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PRODUCT / PROCESS CHANGE NOTIFICATION

PCN-000414

Date: Feb 09, 2017

☐	Semtech Corporation, 200 Flynn Road, Camarillo CA 93012
☒	Semtech Canada Corporation, 4281 Harvester Road, Burlington, Ontario L7L 5M4 Canada
☐	Semtech Irvine, 5141 California Ave., Suite 100, Irvine CA 92617
☐	Semtech Neuchatel Sarl, Route des Gouttes d'Or 40, CH-2000 Neuchatel Switzerland
☐	Nanotech Semiconductor, Semtech Corporation, 2 West Point Court, Bristol, United Kingdom, BS32 4PY
☐	Semtech Corpus Christi SA de CV, Carretera Matamorros Edificio 7, Reynosa, Tamaulipas, Mexico 88780
☐	Semtech Triune, 1101 Resource Drive, Suite 121, Plano TX 75074
☐	

Change Details

Part Number(s) Affected:

Product families GN32xx and GN33xx

Full list attached below.

Customer Part Number(s) Affected: ☒ N/A

Description, Purpose and Effect of Change:

Introducing Pb-free lens cap eliminating RoHS exemption no 7(c) from LR ROSA products.

Replacing lens cap from Schott using Pb in glass seal with ball lens cap from Wuhan Risen using glass seal that is Pb-free.

Change Classification	☒ **Major** ☐ **Minor**	**Impact to Form, Fit, Function**	☐ **Yes** ☒ **No**
Impact to Data Sheet	☐ **Yes** ☒ **No**	**New Revision or Date**	☒ **N/A**

Impact to Performance, Characteristics or Reliability:

Performance, Characteristics and Reliability are not affected as per attached documentation.

Implementation Date	**July 1, 2017**	**Work Week**	
Last Time Ship (LTS) Of unchanged product	**NA**	**Affecting Lot No. / Serial No. (SN)**	**NA**
Sample Availability	**March 10, 2017**	**Qualification Report Availability**	**Available**

Supporting Documents for Change Validation/Attachments:

- **Characterization Report – PRODDOC013839**
- **Reliability Report – PRODDOC014441**
- **Material Composition Declaration for Lens Cap**

Issuing Authority

PRODUCT / PROCESS CHANGE NOTIFICATION

PCN-000414

Date: Feb 09, 2017

Semtech Business Unit:	Signal Integrity Group	
Semtech Contact Info:	Luis Blanco Semtech Corporation Director, Quality Assurance & Engineering 4281 Harvester Road Burlington, ON L7L 5M4 lblanco@semtech.com Office: (905) 632-7253 Fax:(905) 632-2055	
FOR FURTHER INFORMATION & WORLDWIDE SALES COVERAGE: http://www.semtech.com/contact/index.html#support		

List of affected PNs:

GN3250	GN3252	GN3268	GN3257	GN3270	GN3352	GN3357	GN3368	GN3358
GN3250-3EF7AM6E3	GN3252-3EB8AN3E3	GN3268-3EB7AN9E3	GN3257-3EB9AU2E3	GN3270-3EC7AV3E3	GN3352-3EB8AR9E3	GN3357-3EB9AV5E3	GN3368-3EC8AT6E3	GN3358-3EF8AT6E3
GN3250-3EG7AM6E3	GN3252-3EB8AT3E3	GN3268-3EB7AM2E3	GN3257-3EB9AV4E3	GN3270-3EC7AV8E3	GN3352-3EB8AT4E3	GN3357-3EB9AQ9E3	GN3368-3EC8AT8E3	GN3358-3EF8AU2E3
GN3250-3EB7AM2E3		GN3268-3EB7AV4E3	GN3257-3EB9AT5E3	GN3270-3EC7AV9E3	GN3352-3EB8AQ4E3	GN3357-3EB9AS6E3	GN3368-3EC8AU8E3	GN3358-3EF8AT8E3
GN3250-3EB7AK8E3		GN3268-3EB7AS9E3	GN3257-3EB9AP6E3		GN3352-3EB8AQ7E3	GN3357-3EB9AN4E3	GN3368-3EC9AT6E3	GN3358-3EF8AV6E3
GN3250-3EB7AQ5E3		GN3268-3EB7AT2E3			GN3352-3EB8AQ9E3	GN3357-3EB9AT6E3	GN3368-3EC9AT8E3	
GN3250-3EB7AP6E3		GN3268-3EB7AR2E3			GN3352-3EB8AR4E3	GN3357-3EB9AT9E3	GN3368-3EC8AN4E3	
GN3250-3EB7AN9E3		GN3268-3EB7AU2E3			GN3352-3EB8AR6E3	GN3357-3EB9AU2E3	GN3368-3EC8AU6E3	
GN3250-3EB7AP2E3		GN3268-3EB7AP6E3			GN3352-3EB8AS6E3	GN3357-3EB9AU4E3		
GN3250-3EG7AR2E3		GN3268-3EB7AM6E3			GN3352-3EB8AV5E3	GN3357-3EB9AU7E3		
GN3250-3EB7AM6E3		GN3268-3EB7AM7E3						
GN3250-3EB7AM7E3		GN3268-3EB7AM8E3						
GN3250-3EB7AM8E3		GN3268-3EB7AT8E3						
GN3250-3EB7AN4E3		GN3268-3EH8AN3E3						

Material Composition Declaration:

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Material Composition

Product	**RX.CBY.12755**					
Package	**Lens cap Pb-free (Wuhan Risen Tech Co.)**					
Manufacturer	**Semtech Corporation**				**Date**	**12/15/2016**
Component	**Subcomponent**	**Weight of Component mg**	**Substance**	**Weight of Substance mg**	**Homogeneous material %**	**ppm**
Ball LensCap	Base	83.00	C	0.00	0.001	10
			Si	0.13	0.160	1600
			Mn	0.66	0.800	8000
			P	0.00	0.004	40
			S	0.00	0.002	20
			Ni	41.56	50.070	500700
			Co	0.01	0.010	100
			Cr	0.01	0.010	100
			Al	0.01	0.010	100
			Fe	40.61	48.933	489330
			Subtotal	83.00	100.00	1000000
	Solder Glass	6.60	Proprietry	1.80	**No Lead**	1000000
	Window Glass	4.80	Proprietry	4.30	**No Lead**	1000000
	Ni Plating	3.00	Ni	3.00	100.00	1000000
Total		97.40				

SEMTECH CORPORATION - GENNUM PRODUCTS
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The information contained in this document describes the homogeneous material composition of this product according to the definition set forth in the EU RoHS Directive 2002/95/EC. This information may have been derived from calculations based on information obtained from our suppliers. Gennum Corporation assumes no liability for any errors or omissions in this document. Gennum reserves the right to make any changes to this document at any time w ithout notice.

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Pb-free Lens Cap Reliability Qualification Report, (Supplier – Wuhan Risen Tech)

1 Revision History

Version	ECO	Date	Modifications / Changes
0	ECO-034727	Dec 2016	New document

2 Contents

3 Purpose

The purpose of this report is to document the qualification of Pb-free lens cap for the ROSA products. The lens cap is supplied by Wuhan Risen Tech Co., Ltd.

4 Reliability Qualification Stresses

4.1 Qualification Tests

Table 1.: Qualification Stresses

Test	Sample size	Condition	Results
Hermelicity	100pcs	Normal fine leak test, Normal gross leak test	Passed
Temperature Cycling	13pcs	GR-468 Method 3.3.2.2, -40C-85C,10C/min ramp, 15 min dwell time, 500 cycles	Passed
Mechanical Shock	13pcs	GR-468 Method 3.3.1.1 1500g, 1 ms, 5 times/direction, 6directions	Passed
Mechanical Vibration	Same parts with MS	GR-468 Method 3.3.1.1 20 g, 20 to 2000 to 20 Hz, 4 min/cy, 4 cy/axis	Passed
RGA	5	NA	Passed

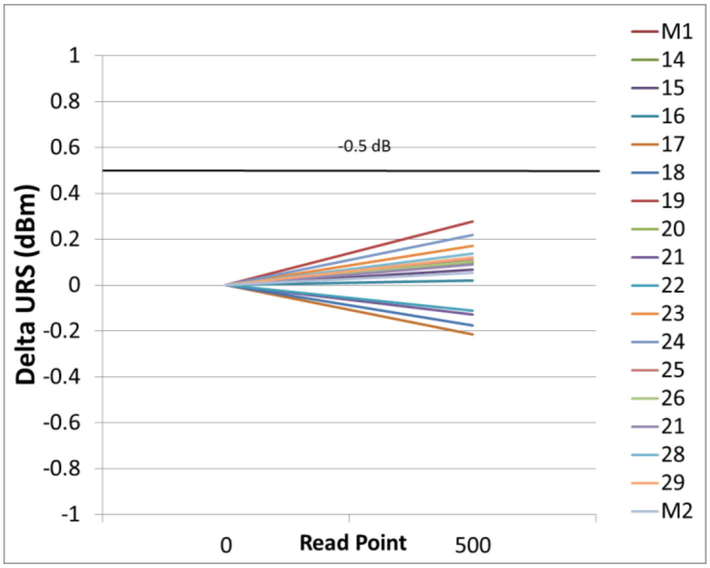
4.2 Pass Fail Criteria

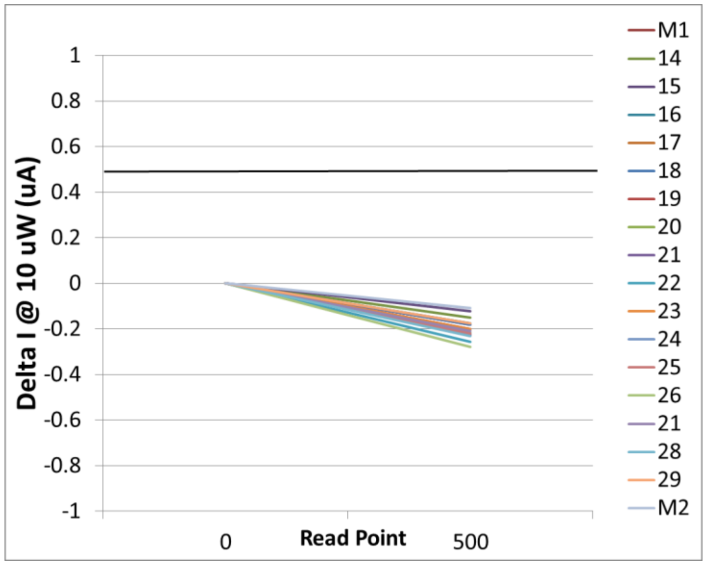
Table 2.: Qualification Stresses

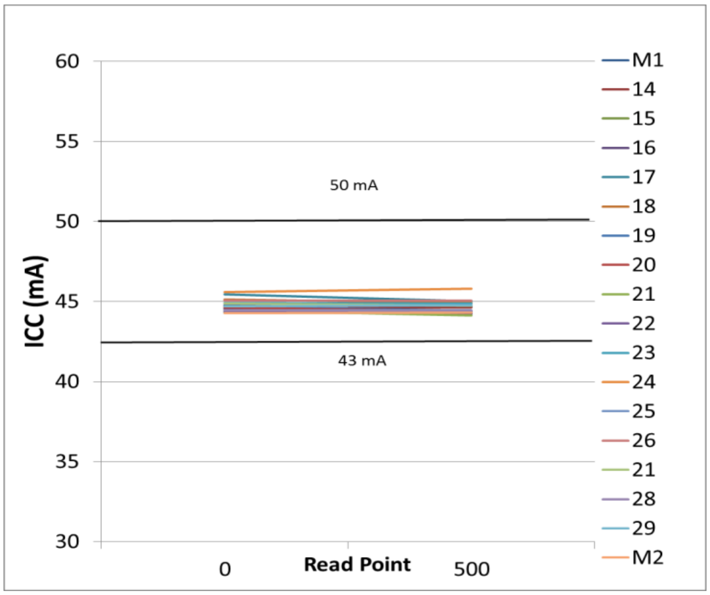
Parameter	Criterion
Unstressed receiver sensitivity (URS)	Change > 1 dB
Dark Current	> 50 nA
ICC	Delta of 10%
RSSI at 10 uW	Change > 1 dB

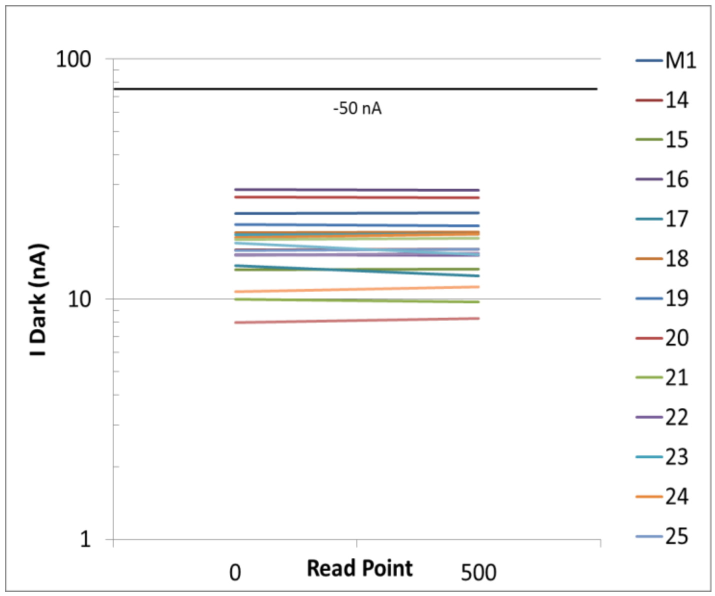
Temperature Cycling Test Drift Analysis (500 cycles)

M1 and M2 are control parts.



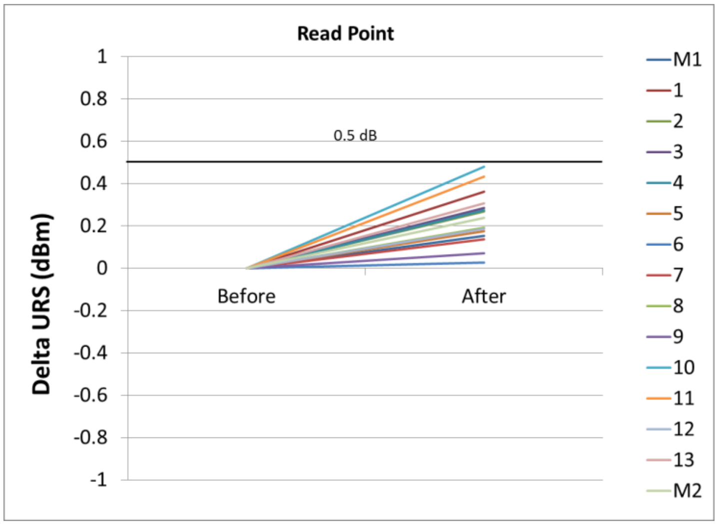


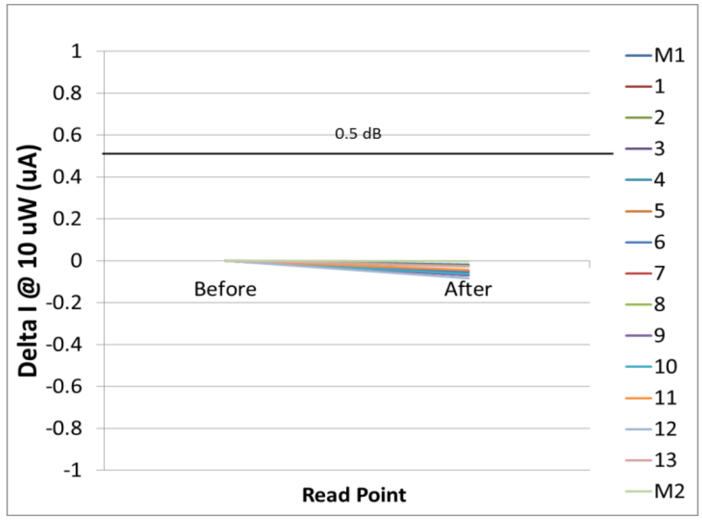


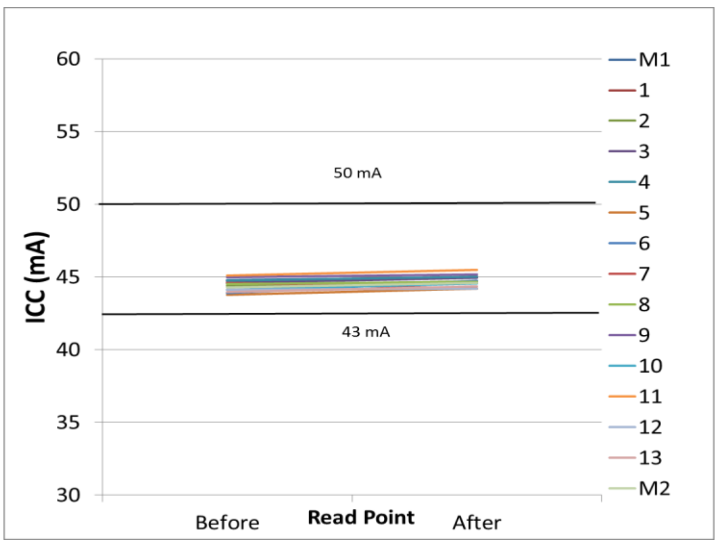


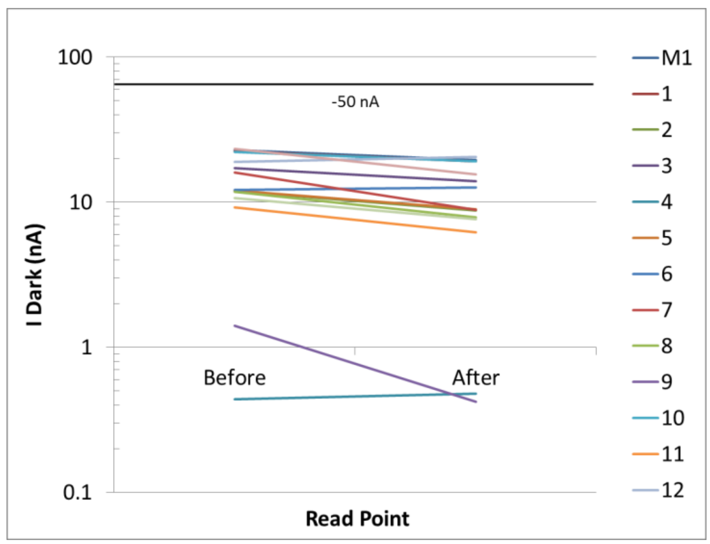
4.3 MS/MV Drift Analysis (1500G, 20-2000Hz)

M1 and M2 are control parts.









4.4 Residual Gas Analysis Results

The RGA content of samples built with Risen cap is acceptable.

SAMPLE ID		1	2	3	4	5
INLET PRESSURE	torr	4.2	3.9	3.9	3.8	4.0
NITROGEN	%v	98.3	98.0	97.6	97.7	97.5
OXYGEN	ppmv	ND	ND	ND	ND	ND
ARGON	%v	1.38	1.34	1.38	1.37	1.36
CO2	ppmv	385	362	488	400	363
MOISTURE	ppmv	898	909	1,556	1,693	713
HYDROGEN	ppmv	1,538	5,612	7,673	7,435	9,962
METHANE	ppmv	ND	ND	ND	ND	ND
AMMONIA	ppmv	ND	ND	ND	ND	ND
HELIUM	ppmv	ND	ND	ND	ND	ND
FLUORO-CARBONS	ppmv	ND	ND	ND	ND	ND

5 Conclusion

The Risen lead-free cap is compliant and reliable and can be used in the ROSA products.

GN3250 Characterization Report

(Pb-free lens cap from Risen)

Author: Alain Bouchard

Revision List

Revision	Author	Description of change	Revision Date (mm/dd/yyyy)	ECO#
A	Alain Bouchard	First Issue	10/04/2016	033675

Table of Contents

1. Scope

This document contains a summary of the results of the characterization testing performed on GN3250 ROSA using Pb-free glass seal lens cap from Risen.

2. Method

The GN3250 with LC optical receptacles (barrels) were tested using a Semtech designed evaluation board. These evaluation boards feature controlled impedance lines that are terminated in SMA connectors, and permit full assessment of the electrical properties of the ROSA using input from optical excitation at a wide range of frequencies.

Characterization plan is Gendoc 53406.

3. Results

3.1. Supply Current (I_{CC})

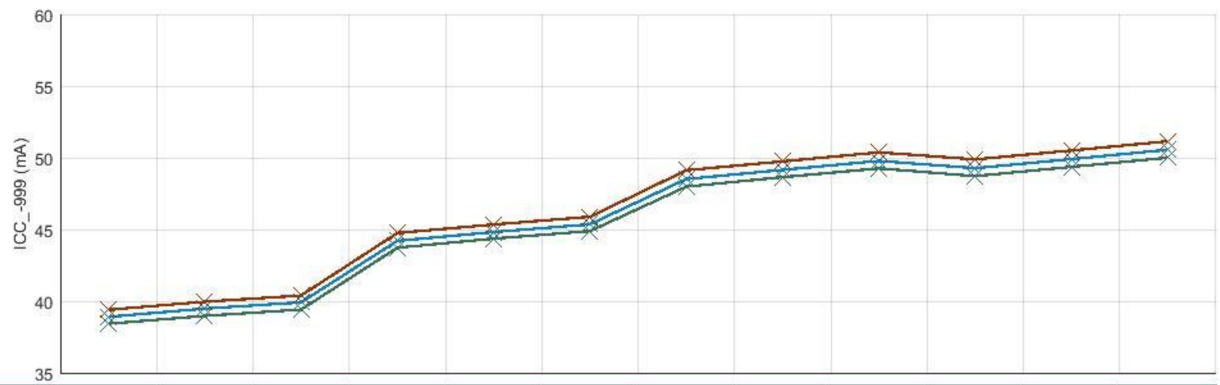
3.1.1. Test Descriptions

In these tests the ROSA was powered up and the current into the V_{CC} pin was measured. During the test the RSSI pin was pulled to ground. The test was performed under the following conditions:

1) No optical power input into the ROSA, i.e. P_o=0mW. This is to test the dark condition.
2) 0.5dBm of avg. optical power

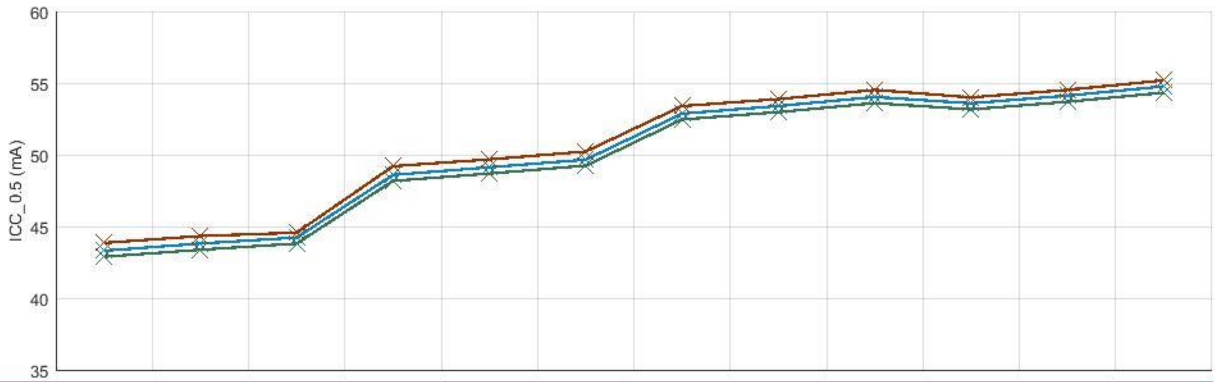
The optical signal input to the ROSA was unmodulated. Test was done at both 1310nm and 1550nm.

