

Transceiver Performance **TEST Report**

Model name : QDD-DR4-400G-Si

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1. Features and Purpose

The purpose of this report is to characterize the electrical and optical performance of transceiver. This document is for the 400G QSFP-DD DR4 design review. Table 1: P/N List

Part Number	Description
QDD-DR4-400G-Si	400G DR4 QSFP-DD PAM4 1310nm 500m DOM MTP/MPO SMF Silicon Photonics Transceiver Module

All the P/Ns share the same PCB design, FW, Mechanics, OSA design.

1.1 Related Documentation

IEEE 802.3bs

QSFP-DD MSA

CMIS 4.0

1.2 General Information

Serial ID	Product Information		
Serial 1	PN		QDD-DR4-400G-Si
Serial 2			
Serial 3			
Serial 4	Application		400G DR4
Serial 5			
Serial 6	Operation Voltage	LV	3.135V
Serial 7		NV	3.300V
Serial 8		HV	3.465V
Serial 9	Operation Tcase	LT	0°C
Serial 10		NT	25°C
Serial 11		HT	70°C

2. Optical Performance

2.1 Test Result Summary

Parameter	Specification		Test Data		Unit	Pass/Total
	Min	Max	Min	MAX		
Center Wavelength	1304.5	1317.5	1308.5	1314.3	nm	3/3
SMSR	30		42.8	59.3	dB	3/3
TX Optical Power	-2.9	4.0	0.80	3.17	dBm	11/11
TX OuterER	3.5		4.55	5.90	dB	11/11
TX TDECQ		3.4	0.65	2.17	dB	11/11
OuterOMA	-0.8	4.2	0.99	3.57	dBm	11/11
OuterOMA-TDECQ	-2.2		-0.19	2.67	dBm	11/11
Linearity			0.955	0.999		11/11
RX Sensitivity(OMA) 2.4E-4		-5.3	-8.31	-6.22	dBm	11/11
RX LOS Assert	-15		-13.84	-11.14	dBm	11/11
RX LOS De-assert		-8.9	-11.74	-9.94	dBm	11/11
RX LOS Hysteresis	0.5		0.9	3	dB	11/11
BER@0dBm		2.4E-4	3.34E-9	1.65E-6		11/11
BER@-2dBm		2.4E-4	4.97E-9	1.69E-6		11/11
BER@-4dBm		2.4E-4	2.58E-8	3E-6		11/11
BER@-5dBm		2.4E-4	1.45E-7	2.05E-5		11/11

