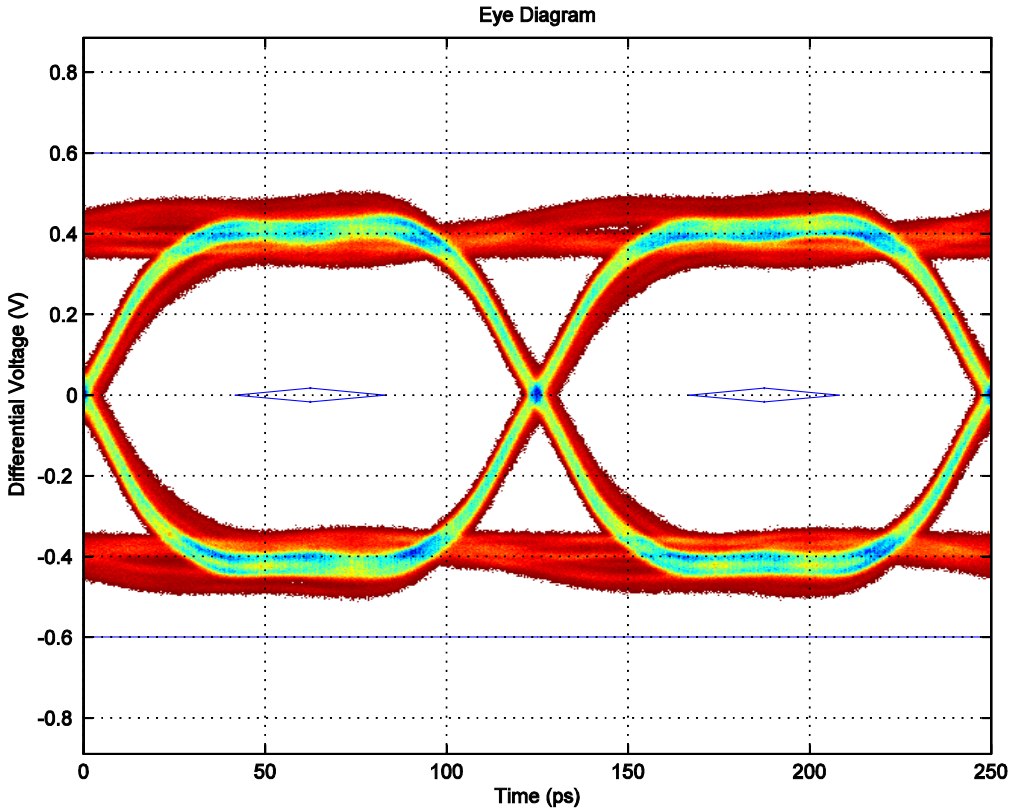


Figure 11: Gen 3 P6 Eye Diagram

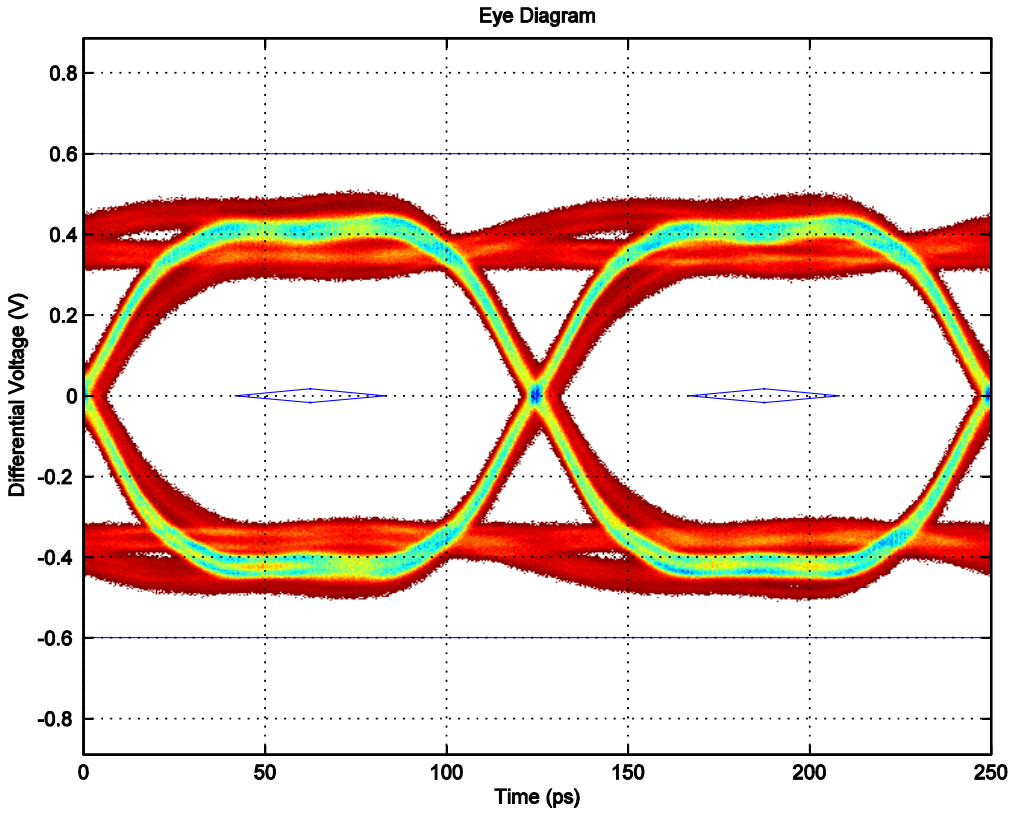