3.1.2. I_{CC} (no optical input)



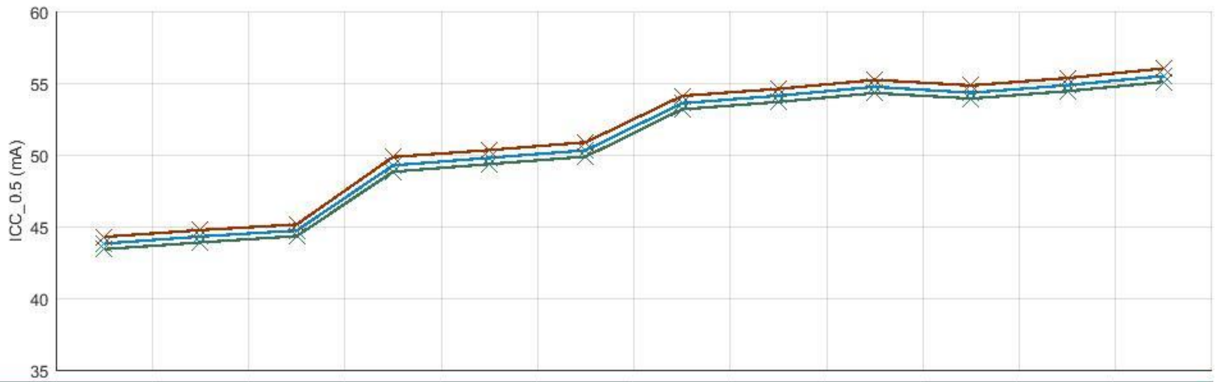
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	38.91	39.48	39.92	44.21	44.82	45.36	48.51	49.16	49.78	49.27	49.91	50.56
Median	38.87	39.47	39.90	44.15	44.79	45.32	48.46	49.11	49.74	49.21	49.86	50.52
Std. Dev.	0.29	0.28	0.29	0.32	0.31	0.31	0.35	0.33	0.34	0.35	0.34	0.35
Max.	39.40	39.96	40.39	44.75	45.35	45.89	49.13	49.75	50.38	49.89	50.51	51.15
Min.	38.43	38.97	39.42	43.73	44.36	44.89	47.99	48.65	49.26	48.72	49.37	50.01
Range	0.97	0.99	0.98	1.03	0.98	1.00	1.14	1.10	1.12	1.17	1.14	1.15
1	38.57	39.18	39.59	43.73	44.36	44.89	47.99	48.65	49.26	48.72	49.37	50.01
2	39.06	39.63	40.07	44.39	45.01	45.55	48.70	49.34	49.97	49.46	50.09	50.75
3	38.85	39.48	39.90	44.12	44.81	45.32	48.43	49.12	49.74	49.19	49.85	50.51
4	38.78	39.33	39.77	44.08	44.70	45.25	48.39	49.06	49.69	49.16	49.83	50.48
5	39.02	39.58	40.02	44.38	44.98	45.52	48.67	49.29	49.92	49.45	50.05	50.71
6	38.86	39.46	39.89	44.08	44.69	45.23	48.37	49.03	49.63	49.11	49.76	50.39
7	39.23	39.79	40.24	44.55	45.15	45.70	48.89	49.51	50.15	49.65	50.27	50.94
8	38.88	39.44	39.90	44.17	44.76	45.32	48.49	49.09	49.74	49.24	49.86	50.52
9	39.40	39.96	40.39	44.75	45.35	45.89	49.13	49.75	50.38	49.89	50.51	51.15
10	38.43	38.97	39.42	43.81	44.40	44.94	48.10	48.72	49.34	48.88	49.49	50.14

3.1.3. I_{CC} (0.5dBm avg. optical power @ 1310nm)



Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	43.31	43.81	44.23	48.60	49.13	49.66	52.87	53.40	54.03	53.59	54.12	54.77
Median	43.31	43.84	44.26	48.61	49.20	49.71	52.81	53.40	54.01	53.54	54.10	54.75
Std. Dev.	0.29	0.29	0.25	0.34	0.33	0.34	0.34	0.32	0.33	0.33	0.32	0.33
Max.	43.86	44.33	44.57	49.20	49.68	50.23	53.40	53.88	54.52	54.00	54.52	55.19
Min.	42.89	43.38	43.81	48.18	48.69	49.24	52.46	52.97	53.60	53.16	53.70	54.33
Range	0.97	0.96	0.76	1.03	0.99	0.99	0.94	0.91	0.92	0.83	0.83	0.86
1	43.04	43.58	43.98	48.20	48.77	49.27	52.47	53.02	53.64	53.16	53.72	54.33
2	43.44	43.94	44.38	48.79	49.31	49.86	53.11	53.65	54.29	53.86	54.39	55.05
3	43.30	43.86	44.28	48.62	49.26	49.73	52.85	53.45	54.04	53.56	54.12	54.79
4	43.31	43.81	44.25	48.60	49.13	49.69	52.78	53.34	53.98	53.51	54.08	54.71
5	43.46	43.94	44.38	48.82	49.32	49.86	53.11	53.61	54.25	53.89	54.39	55.04
6	42.99	43.51	43.93	48.18	48.74	49.24	52.50	53.05	53.64	53.23	53.77	54.40
7	43.58	44.07	44.52	48.89	49.41	49.97	53.24	53.76	54.40	54.00	54.52	55.19
8	43.20	43.69	44.16	48.45	48.96	49.51	52.76	53.27	53.92	53.52	54.03	54.70
9	43.86	44.33	44.57	49.20	49.68	50.23	53.40	53.88	54.52	53.99	54.50	55.15
10	42.89	43.38	43.81	48.19	48.69	49.24	52.46	52.97	53.60	53.18	53.70	54.35

3.1.4. I_{CC} (0.5dBm avg. optical power @ 1550nm)



Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	43.80	44.30	44.72	49.26	49.79	50.31	53.59	54.12	54.74	54.32	54.85	55.50
Median	43.75	44.27	44.71	49.24	49.82	50.32	53.53	54.08	54.71	54.24	54.80	55.44
Std. Dev.	0.29	0.29	0.26	0.36	0.34	0.35	0.36	0.34	0.35	0.35	0.34	0.35
Max.	44.27	44.75	45.14	49.85	50.33	50.87	54.10	54.60	55.22	54.83	55.35	56.02
Min.	43.41	43.89	44.33	48.82	49.35	49.87	53.17	53.68	54.30	53.92	54.44	55.08
Range	0.86	0.86	0.81	1.03	0.98	1.00	0.93	0.91	0.92	0.91	0.92	0.94
1	43.58	44.10	44.52	48.89	49.46	49.94	53.19	53.76	54.35	53.93	54.46	55.08
2	44.00	44.49	44.94	49.46	49.98	50.53	53.86	54.39	55.01	54.59	55.11	55.76
3	43.75	44.29	44.72	49.26	49.88	50.35	53.59	54.14	54.77	54.25	54.85	55.47
4	43.76	44.25	44.70	49.22	49.76	50.30	53.47	54.02	54.65	54.18	54.76	55.40
5	43.95	44.43	44.87	49.50	49.99	50.52	53.84	54.34	54.96	54.64	55.13	55.77
6	43.50	44.00	44.44	48.82	49.38	49.87	53.19	53.74	54.33	53.92	54.44	55.08
7	44.20	44.68	45.14	49.66	50.17	50.73	54.06	54.57	55.21	54.83	55.35	56.02
8	43.62	44.11	44.58	49.06	49.57	50.12	53.45	53.95	54.59	54.23	54.74	55.40
9	44.27	44.75	44.93	49.85	50.33	50.87	54.10	54.60	55.22	54.72	55.23	55.90
10	43.41	43.89	44.33	48.86	49.35	49.90	53.17	53.68	54.30	53.93	54.44	55.08

3.2. Responsivity, RSSI Dark

3.2.1. Test Descriptions

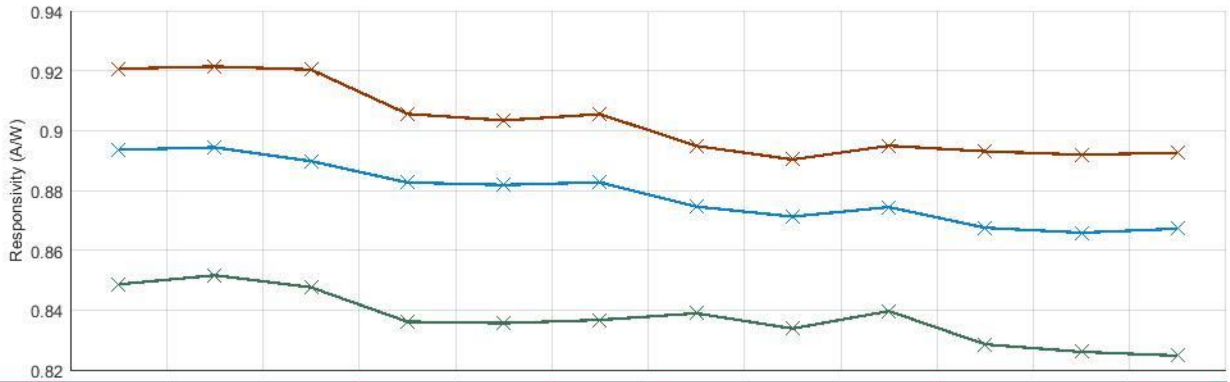
Responsivity is calculated by dividing the measured the RSSI current by the input optical power at an input optical power of -10dBm (100uW). The input optical signal is unmodulated.

In these tests the ROSA was powered up and the current sunk from the RSSI pin was measured. During the test the RSSI pin was pulled to ground. The test was performed under the following conditions:

1) No optical power input into the ROSA, i.e. P_o=0mW. This is to test the dark condition.
2) -10dBm of avg. optical power

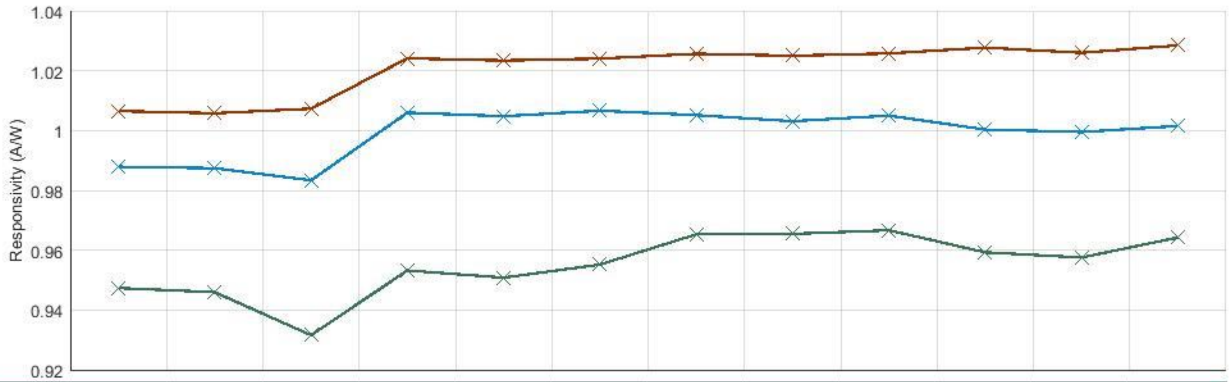
The optical signal input to the ROSA was unmodulated. Test was done at both 1310nm and 1550nm.

3.2.2. Responsivity (A/W) at 1310nm



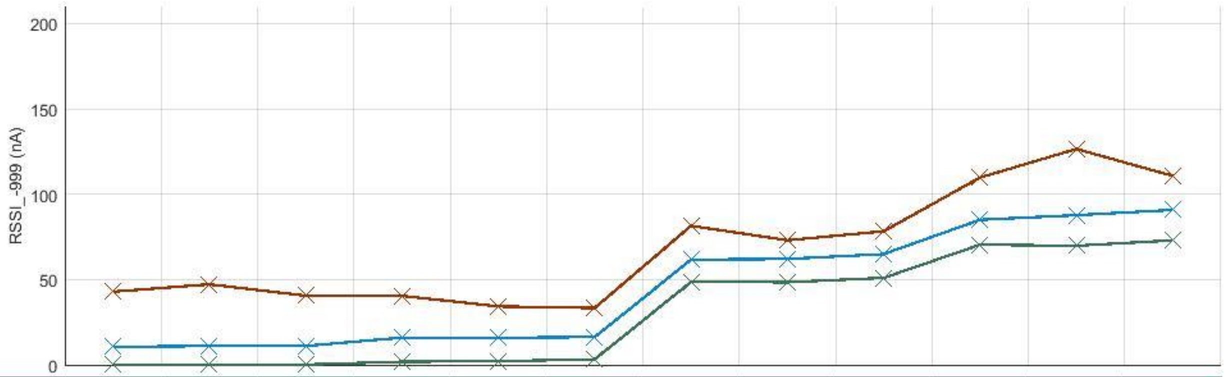
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	0.89	0.89	0.89	0.88	0.88	0.88	0.87	0.87	0.87	0.87	0.87	0.87
Median	0.90	0.90	0.89	0.89	0.88	0.89	0.88	0.87	0.88	0.87	0.87	0.87
Std. Dev.	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Max.	0.92	0.92	0.92	0.91	0.90	0.91	0.89	0.89	0.89	0.89	0.89	0.89
Min.	0.85	0.85	0.85	0.84	0.84	0.84	0.84	0.83	0.84	0.83	0.83	0.82
Range	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.07	0.07
1	0.90	0.91	0.90	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
2	0.89	0.89	0.89	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
3	0.91	0.90	0.91	0.90	0.90	0.90	0.89	0.89	0.89	0.88	0.88	0.88
4	0.92	0.92	0.92	0.91	0.90	0.91	0.88	0.87	0.88	0.87	0.87	0.87
5	0.91	0.90	0.91	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
6	0.85	0.85	0.85	0.84	0.84	0.84	0.84	0.83	0.84	0.84	0.84	0.84
7	0.89	0.89	0.89	0.88	0.88	0.88	0.88	0.88	0.87	0.87	0.87	0.87
8	0.88	0.88	0.88	0.87	0.87	0.87	0.87	0.86	0.87	0.86	0.86	0.86
9	0.90	0.90	0.86	0.89	0.89	0.89	0.86	0.86	0.86	0.83	0.83	0.82
10	0.89	0.89	0.89	0.88	0.88	0.88	0.87	0.87	0.87	0.86	0.86	0.86

3.2.3. Responsivity (A/W) at 1550nm



Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	0.99	0.99	0.98	1.01	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.00
Median	0.99	0.99	0.99	1.01	1.01	1.02	1.01	1.01	1.01	1.00	1.00	1.00
Std. Dev.	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Max.	1.01	1.01	1.01	1.02	1.02	1.02	1.03	1.03	1.03	1.03	1.03	1.03
Min.	0.95	0.95	0.93	0.95	0.95	0.96	0.97	0.97	0.97	0.96	0.96	0.96
Range	0.06	0.06	0.08	0.07	0.07	0.07	0.06	0.06	0.06	0.07	0.07	0.06
1	1.01	1.01	1.01	1.02	1.02	1.02	1.02	1.03	1.02	1.03	1.02	1.03
2	1.00	0.99	1.00	1.01	1.01	1.01	1.01	1.01	1.02	1.01	1.01	1.01
3	0.99	0.99	0.99	1.02	1.02	1.02	1.02	1.01	1.02	1.00	1.01	1.00
4	1.01	1.01	1.01	1.02	1.02	1.02	1.01	1.00	1.01	1.00	1.00	1.00
5	1.00	1.00	1.00	1.02	1.02	1.02	1.02	1.02	1.02	1.03	1.03	1.03
6	0.95	0.95	0.95	0.95	0.95	0.96	0.97	0.97	0.97	0.97	0.96	0.96
7	1.01	1.00	1.01	1.02	1.02	1.02	1.03	1.02	1.03	1.03	1.03	1.03
8	0.97	0.96	0.97	0.98	0.98	0.98	0.99	0.99	0.99	1.00	1.00	1.00
9	0.98	0.98	0.93	1.01	1.01	1.01	0.98	0.98	0.98	0.96	0.96	0.96
10	0.99	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99

3.2.4. RSSI dark (nA)



Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	10.56	11.08	11.09	15.97	15.86	16.33	61.64	62.05	64.91	84.99	87.68	90.77
Median	6.47	6.87	7.23	14.40	14.77	15.65	58.33	61.26	62.89	82.73	84.33	89.03
Std. Dev.	12.95	14.13	12.25	10.61	9.09	8.54	10.24	8.00	8.98	11.27	15.60	11.63
Max.	42.88	47.17	40.55	40.43	34.25	33.32	81.46	72.97	78.27	109.75	126.46	110.69
Min.	0.02	0.06	0.14	1.86	2.18	3.24	48.62	48.43	50.96	70.40	69.77	72.93
Range	42.86	47.10	40.41	38.57	32.07	30.08	32.84	24.55	27.31	39.35	56.69	37.76
1	6.06	6.45	6.71	14.43	14.73	15.65	57.97	60.84	61.64	78.45	79.68	83.64
2	42.88	47.17	40.55	40.43	34.25	33.32	73.89	72.97	78.27	91.27	93.38	101.61
3	13.07	10.91	13.57	14.38	14.80	15.65	58.01	61.68	63.43	83.24	84.43	89.24
4	1.59	1.71	2.05	10.16	10.38	11.31	52.90	53.32	55.87	74.46	75.15	78.27
5	3.42	3.66	3.87	9.08	9.45	10.55	55.36	57.88	61.22	82.80	84.61	92.21
6	3.24	3.66	2.34	10.34	11.20	11.65	59.27	63.19	63.88	82.66	84.24	88.83
7	6.88	7.29	12.07	14.69	14.94	15.90	58.65	59.71	62.35	81.83	83.53	87.06
8	7.10	7.54	7.75	19.05	21.02	19.37	81.46	71.28	76.81	109.75	126.46	110.69
9	21.33	22.37	21.82	25.24	25.67	26.62	70.23	71.22	74.70	94.99	95.53	103.24
10	0.02	0.06	0.14	1.86	2.18	3.24	48.62	48.43	50.96	70.40	69.77	72.93

3.3. Optical Receiver Sensitivity

3.3.1. Test Descriptions

The receiver sensitivity tests were performed by performing a sweep of optical powers and recording the BER for those optical powers.

In the case of 10.3125 and 11.3 data rates the output of the ROSA is passed through a GN2013 CDR before reaching the BERT. This is done because the sensitivity of the GN2013 CDR is much better than the BERT inputs and allows for a much better measurement of the true sensitivity of the ROSA.

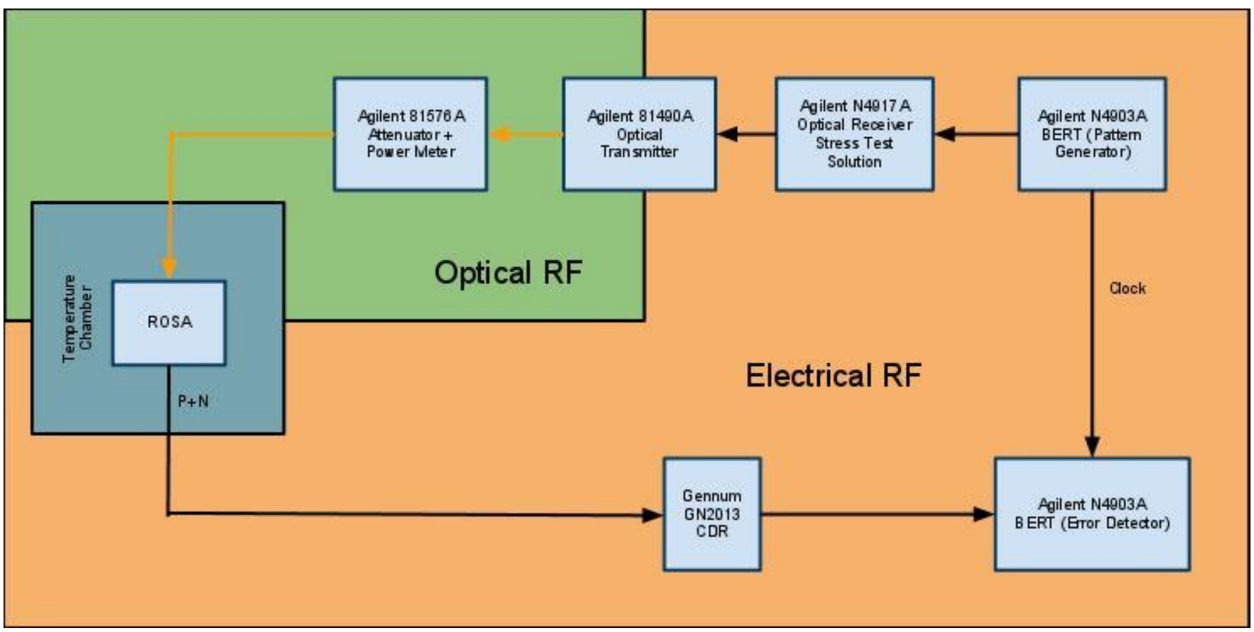


Figure 1. Sensitivity testing Block Diagram.

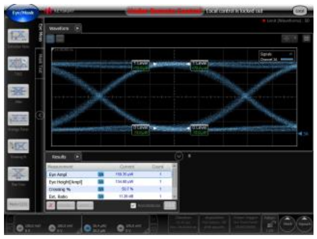


Figure 2. 1310nm 11.3Gbps Input Eye

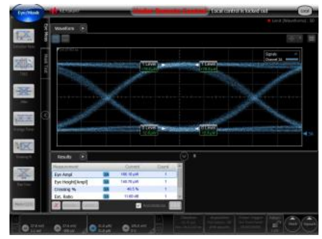


Figure 3. 1550nm 11.3Gbps Input Eye

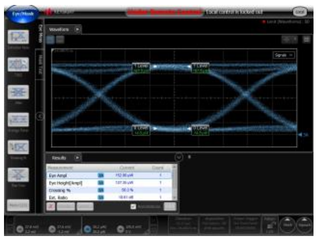


Figure 4. 1310nm 10.3125Gbps Input Eye

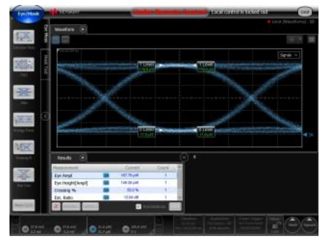


Figure 5. 1550nm 10.3125Gbps Input Eye

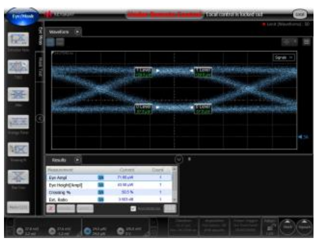


Figure 6. 1310 BaseL Input Eye

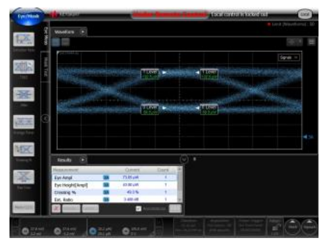


Figure 7. 1550 BaseL Input Eye

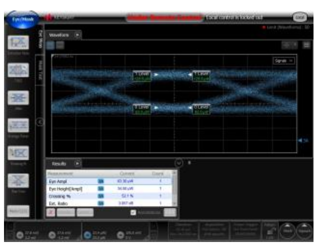


Figure 8. 1310 BaseE Input Eye

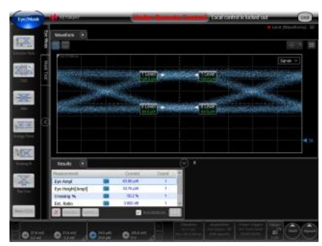
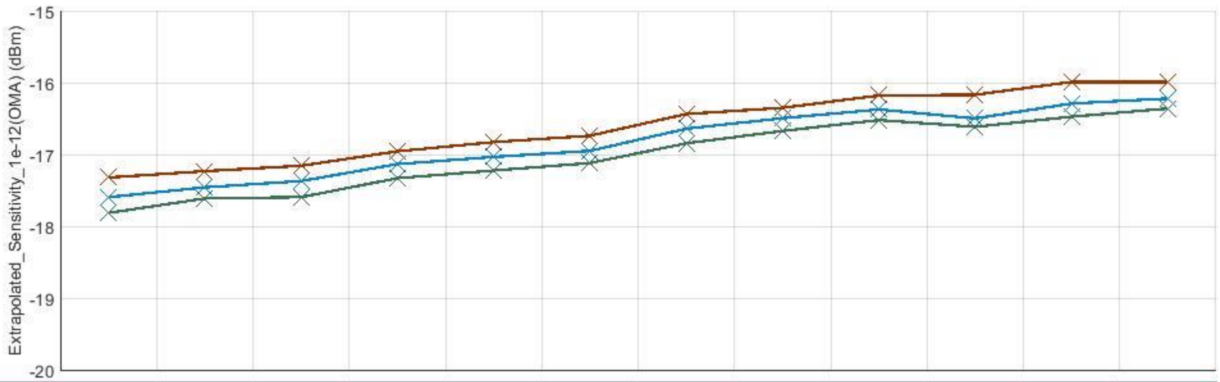


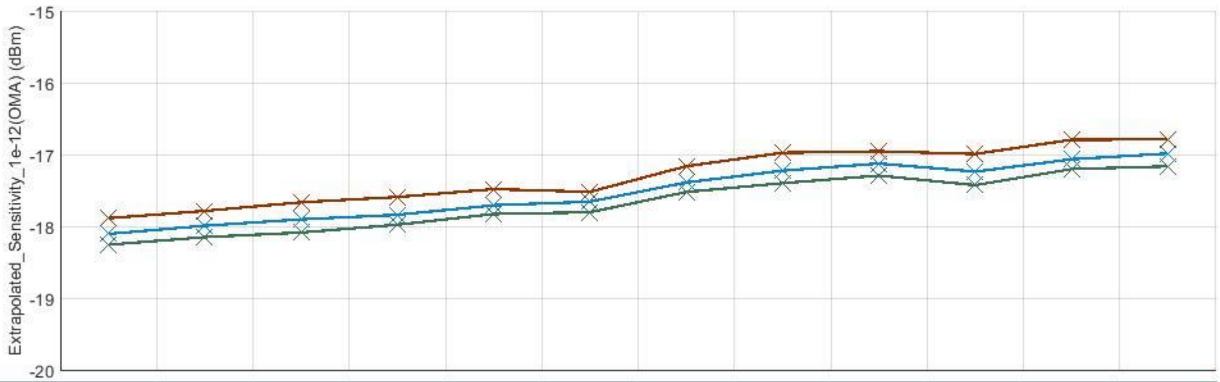
Figure 9. 1550 BaseE Input Eye

3.3.2. Unstressed Receiver Sensitivity at 1310nm and 11.3Gbps (dBm OMA)



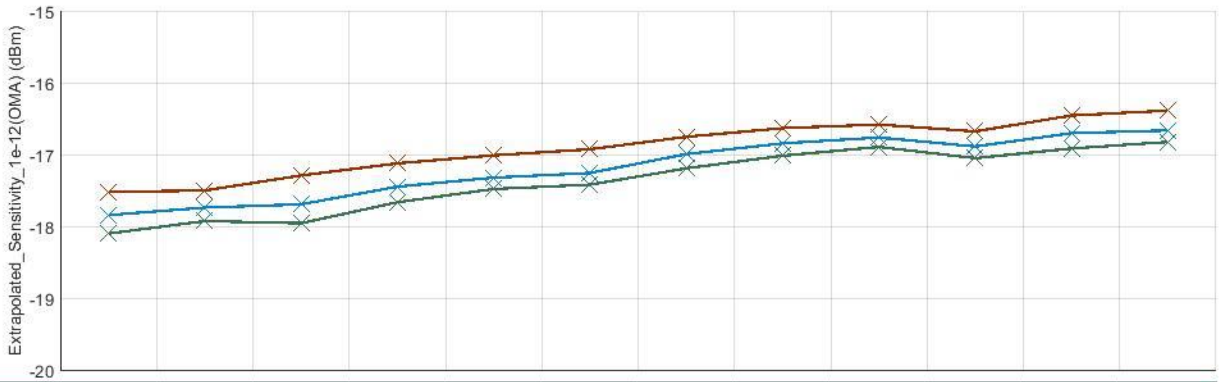
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	-17.59	-17.46	-17.37	-17.13	-17.03	-16.95	-16.64	-16.49	-16.37	-16.50	-16.29	-16.22
Median	-17.59	-17.47	-17.35	-17.13	-17.04	-16.96	-16.63	-16.47	-16.41	-16.54	-16.30	-16.24
Std. Dev.	0.15	0.12	0.15	0.11	0.12	0.11	0.12	0.11	0.09	0.13	0.14	0.11
Max.	-17.32	-17.23	-17.16	-16.96	-16.83	-16.74	-16.44	-16.35	-16.18	-16.17	-15.99	-15.99
Min.	-17.81	-17.61	-17.59	-17.33	-17.22	-17.12	-16.84	-16.67	-16.52	-16.61	-16.47	-16.36
Range	0.49	0.38	0.44	0.37	0.40	0.38	0.41	0.32	0.34	0.45	0.48	0.37
1	-17.55	-17.47	-17.35	-17.13	-17.09	-16.88	-16.67	-16.56	-16.43	-16.61	-16.40	-16.31
2	-17.59	-17.43	-17.38	-17.07	-16.93	-16.88	-16.61	-16.46	-16.42	-16.51	-16.32	-16.26
3	-17.61	-17.47	-17.35	-17.18	-17.04	-16.99	-16.68	-16.42	-16.31	-16.46	-16.20	-16.21
4	-17.81	-17.60	-17.57	-17.25	-17.22	-17.04	-16.65	-16.48	-16.41	-16.52	-16.29	-16.20
5	-17.68	-17.56	-17.49	-17.33	-17.12	-17.03	-16.79	-16.64	-16.42	-16.60	-16.47	-16.23
6	-17.32	-17.23	-17.16	-16.96	-16.83	-16.74	-16.44	-16.36	-16.18	-16.40	-16.22	-16.09
7	-17.47	-17.36	-17.34	-17.02	-17.05	-16.93	-16.61	-16.54	-16.41	-16.55	-16.35	-16.30
8	-17.53	-17.33	-17.27	-17.06	-16.93	-16.88	-16.61	-16.45	-16.31	-16.57	-16.23	-16.25
9	-17.59	-17.51	-17.20	-17.13	-16.95	-17.00	-16.52	-16.35	-16.34	-16.17	-15.99	-15.99
10	-17.79	-17.61	-17.59	-17.22	-17.17	-17.12	-16.84	-16.67	-16.52	-16.58	-16.43	-16.36