2.2 Test Result Data

2.2.1 Typical TX Eye Diagrams

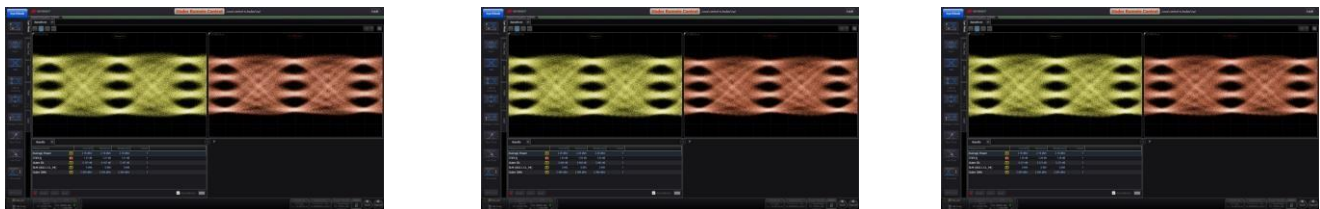


Figure 2-1– 1# Sample optical eye CH1, LTHV/NTNV/HTLV

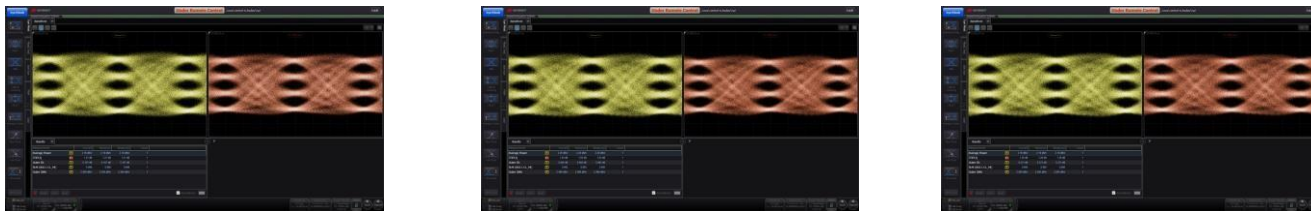


Figure 2-2- 1# Sample optical eye CH2, LTHV/NTNV/HTLV

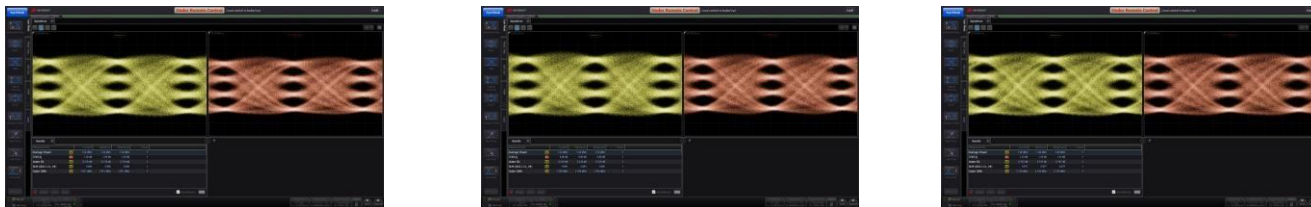