Figure 12: Gen 3 P7 Eye Diagram

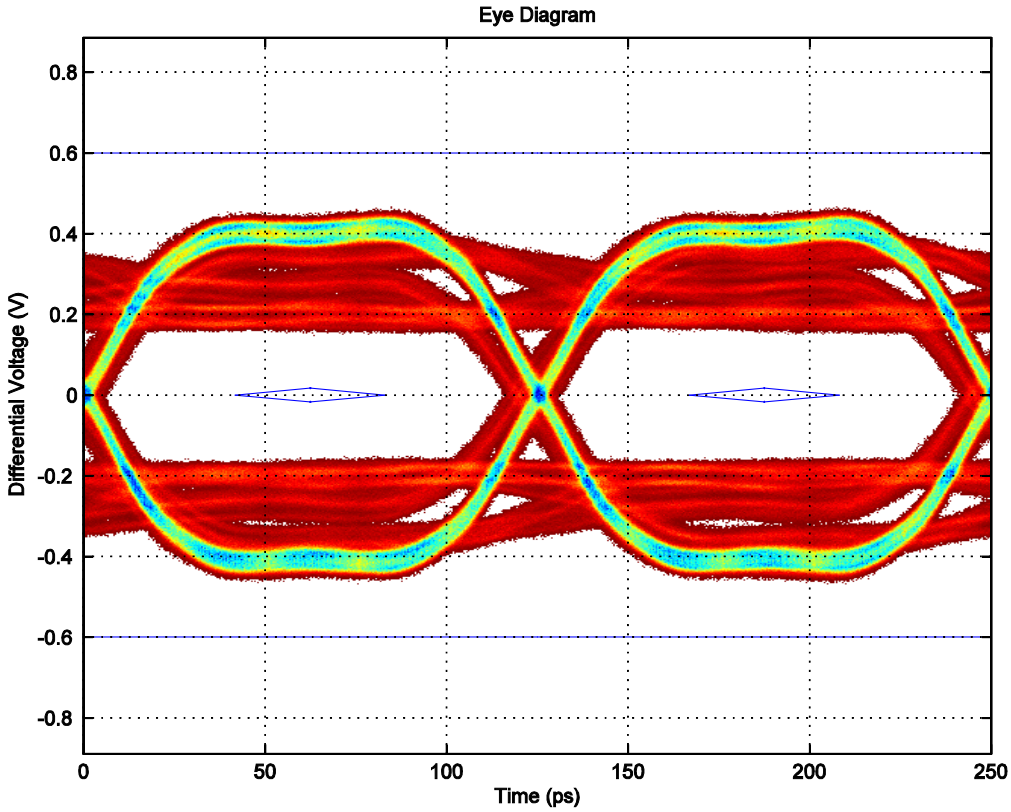


Figure 13: Gen 3 P8 Eye Diagram