3.3.3. Unstressed Receiver Sensitivity at 1550nm and 11.3Gbps (dBm OMA)



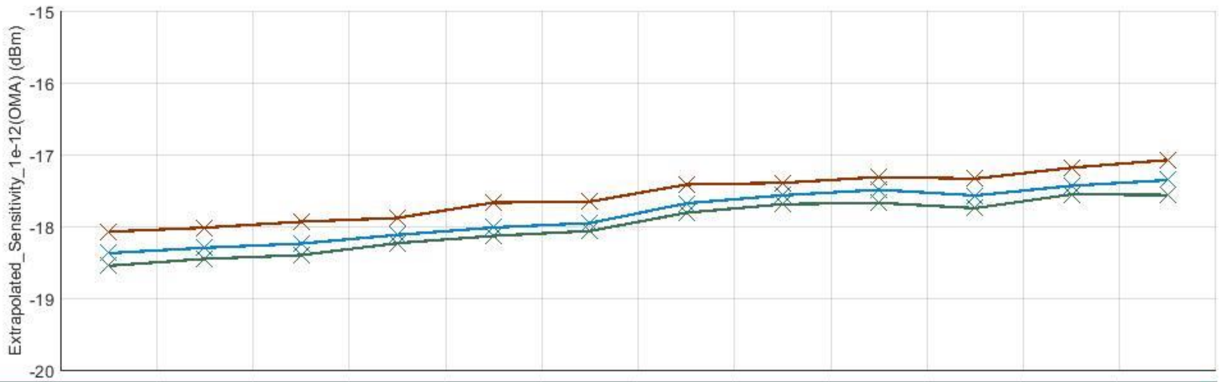
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	-18.11	-17.99	-17.90	-17.84	-17.71	-17.66	-17.39	-17.23	-17.13	-17.24	-17.07	-16.99
Median	-18.12	-17.99	-17.91	-17.86	-17.72	-17.68	-17.41	-17.24	-17.13	-17.23	-17.11	-16.96
Std. Dev.	0.12	0.11	0.14	0.11	0.11	0.08	0.11	0.12	0.10	0.13	0.13	0.13
Max.	-17.89	-17.79	-17.67	-17.59	-17.48	-17.52	-17.16	-16.98	-16.95	-16.99	-16.80	-16.79
Min.	-18.26	-18.15	-18.09	-17.98	-17.83	-17.80	-17.52	-17.40	-17.29	-17.43	-17.20	-17.17
Range	0.37	0.37	0.42	0.39	0.35	0.28	0.36	0.42	0.34	0.43	0.41	0.38
1	-18.15	-18.11	-18.01	-17.86	-17.83	-17.63	-17.49	-17.26	-17.14	-17.40	-17.17	-17.11
2	-18.21	-17.97	-17.95	-17.87	-17.67	-17.67	-17.40	-17.24	-17.13	-17.21	-17.09	-16.92
3	-18.07	-17.92	-17.83	-17.81	-17.73	-17.59	-17.40	-17.24	-17.10	-17.25	-17.14	-16.96
4	-18.20	-18.06	-18.09	-17.91	-17.82	-17.69	-17.46	-17.22	-17.15	-17.16	-17.04	-16.97
5	-18.19	-18.09	-17.99	-17.92	-17.77	-17.71	-17.52	-17.34	-17.21	-17.43	-17.20	-17.09
6	-17.89	-17.79	-17.75	-17.59	-17.48	-17.52	-17.16	-16.98	-16.95	-17.12	-16.90	-16.80
7	-18.09	-17.99	-17.87	-17.89	-17.72	-17.69	-17.43	-17.29	-17.22	-17.32	-17.15	-17.12
8	-17.93	-17.86	-17.82	-17.77	-17.60	-17.58	-17.28	-17.20	-17.05	-17.21	-17.01	-16.94
9	-18.07	-17.99	-17.67	-17.81	-17.70	-17.69	-17.29	-17.10	-17.01	-16.99	-16.80	-16.79
10	-18.26	-18.15	-18.06	-17.98	-17.76	-17.80	-17.47	-17.40	-17.29	-17.31	-17.16	-17.17

3.3.1. Unstressed Receiver Sensitivity at 1310nm and 10.3125Gbps (dBm OMA)



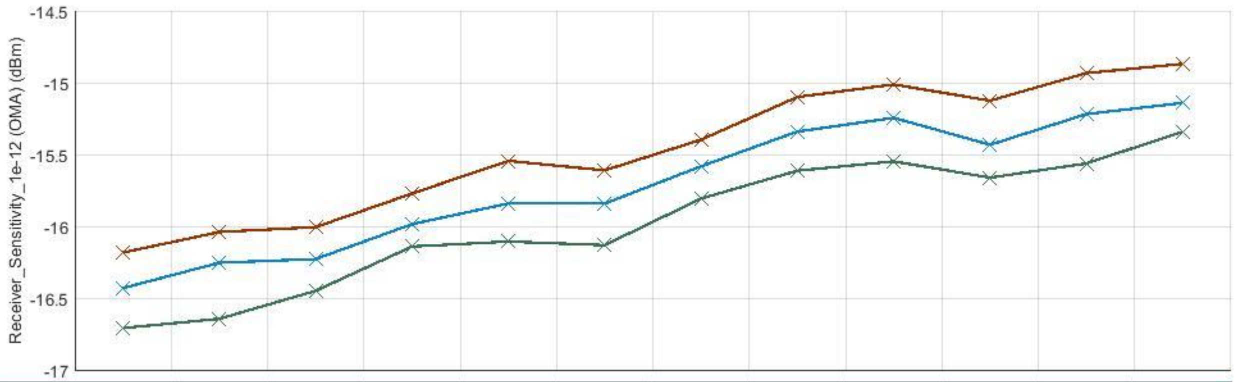
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	-17.84	-17.74	-17.69	-17.45	-17.32	-17.26	-16.99	-16.85	-16.76	-16.89	-16.70	-16.66
Median	-17.87	-17.77	-17.70	-17.47	-17.34	-17.30	-17.01	-16.84	-16.78	-16.89	-16.73	-16.67
Std. Dev.	0.17	0.14	0.21	0.15	0.14	0.15	0.14	0.11	0.11	0.13	0.14	0.13
Max.	-17.52	-17.50	-17.29	-17.12	-17.01	-16.93	-16.75	-16.63	-16.58	-16.68	-16.46	-16.39
Min.	-18.10	-17.93	-17.96	-17.67	-17.48	-17.42	-17.19	-17.02	-16.89	-17.05	-16.92	-16.83
Range	0.58	0.43	0.67	0.54	0.47	0.49	0.44	0.38	0.31	0.37	0.46	0.44
1	-17.89	-17.83	-17.79	-17.47	-17.31	-17.25	-17.01	-16.92	-16.89	-17.04	-16.92	-16.83
2	-17.88	-17.72	-17.66	-17.42	-17.33	-17.28	-17.06	-16.79	-16.77	-16.98	-16.72	-16.74
3	-17.83	-17.74	-17.75	-17.41	-17.45	-17.33	-17.00	-16.91	-16.75	-16.81	-16.68	-16.65
4	-18.10	-17.93	-17.95	-17.59	-17.43	-17.42	-17.07	-16.89	-16.79	-16.93	-16.74	-16.74
5	-17.81	-17.87	-17.85	-17.53	-17.35	-17.36	-17.15	-17.02	-16.88	-16.98	-16.79	-16.67
6	-17.52	-17.50	-17.29	-17.12	-17.01	-16.93	-16.75	-16.63	-16.58	-16.74	-16.48	-16.50
7	-17.64	-17.51	-17.52	-17.31	-17.21	-17.12	-16.90	-16.79	-16.79	-16.83	-16.79	-16.67
8	-17.85	-17.67	-17.58	-17.50	-17.27	-17.15	-16.97	-16.79	-16.73	-16.85	-16.66	-16.66
9	-17.94	-17.80	-17.61	-17.46	-17.40	-17.32	-16.84	-16.76	-16.59	-16.68	-16.46	-16.39
10	-17.98	-17.83	-17.96	-17.67	-17.48	-17.41	-17.19	-16.96	-16.86	-17.05	-16.80	-16.81

3.3.2. Unstressed Receiver Sensitivity at 1550nm and 10.3125Gbps (dBm OMA)



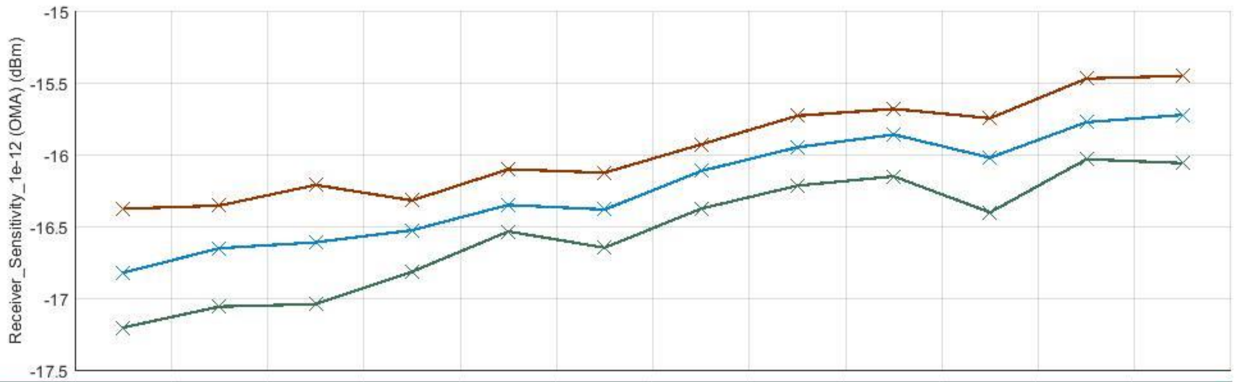
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	-18.37	-18.30	-18.24	-18.12	-18.02	-17.96	-17.68	-17.57	-17.49	-17.57	-17.44	-17.36
Median	-18.38	-18.33	-18.31	-18.16	-18.05	-18.01	-17.71	-17.59	-17.51	-17.57	-17.46	-17.36
Std. Dev.	0.13	0.13	0.16	0.11	0.14	0.13	0.12	0.09	0.12	0.13	0.12	0.15
Max.	-18.08	-18.02	-17.94	-17.88	-17.67	-17.66	-17.42	-17.40	-17.31	-17.34	-17.18	-17.08
Min.	-18.55	-18.45	-18.40	-18.24	-18.13	-18.07	-17.81	-17.69	-17.67	-17.75	-17.56	-17.57
Range	0.48	0.43	0.46	0.35	0.46	0.41	0.39	0.30	0.36	0.41	0.37	0.49
1	-18.34	-18.32	-18.34	-18.11	-18.09	-17.95	-17.71	-17.64	-17.57	-17.58	-17.56	-17.48
2	-18.39	-18.33	-18.31	-18.15	-17.99	-18.00	-17.81	-17.58	-17.46	-17.65	-17.45	-17.35
3	-18.35	-18.22	-18.22	-18.19	-18.06	-18.02	-17.62	-17.59	-17.49	-17.55	-17.40	-17.28
4	-18.48	-18.45	-18.35	-18.24	-18.11	-18.07	-17.70	-17.56	-17.58	-17.52	-17.43	-17.38
5	-18.50	-18.37	-18.37	-18.19	-18.13	-18.02	-17.74	-17.69	-17.60	-17.69	-17.54	-17.51
6	-18.08	-18.02	-17.94	-17.88	-17.67	-17.66	-17.42	-17.40	-17.32	-17.38	-17.28	-17.18
7	-18.38	-18.33	-18.31	-18.17	-18.04	-18.03	-17.79	-17.60	-17.53	-17.70	-17.51	-17.42
8	-18.29	-18.16	-18.17	-18.01	-17.93	-17.81	-17.64	-17.55	-17.38	-17.56	-17.48	-17.34
9	-18.39	-18.34	-18.00	-18.07	-18.04	-17.94	-17.58	-17.43	-17.31	-17.34	-17.18	-17.08
10	-18.55	-18.45	-18.40	-18.20	-18.11	-18.07	-17.79	-17.66	-17.67	-17.75	-17.54	-17.57

3.3.3. Stressed Receiver Sensitivity at 1310nm and BaseL (dBm OMA)



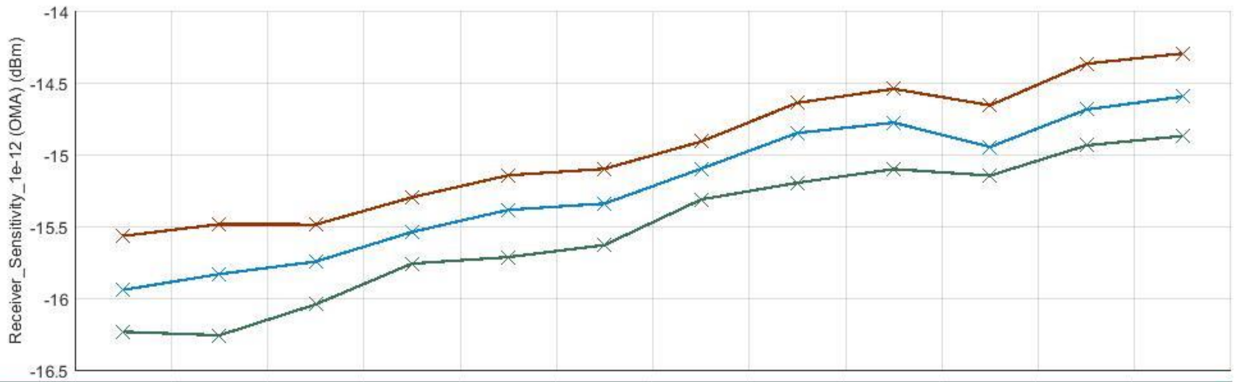
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	-16.43	-16.25	-16.23	-15.99	-15.84	-15.84	-15.58	-15.34	-15.24	-15.43	-15.22	-15.14
Median	-16.43	-16.16	-16.21	-16.05	-15.82	-15.82	-15.56	-15.32	-15.22	-15.46	-15.20	-15.14
Std. Dev.	0.16	0.21	0.17	0.15	0.17	0.16	0.12	0.16	0.15	0.16	0.19	0.14
Max.	-16.18	-16.04	-16.01	-15.77	-15.54	-15.61	-15.40	-15.10	-15.01	-15.13	-14.93	-14.87
Min.	-16.71	-16.64	-16.45	-16.14	-16.11	-16.13	-15.81	-15.61	-15.55	-15.66	-15.56	-15.34
Range	0.53	0.60	0.44	0.37	0.56	0.52	0.41	0.51	0.54	0.54	0.63	0.47
1	-16.37	-16.19	-16.15	-15.77	-15.54	-15.82	-15.62	-15.28	-15.15	-15.29	-15.18	-15.00
2	-16.53	-16.15	-16.45	-16.05	-15.79	-15.82	-15.47	-15.20	-15.17	-15.51	-15.22	-15.11
3	-16.29	-16.17	-16.04	-15.82	-15.71	-15.86	-15.52	-15.22	-15.17	-15.40	-14.94	-15.09
4	-16.71	-16.54	-16.37	-16.14	-16.11	-16.13	-15.53	-15.36	-15.26	-15.43	-15.18	-15.08
5	-16.47	-16.11	-16.28	-16.05	-15.94	-15.75	-15.66	-15.50	-15.32	-15.52	-15.36	-15.17
6	-16.18	-16.14	-16.08	-15.81	-15.76	-15.61	-15.51	-15.48	-15.21	-15.29	-15.19	-15.26
7	-16.53	-16.47	-16.35	-16.10	-15.96	-15.94	-15.81	-15.38	-15.40	-15.61	-15.41	-15.31
8	-16.27	-16.08	-16.12	-15.89	-15.70	-15.66	-15.58	-15.28	-15.22	-15.50	-15.21	-15.18
9	-16.39	-16.04	-16.01	-16.10	-15.85	-15.77	-15.40	-15.10	-15.01	-15.13	-14.93	-14.87
10	-16.55	-16.64	-16.45	-16.13	-16.05	-16.06	-15.73	-15.61	-15.55	-15.66	-15.56	-15.34

3.3.4. Stressed Receiver Sensitivity at 1550nm and BaseL (dBm OMA)



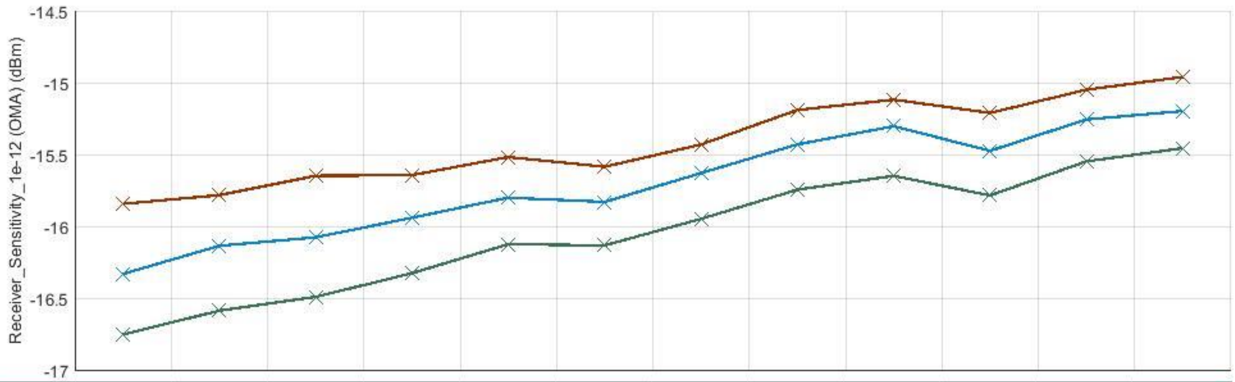
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	-16.82	-16.65	-16.61	-16.53	-16.35	-16.38	-16.12	-15.95	-15.86	-16.02	-15.78	-15.72
Median	-16.81	-16.58	-16.60	-16.44	-16.32	-16.36	-16.07	-15.92	-15.80	-15.96	-15.73	-15.68
Std. Dev.	0.27	0.26	0.27	0.19	0.17	0.16	0.16	0.15	0.17	0.19	0.18	0.20
Max.	-16.38	-16.36	-16.21	-16.32	-16.10	-16.13	-15.93	-15.73	-15.68	-15.75	-15.47	-15.45
Min.	-17.21	-17.06	-17.04	-16.82	-16.54	-16.65	-16.38	-16.22	-16.15	-16.40	-16.03	-16.06
Range	0.83	0.70	0.83	0.50	0.43	0.52	0.45	0.49	0.47	0.66	0.56	0.61
1	-16.77	-16.61	-16.49	-16.36	-16.27	-16.35	-16.13	-15.95	-15.84	-15.97	-15.66	-15.59
2	-16.99	-16.67	-16.89	-16.32	-16.23	-16.39	-15.99	-15.87	-15.68	-15.94	-15.75	-15.62
3	-16.67	-16.54	-16.36	-16.38	-16.10	-16.30	-16.04	-16.01	-15.92	-16.04	-15.69	-15.73
4	-17.08	-16.94	-16.68	-16.82	-16.51	-16.51	-16.06	-15.88	-15.74	-15.95	-15.68	-15.66
5	-16.86	-16.54	-16.73	-16.81	-16.53	-16.36	-16.27	-16.10	-16.06	-16.17	-16.03	-15.96
6	-16.63	-16.36	-16.37	-16.41	-16.17	-16.13	-15.93	-15.83	-15.73	-15.89	-15.71	-15.56
7	-17.21	-16.99	-16.84	-16.68	-16.54	-16.59	-16.32	-16.08	-16.05	-16.18	-15.96	-15.92
8	-16.58	-16.46	-16.51	-16.48	-16.25	-16.21	-16.07	-15.83	-15.76	-15.93	-15.80	-15.70
9	-16.38	-16.36	-16.21	-16.38	-16.37	-16.35	-15.97	-15.73	-15.69	-15.75	-15.47	-15.45
10	-17.09	-17.06	-17.04	-16.63	-16.54	-16.65	-16.38	-16.22	-16.15	-16.40	-16.00	-16.06

3.3.5. Stressed Receiver Sensitivity at 1310nm and BaseE (dBm OMA)



Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	-15.94	-15.83	-15.75	-15.54	-15.39	-15.34	-15.10	-14.85	-14.78	-14.95	-14.69	-14.60
Median	-15.94	-15.80	-15.79	-15.53	-15.38	-15.32	-15.11	-14.79	-14.78	-14.95	-14.75	-14.58
Std. Dev.	0.22	0.24	0.20	0.16	0.18	0.16	0.13	0.18	0.16	0.16	0.19	0.17
Max.	-15.57	-15.49	-15.49	-15.30	-15.15	-15.10	-14.91	-14.64	-14.54	-14.66	-14.37	-14.30
Min.	-16.23	-16.26	-16.04	-15.76	-15.72	-15.63	-15.31	-15.20	-15.10	-15.15	-14.94	-14.87
Range	0.67	0.77	0.56	0.46	0.57	0.53	0.40	0.56	0.56	0.49	0.57	0.57
1	-15.85	-15.80	-15.54	-15.31	-15.19	-15.27	-15.03	-14.83	-14.78	-14.82	-14.37	-14.47
2	-16.13	-15.85	-15.84	-15.45	-15.35	-15.40	-14.97	-14.71	-14.67	-14.95	-14.60	-14.48
3	-15.85	-15.79	-15.53	-15.30	-15.15	-15.16	-15.20	-14.77	-14.61	-14.84	-14.60	-14.58
4	-16.23	-16.09	-15.98	-15.76	-15.72	-15.49	-15.18	-14.71	-14.80	-14.87	-14.80	-14.55
5	-16.07	-15.53	-15.88	-15.60	-15.43	-15.36	-15.18	-15.12	-14.92	-15.12	-14.85	-14.74
6	-15.57	-15.70	-15.56	-15.54	-15.24	-15.10	-14.96	-14.76	-14.69	-14.94	-14.76	-14.57
7	-16.03	-16.02	-15.85	-15.69	-15.61	-15.47	-15.21	-14.94	-14.89	-15.13	-14.83	-14.81
8	-15.71	-15.80	-15.75	-15.48	-15.41	-15.27	-15.05	-14.81	-14.78	-14.99	-14.73	-14.61
9	-15.82	-15.49	-15.49	-15.53	-15.27	-15.26	-14.91	-14.64	-14.54	-14.66	-14.39	-14.30
10	-16.17	-16.26	-16.04	-15.74	-15.50	-15.63	-15.31	-15.20	-15.10	-15.15	-14.94	-14.87

3.3.6. Stressed Receiver Sensitivity at 1550nm and BaseE (dBm OMA)



Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	-16.33	-16.14	-16.08	-15.94	-15.80	-15.83	-15.63	-15.43	-15.30	-15.47	-15.26	-15.20
Median	-16.32	-16.06	-16.09	-15.89	-15.75	-15.81	-15.58	-15.40	-15.24	-15.43	-15.23	-15.17
Std. Dev.	0.33	0.29	0.26	0.21	0.20	0.20	0.18	0.17	0.17	0.19	0.18	0.16
Max.	-15.84	-15.78	-15.65	-15.64	-15.52	-15.59	-15.43	-15.19	-15.12	-15.21	-15.05	-14.96
Min.	-16.75	-16.59	-16.49	-16.33	-16.13	-16.13	-15.95	-15.75	-15.65	-15.79	-15.55	-15.46
Range	0.91	0.80	0.84	0.68	0.61	0.55	0.52	0.56	0.53	0.57	0.50	0.50
1	-16.31	-16.10	-15.86	-15.68	-15.64	-15.77	-15.60	-15.47	-15.18	-15.29	-15.10	-15.15
2	-16.52	-16.18	-16.34	-15.84	-15.71	-15.85	-15.51	-15.26	-15.14	-15.44	-15.14	-15.05
3	-16.10	-16.01	-15.83	-15.64	-15.52	-15.65	-15.62	-15.44	-15.37	-15.45	-15.24	-15.12
4	-16.68	-16.40	-16.17	-16.11	-16.05	-15.97	-15.52	-15.34	-15.22	-15.36	-15.09	-15.24
5	-16.33	-15.89	-16.13	-16.03	-15.92	-15.91	-15.76	-15.54	-15.42	-15.73	-15.37	-15.33
6	-15.99	-15.78	-15.93	-15.84	-15.63	-15.59	-15.46	-15.34	-15.26	-15.42	-15.23	-15.08
7	-16.75	-16.59	-16.33	-16.33	-16.13	-16.13	-15.88	-15.61	-15.49	-15.68	-15.54	-15.40
8	-15.84	-16.00	-16.05	-15.91	-15.68	-15.65	-15.56	-15.36	-15.18	-15.38	-15.26	-15.20
9	-16.06	-15.85	-15.65	-15.87	-15.79	-15.66	-15.43	-15.19	-15.12	-15.21	-15.05	-14.96
10	-16.73	-16.56	-16.49	-16.14	-15.96	-16.12	-15.95	-15.75	-15.65	-15.79	-15.55	-15.46

3.4. Optical Overload

3.4.1. Test Descriptions

The optical overload is measured by decreasing the average optical power to the ROSA in steps from a suitable power level.