Figure 2-3 - 1# Sample optical eye CH3, LTHV/NTNV/HTLV

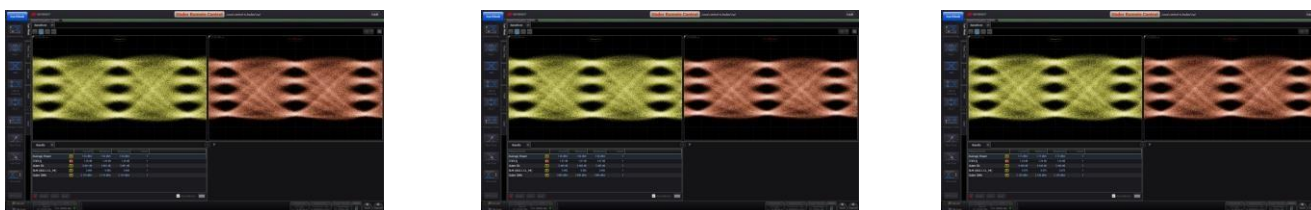


Figure 2-4 - 1# Sample optical eye CH4, LTHV/NTNV/HTLV

2.2.2 TX Test Data Diagram For Nine Corners

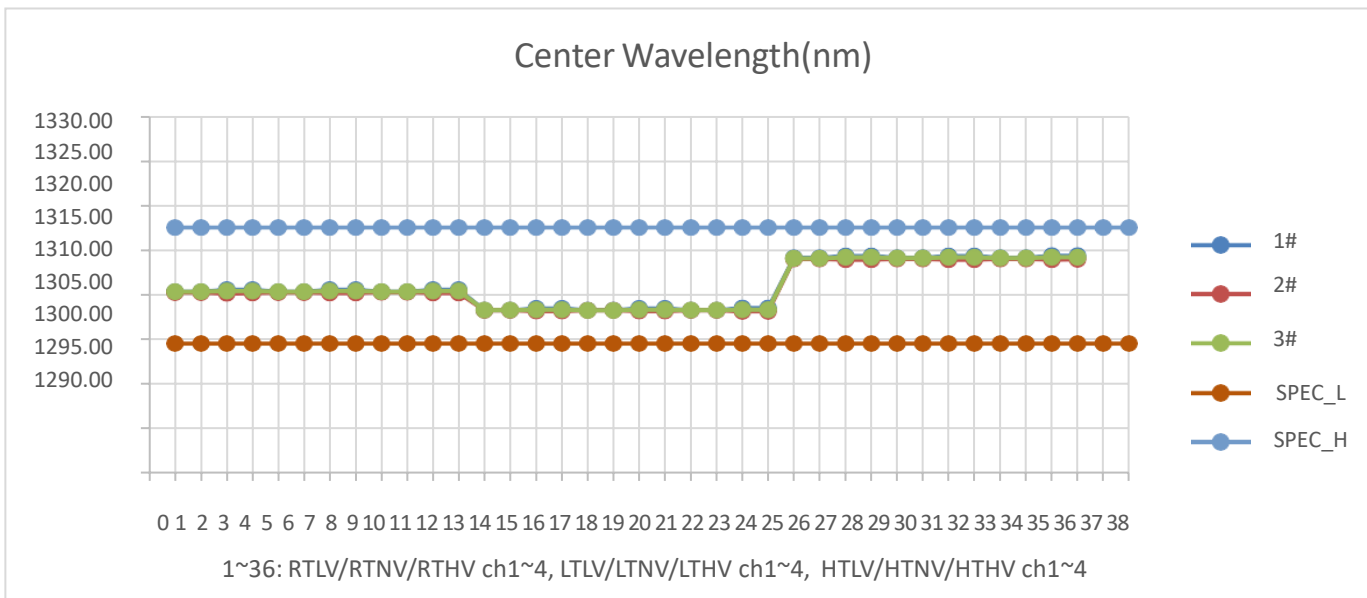


Figure 2-5 TX Optical Center Wavelength test results for nine corners