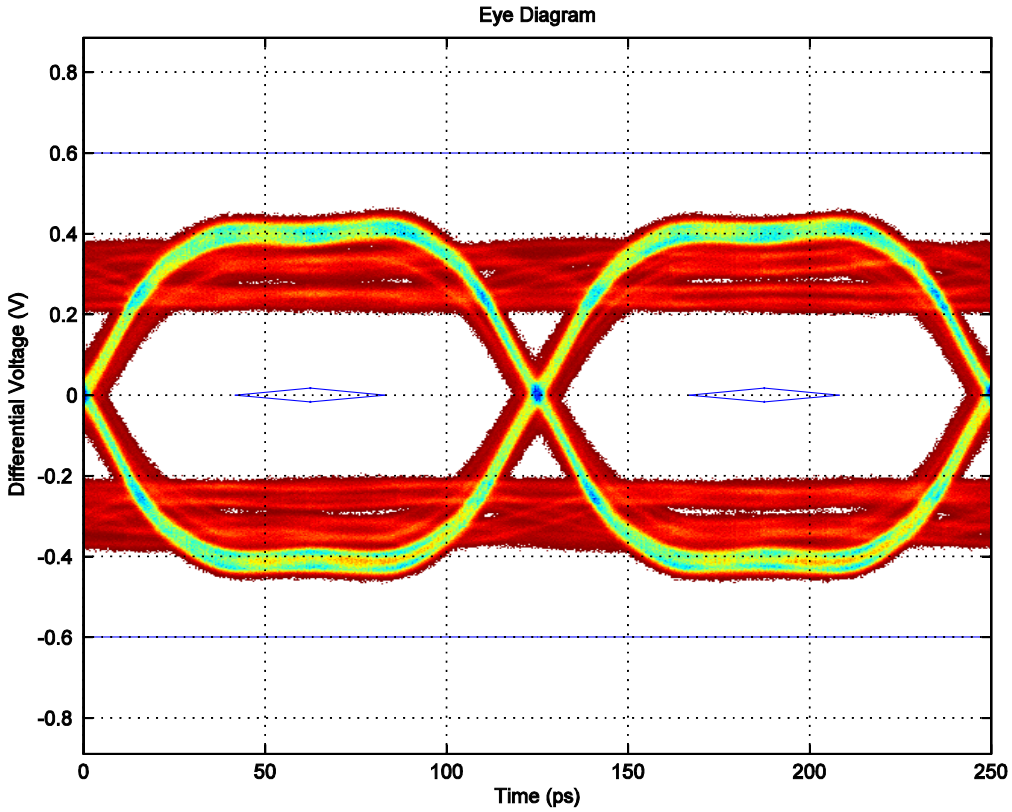


Figure 14: Gen 3 P9 Eye Diagram

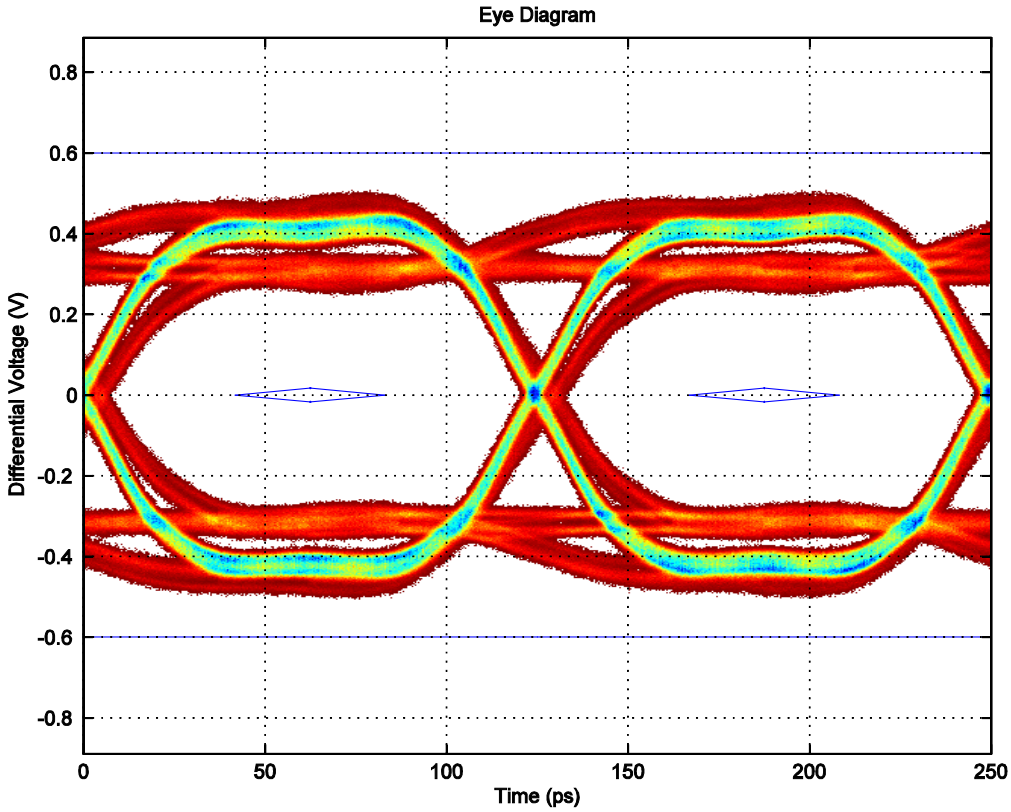