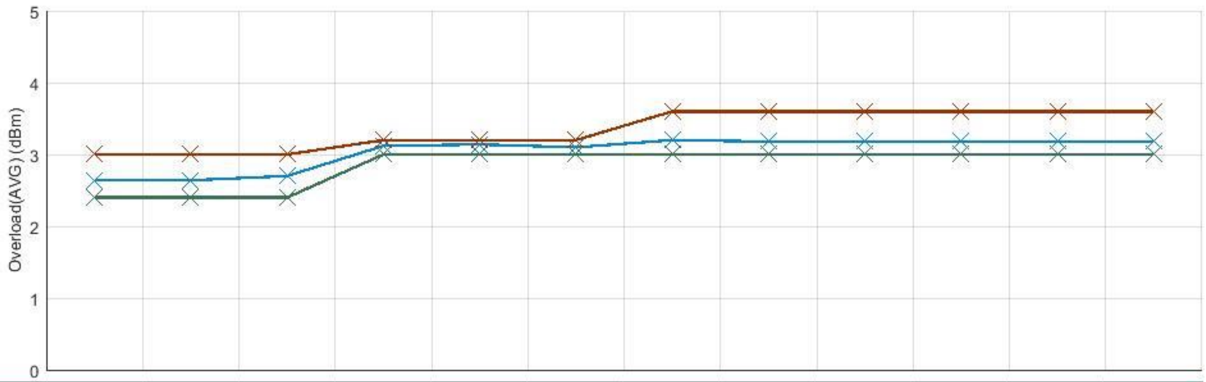
In the case of 10.3125 and 11.3 data rates the output of the ROSA is passed through a GN2013 CDR before reaching the BERT.

In some cases, the overload test was limited by the maximum optical power of the optical transmitter. As a result, the results in the report only represent a lower bound to the performance of the ROSAs. The ROSA performance is better than results presented in some cases. (Worst case is -40C, 11.3G and 1550nm)

The input eyes used are the same as for the sensitivity tests.

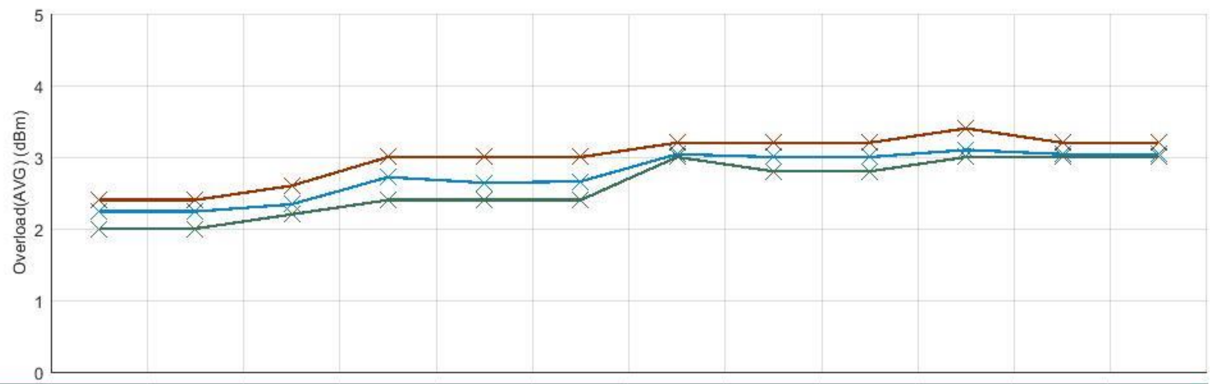
The equipment setup is the same as for the sensitivity tests.

3.4.2. Overload at 1310nm and 11.3Gbps (Avg. power dBm)



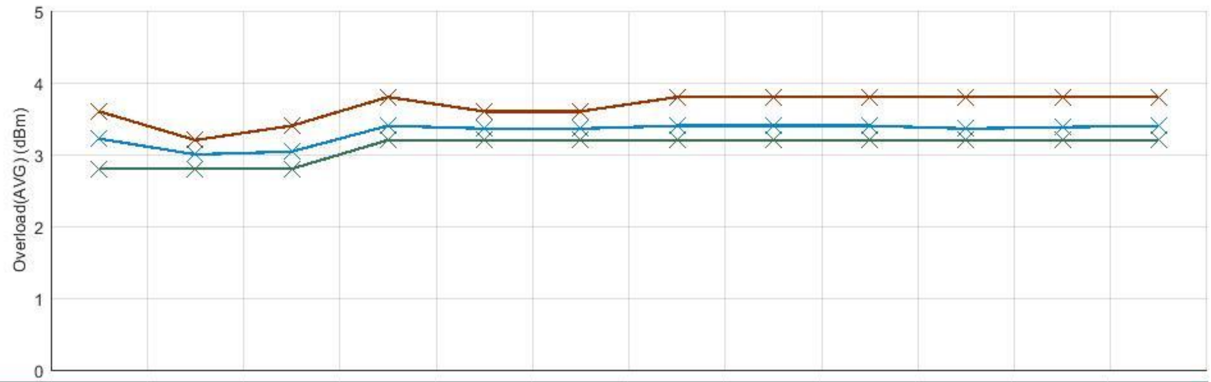
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	2.64	2.64	2.70	3.12	3.14	3.10	3.20	3.18	3.18	3.18	3.18	3.18
Median	2.60	2.60	2.70	3.20	3.20	3.10	3.20	3.20	3.20	3.20	3.20	3.20
Std. Dev.	0.16	0.16	0.17	0.10	0.10	0.11	0.23	0.20	0.20	0.20	0.20	0.20
Max.	3.00	3.00	3.00	3.20	3.20	3.20	3.60	3.60	3.60	3.60	3.60	3.60
Min.	2.40	2.40	2.40	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Range	0.60	0.60	0.60	0.20	0.20	0.20	0.60	0.60	0.60	0.60	0.60	0.60
1	2.60	2.60	2.60	3.20	3.20	3.00	3.60	3.40	3.40	3.40	3.40	3.40
2	2.60	2.60	2.60	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
3	2.60	2.60	2.60	3.20	3.20	3.20	3.60	3.60	3.60	3.60	3.60	3.60
4	2.40	2.40	2.40	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
5	2.60	2.60	2.80	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
6	3.00	3.00	3.00	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
7	2.80	2.80	2.80	3.00	3.20	3.00	3.00	3.00	3.00	3.00	3.00	3.00
8	2.60	2.60	2.80	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
9	2.60	2.60	2.80	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
10	2.60	2.60	2.60	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20

3.4.3. Overload at 1550nm and 11.3Gbps (Avg. power dBm)



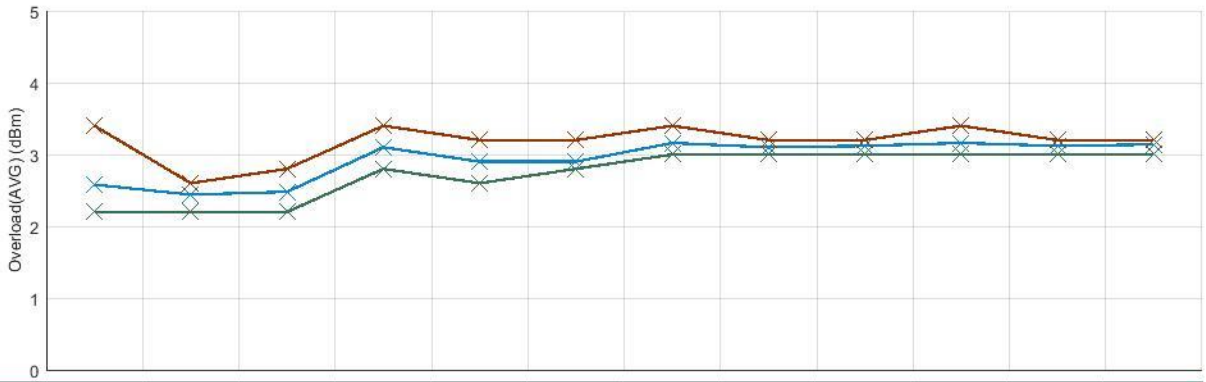
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	2.24	2.24	2.34	2.72	2.64	2.66	3.04	3.00	3.00	3.10	3.04	3.04
Median	2.20	2.20	2.30	2.80	2.60	2.60	3.00	3.00	3.00	3.00	3.00	3.00
Std. Dev.	0.13	0.13	0.16	0.17	0.16	0.16	0.08	0.09	0.09	0.14	0.08	0.08
Max.	2.40	2.40	2.60	3.00	3.00	3.00	3.20	3.20	3.20	3.40	3.20	3.20
Min.	2.00	2.00	2.20	2.40	2.40	2.40	3.00	2.80	2.80	3.00	3.00	3.00
Range	0.40	0.40	0.40	0.60	0.60	0.60	0.20	0.40	0.40	0.40	0.20	0.20
1	2.20	2.20	2.20	2.60	2.60	2.60	3.20	2.80	2.80	3.20	3.00	3.00
2	2.20	2.20	2.20	2.80	2.60	2.60	3.00	3.00	3.00	3.20	3.20	3.20
3	2.20	2.20	2.40	2.60	2.60	2.60	3.00	3.00	3.00	3.40	3.00	3.00
4	2.00	2.00	2.20	2.40	2.40	2.40	3.00	3.00	3.00	3.00	3.00	3.00
5	2.20	2.20	2.40	2.80	2.60	2.80	3.00	3.00	3.00	3.00	3.00	3.00
6	2.40	2.40	2.60	3.00	3.00	3.00	3.20	3.20	3.20	3.20	3.20	3.20
7	2.20	2.20	2.20	2.60	2.60	2.60	3.00	3.00	3.00	3.00	3.00	3.00
8	2.40	2.40	2.40	2.80	2.80	2.80	3.00	3.00	3.00	3.00	3.00	3.00
9	2.40	2.40	2.60	2.80	2.60	2.60	3.00	3.00	3.00	3.00	3.00	3.00
10	2.20	2.20	2.20	2.80	2.60	2.60	3.00	3.00	3.00	3.00	3.00	3.00

3.4.4. Overload at 1310nm and 10.3125Gbps (Avg. power dBm)



Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	3.22	3.00	3.04	3.40	3.36	3.36	3.40	3.40	3.40	3.36	3.38	3.40
Median	3.20	3.00	3.00	3.40	3.40	3.40	3.40	3.40	3.40	3.30	3.40	3.40
Std. Dev.	0.27	0.13	0.18	0.23	0.16	0.13	0.23	0.23	0.23	0.21	0.20	0.23
Max.	3.60	3.20	3.40	3.80	3.60	3.60	3.80	3.80	3.80	3.80	3.80	3.80
Min.	2.80	2.80	2.80	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
Range	0.80	0.40	0.60	0.60	0.40	0.40	0.60	0.60	0.60	0.60	0.60	0.60
1	3.60	2.80	2.80	3.80	3.60	3.40	3.80	3.80	3.80	3.60	3.60	3.80
2	3.00	3.00	3.00	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40
3	3.60	3.00	3.00	3.80	3.60	3.60	3.80	3.80	3.80	3.80	3.80	3.80
4	2.80	2.80	2.80	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
5	3.40	3.00	3.00	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40
6	3.40	3.20	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.20	3.40	3.40
7	3.20	3.20	3.20	3.20	3.20	3.40	3.20	3.20	3.20	3.20	3.20	3.20
8	3.00	3.00	3.00	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
9	3.20	3.00	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
10	3.00	3.00	3.00	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40

3.4.5. Overload at 1550nm and 10.3125Gbps (Avg. power dBm)



Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	2.58	2.44	2.48	3.10	2.90	2.90	3.16	3.10	3.12	3.16	3.12	3.14
Median	2.60	2.40	2.40	3.00	2.90	2.80	3.20	3.10	3.20	3.20	3.20	3.20
Std. Dev.	0.32	0.13	0.17	0.19	0.17	0.14	0.16	0.11	0.10	0.16	0.10	0.10
Max.	3.40	2.60	2.80	3.40	3.20	3.20	3.40	3.20	3.20	3.40	3.20	3.20
Min.	2.20	2.20	2.20	2.80	2.60	2.80	3.00	3.00	3.00	3.00	3.00	3.00
Range	1.20	0.40	0.60	0.60	0.60	0.40	0.40	0.20	0.20	0.40	0.20	0.20
1	2.40	2.40	2.40	3.40	2.80	2.80	3.40	3.00	3.00	3.40	3.20	3.20
2	2.40	2.40	2.40	3.00	2.80	2.80	3.20	3.20	3.20	3.20	3.20	3.20
3	3.40	2.40	2.40	3.40	2.80	2.80	3.40	3.20	3.20	3.40	3.20	3.20
4	2.20	2.20	2.20	2.80	2.60	2.80	3.00	3.00	3.20	3.00	3.00	3.20
5	2.60	2.40	2.60	3.00	3.00	3.00	3.20	3.20	3.20	3.20	3.20	3.20
6	2.60	2.60	2.60	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
7	2.60	2.40	2.40	3.20	3.00	2.80	3.00	3.00	3.00	3.00	3.00	3.00
8	2.60	2.60	2.60	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
9	2.60	2.60	2.80	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
10	2.40	2.40	2.40	3.00	2.80	2.80	3.20	3.20	3.20	3.20	3.20	3.20

3.5. Electrical Output Eyes

3.5.1. Test Descriptions

Electrical output eyes of the P channel for the following conditions were measured at 11.3G data rate, unstressed eye at 1550nm wavelength.

1) Average power of -18dBm
2) Average power of -10dBm
3) Average power of 1.6dBm

Eye parameter measurements were made single ended. The following was measured.
1) Crossing Percentage
2) Rise Time
3) Fall Time
4) Eye Height
5) Eye Amplitude
6) Peak to Peak Jitter
7) RMS Jitter

The following tables contain P channel measurements obtained.

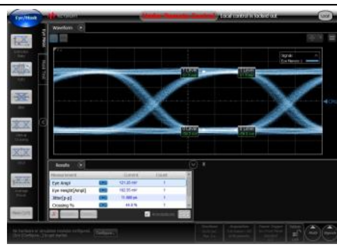
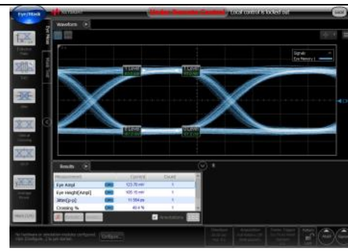
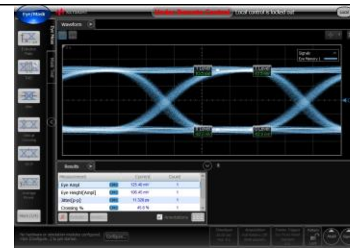
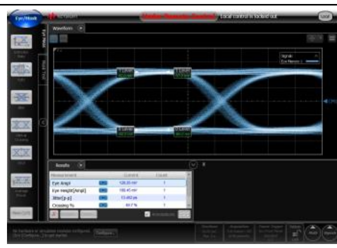
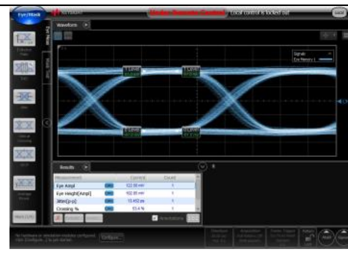
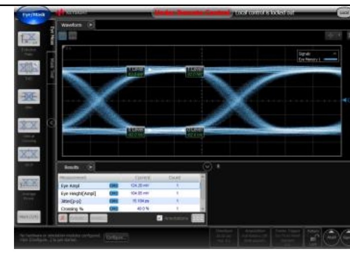
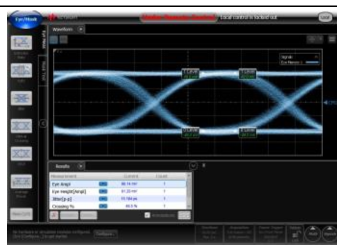
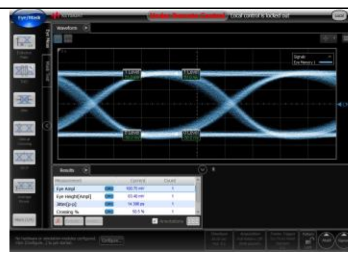
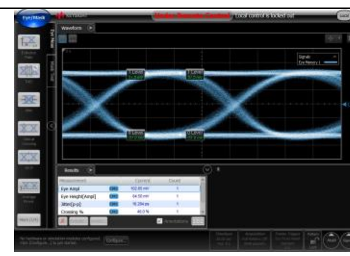
The input eyes used are the same as for the sensitivity tests.

The Jitter measurements are uncorrected for jitter of the source.

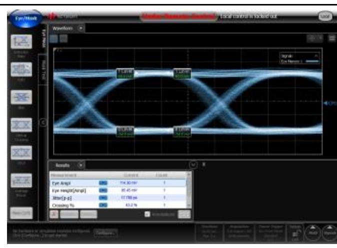
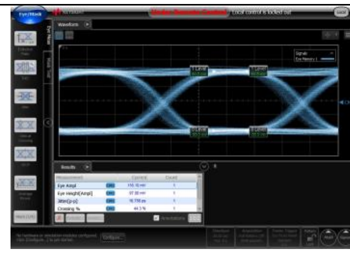
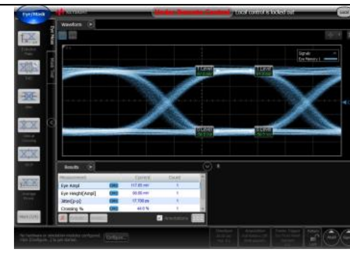
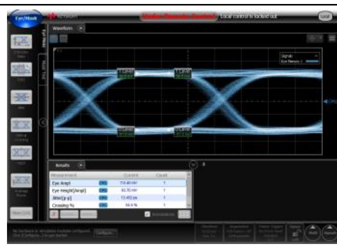
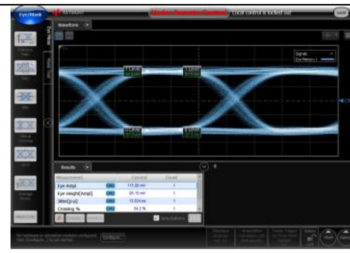
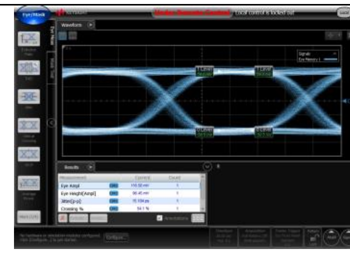
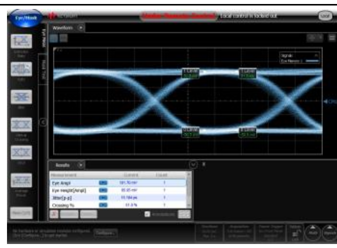
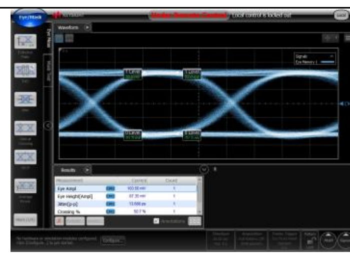
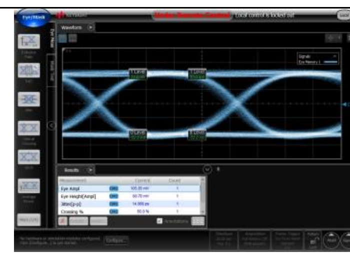
Long RF cables had to be used to test the ROSAs in a temperature chamber. Due to the attenuation in the RF cables from the ROSA to the scope, the measured parameters of the output eyes are negatively affected. The measured heights and amplitudes are lower than if the signal was directly measured at the output of the ROSA.

For information on the definitions of the eye diagram measurements see Appendix 1

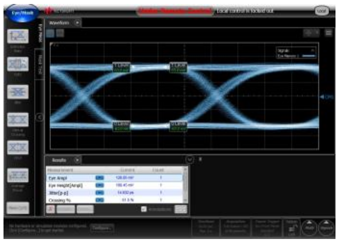
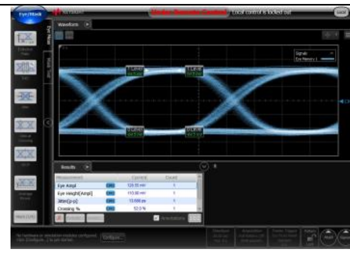
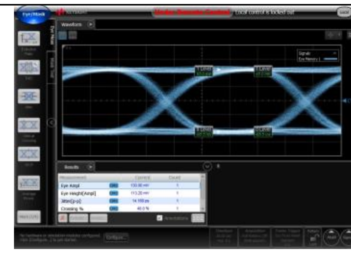
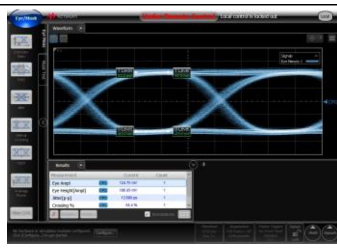
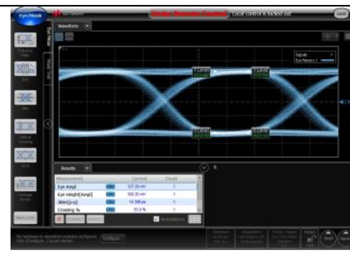
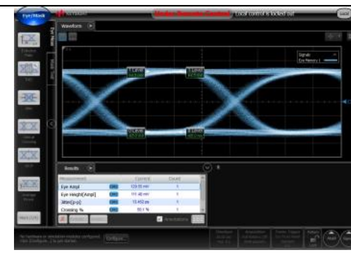
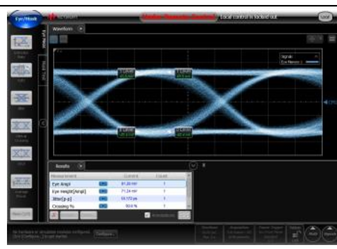
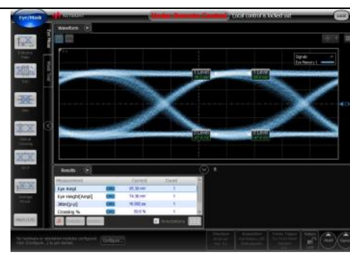
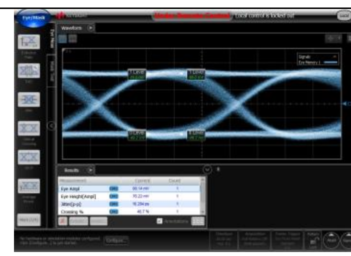
3.5.2. Typical Eye Diagrams at 25C

Optical Power\Vcc	2.97V	3. 3V	3.63V
1.6dBm			
-10dBm			
-18dBm			

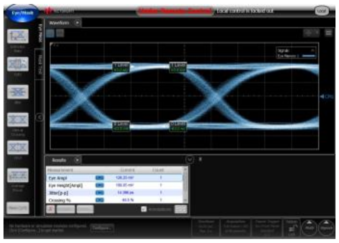
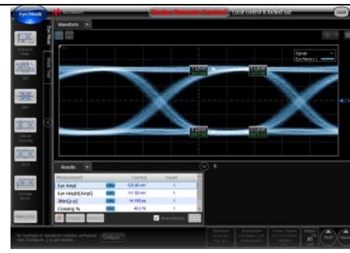
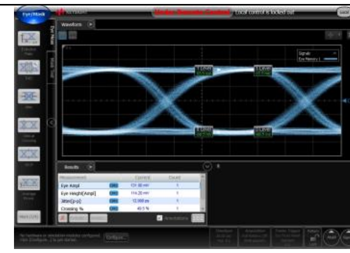
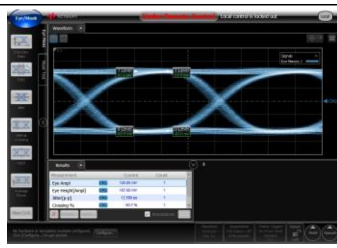
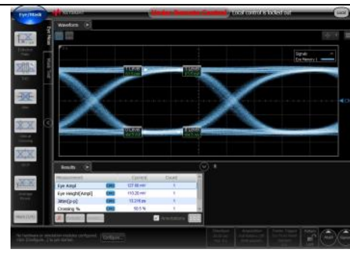
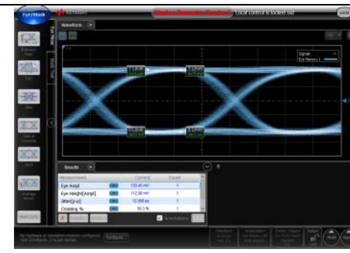
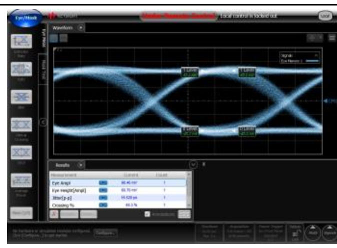
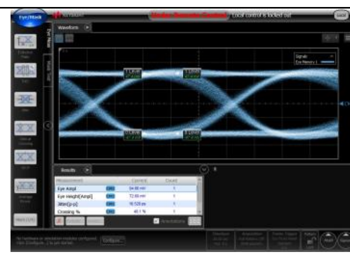
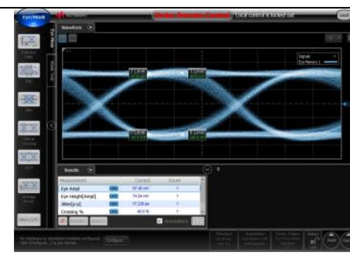
3.5.1. Typical Eye Diagrams at -40C