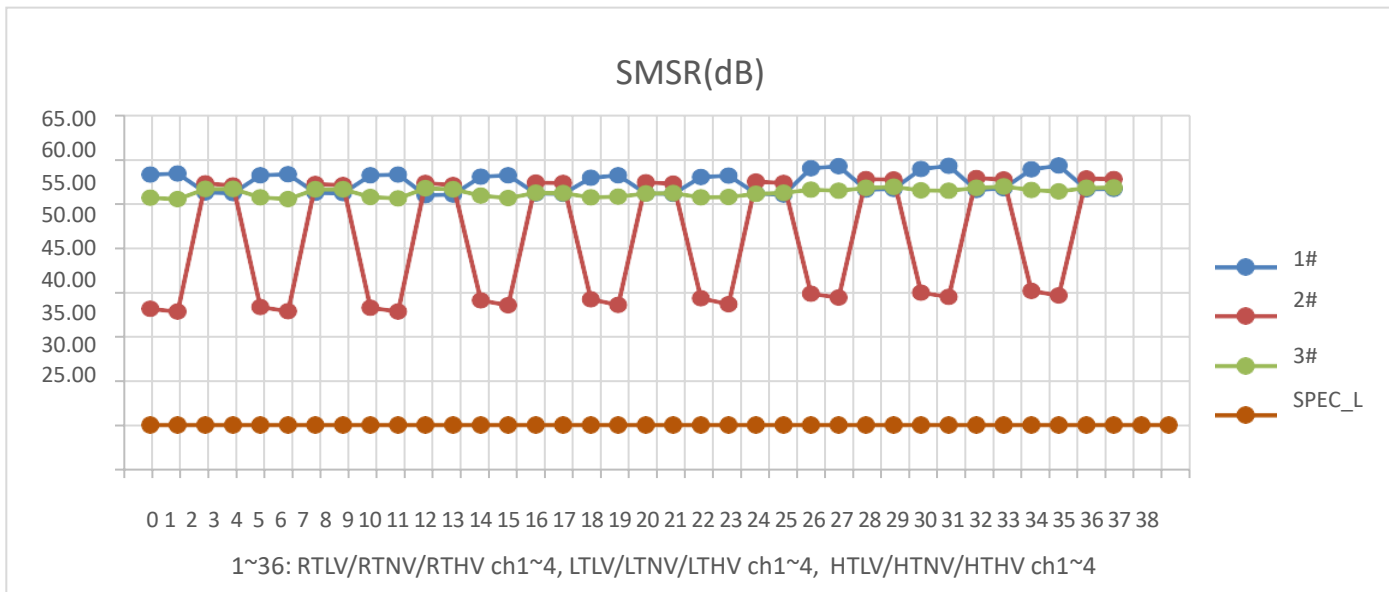


Figure 2-6 TX Optical SMSR test results for nine corners

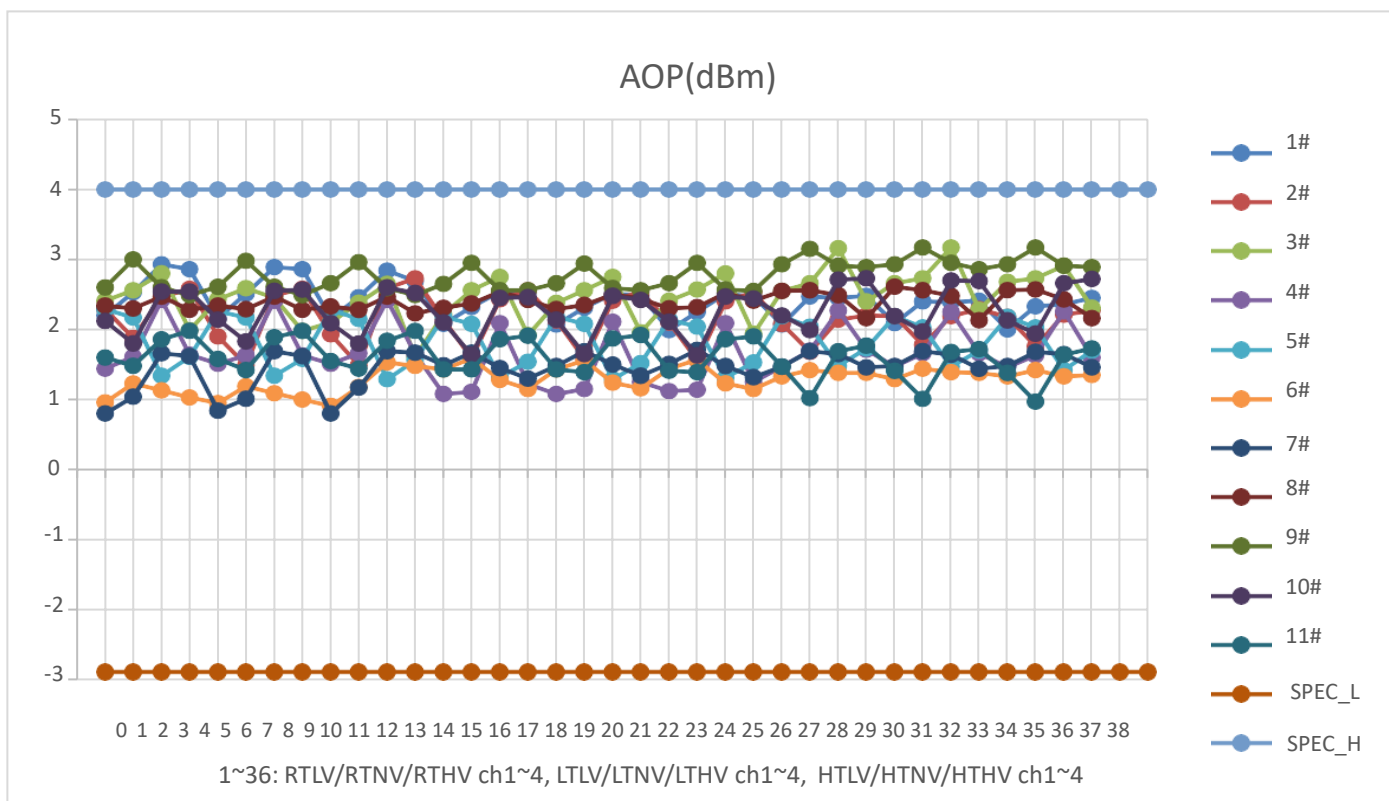


Figure 2-7 TX Optical Power test results for nine corners

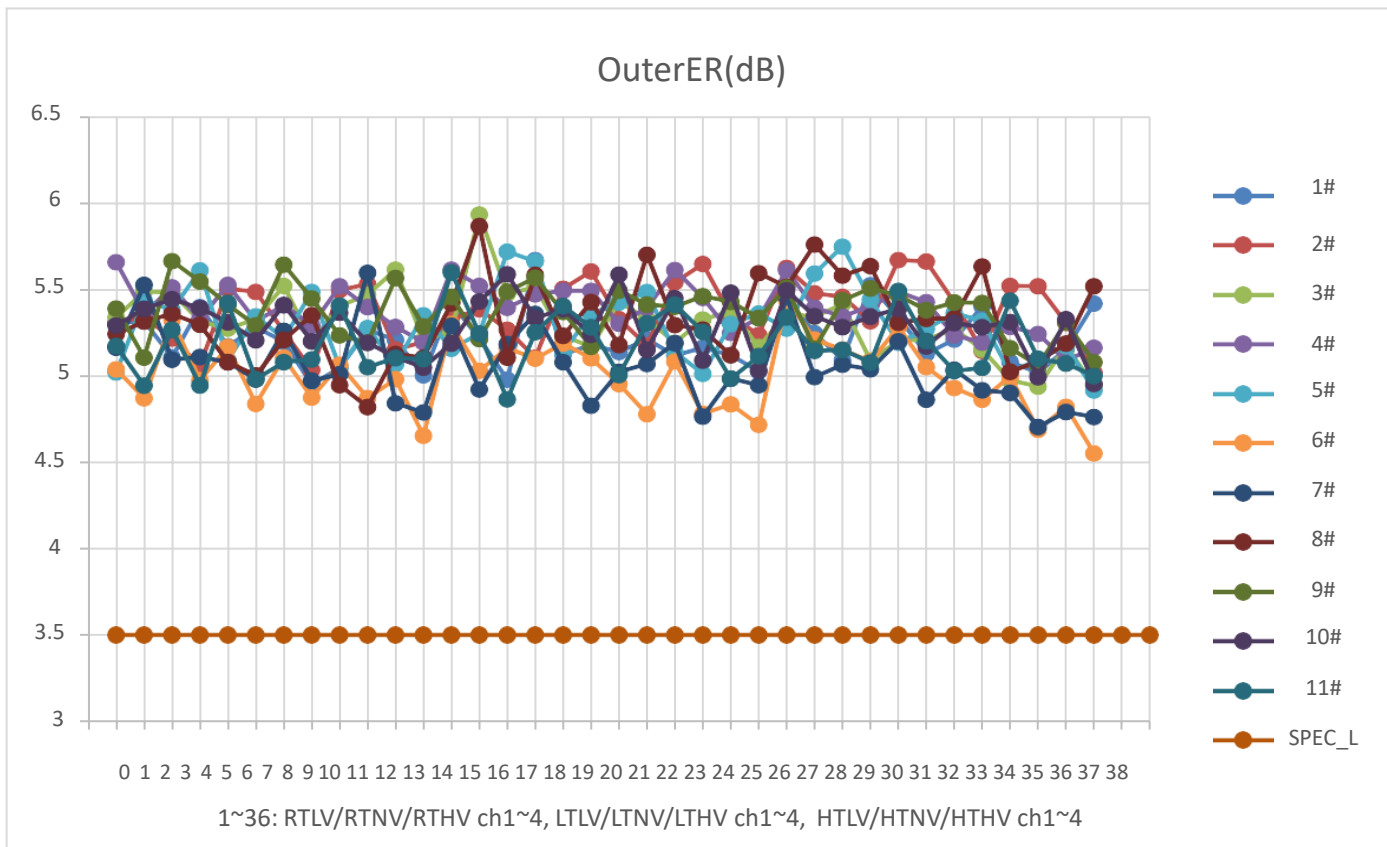


Figure 2-8 TX OuterER test results for nine corners