Figure 15: Gen 3 P10 Eye Diagram

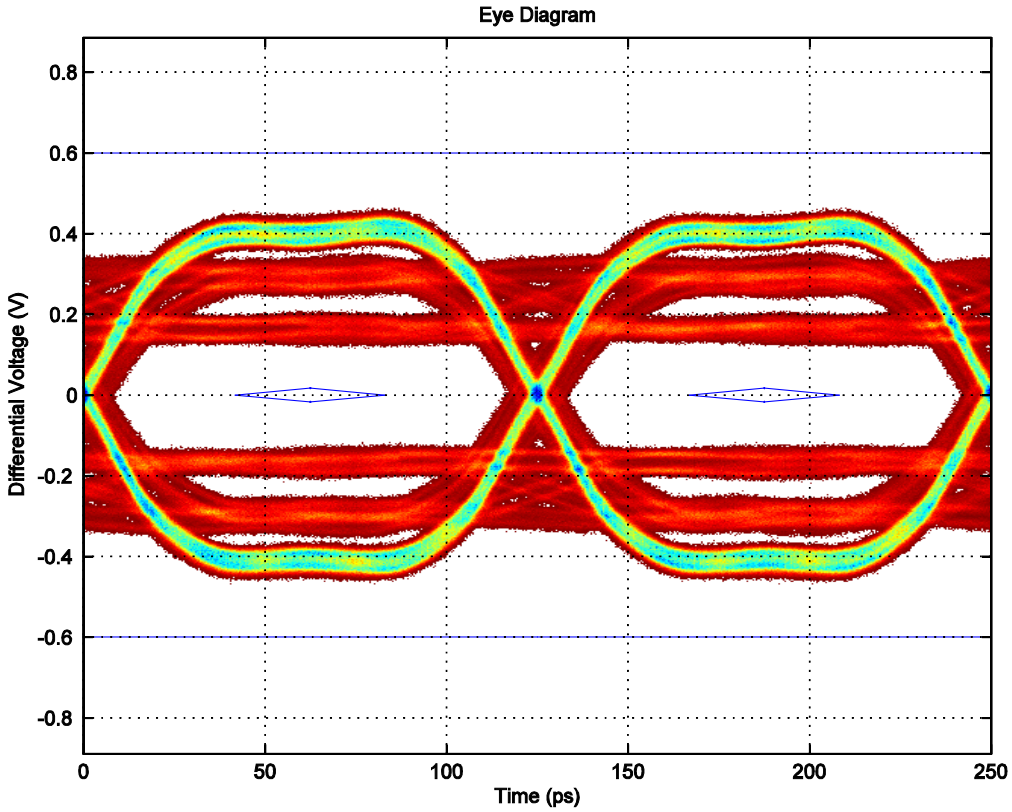


Figure 16: Gen 2 SSC Profile