Optical Power\Vcc	2.97V	3. 3V	3.63V
1.6dBm			
-10dBm			
-18dBm			

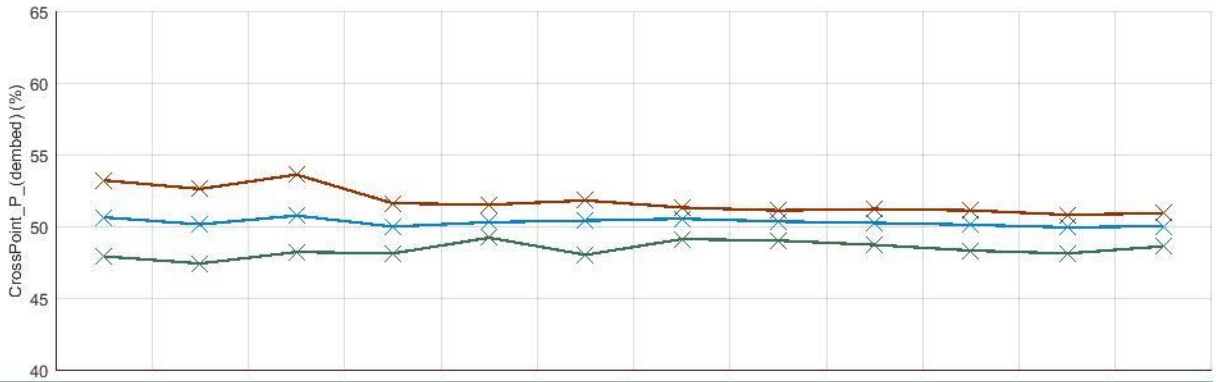
3.5.2. Typical Eye Diagrams at 85C

Optical Power\Vcc	2.97V	3. 3V	3.63V
1.6dBm			
-10dBm			
-18dBm			

3.5.3. Typical Eye Diagrams at 95C

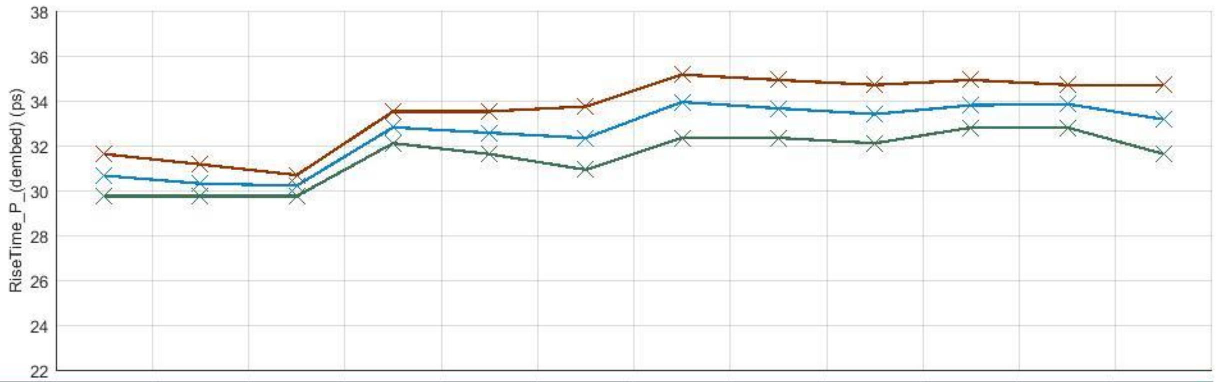
Optical Power\Vcc	2.97V	3. 3V	3.63V
1.6dBm			
-10dBm			
-18dBm			

3.5.4. Crossing Percentage at -18 dBm avg. Power at 1550nm and 11.3Gbps



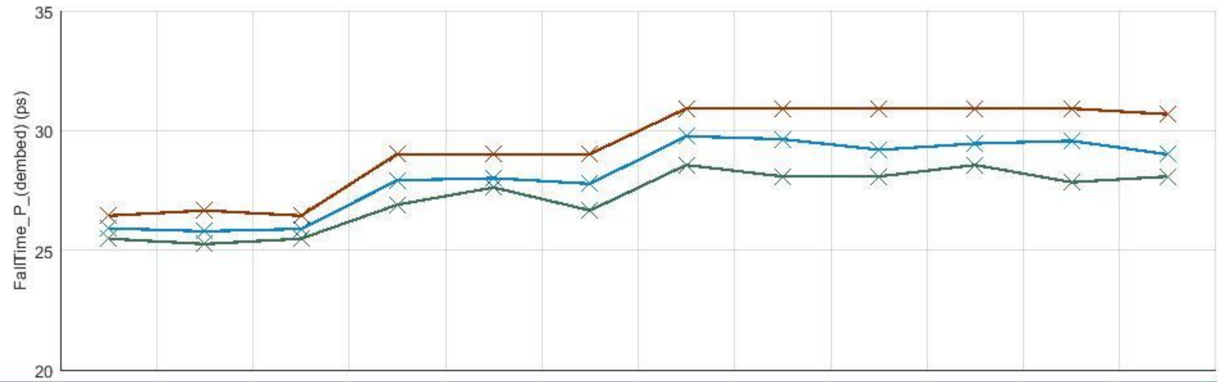
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	50.62	50.13	50.74	49.97	50.28	50.39	50.52	50.33	50.23	50.10	49.92	50.00
Median	50.45	50.40	50.75	50.35	50.25	50.55	50.65	50.55	50.60	50.50	50.40	50.35
Std. Dev.	1.53	1.67	1.60	1.19	0.82	1.17	0.71	0.74	1.00	0.98	0.93	0.84
Max.	53.20	52.60	53.60	51.60	51.50	51.80	51.30	51.10	51.20	51.10	50.80	50.90
Min.	47.90	47.40	48.20	48.10	49.20	48.00	49.10	49.00	48.70	48.30	48.10	48.60
Range	5.30	5.20	5.40	3.50	2.30	3.80	2.20	2.10	2.50	2.80	2.70	2.30
1	51.00	50.70	50.90	48.50	50.50	48.00	50.60	50.60	48.70	48.30	48.10	48.60
2	52.50	49.80	52.40	48.80	49.20	51.10	49.50	49.10	48.90	49.20	49.00	49.10
3	50.40	50.40	48.20	48.10	50.00	48.90	50.80	50.40	50.70	50.20	50.40	50.40
4	51.50	49.00	49.10	50.80	51.00	50.80	49.10	49.00	48.90	48.80	48.90	48.80
5	50.50	48.00	50.90	50.80	50.50	50.30	50.60	50.60	51.00	50.60	50.60	50.40
6	49.50	52.30	51.90	51.00	51.30	51.20	51.30	50.90	51.20	51.10	50.60	50.90
7	53.20	50.70	53.60	51.60	51.50	51.80	51.10	51.00	51.00	51.10	50.80	50.50
8	47.90	50.40	50.60	50.30	49.90	50.30	50.40	50.10	50.30	50.50	49.80	50.30
9	49.80	47.40	49.90	50.40	49.70	50.10	50.70	50.50	50.50	50.50	50.40	50.20
10	49.90	52.60	49.90	49.40	49.20	51.40	51.10	51.10	51.10	50.70	50.60	50.80

3.5.5. Rise Time at -18 dBm avg. Power at 1550nm and 11.3Gbps



Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	30.66	30.30	30.21	32.81	32.57	32.33	33.94	33.65	33.40	33.79	33.85	33.16
Median	30.56	30.20	30.20	32.92	32.68	32.22	33.75	33.63	33.40	33.40	33.75	33.16
Std. Dev.	0.57	0.54	0.37	0.54	0.52	0.92	1.01	0.90	0.92	0.91	0.71	1.02
Max.	31.62	31.16	30.68	33.52	33.52	33.74	35.16	34.92	34.70	34.92	34.70	34.70
Min.	29.74	29.74	29.74	32.10	31.62	30.92	32.34	32.34	32.10	32.80	32.80	31.62
Range	1.88	1.42	0.94	1.42	1.90	2.82	2.82	2.58	2.60	2.12	1.90	3.08
1	29.98	29.74	29.74	33.28	31.62	31.62	33.28	34.46	33.28	34.92	33.52	33.04
2	31.16	30.92	30.20	32.10	32.56	33.28	35.16	33.52	33.52	33.28	34.46	33.28
3	31.16	29.98	30.68	32.34	32.10	32.34	33.52	33.04	34.70	33.28	34.70	34.70
4	31.62	30.92	30.68	32.10	32.80	33.74	35.16	34.92	33.28	33.52	33.52	33.52
5	30.44	30.20	30.20	33.28	32.80	32.80	34.46	32.34	33.74	34.92	32.80	34.46
6	30.92	31.16	30.68	33.52	33.52	33.28	35.16	32.80	34.46	32.80	33.04	31.62
7	29.74	29.74	29.98	32.80	32.80	30.92	32.34	33.74	32.34	34.46	33.98	32.34
8	30.44	30.44	29.74	33.04	32.10	31.62	33.28	34.22	34.22	33.04	34.70	32.34
9	30.68	29.74	30.20	33.28	32.80	32.10	33.04	34.70	32.10	34.92	34.46	32.34
10	30.44	30.20	29.98	32.34	32.56	31.62	33.98	32.80	32.34	32.80	33.28	33.98

3.5.6. Fall Time at -18 dBm avg. Power at 1550nm and 11.3Gbps



Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	25.91	25.79	25.89	27.92	28.01	27.78	29.76	29.64	29.19	29.45	29.57	29.00
Median	25.84	25.72	25.96	27.96	27.84	27.73	29.74	29.62	28.68	29.02	29.74	28.56
Std. Dev.	0.35	0.38	0.30	0.57	0.43	0.74	0.85	0.93	1.00	0.95	1.10	0.96
Max.	26.44	26.66	26.44	29.02	29.02	29.02	30.92	30.92	30.92	30.92	30.92	30.68
Min.	25.48	25.26	25.48	26.90	27.62	26.66	28.56	28.08	28.08	28.56	27.84	28.08
Range	0.96	1.40	0.96	2.12	1.40	2.36	2.36	2.84	2.84	2.36	3.08	2.60
1	25.72	25.26	25.48	28.32	27.84	26.66	29.50	30.44	28.56	30.68	27.84	28.32
2	25.96	25.96	25.96	27.38	27.84	28.32	30.68	28.08	28.56	28.80	30.20	28.56
3	25.96	25.72	25.96	26.90	27.62	27.38	28.80	29.26	30.44	28.56	30.92	30.68
4	26.44	25.96	25.96	27.84	28.32	28.56	30.92	30.92	28.32	28.56	28.32	28.56
5	25.72	25.48	25.72	28.08	27.84	28.08	30.20	28.56	29.50	30.44	28.32	30.20
6	26.44	26.66	26.44	29.02	29.02	29.02	30.68	29.50	30.92	29.02	29.26	28.08
7	25.48	25.72	25.48	27.62	27.84	26.90	28.56	29.74	28.56	29.98	29.74	28.80
8	25.72	25.96	25.72	28.08	27.62	27.38	29.26	30.20	30.20	29.02	30.68	28.32
9	25.48	25.48	25.96	28.08	28.32	27.62	29.02	30.68	28.08	30.92	30.68	28.32
10	26.20	25.72	26.20	27.84	27.84	27.84	29.98	29.02	28.80	28.56	29.74	30.20

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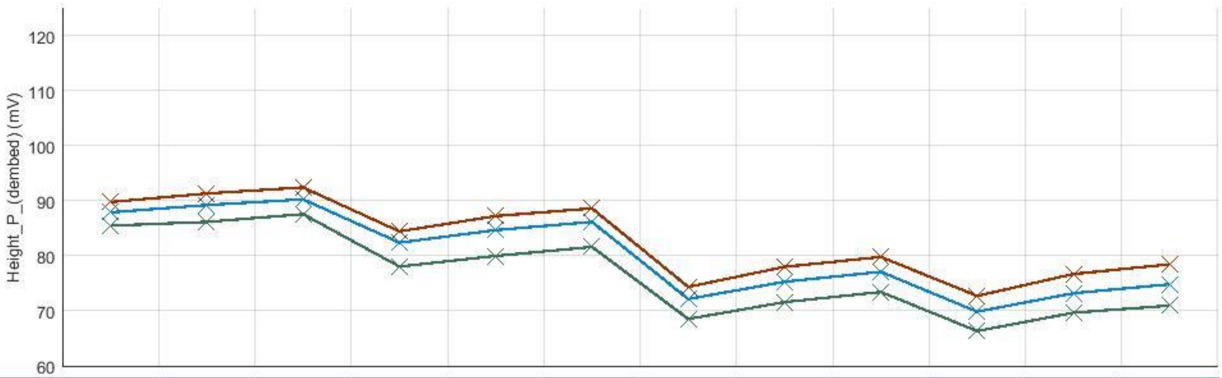
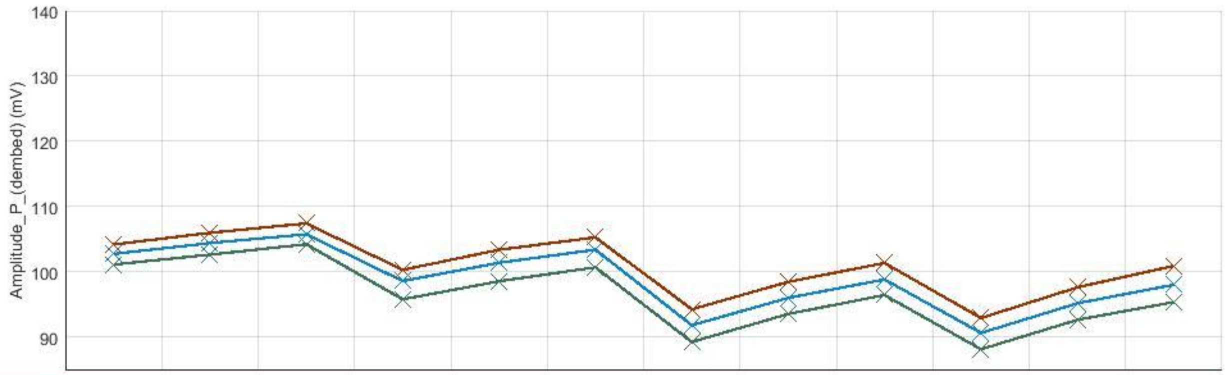
3.5.7. Height at -18 dBm avg. Power at 1550nm and 11.3Gbps



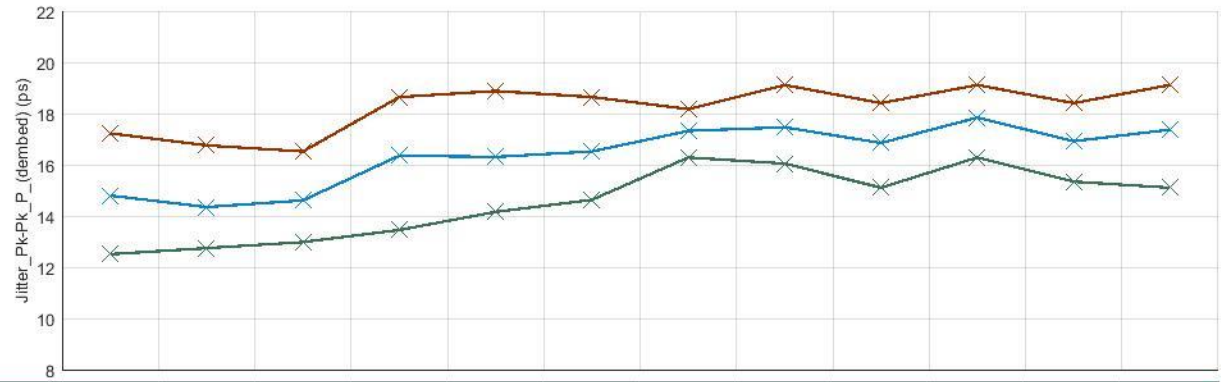
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	87.87	89.20	90.23	82.38	84.65	86.14	72.13	75.28	77.08	69.84	73.20	74.81
Median	88.13	89.88	90.42	83.07	85.25	86.89	72.28	75.37	77.24	69.87	72.96	74.41
Std. Dev.	1.51	1.72	1.51	1.93	2.14	2.18	1.68	1.80	1.80	1.78	1.88	2.03
Max.	89.75	91.30	92.40	84.42	87.20	88.60	74.34	77.98	79.78	72.70	76.68	78.44
Min.	85.46	86.14	87.55	78.04	79.96	81.60	68.52	71.58	73.42	66.32	69.66	70.94
Range	4.29	5.16	4.85	6.38	7.24	7.00	5.82	6.40	6.36	6.38	7.02	7.50
1	85.95	87.35	88.70	81.28	83.40	84.50	71.24	74.36	76.22	69.78	72.68	74.04
2	87.95	89.70	90.55	83.20	85.50	87.15	73.56	77.00	78.72	71.12	74.46	76.12
3	86.80	87.85	89.25	81.72	84.30	85.10	71.16	74.34	76.24	69.00	72.30	73.68
4	88.65	90.10	91.40	83.52	85.66	87.25	73.10	75.62	77.42	69.96	73.20	74.70
5	89.65	91.30	92.40	84.42	87.02	88.55	74.34	77.98	79.78	72.70	76.68	78.44
6	85.46	86.14	87.55	78.04	79.96	81.60	68.52	71.58	73.42	66.32	69.66	70.94
7	88.30	90.05	90.90	83.32	85.40	87.45	73.48	76.76	78.56	71.24	74.74	76.84
8	87.02	88.20	89.40	81.04	82.98	84.60	71.38	74.26	75.76	69.28	72.72	74.12
9	89.75	91.25	90.30	84.34	87.20	88.60	71.88	75.12	77.06	68.26	71.86	73.98
10	89.20	90.05	91.90	82.94	85.10	86.64	72.68	75.74	77.64	70.74	73.70	75.28

3.5.8. Amplitude at -18 dBm avg. Power at 1550nm and 11.3Gbps



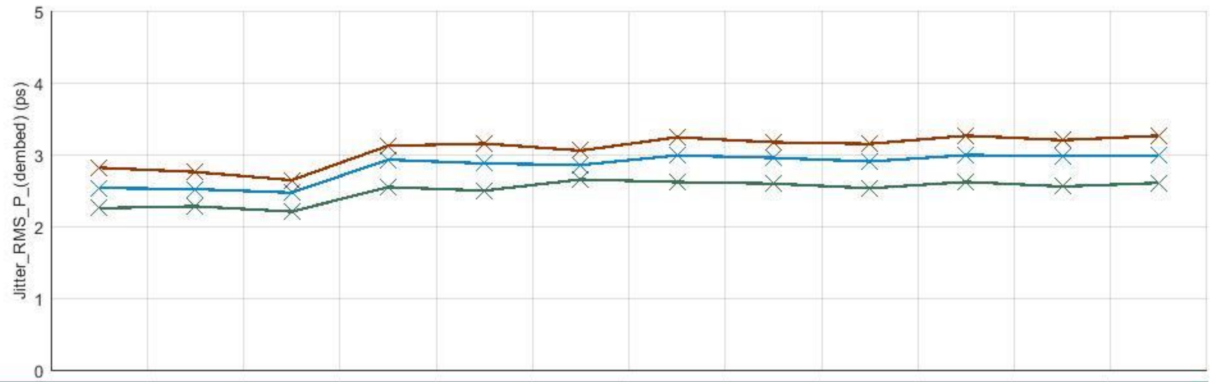
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	102.71	104.38	105.73	98.55	101.35	103.36	91.76	95.96	98.79	90.58	95.14	97.98
Median	102.28	103.88	105.38	98.49	101.30	103.12	91.50	95.48	98.27	90.27	94.86	97.49
Std. Dev.	1.15	1.21	1.07	1.34	1.42	1.42	1.36	1.42	1.46	1.37	1.48	1.64
Max.	104.15	105.95	107.40	100.26	103.35	105.25	94.22	98.42	101.32	92.88	97.58	100.88
Min.	101.08	102.60	104.20	95.74	98.52	100.66	89.20	93.50	96.40	88.08	92.60	95.32
Range	3.07	3.35	3.20	4.52	4.83	4.59	5.02	4.92	4.92	4.80	4.98	5.56
1	101.70	103.50	105.05	98.14	100.75	102.65	91.28	95.38	98.14	90.46	94.66	97.40
2	104.15	105.95	107.40	99.40	102.20	104.35	93.04	97.42	100.28	91.92	96.42	99.38
3	102.05	103.65	105.15	98.50	101.42	103.05	91.50	95.54	98.40	90.26	94.74	97.34
4	102.50	104.05	105.55	98.48	101.18	103.20	91.50	95.38	98.12	89.88	94.22	97.06
5	103.60	105.30	106.85	99.38	102.28	104.30	92.58	97.10	99.94	92.06	96.92	99.86
6	101.08	102.60	104.20	95.74	98.52	100.66	89.20	93.50	96.40	88.08	92.60	95.32
7	104.00	105.80	107.25	100.26	102.95	105.25	94.22	98.42	101.32	92.88	97.58	100.88
8	102.00	103.70	105.20	97.76	100.38	102.50	91.34	95.42	98.12	90.28	94.98	97.58
9	104.15	105.80	105.55	100.12	103.35	105.15	92.18	96.54	99.60	90.26	95.16	98.24
10	101.90	103.45	105.10	97.76	100.48	102.50	90.80	94.94	97.62	89.76	94.08	96.74

3.5.9. Jitter pk-pk at -18 dBm avg. Power at 1550nm and 11.3Gbps



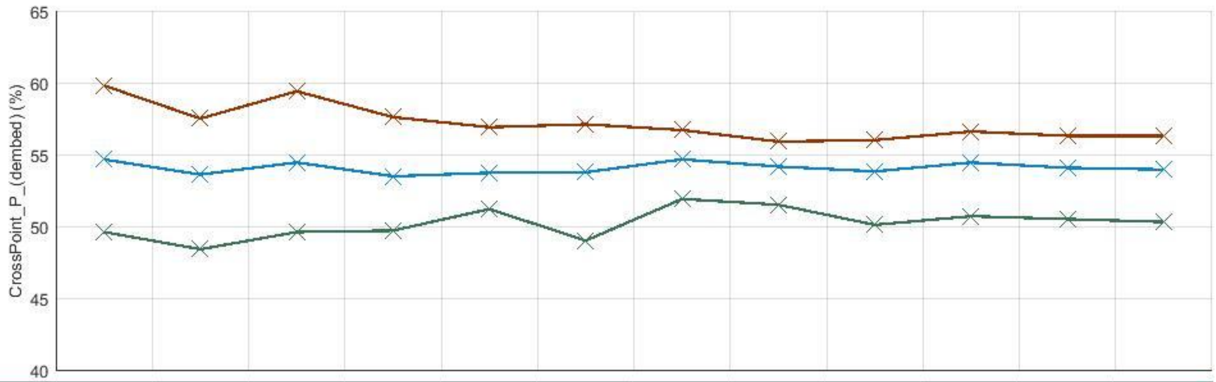
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	14.80	14.35	14.61	16.35	16.31	16.52	17.32	17.46	16.85	17.84	16.92	17.37
Median	14.99	14.16	14.40	16.40	16.52	16.28	17.35	17.46	16.64	17.94	17.11	17.23
Std. Dev.	1.55	1.21	1.08	1.39	1.79	1.22	0.55	0.93	1.24	1.09	1.12	1.36
Max.	17.23	16.76	16.52	18.64	18.88	18.64	18.17	19.12	18.41	19.12	18.41	19.12
Min.	12.51	12.74	12.98	13.45	14.16	14.63	16.28	16.05	15.10	16.28	15.34	15.10
Range	4.72	4.01	3.54	5.19	4.72	4.01	1.89	3.07	3.30	2.83	3.07	4.01
1	15.10	13.69	14.87	15.10	14.40	16.28	18.17	16.99	16.28	16.52	16.52	17.23
2	16.28	13.22	14.40	16.28	15.10	15.81	16.99	17.46	16.52	16.28	15.34	16.28
3	16.05	16.76	14.40	16.76	16.52	16.76	17.46	18.17	18.17	19.12	18.41	19.12
4	14.87	14.87	13.69	16.52	18.64	18.64	17.70	16.05	15.58	18.64	16.99	16.05
5	15.10	14.63	14.63	18.64	17.23	16.28	17.70	17.94	18.17	17.94	17.23	18.17
6	14.87	15.10	16.28	16.76	18.88	16.76	17.70	18.17	16.76	18.88	17.94	18.88
7	12.51	12.74	14.16	16.28	14.16	14.63	16.28	16.99	15.58	17.23	15.81	16.76
8	12.98	13.69	14.16	16.05	17.46	18.41	17.23	17.46	17.94	17.94	17.70	17.23
9	17.23	13.45	16.52	17.70	16.52	16.05	17.23	19.12	18.41	19.12	17.94	18.88
10	12.98	15.34	12.98	13.45	14.16	15.58	16.76	16.28	15.10	16.76	15.34	15.10