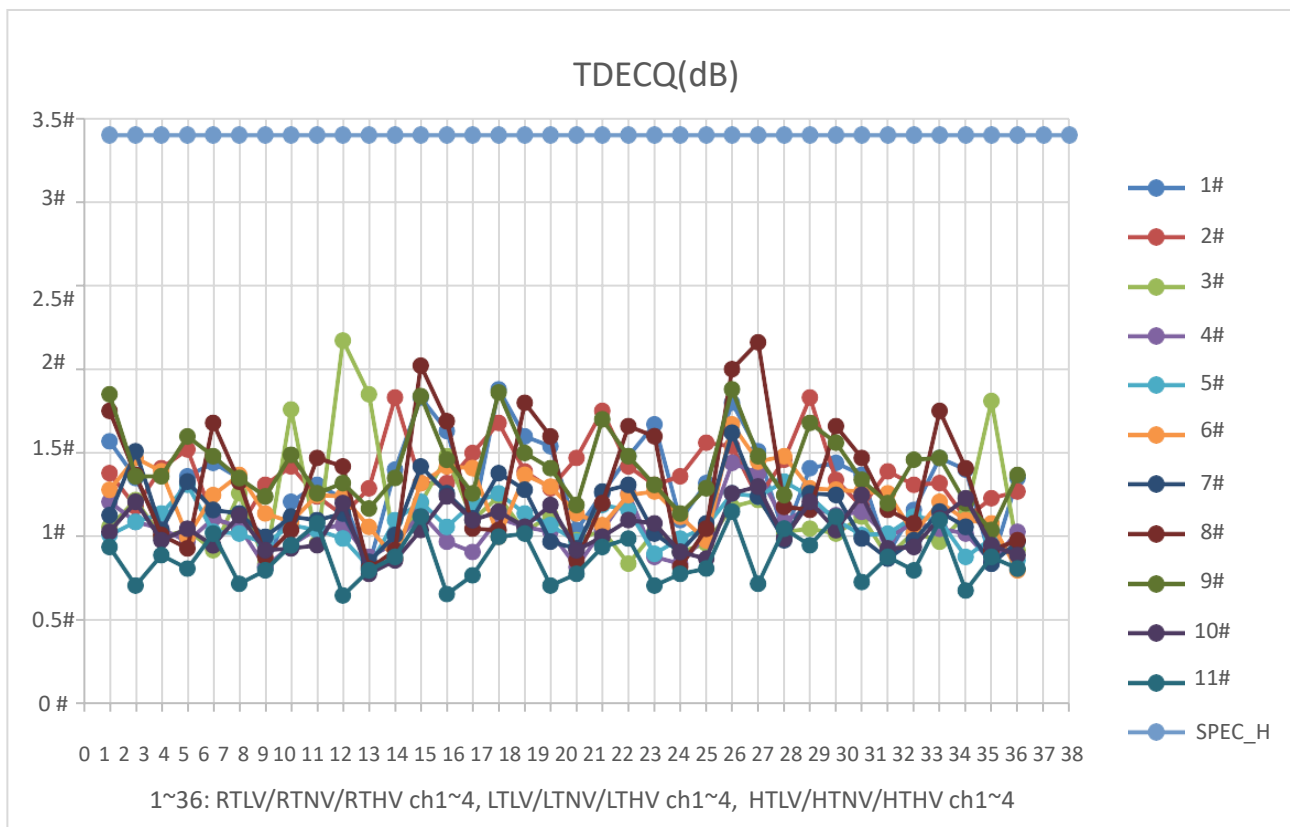


Figure 2-9 TX Eye TDECQ test results for nine corners

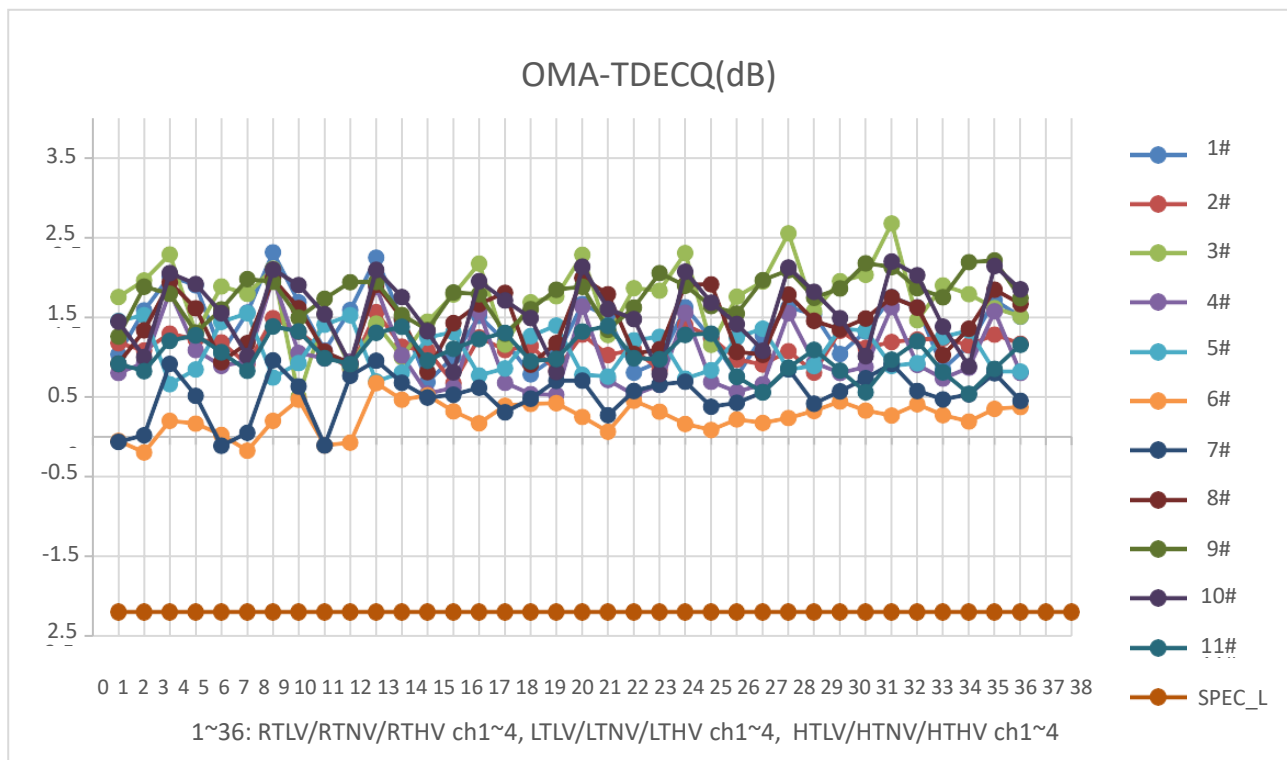


Figure 2-10 TX Eye OMA-corners

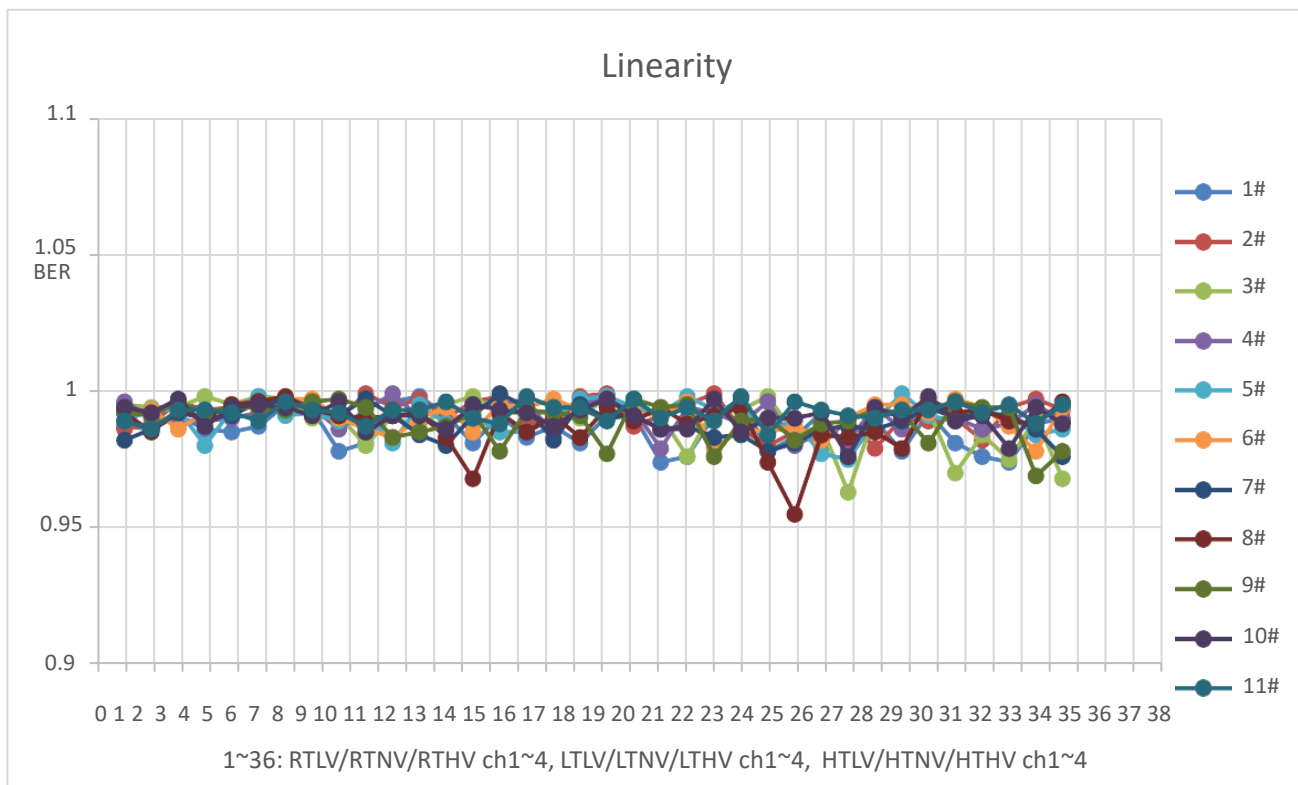


Figure 2-11 TX Eye Linearity test results for nine corners

2.2.3 RX Test Data Diagram For Nine Corners