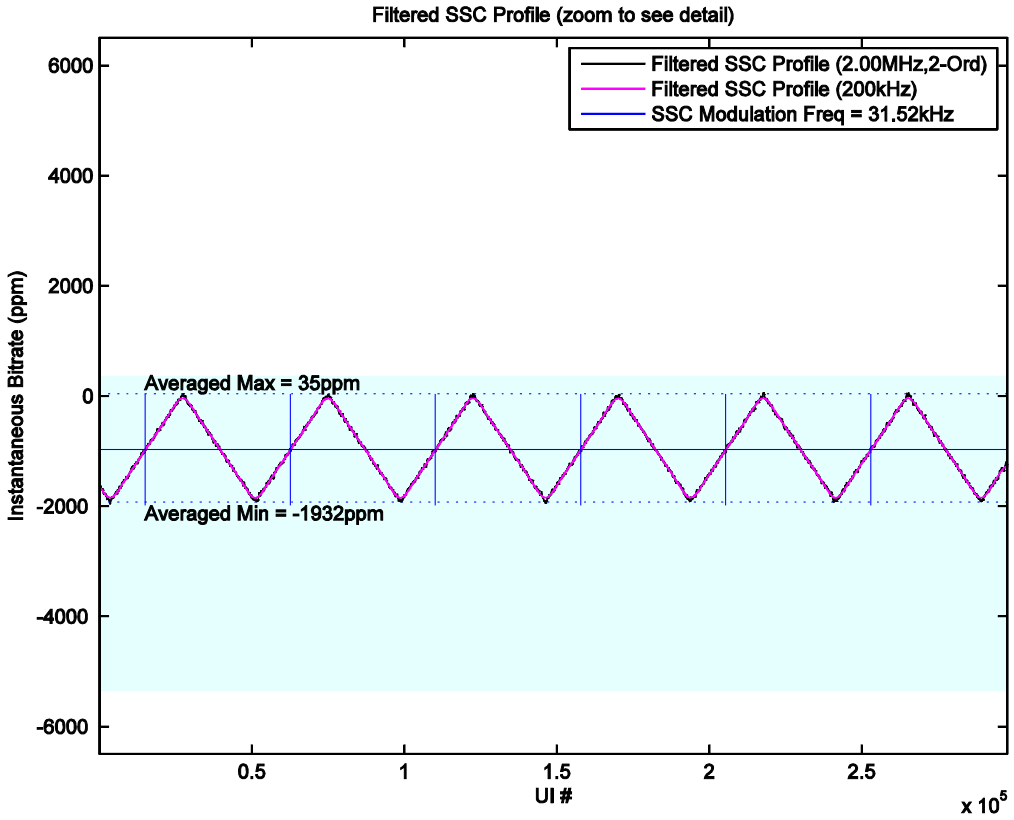


Figure 17: Gen 2 SSC dF/dt

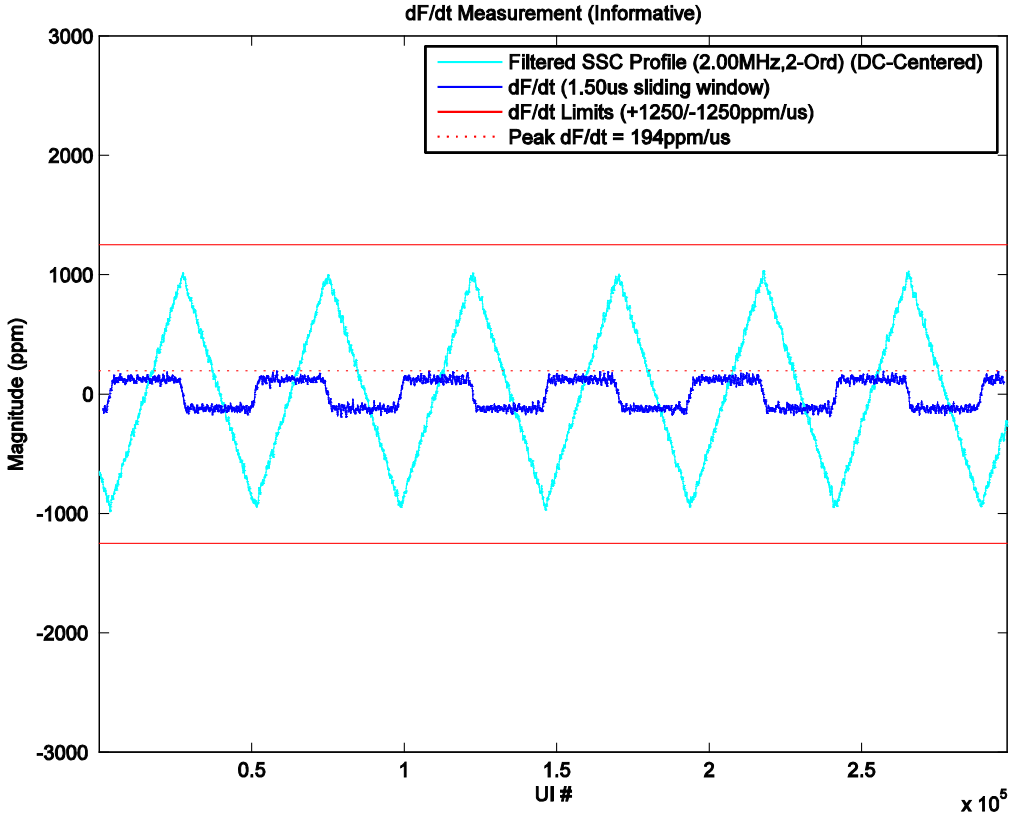