3.5.10. Jitter RMS at -18 dBm avg. Power at 1550nm and 11.3Gbps



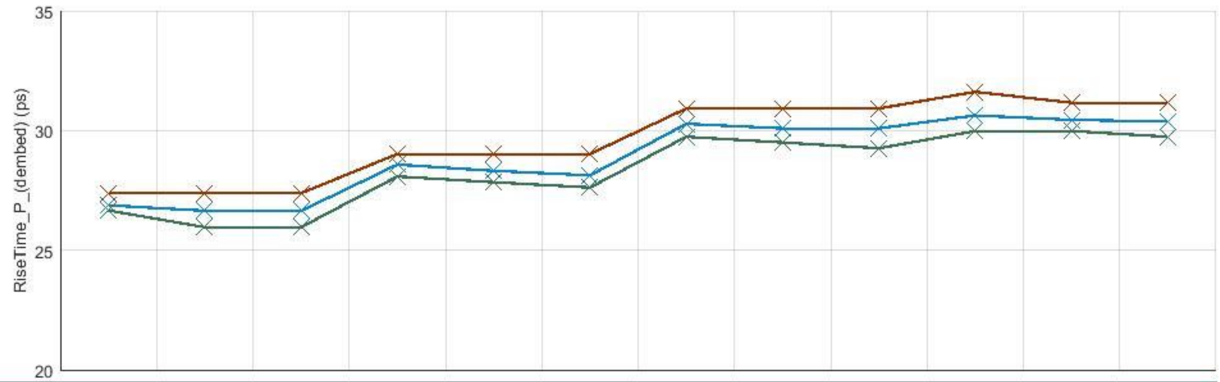
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	2.53	2.52	2.47	2.93	2.88	2.85	2.99	2.95	2.90	2.99	2.98	2.99
Median	2.52	2.50	2.49	2.99	2.90	2.83	3.02	2.98	2.94	3.02	3.02	3.04
Std. Dev.	0.18	0.15	0.13	0.17	0.21	0.13	0.19	0.17	0.18	0.20	0.20	0.22
Max.	2.82	2.76	2.64	3.12	3.15	3.05	3.24	3.17	3.15	3.26	3.20	3.26
Min.	2.25	2.28	2.20	2.55	2.50	2.65	2.62	2.59	2.53	2.62	2.55	2.60
Range	0.56	0.48	0.44	0.57	0.66	0.40	0.62	0.58	0.62	0.64	0.65	0.66
1	2.44	2.50	2.47	2.85	2.66	2.82	2.89	2.90	2.76	2.91	2.86	2.77
2	2.58	2.43	2.52	3.02	2.89	2.82	2.92	2.97	2.89	3.10	3.00	3.09
3	2.82	2.76	2.64	3.03	2.89	2.98	3.13	3.17	3.15	3.26	3.20	3.26
4	2.47	2.49	2.43	3.04	3.05	2.91	3.09	2.98	2.99	3.02	3.11	3.04
5	2.60	2.53	2.55	3.00	3.08	2.80	3.07	3.00	3.07	3.02	3.03	3.04
6	2.70	2.74	2.55	3.12	3.15	3.05	3.24	3.14	2.99	3.12	3.18	3.19
7	2.32	2.28	2.30	2.72	2.65	2.65	2.78	2.78	2.76	2.74	2.82	2.75
8	2.46	2.51	2.46	2.99	2.91	2.84	2.96	2.90	2.87	2.91	2.91	2.95
9	2.70	2.56	2.56	2.97	2.96	2.99	3.19	3.09	3.00	3.20	3.10	3.16
10	2.25	2.38	2.20	2.55	2.50	2.67	2.62	2.59	2.53	2.62	2.55	2.60

3.5.11. Crossing Percentage at -10 dBm avg. Power at 1550nm and 11.3Gbps



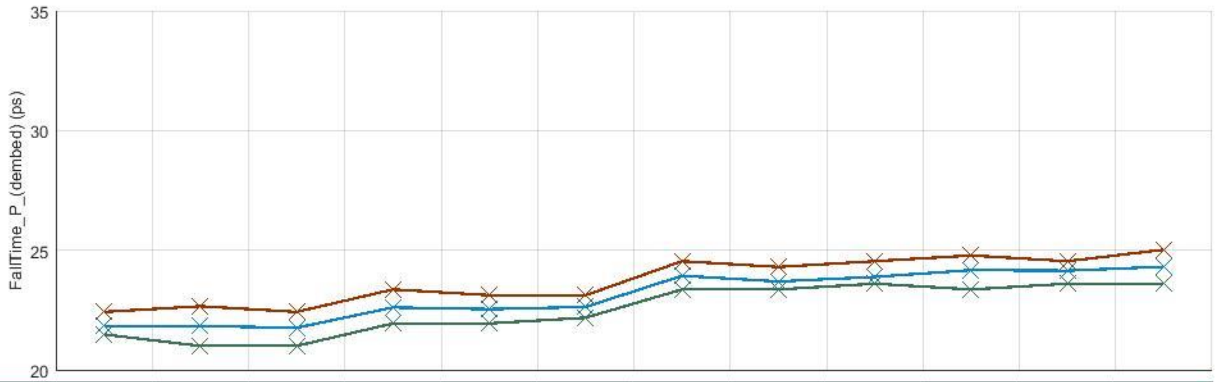
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	54.65	53.60	54.44	53.48	53.72	53.76	54.66	54.16	53.82	54.44	54.07	53.95
Median	54.45	54.05	54.05	53.55	53.50	54.55	54.65	54.30	54.35	55.00	54.55	54.40
Std. Dev.	2.79	2.98	3.00	2.61	1.69	2.69	1.60	1.53	2.02	1.94	2.03	2.04
Max.	59.80	57.50	59.40	57.60	56.90	57.10	56.70	55.90	56.00	56.60	56.30	56.30
Min.	49.60	48.40	49.60	49.70	51.20	49.00	51.90	51.50	50.10	50.70	50.50	50.30
Range	10.20	9.10	9.80	7.90	5.70	8.10	4.80	4.40	5.90	5.90	5.80	6.00
1	54.50	54.20	54.10	49.70	53.40	49.00	54.40	53.90	50.10	50.70	50.50	50.30
2	57.80	53.40	57.90	51.70	51.20	55.70	52.30	51.70	51.80	52.80	51.90	51.80
3	54.40	54.10	49.60	49.80	53.00	49.60	54.70	54.20	54.10	54.30	54.50	54.20
4	55.90	51.20	51.50	55.20	54.40	55.00	51.90	51.50	51.50	52.30	51.70	51.60
5	54.80	50.10	54.60	54.70	53.90	54.10	55.20	54.70	54.60	55.20	55.10	54.80
6	53.00	57.40	57.20	56.30	55.90	55.60	56.60	55.90	56.00	56.60	56.30	56.00
7	59.80	55.70	59.40	57.60	56.90	57.10	56.70	55.90	55.90	56.60	56.30	56.30
8	49.60	54.00	54.00	53.90	53.60	53.20	54.60	54.40	54.60	55.10	54.60	54.60
9	53.10	48.40	52.50	53.20	52.70	52.60	54.30	54.00	54.10	54.90	54.10	54.20
10	53.60	57.50	53.60	52.70	52.20	55.70	55.90	55.40	55.50	55.90	55.70	55.70

3.5.12. Rise Time at -10 dBm avg. Power at 1550nm and 11.3Gbps



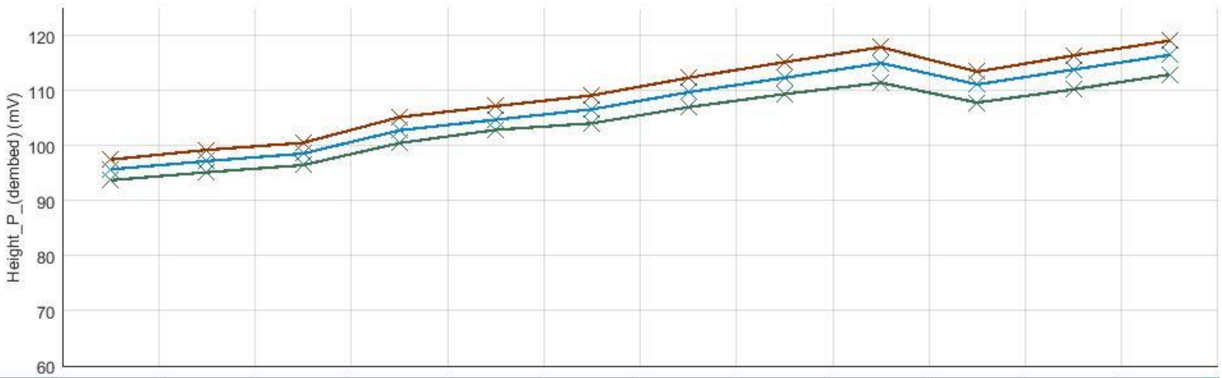
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	26.88	26.65	26.64	28.58	28.32	28.13	30.28	30.09	30.09	30.63	30.45	30.37
Median	26.78	26.44	26.66	28.56	28.32	28.08	30.20	30.09	30.09	30.44	30.44	30.32
Std. Dev.	0.26	0.44	0.45	0.37	0.43	0.38	0.44	0.45	0.54	0.52	0.42	0.51
Max.	27.38	27.38	27.38	29.02	29.02	29.02	30.92	30.92	30.92	31.62	31.16	31.16
Min.	26.66	25.96	25.96	28.08	27.84	27.62	29.74	29.50	29.26	29.98	29.98	29.74
Range	0.72	1.42	1.42	0.94	1.18	1.40	1.18	1.42	1.66	1.64	1.18	1.42
1	26.66	25.96	25.96	28.08	27.84	27.84	29.98	29.50	29.98	30.20	29.98	29.74
2	27.14	27.14	27.14	29.02	29.02	28.32	30.92	30.68	30.68	31.16	30.68	31.16
3	27.38	27.38	26.90	29.02	28.32	28.08	30.68	30.20	30.44	31.16	30.92	30.68
4	27.14	27.14	27.38	29.02	29.02	29.02	30.92	30.92	30.92	31.62	31.16	31.16
5	26.90	26.44	26.20	28.08	28.32	27.84	29.98	29.74	29.98	30.44	30.44	30.20
6	26.66	26.66	26.66	28.56	28.32	28.08	30.20	29.98	29.98	30.44	30.20	30.20
7	26.66	26.44	26.20	28.32	27.84	27.62	29.74	29.74	29.26	30.20	29.98	29.74
8	26.90	26.44	26.66	28.80	28.32	28.08	30.44	30.20	30.20	30.68	30.68	30.44
9	26.66	26.44	26.90	28.56	28.32	28.32	30.20	30.20	30.20	30.44	30.44	30.44
10	26.66	26.44	26.44	28.32	27.84	28.08	29.74	29.74	29.26	29.98	29.98	29.98

3.5.13. Fall Time at -10 dBm avg. Power at 1550nm and 11.3Gbps



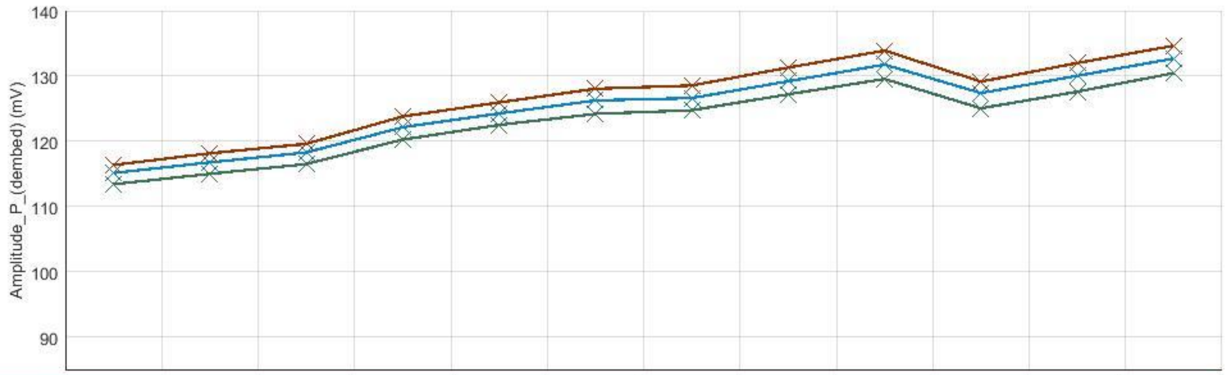
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	21.83	21.83	21.76	22.61	22.54	22.63	23.93	23.69	23.88	24.17	24.14	24.31
Median	21.83	21.83	21.83	22.54	22.42	22.42	24.08	23.72	23.84	24.08	24.08	24.19
Std. Dev.	0.35	0.55	0.47	0.52	0.41	0.39	0.37	0.34	0.33	0.40	0.29	0.41
Max.	22.42	22.66	22.42	23.36	23.12	23.12	24.54	24.30	24.54	24.78	24.54	25.02
Min.	21.48	21.00	21.00	21.94	21.94	22.18	23.36	23.36	23.60	23.36	23.60	23.60
Range	0.94	1.66	1.42	1.42	1.18	0.94	1.18	0.94	0.94	1.42	0.94	1.42
1	21.48	21.00	21.00	22.18	22.18	22.42	23.60	23.36	23.60	23.36	23.60	23.60
2	22.18	22.18	21.94	23.36	22.90	23.12	24.08	24.08	24.30	24.54	24.30	24.54
3	21.94	21.94	21.94	22.90	22.42	22.42	24.08	23.84	23.84	24.30	24.08	24.54
4	22.18	22.42	22.42	22.90	23.12	23.12	24.30	23.84	24.08	24.54	24.54	24.78
5	21.48	21.72	21.24	21.94	21.94	22.42	23.60	23.36	23.84	24.08	24.30	24.08
6	22.42	22.66	22.42	23.36	23.12	23.12	24.54	24.30	24.54	24.78	24.54	25.02
7	21.72	21.72	21.48	22.42	22.42	22.42	23.36	23.36	23.84	24.08	24.08	24.08
8	21.48	21.24	21.48	22.42	22.42	22.18	23.60	23.36	23.60	23.84	23.84	24.08
9	21.48	21.24	21.72	21.94	22.18	22.18	24.08	23.84	23.60	24.08	24.08	24.08
10	21.94	22.18	21.94	22.66	22.66	22.90	24.08	23.60	23.60	24.08	24.08	24.30

3.5.14. Height at -10 dBm avg. Power at 1550nm and 11.3Gbps



Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	95.67	97.18	98.55	102.76	104.69	106.58	109.68	112.29	114.98	111.10	113.79	116.44
Median	95.55	97.00	98.37	102.68	104.50	106.38	109.70	112.27	115.03	111.13	113.75	116.43
Std. Dev.	1.14	1.20	1.23	1.37	1.27	1.48	1.60	1.71	1.85	1.69	1.80	1.80
Max.	97.45	99.20	100.50	105.15	107.15	109.10	112.30	115.15	117.85	113.40	116.35	119.05
Min.	93.70	95.15	96.45	100.45	102.85	104.05	106.95	109.35	111.40	107.80	110.20	112.90
Range	3.75	4.05	4.05	4.70	4.30	5.05	5.35	5.80	6.45	5.60	6.15	6.15
1	93.70	95.15	96.45	100.45	102.85	104.05	106.95	109.35	111.40	107.80	110.20	112.90
2	95.50	96.90	98.30	101.95	103.80	106.20	108.85	111.35	114.05	110.55	113.05	115.75
3	94.80	96.15	97.65	101.65	103.90	105.20	108.00	110.50	113.30	109.35	112.15	114.65
4	95.60	97.10	98.45	102.80	104.70	106.55	109.55	112.20	114.90	111.20	113.75	116.55
5	95.35	96.80	98.10	102.55	104.30	106.20	110.40	113.05	115.90	112.00	114.70	117.45
6	96.15	97.80	99.25	103.30	105.10	107.15	109.85	112.35	115.15	111.05	113.75	116.30
7	97.20	99.20	100.20	105.15	107.15	109.10	112.30	115.15	117.85	113.40	116.35	119.05
8	94.75	96.35	97.55	102.00	103.85	105.85	108.80	111.50	114.30	110.40	113.15	115.85
9	96.20	97.60	99.00	103.25	105.00	106.90	111.20	113.80	116.65	112.95	115.60	118.10
10	97.45	98.70	100.50	104.45	106.25	108.55	110.90	113.70	116.35	112.30	115.15	117.80

3.5.15. Amplitude at -10 dBm avg. Power at 1550nm and 11.3Gbps



Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	115.11	116.76	118.28	122.14	124.26	126.26	126.62	129.20	131.76	127.39	130.04	132.69
Median	115.03	116.80	118.27	122.22	124.30	126.40	126.52	129.15	131.75	127.35	130.00	132.65
Std. Dev.	0.92	0.94	0.95	1.00	0.96	1.07	1.12	1.19	1.25	1.21	1.25	1.21
Max.	116.35	118.15	119.60	123.80	125.95	128.05	128.55	131.30	133.90	129.15	132.00	134.65
Min.	113.40	115.00	116.50	120.25	122.50	124.20	124.75	127.20	129.55	125.05	127.60	130.45
Range	2.95	3.15	3.10	3.55	3.45	3.85	3.80	4.10	4.35	4.10	4.40	4.20
1	113.40	115.00	116.50	120.25	122.50	124.20	124.75	127.20	129.55	125.05	127.60	130.45
2	115.95	117.55	119.10	122.20	124.30	126.40	126.55	129.15	131.70	127.50	130.10	132.80
3	114.55	116.15	117.65	121.30	123.55	125.30	125.60	128.05	130.65	126.35	129.00	131.50
4	114.45	116.00	117.50	121.55	123.65	125.65	126.05	128.60	131.15	127.00	129.65	132.30
5	115.50	117.00	118.65	122.40	124.45	126.45	126.95	129.55	132.10	127.80	130.40	133.10
6	115.05	116.80	118.30	122.35	124.40	126.50	126.80	129.30	131.90	127.45	130.10	132.70
7	116.35	118.15	119.60	123.80	125.95	128.05	128.55	131.30	133.90	129.15	132.00	134.65
8	115.00	116.80	118.25	122.25	124.30	126.40	126.50	129.15	131.80	127.25	129.90	132.60
9	116.25	117.80	119.40	123.35	125.45	127.45	128.15	130.75	133.40	129.15	131.75	134.30
10	114.65	116.30	117.85	121.95	124.05	126.20	126.30	128.95	131.45	127.20	129.90	132.50

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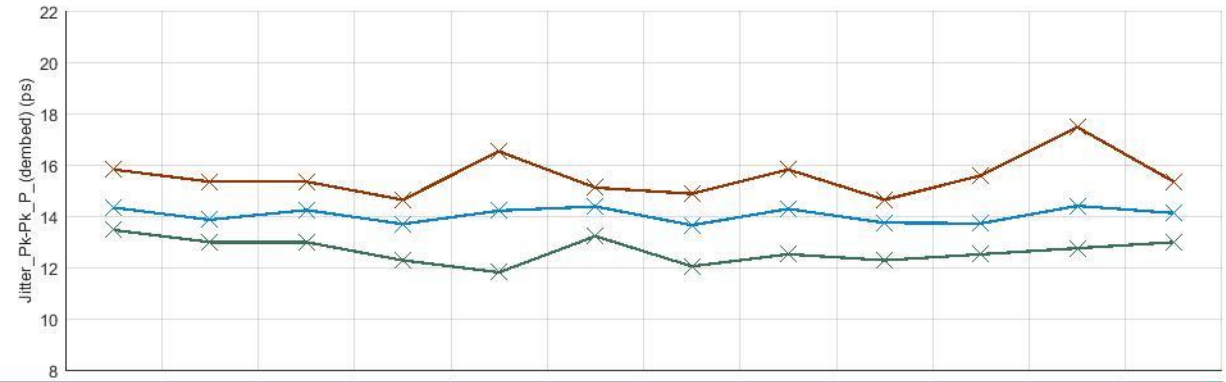
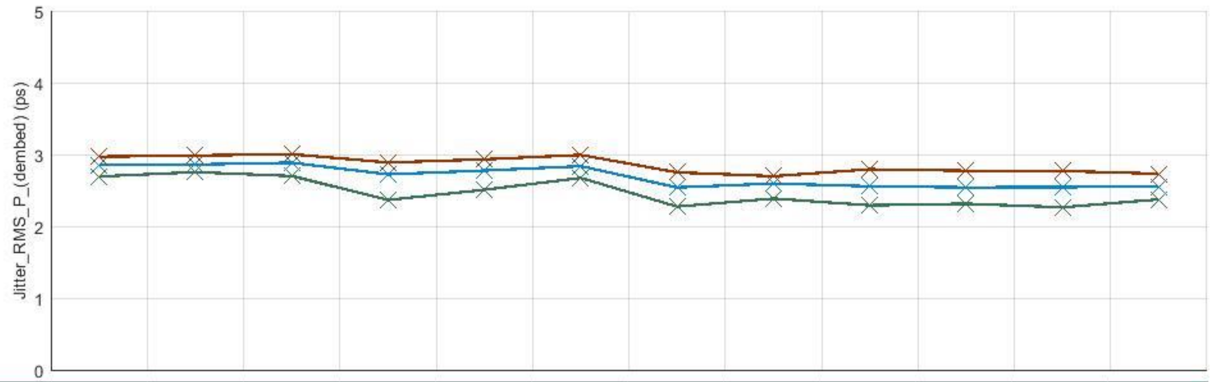
3.5.16. Jitter pk-pk at -10 dBm avg. Power at 1550nm and 11.3Gbps



Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	14.33	13.85	14.23	13.69	14.21	14.37	13.64	14.28	13.74	13.71	14.40	14.11
Median	14.16	13.69	14.28	13.57	14.28	14.51	13.92	14.28	13.81	13.33	14.04	14.04
Std. Dev.	0.83	0.80	0.83	0.69	1.48	0.54	0.89	0.93	0.72	1.03	1.45	0.84
Max.	15.81	15.34	15.34	14.63	16.52	15.10	14.87	15.81	14.63	15.58	17.46	15.34
Min.	13.45	12.98	12.98	12.27	11.80	13.22	12.04	12.51	12.27	12.51	12.74	12.98
Range	2.36	2.36	2.36	2.36	4.72	1.89	2.83	3.30	2.36	3.07	4.72	2.36
1	13.45	13.92	15.10	13.45	13.45	15.10	13.69	14.40	13.45	12.51	13.22	12.98
2	14.40	13.22	15.34	13.45	14.40	14.63	13.92	13.69	13.22	13.22	12.98	13.22
3	15.58	15.10	13.92	13.45	11.80	14.16	14.16	14.40	14.40	14.63	17.46	15.34
4	13.92	13.69	12.98	14.63	14.87	14.87	14.16	12.51	13.22	12.98	13.92	13.22
5	15.81	13.69	14.40	14.16	15.10	14.63	12.04	13.92	13.92	14.16	14.63	13.92
6	13.69	15.34	14.40	13.69	16.52	14.40	13.22	13.92	14.40	14.87	14.87	14.16
7	14.63	12.98	13.92	13.22	13.69	13.22	14.87	14.40	13.69	12.74	13.92	14.63
8	13.45	13.92	14.16	14.40	14.16	13.92	13.92	15.81	14.16	15.58	14.16	14.40
9	14.40	13.69	15.10	14.16	15.81	14.63	14.16	15.58	14.63	13.45	16.05	15.34
10	13.92	12.98	12.98	12.27	12.27	14.16	12.27	14.16	12.27	12.98	12.74	13.92

3.5.17. Jitter RMS at -10 dBm avg. Power at 1550nm and 11.3Gbps



Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	2.85	2.86	2.89	2.72	2.78	2.84	2.54	2.60	2.56	2.54	2.55	2.55
Median	2.86	2.87	2.91	2.75	2.80	2.85	2.58	2.62	2.57	2.55	2.56	2.54
Std. Dev.	0.09	0.08	0.10	0.15	0.14	0.10	0.14	0.09	0.14	0.15	0.16	0.11
Max.	2.97	2.99	3.00	2.89	2.93	2.99	2.75	2.70	2.79	2.77	2.77	2.73
Min.	2.69	2.75	2.70	2.37	2.51	2.67	2.27	2.39	2.29	2.31	2.26	2.37
Range	0.28	0.23	0.30	0.52	0.42	0.32	0.48	0.31	0.50	0.46	0.51	0.36
1	2.85	2.88	3.00	2.74	2.67	2.99	2.60	2.62	2.57	2.34	2.41	2.53
2	2.97	2.83	2.93	2.73	2.75	2.94	2.59	2.62	2.57	2.51	2.57	2.50
3	2.95	2.96	2.90	2.77	2.72	2.82	2.75	2.70	2.79	2.77	2.77	2.73
4	2.87	2.79	2.81	2.86	2.91	2.85	2.39	2.59	2.46	2.49	2.49	2.48
5	2.91	2.91	2.85	2.75	2.93	2.79	2.59	2.57	2.60	2.63	2.55	2.58
6	2.84	2.89	2.98	2.78	2.91	2.87	2.55	2.69	2.57	2.70	2.64	2.55
7	2.81	2.75	2.76	2.61	2.65	2.70	2.40	2.50	2.45	2.46	2.43	2.43
8	2.76	2.99	2.93	2.74	2.85	2.85	2.57	2.64	2.57	2.60	2.58	2.61
9	2.90	2.85	3.00	2.89	2.86	2.88	2.68	2.65	2.69	2.61	2.76	2.71
10	2.69	2.76	2.70	2.37	2.51	2.67	2.27	2.39	2.29	2.31	2.26	2.37