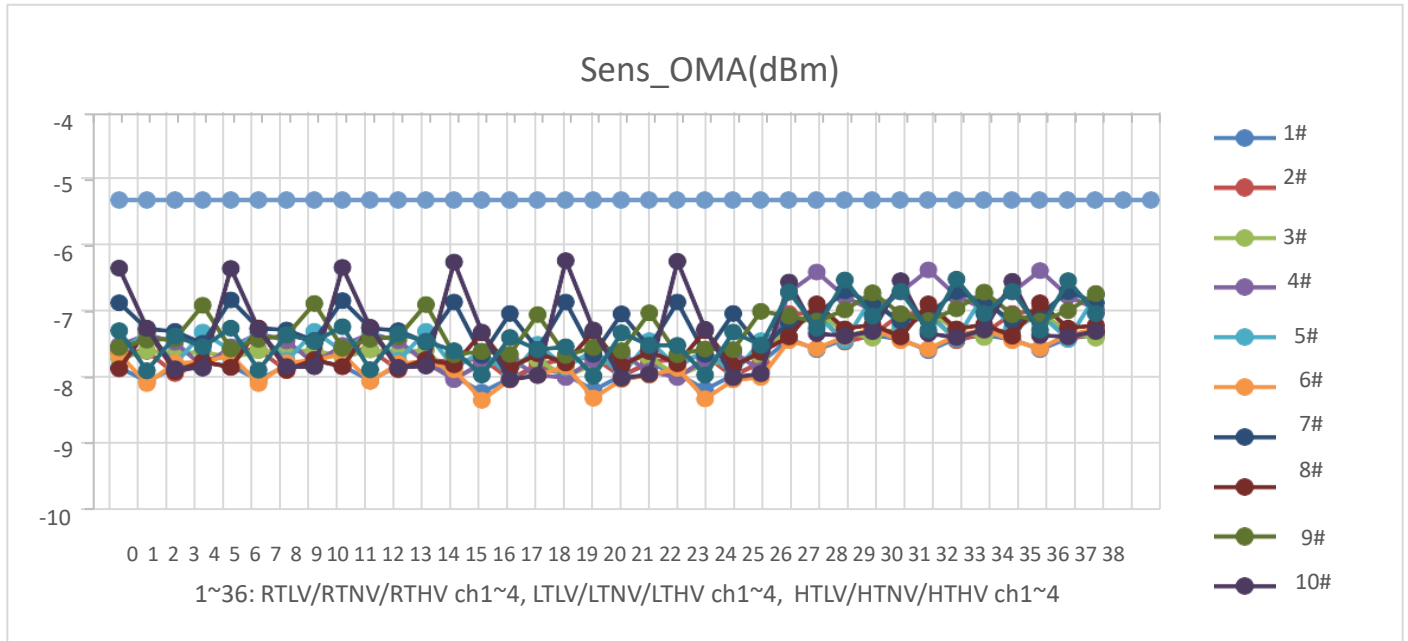


Figure 2-12 RX OMA Sensitivity test results for nine corners

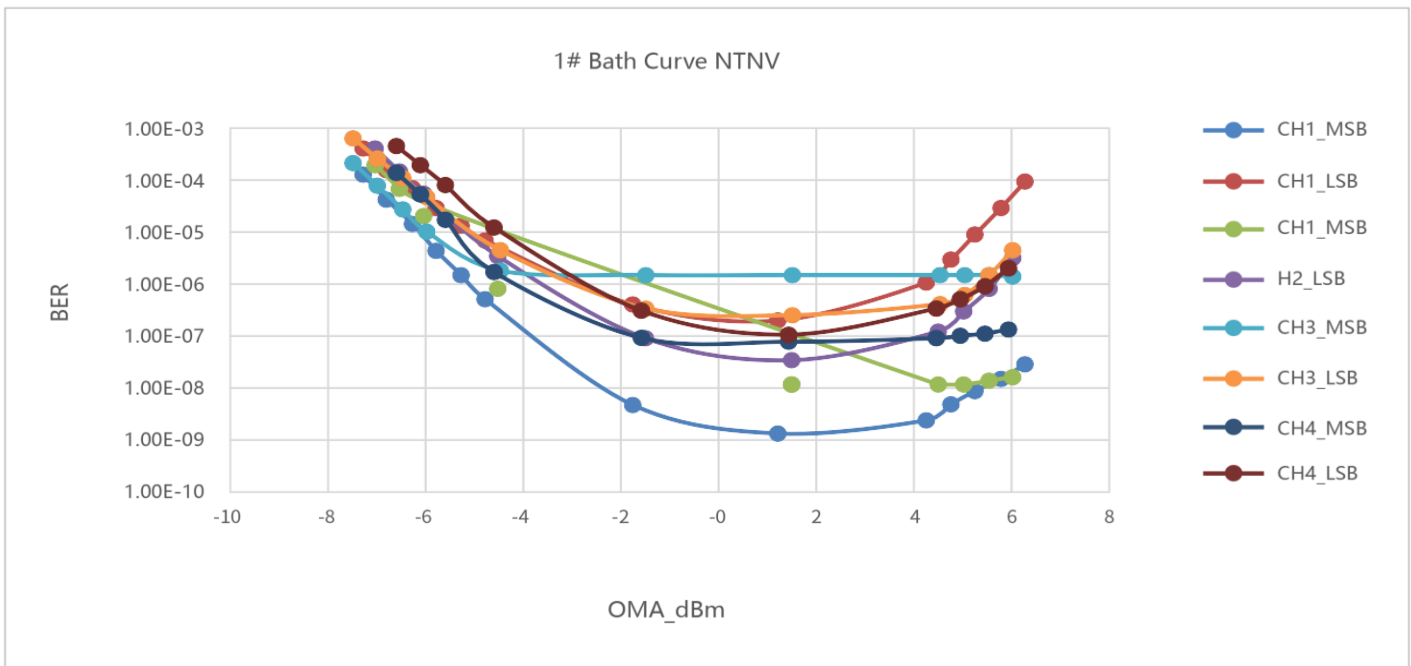


Figure 2-13 1# RX BER test results for NTNV

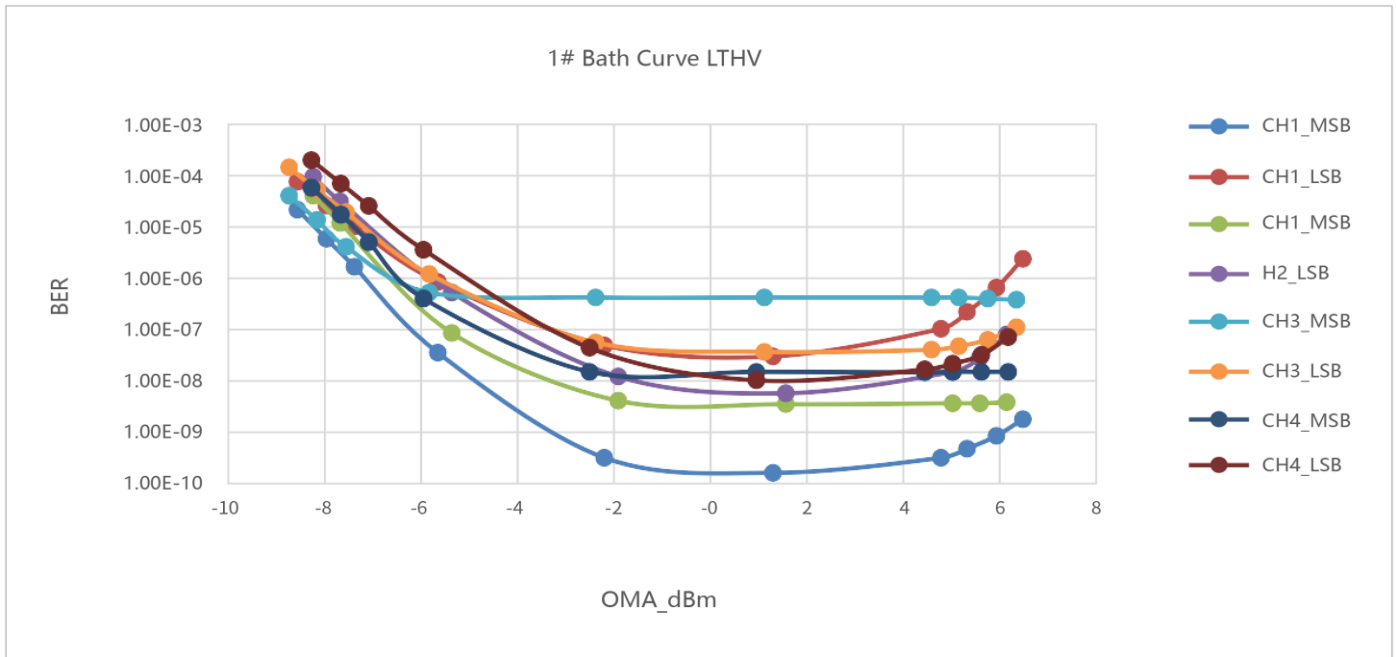


Figure 2-14 1# RX BER test results for LTHV