Figure 18: Gen 3 SSC Profile

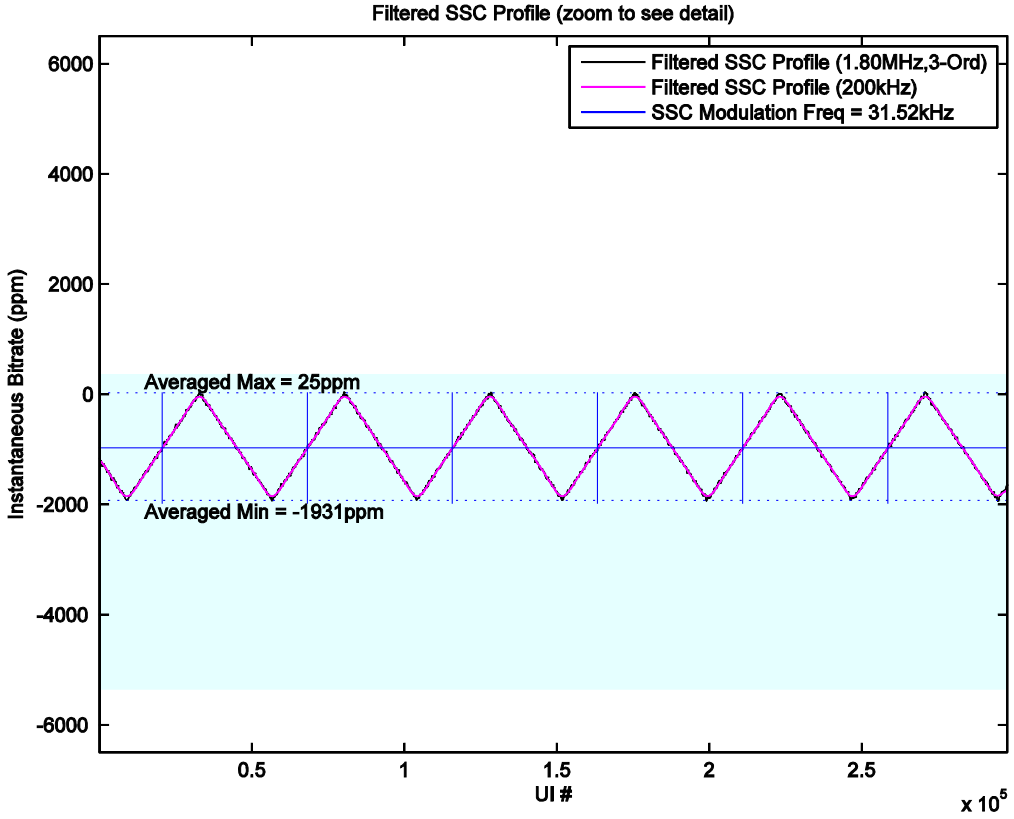


Figure 19: Gen 3 SSC dF/dt