SEMTECH
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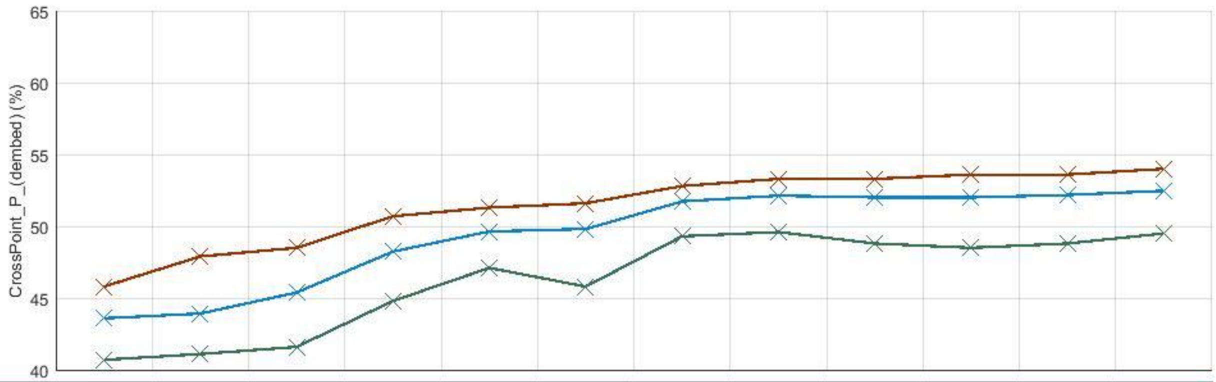
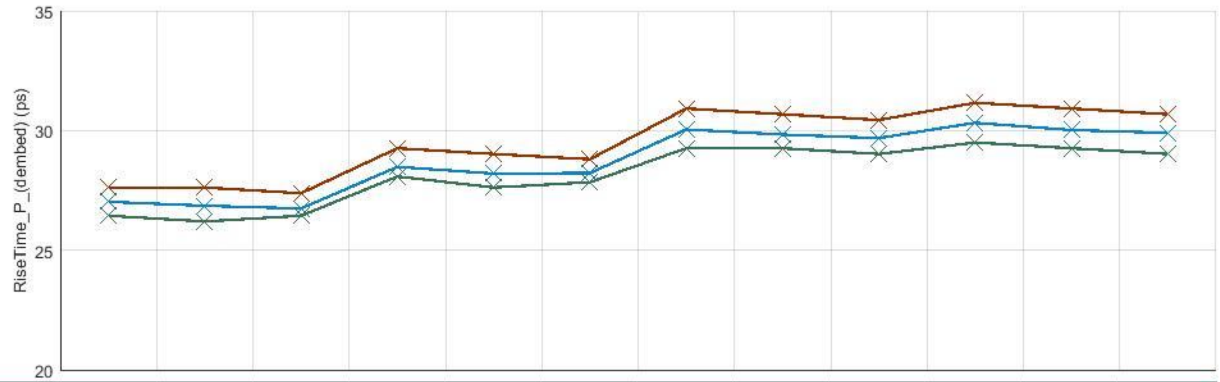
3.5.18. Crossing Percentage at +1.6 dBm avg. Power at 1550nm and 11.3Gbps



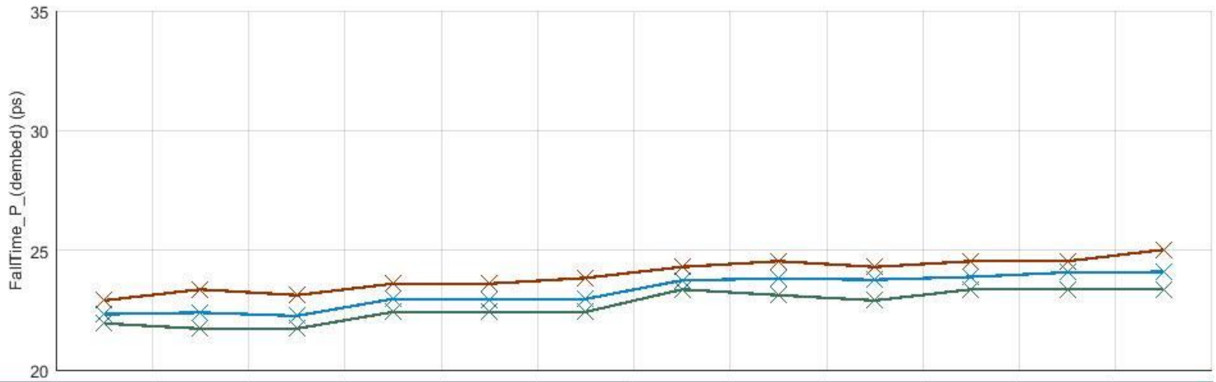
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	43.59	43.92	45.39	48.24	49.64	49.81	51.73	52.13	52.01	52.01	52.18	52.47
Median	43.80	43.25	46.15	49.30	49.80	50.35	52.25	52.70	52.90	53.00	53.00	53.30
Std. Dev.	1.58	2.57	2.13	2.11	1.31	1.98	1.32	1.38	1.72	1.82	1.68	1.61
Max.	45.80	47.90	48.50	50.70	51.30	51.60	52.80	53.30	53.30	53.60	53.60	54.00
Min.	40.70	41.10	41.60	44.80	47.10	45.80	49.30	49.60	48.80	48.50	48.80	49.50
Range	5.10	6.80	6.90	5.90	4.20	5.80	3.50	3.70	4.50	5.10	4.80	4.50
1	43.20	44.30	44.60	44.80	49.40	45.80	51.50	52.00	48.80	48.50	48.80	49.50
2	44.70	41.90	46.60	46.40	47.10	51.00	49.30	49.70	49.90	50.30	50.60	50.70
3	45.80	47.00	43.30	45.60	49.60	46.70	51.90	52.50	52.80	52.30	52.80	53.10
4	43.10	41.10	41.60	49.50	50.20	50.00	49.40	49.60	50.00	49.70	50.20	50.40
5	44.60	41.40	46.40	49.50	50.40	50.50	52.50	52.90	53.20	53.10	53.20	53.40
6	43.10	47.90	48.50	50.70	51.30	51.40	52.80	53.30	53.30	53.60	53.60	54.00
7	44.40	42.20	46.50	50.40	51.10	51.60	52.80	53.00	53.20	53.30	53.30	53.40
8	40.70	45.40	45.90	49.40	50.00	50.20	52.00	52.10	52.80	53.00	52.70	53.20
9	44.80	41.70	47.20	49.20	49.40	49.80	52.60	53.10	53.10	53.30	53.30	53.40
10	41.50	46.30	43.30	46.90	47.90	51.10	52.50	53.10	53.00	53.00	53.30	53.60

3.5.19. Rise Time at +1.6 dBm avg. Power at 1550nm and 11.3Gbps



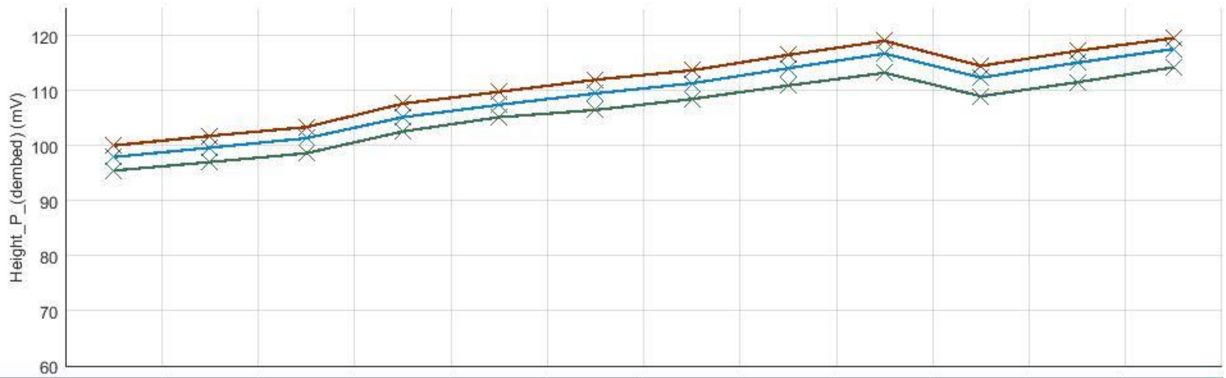
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	27.02	26.86	26.74	28.48	28.20	28.22	30.04	29.83	29.69	30.32	30.02	29.90
Median	26.90	26.78	26.55	28.32	28.20	28.08	29.86	29.74	29.62	30.32	29.98	29.74
Std. Dev.	0.41	0.43	0.40	0.46	0.49	0.43	0.51	0.45	0.47	0.48	0.51	0.56
Max.	27.62	27.62	27.38	29.26	29.02	28.80	30.92	30.68	30.44	31.16	30.92	30.68
Min.	26.44	26.20	26.44	28.08	27.62	27.84	29.26	29.26	29.02	29.50	29.26	29.02
Range	1.18	1.42	0.94	1.18	1.40	0.96	1.66	1.42	1.42	1.66	1.66	1.66
1	27.14	26.66	26.44	28.32	27.62	28.08	29.74	29.50	29.26	30.20	29.74	29.74
2	27.38	27.14	27.38	29.02	28.80	28.80	30.92	30.68	30.44	31.16	30.92	30.68
3	27.62	27.38	27.38	29.02	28.56	28.80	30.44	29.98	30.20	30.68	30.20	30.44
4	27.62	27.62	27.14	29.26	29.02	28.80	30.68	30.44	30.20	30.68	30.68	30.68
5	26.90	26.20	26.44	28.32	28.08	28.08	29.74	29.74	29.50	30.44	29.98	29.74
6	26.44	26.90	26.66	28.08	27.84	27.84	29.74	29.50	29.50	30.20	29.74	29.74
7	26.90	26.44	26.44	28.08	27.84	27.84	29.74	29.26	29.26	29.50	29.26	29.02
8	26.66	26.90	26.66	28.08	28.32	27.84	30.20	29.74	29.74	30.20	29.98	29.74
9	26.90	26.66	26.44	28.56	28.32	28.32	29.98	29.98	29.74	30.44	30.20	29.98
10	26.66	26.66	26.44	28.08	27.62	27.84	29.26	29.50	29.02	29.74	29.50	29.26

3.5.20. Fall Time at +1.6 dBm avg. Power at 1550nm and 11.3Gbps



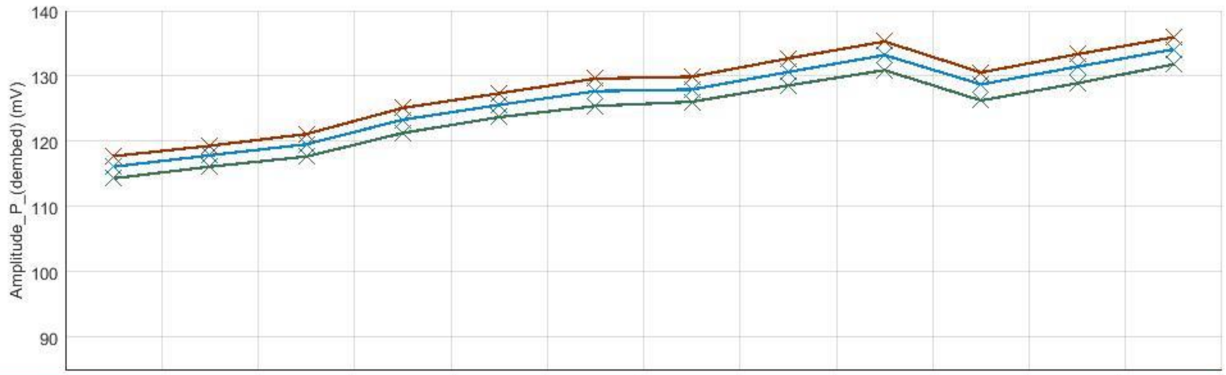
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	22.32	22.39	22.25	22.96	22.94	22.96	23.74	23.81	23.77	23.88	24.07	24.10
Median	22.30	22.42	22.06	22.90	22.90	23.01	23.72	23.84	23.72	23.84	24.08	24.08
Std. Dev.	0.34	0.51	0.50	0.50	0.40	0.46	0.34	0.38	0.41	0.38	0.37	0.48
Max.	22.90	23.36	23.12	23.60	23.60	23.84	24.30	24.54	24.30	24.54	24.54	25.02
Min.	21.94	21.72	21.72	22.42	22.42	22.42	23.36	23.12	22.90	23.36	23.36	23.36
Range	0.96	1.64	1.40	1.18	1.18	1.42	0.94	1.42	1.40	1.18	1.18	1.66
1	21.94	21.72	21.94	22.42	22.42	22.42	23.36	23.12	22.90	23.36	23.36	23.36
2	22.66	23.36	22.66	23.60	23.36	23.84	24.08	24.08	24.30	24.30	24.54	24.54
3	21.94	22.42	21.94	23.12	22.66	23.12	23.84	23.84	23.84	24.08	24.30	24.30
4	22.90	23.12	23.12	23.60	23.60	23.12	24.08	24.08	24.08	24.08	24.30	24.30
5	22.18	21.94	22.18	22.42	22.90	22.90	23.36	23.60	23.60	23.84	23.84	23.84
6	22.66	22.42	22.90	23.60	23.36	23.36	24.30	24.54	24.30	24.54	24.54	25.02
7	22.42	22.18	21.94	22.66	22.90	22.90	23.60	23.84	23.84	23.84	23.84	23.60
8	22.18	21.94	21.72	22.90	22.90	22.42	23.36	23.60	23.60	23.36	23.84	23.84
9	21.94	22.42	21.72	22.42	22.42	22.42	23.60	23.84	23.60	23.84	24.08	24.08
10	22.42	22.42	22.42	22.90	22.90	23.12	23.84	23.60	23.60	23.60	24.08	24.08

3.5.21. Height at +1.6 dBm avg. Power at 1550nm and 11.3Gbps



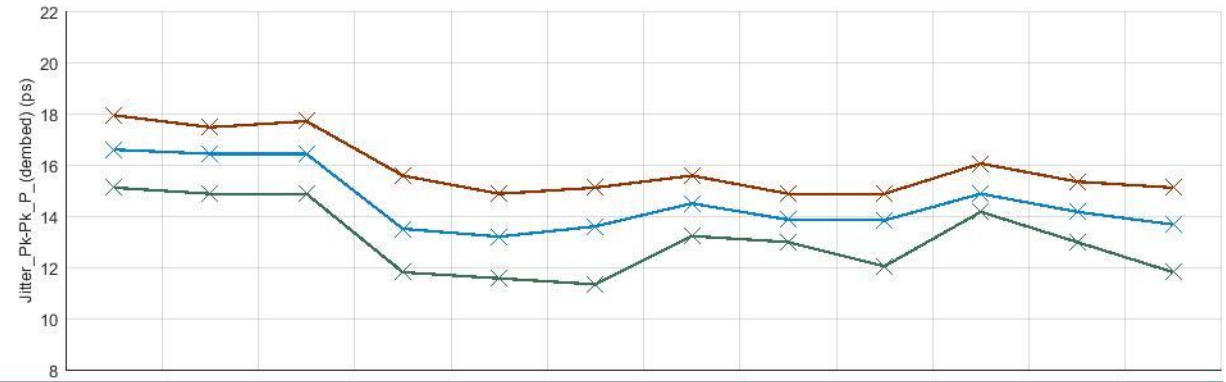
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	97.91	99.61	101.33	105.14	107.39	109.46	111.29	114.05	116.69	112.33	115.05	117.53
Median	97.75	99.32	101.23	105.15	107.30	109.38	111.30	114.02	116.72	112.33	115.03	117.50
Std. Dev.	1.31	1.37	1.39	1.47	1.34	1.58	1.60	1.71	1.76	1.70	1.75	1.66
Max.	100.00	101.75	103.35	107.60	109.75	111.95	113.65	116.45	119.00	114.45	117.20	119.50
Min.	95.45	97.00	98.60	102.55	105.15	106.45	108.45	110.90	113.20	108.95	111.50	114.20
Range	4.55	4.75	4.75	5.05	4.60	5.50	5.20	5.55	5.80	5.50	5.70	5.30
1	95.45	97.00	98.60	102.55	105.15	106.45	108.45	110.90	113.20	108.95	111.50	114.20
2	97.65	99.20	101.15	104.10	106.45	109.10	110.30	113.05	115.70	111.60	114.30	116.80
3	97.10	98.80	100.45	103.85	106.50	108.00	109.70	112.30	115.00	110.65	113.50	115.80
4	97.30	98.95	100.80	105.15	107.35	109.40	111.20	113.95	116.75	112.40	115.25	117.70
5	97.85	99.45	101.30	105.15	107.25	109.35	112.10	115.05	117.70	113.40	116.00	118.55
6	98.30	100.20	101.75	105.55	107.75	109.85	111.40	114.10	116.70	112.25	114.80	117.30
7	100.00	101.75	103.35	107.60	109.75	111.95	113.65	116.45	119.00	114.45	117.20	119.50
8	97.10	99.00	100.50	104.60	106.60	108.80	110.50	113.45	116.25	111.75	114.45	117.25
9	99.10	100.75	102.55	106.15	108.20	110.30	113.10	115.90	118.55	114.30	117.05	119.25
10	99.25	101.05	102.85	106.70	108.95	111.40	112.50	115.35	118.05	113.50	116.45	118.95

3.5.22. Amplitude at +1.6 dBm avg. Power at 1550nm and 11.3Gbps



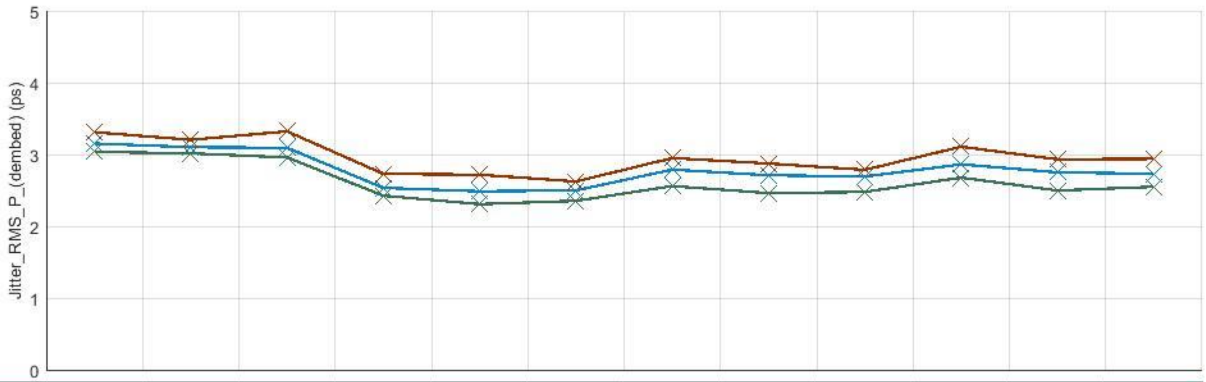
Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	116.10	117.84	119.53	123.30	125.57	127.68	127.94	130.62	133.22	128.72	131.44	134.10
Median	115.90	117.95	119.58	123.33	125.57	127.85	127.82	130.53	133.17	128.65	131.38	134.07
Std. Dev.	1.05	0.96	1.09	1.09	1.02	1.16	1.16	1.22	1.27	1.26	1.28	1.22
Max.	117.70	119.30	121.10	125.10	127.35	129.60	129.90	132.70	135.30	130.55	133.35	135.95
Min.	114.30	116.10	117.65	121.25	123.70	125.40	126.05	128.55	130.90	126.25	128.90	131.80
Range	3.40	3.20	3.45	3.85	3.65	4.20	3.85	4.15	4.40	4.30	4.45	4.15
1	114.30	116.10	117.65	121.25	123.70	125.40	126.05	128.55	130.90	126.25	128.90	131.80
2	117.00	118.50	120.50	123.20	125.50	127.90	127.80	130.45	133.10	128.75	131.45	134.15
3	115.60	117.40	118.85	122.35	124.85	126.65	126.90	129.50	132.10	127.70	130.45	132.95
4	115.35	116.85	118.50	122.80	125.00	127.05	127.25	129.95	132.60	128.25	131.05	133.65
5	116.50	117.95	119.90	123.60	125.75	127.85	128.25	130.95	133.55	129.20	131.80	134.50
6	115.95	118.00	119.60	123.60	125.80	127.95	128.20	130.85	133.45	128.90	131.55	134.20
7	117.70	119.30	121.10	125.10	127.35	129.60	129.90	132.70	135.30	130.55	133.35	135.95
8	115.85	117.95	119.55	123.45	125.65	127.85	127.85	130.60	133.25	128.55	131.30	134.00
9	117.40	118.95	120.80	124.65	126.85	128.95	129.60	132.30	134.95	130.55	133.25	135.85
10	115.35	117.40	118.85	123.00	125.25	127.60	127.60	130.35	132.95	128.50	131.30	133.95

3.5.23. Jitter pk-pk at +1.6 dBm avg. Power at 1550nm and 11.3Gbps



Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	16.59	16.43	16.43	13.50	13.19	13.59	14.49	13.85	13.83	14.87	14.16	13.66
Median	16.52	16.64	16.52	13.57	13.10	13.81	14.63	13.81	14.04	14.63	14.28	13.57
Std. Dev.	0.94	0.82	0.92	1.14	1.07	1.23	0.80	0.62	0.78	0.66	0.69	0.97
Max.	17.94	17.46	17.70	15.58	14.87	15.10	15.58	14.87	14.87	16.05	15.34	15.10
Min.	15.10	14.87	14.87	11.80	11.56	11.33	13.22	12.98	12.04	14.16	12.98	11.80
Range	2.83	2.60	2.83	3.78	3.30	3.78	2.36	1.89	2.83	1.89	2.36	3.30
1	17.70	16.76	17.70	11.80	11.56	11.33	14.63	13.69	14.16	14.40	14.16	12.98
2	16.52	16.05	16.99	12.27	13.45	14.40	14.63	13.69	14.40	14.16	13.92	13.22
3	16.52	16.99	15.81	13.45	11.80	12.98	15.58	14.87	14.16	15.58	15.34	15.10
4	17.46	14.87	14.87	13.69	13.69	12.74	14.87	14.87	13.92	15.34	14.40	13.69
5	17.94	16.76	16.52	15.58	14.40	15.10	15.58	12.98	13.45	14.63	14.40	14.16
6	16.28	17.23	17.70	13.92	12.74	14.87	14.16	13.22	12.04	14.40	12.98	11.80
7	15.58	15.34	15.81	14.16	12.74	13.92	13.22	13.45	13.22	15.34	13.69	14.16
8	15.81	17.46	16.76	13.45	13.92	14.63	13.69	13.92	14.87	14.63	14.87	14.87
9	16.99	16.28	16.52	14.40	14.87	13.69	14.87	13.92	14.16	16.05	14.40	13.22
10	15.10	16.52	15.58	12.27	12.74	12.27	13.69	13.92	13.92	14.16	13.45	13.45

3.5.24. Jitter RMS at +1.6 dBm avg. Power at 1550nm and 11.3Gbps



Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	3.15	3.10	3.09	2.53	2.49	2.50	2.79	2.71	2.69	2.86	2.75	2.73
Median	3.12	3.10	3.07	2.52	2.49	2.53	2.80	2.73	2.72	2.86	2.76	2.73
Std. Dev.	0.09	0.06	0.11	0.08	0.13	0.09	0.12	0.12	0.09	0.13	0.13	0.11
Max.	3.31	3.20	3.32	2.73	2.72	2.62	2.95	2.87	2.79	3.11	2.93	2.94
Min.	3.04	3.02	2.96	2.43	2.31	2.35	2.56	2.46	2.48	2.68	2.50	2.55
Range	0.27	0.19	0.36	0.30	0.41	0.27	0.39	0.41	0.31	0.43	0.43	0.39
1	3.26	3.18	3.21	2.53	2.33	2.42	2.80	2.73	2.66	2.81	2.72	2.65
2	3.11	3.02	3.04	2.52	2.49	2.62	2.86	2.79	2.76	2.89	2.80	2.71
3	3.25	3.10	3.16	2.73	2.49	2.54	2.90	2.87	2.79	3.11	2.93	2.94
4	3.31	3.06	3.06	2.58	2.55	2.49	2.81	2.72	2.66	2.79	2.70	2.75
5	3.17	3.13	3.08	2.51	2.50	2.38	2.79	2.74	2.72	2.86	2.71	2.72
6	3.10	3.20	3.32	2.45	2.31	2.52	2.56	2.46	2.48	2.68	2.50	2.55
7	3.10	3.10	3.03	2.51	2.56	2.55	2.80	2.68	2.72	2.86	2.85	2.79
8	3.04	3.15	2.98	2.56	2.72	2.55	2.95	2.80	2.78	2.97	2.80	2.81
9	3.06	3.03	3.10	2.54	2.59	2.58	2.80	2.71	2.75	2.95	2.87	2.77
10	3.13	3.04	2.96	2.43	2.35	2.35	2.60	2.58	2.61	2.71	2.64	2.62

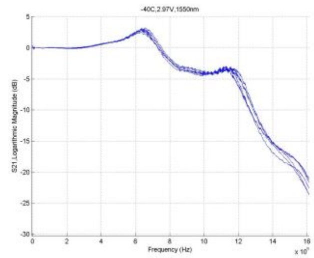
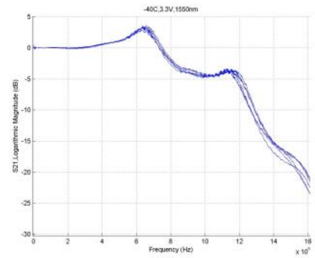
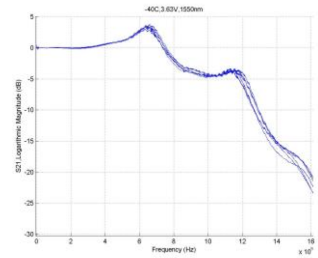
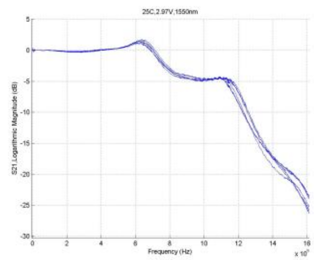
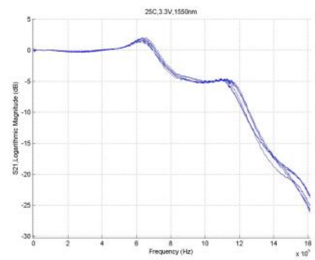
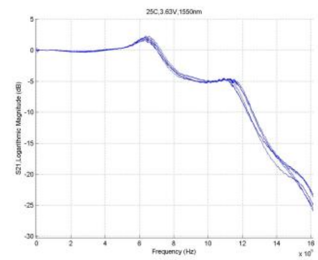
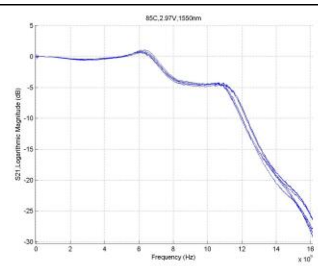
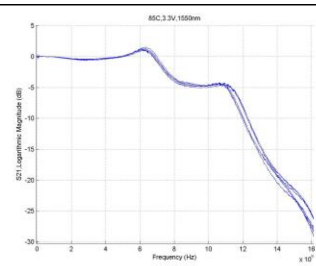
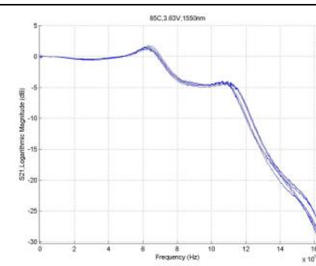
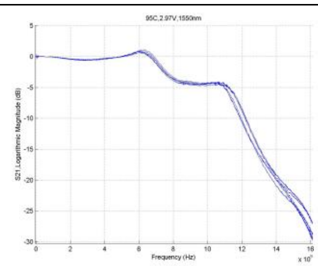
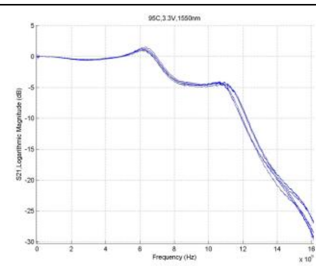
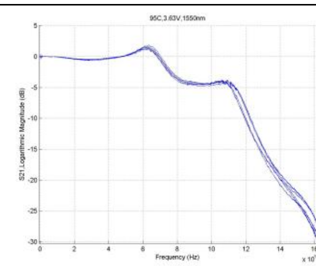
3.6. S-parameters