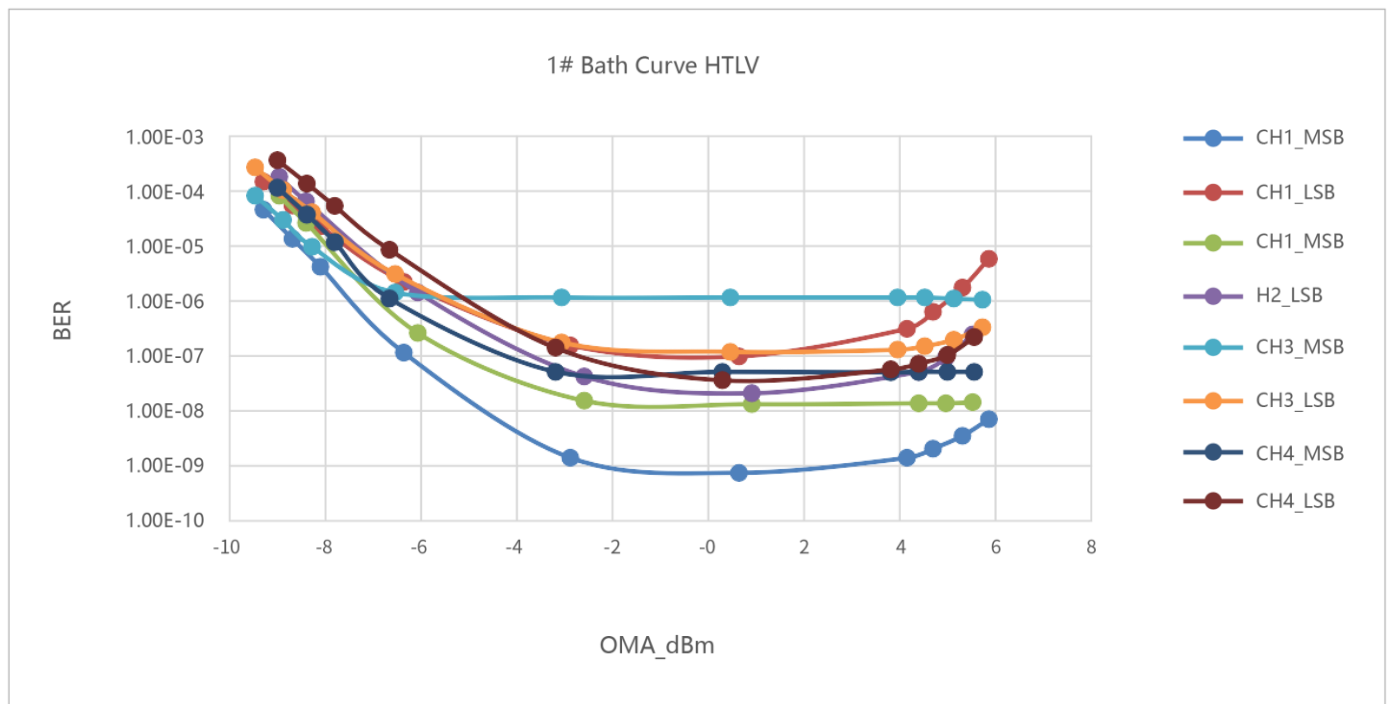


Figure 2-15 1# RX BER test results for HTLV

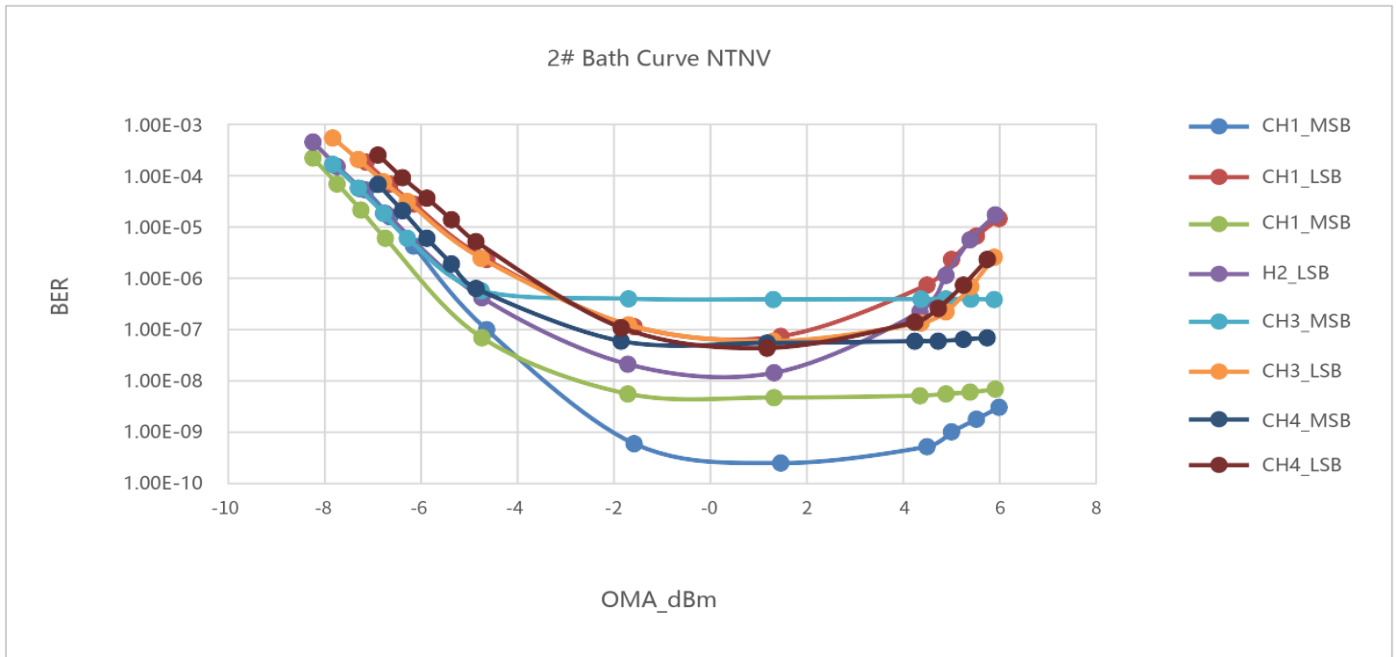


Figure 2-16 2# RX BER test results for NTNV

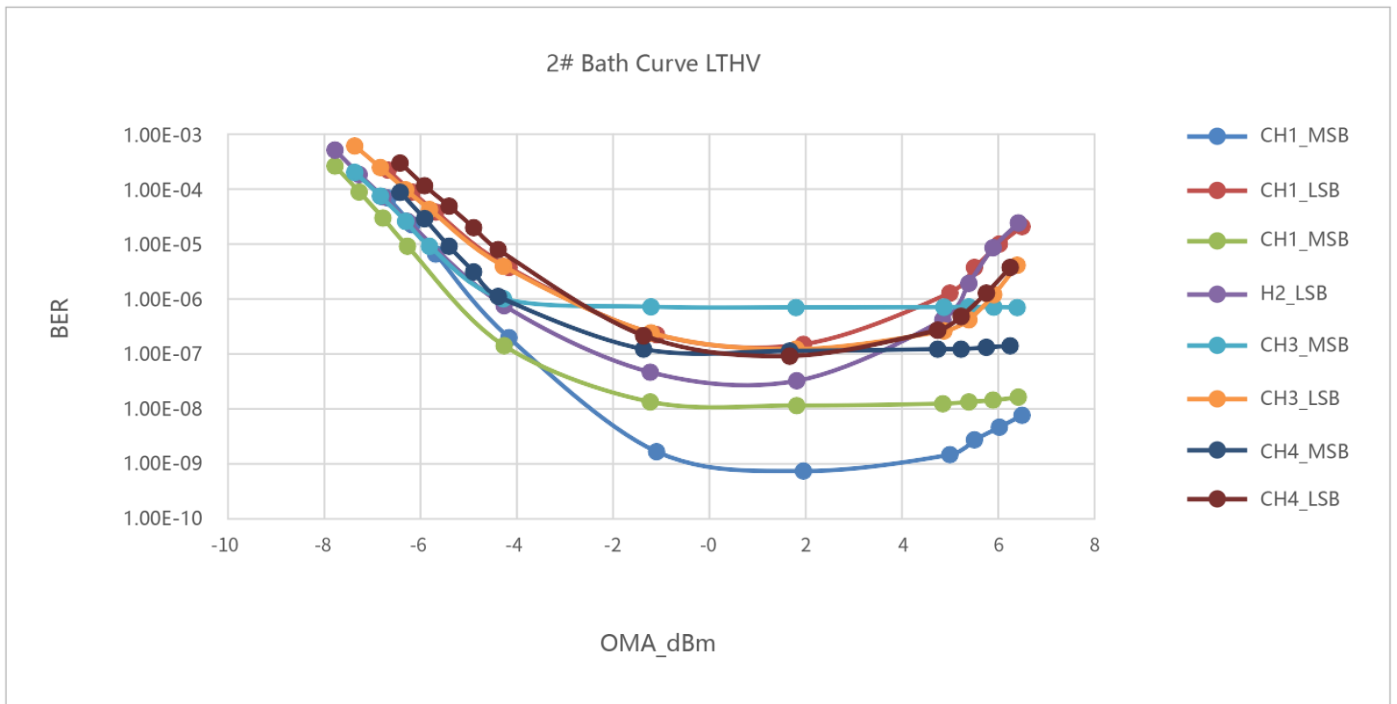


Figure 2-17 2# RX BER test results for LTHV

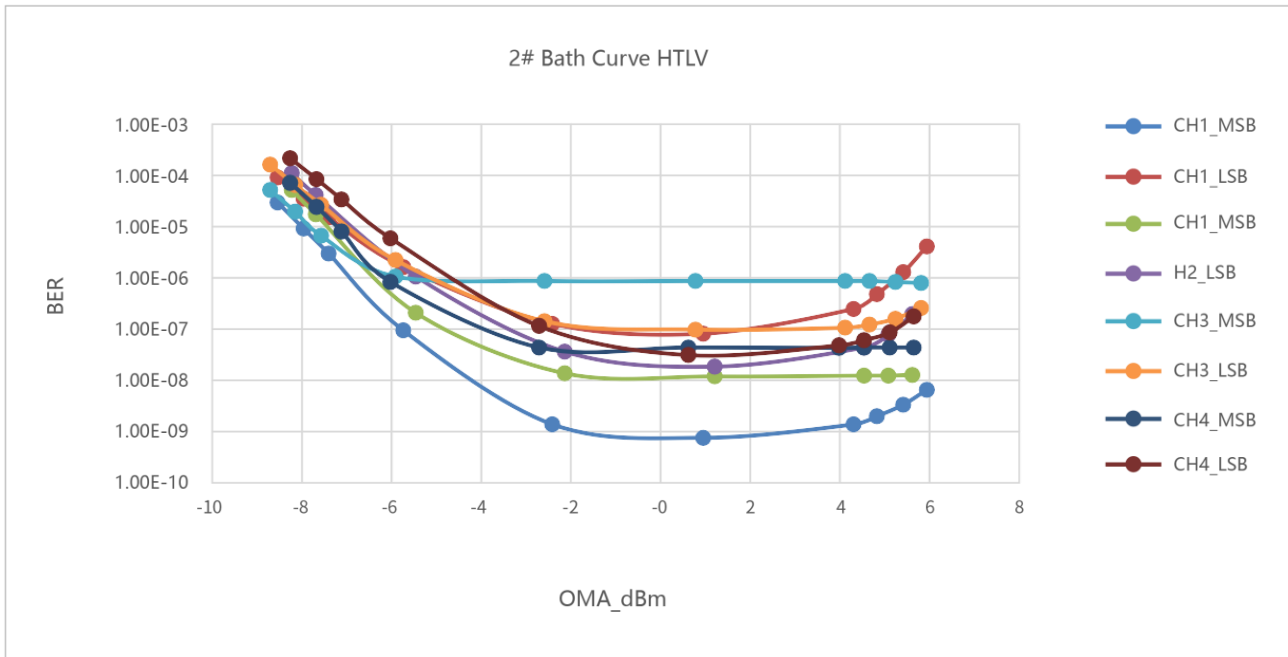