3.6.1. Test Descriptions

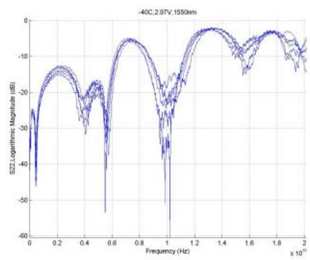
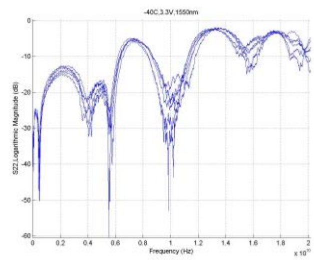
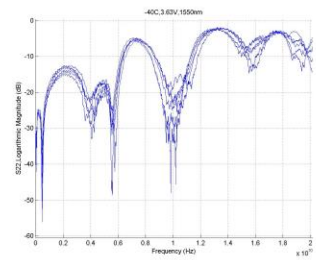
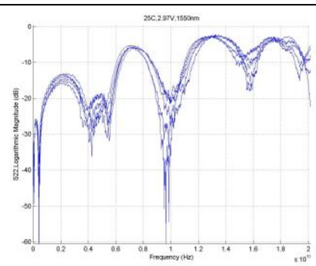
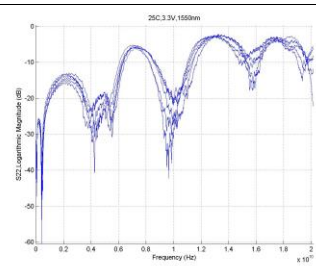
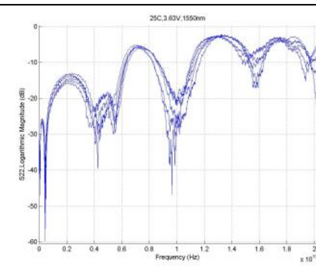
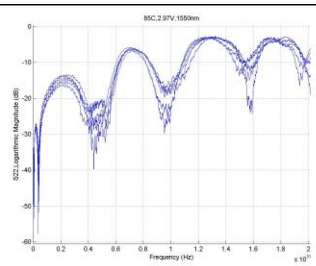
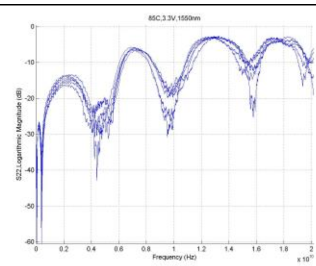
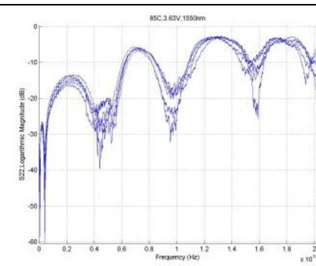
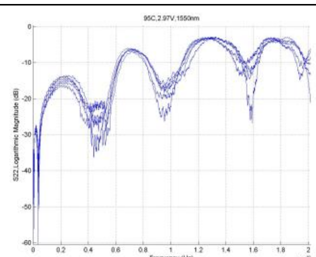
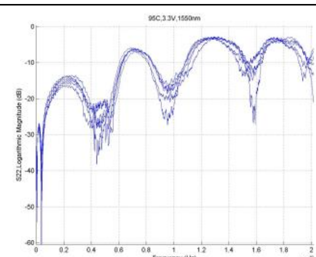
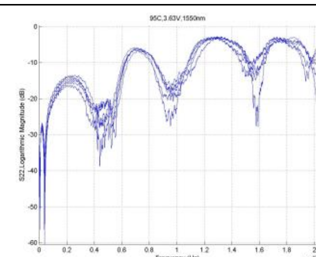
An s-parameter sweep was performed with an input optical power of -19dBm and electrical power of 0dBm at 1550nm.

*Note that only 6/10 parts were tested for S-parameters due to equipment availability.

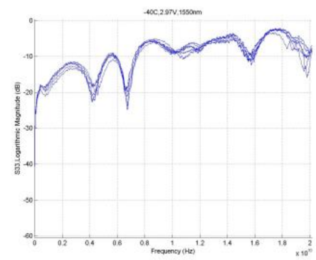
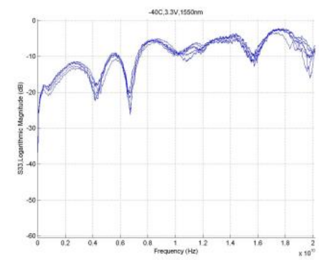
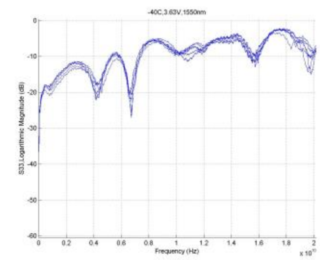
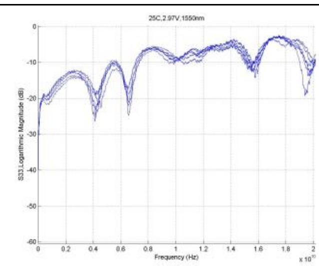
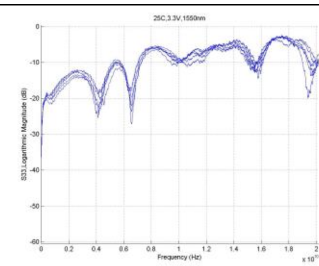
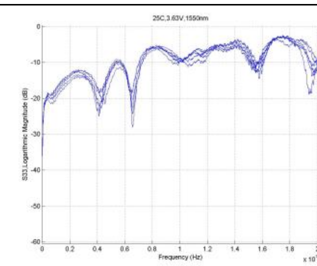
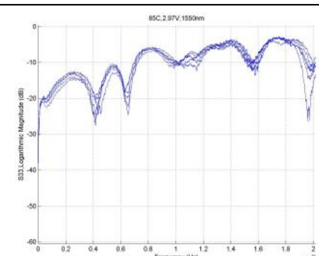
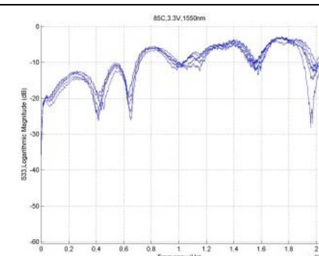
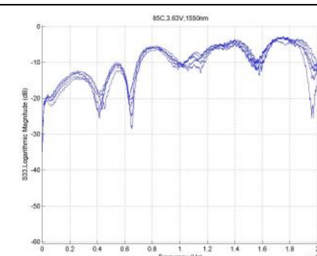
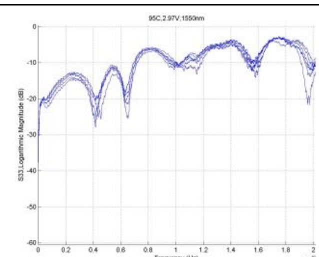
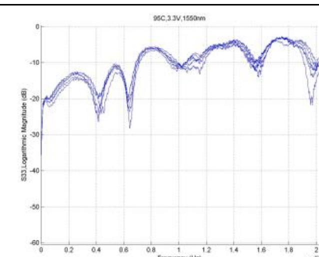
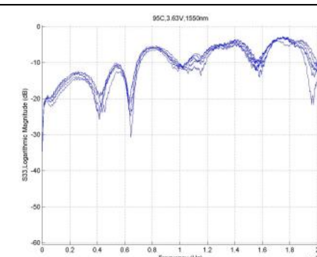
3.6.2. P-Channel S21 plots at 1550nm and -19dBm Optical Input Power

	2.97V	3.3V	3.63V
-40C			
25C			
85C			
95C			

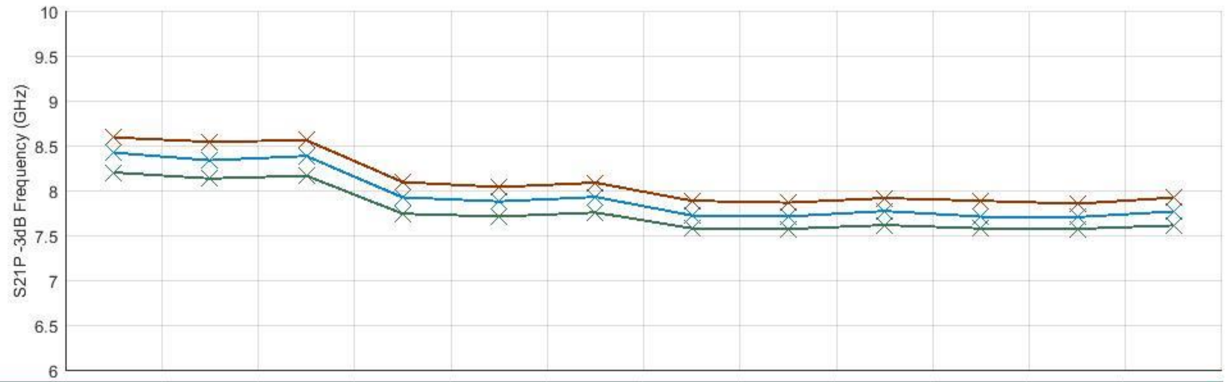
3.6.3. P-Channel S22 plots at 1550nm and 0dBm electrical input power

	2.97V	3.3V	3.63V
-40C			
25C			
85C			
95C			

3.6.4. N-Channel S22 plots at 1550nm and 0dBm electrical input power

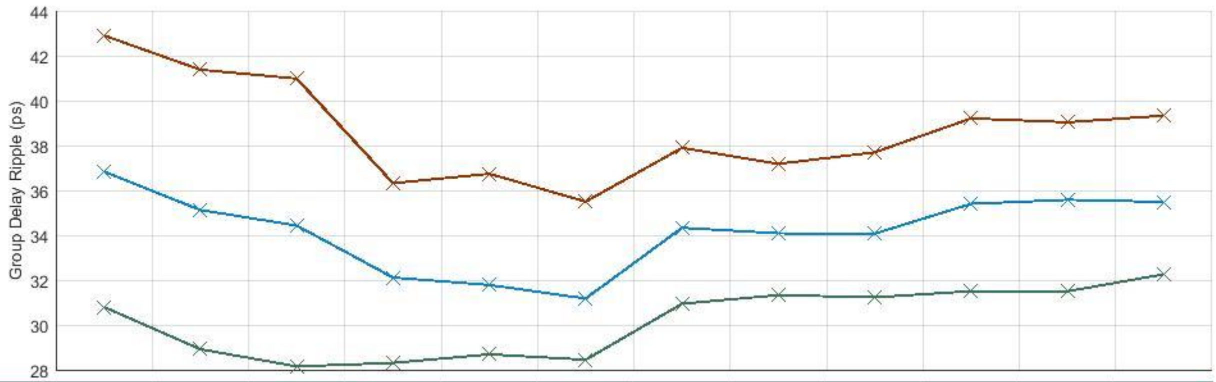
	2.97V	3.3V	3.63V
-40C			
25C			
85C			
95C			

3.6.5. S21 -3dB Bandwidth (GHz) at 1550nm



Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	8.42	8.33	8.38	7.92	7.88	7.93	7.72	7.71	7.77	7.71	7.70	7.77
Median	8.44	8.30	8.37	7.91	7.86	7.92	7.73	7.72	7.78	7.69	7.70	7.77
Std. Dev.	0.15	0.15	0.15	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.11
Max.	8.59	8.54	8.56	8.09	8.04	8.09	7.88	7.86	7.91	7.88	7.85	7.92
Min.	8.20	8.13	8.16	7.74	7.71	7.75	7.58	7.57	7.61	7.58	7.57	7.61
Range	0.39	0.41	0.40	0.35	0.33	0.33	0.31	0.29	0.30	0.31	0.28	0.31
1	8.31	8.25	8.29	7.88	7.85	7.90	7.71	7.70	7.76	7.72	7.70	7.76
2	8.44	8.30	8.35	7.89	7.83	7.88	7.61	7.61	7.70	7.61	7.61	7.70
3	8.43	8.31	8.40	7.92	7.88	7.93	7.74	7.74	7.80	7.66	7.69	7.78
4	8.20	8.13	8.16	7.74	7.71	7.75	7.58	7.57	7.61	7.58	7.57	7.61
5	8.59	8.54	8.56	8.09	8.04	8.09	7.88	7.86	7.91	7.88	7.85	7.92
6	8.55	8.48	8.53	8.00	7.96	8.00	7.80	7.78	7.84	7.79	7.78	7.83

3.6.6. Group Delay (ps) at 1550 nm (6GHz)



Oventemp	-40C	-40C	-40C	25C	25C	25C	85C	85C	85C	95C	95C	95C
Vcc	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V	2.97V	3.3V	3.63V
Mean	36.84	35.12	34.43	32.11	31.78	31.18	34.33	34.09	34.07	35.40	35.58	35.48
Median	36.76	35.19	34.60	31.42	30.80	30.73	33.41	33.48	33.55	34.45	34.82	34.46
Std. Dev.	4.87	4.80	4.76	3.05	2.98	2.56	2.75	2.36	2.44	2.89	2.88	2.83
Max.	42.90	41.38	40.98	36.32	36.74	35.50	37.89	37.18	37.70	39.21	39.03	39.33
Min.	30.80	28.92	28.15	28.31	28.69	28.45	30.94	31.33	31.23	31.51	31.50	32.26
Range	12.11	12.46	12.83	8.01	8.05	7.05	6.95	5.85	6.47	7.70	7.54	7.07
1	35.75	34.52	34.13	31.31	31.31	31.16	33.86	34.07	34.20	34.48	34.49	34.86
2	41.56	39.31	38.03	35.13	33.79	32.52	37.42	36.64	36.07	38.43	38.81	38.58
3	42.90	41.38	40.98	36.32	36.74	35.50	37.89	37.18	37.70	39.21	39.03	39.33
4	37.76	35.86	35.07	31.54	29.86	29.15	32.97	32.41	32.33	34.34	35.09	34.05
5	30.80	28.92	28.15	28.31	28.69	28.45	30.94	31.33	31.23	31.51	31.50	32.26
6	32.26	30.76	30.23	30.07	30.29	30.29	32.90	32.89	32.90	34.43	34.55	33.82

4. Notes and Conclusions

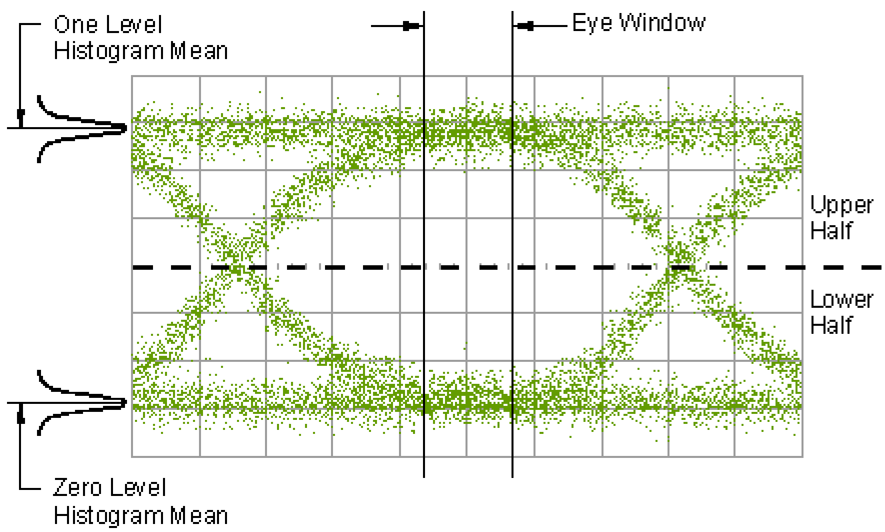
GN3250 ROSA using lead free lens cap shows comparable performance to GN3250 ROSA as documented in PRODDOC4073 characterization report.

All results satisfy the datasheet.

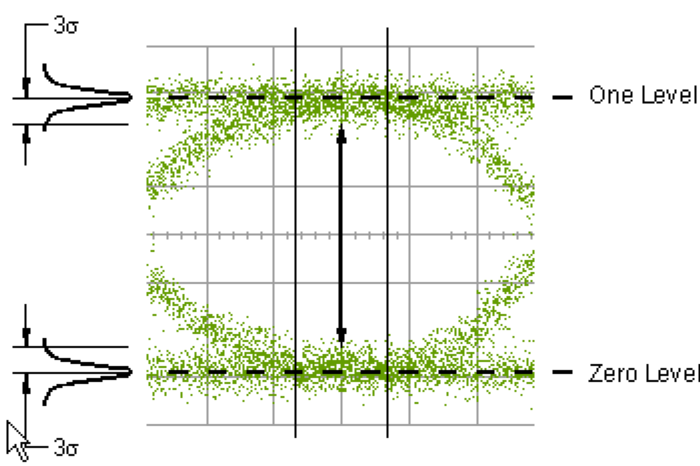
5. Appendix 1: Eye Diagram Measurement Definitions

a. Eye Heights

Eye height is a measure of the vertical opening of an eye diagram. Histograms are constructed to characterize both the one and zero levels *and* their noise levels within the eye window boundaries. The one and zero level measurements are made in a section of the eye referred to as the eye window boundaries. The eye window boundary is the central 20% of the bit period.



The one and zero levels are the relative means of the histograms. The noise is measured through the histograms as three standard deviations from both the one level and zero level into the eye opening.

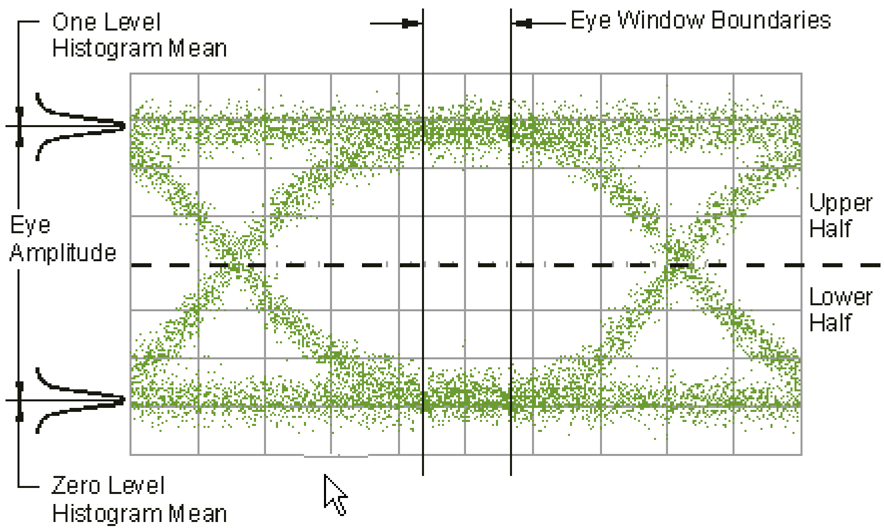


The eye height is determined as follows, eye height = (one level - 3σ) - (zero level + 3σ)

b. Eye Amplitudes

Eye amplitude is the difference between the logic 1 level and the logic 0 level histogram mean values of an eye diagram. This measurement is made in a section of the eye referred to as the eye window boundaries. The eye window boundary is the central 20% of the bit period.

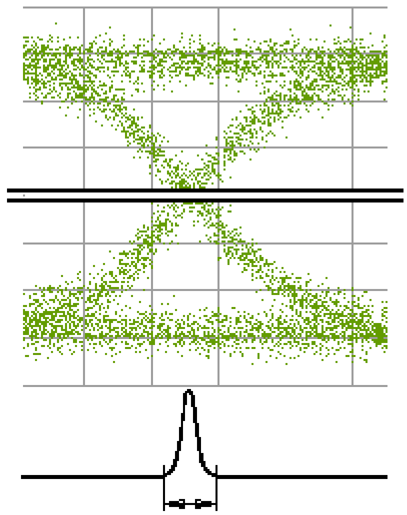
A histogram is constructed using the sampled portion of the eye diagram within the eye window. This histogram is comprised of data points from the upper and lower halves of the eye diagram and is used to determine the mean values of the logic 1 and logic 0 levels. The eye amplitude is determined as follows:



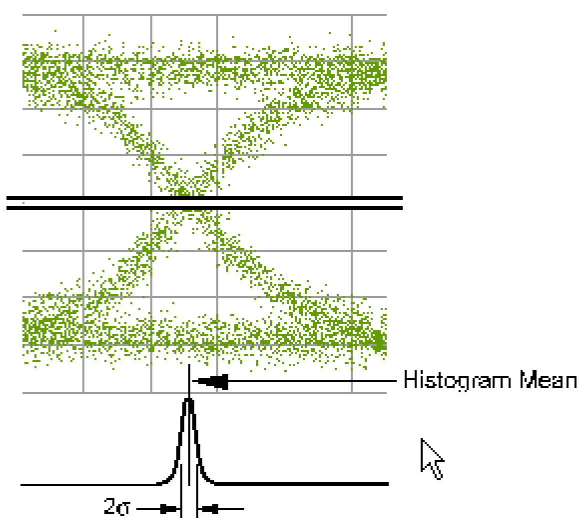
c. Jitter RMS and pk-pk

Eye Jitter is the measure of the time variances of the rising and falling edges of an eye diagram, as these edges affect the crossing point of the eye. To compute jitter, the level of the crossing point of the eye is first determined. Then a vertically thin measurement window is placed horizontally through the crossing point, and a time histogram is generated.

Jitter pk-pk is equal to the full width of the histogram at the eye crossing point.



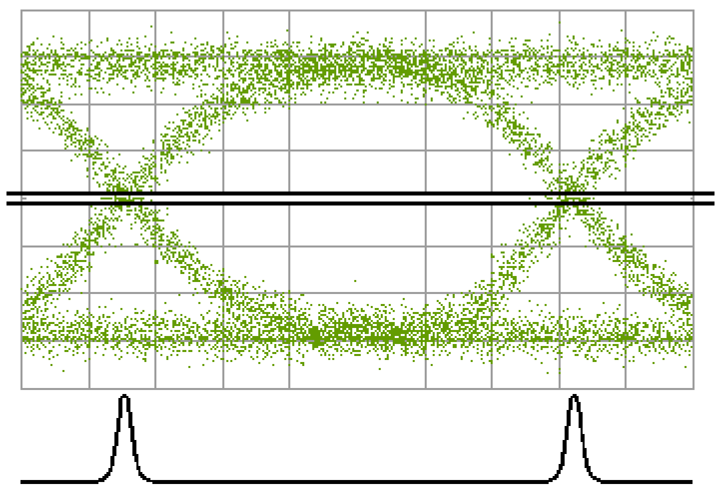
Jitter RMS is defined as 1 σ (standard deviation) of the crossing point histogram



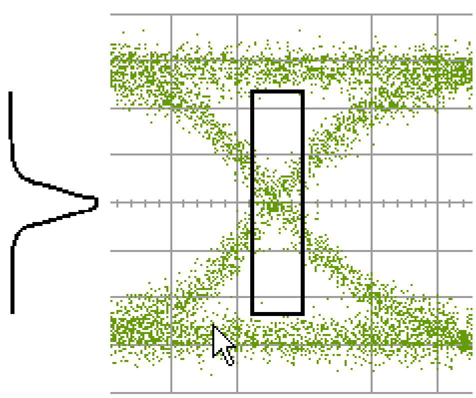
d. Crossing percentage

Crossing percentage is a measure of the amplitude of the crossing points relative to the one level and zero level. The one and zero level measurements are made in a section of the eye referred to as the eye window boundaries. The eye window boundary is the central 20% of the bit period.

A vertically thin measurement window is placed horizontally through the crossing points, and a horizontal histogram is used to determine the mean location (in time) of the crossing point.



A narrow vertical histogram is used to determine the amplitude of crossing points.

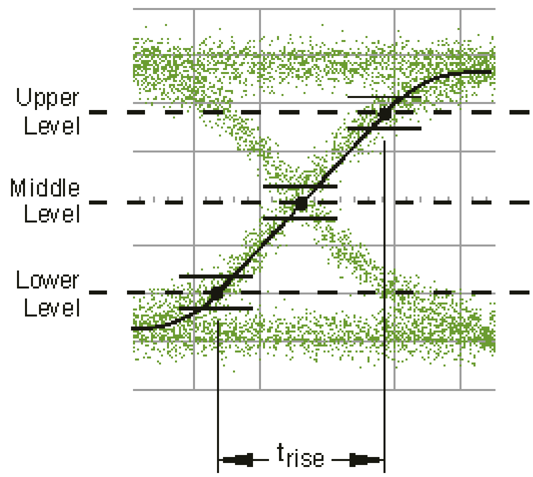


The mean derived from the horizontal and vertical histogram results in V_{cross}. Crossing percentage is then determined by the following:

Crossing percent = 100 $(V_{cross} - V_{zero\ level})/(V_{one\ level} - V_{zero\ level})$

e. Rise Time and Fall Time

Rise time is a measure of the mean transition time of the data on the upward slope of an eye diagram. The data crosses through the following three thresholds: the lower, middle, and upper thresholds, as well as through the eye crossing point. The settings for the threshold levels are the 20% to 80% points on the transition.



Rise time= time at the upper threshold crossing – time at the lower threshold crossing

Fall times are similarly calculated except on the downward slope of an eye diagram.