Figure 2-18 2# RX BER test results for HTLV

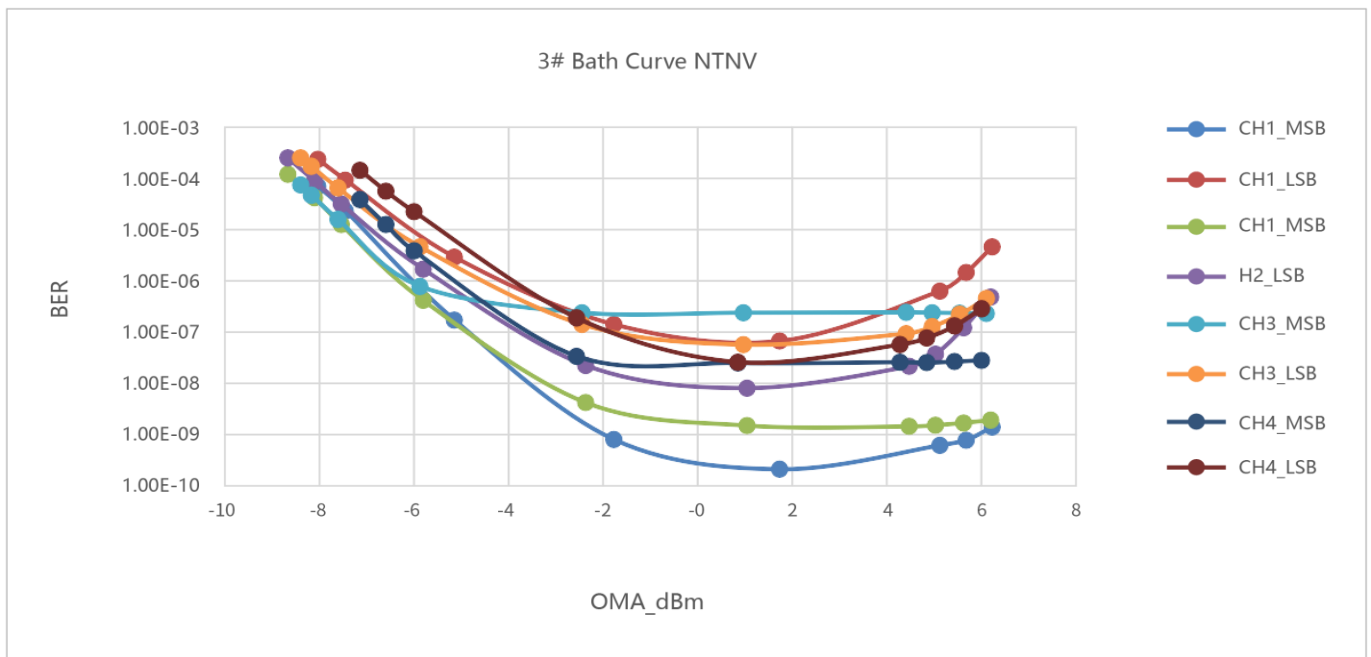


Figure 2-19 3# RX BER test results for NTN

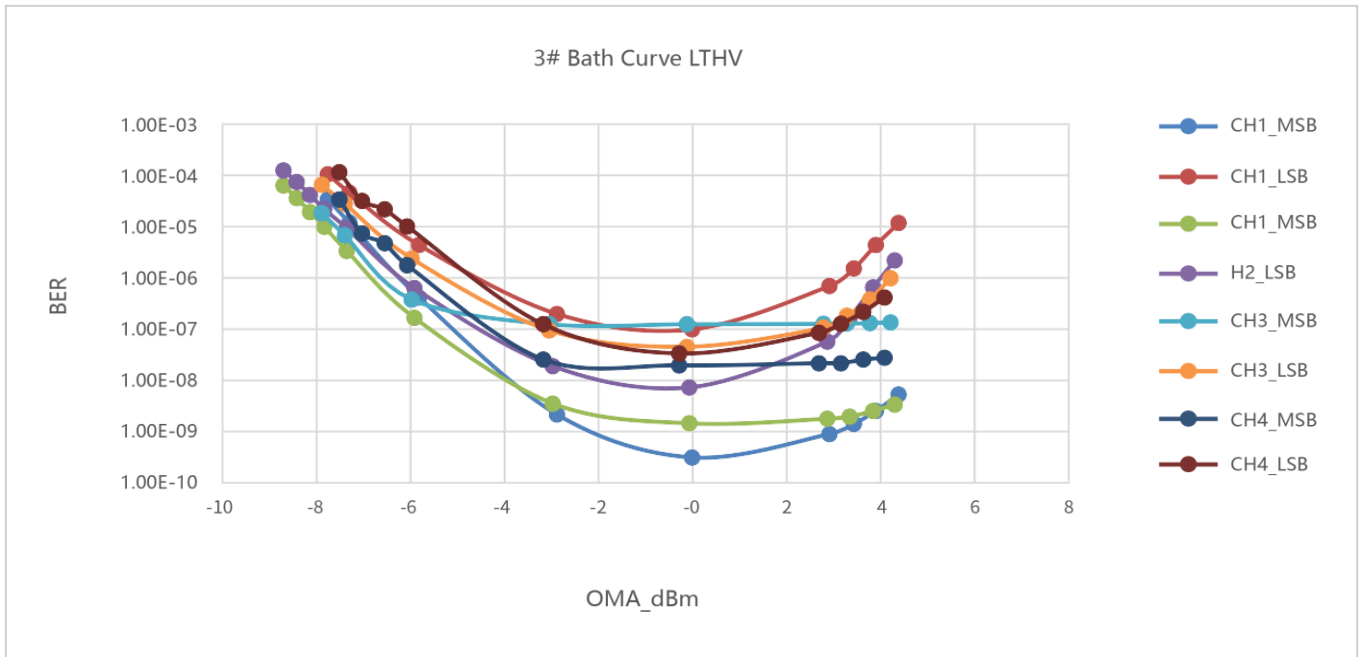


Figure 2-20 3# RX BER test results for LTHV

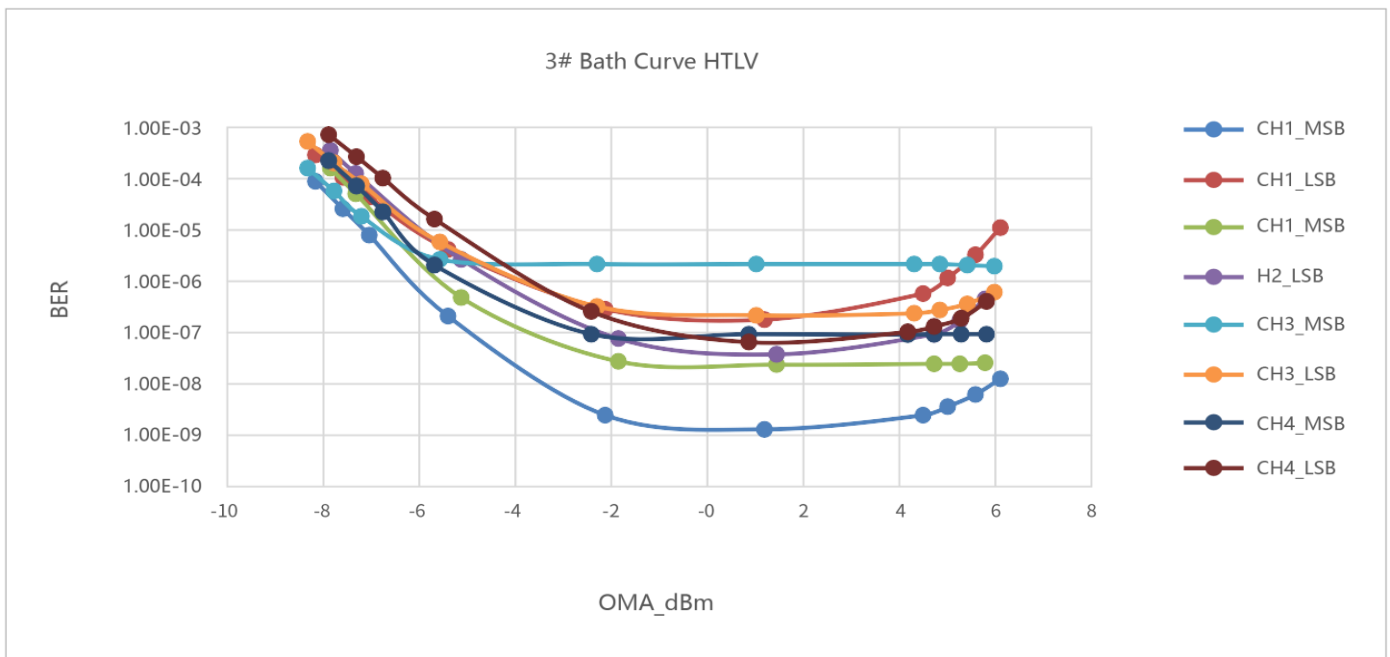


Figure 2-21 3# RX BER test results for HTLV

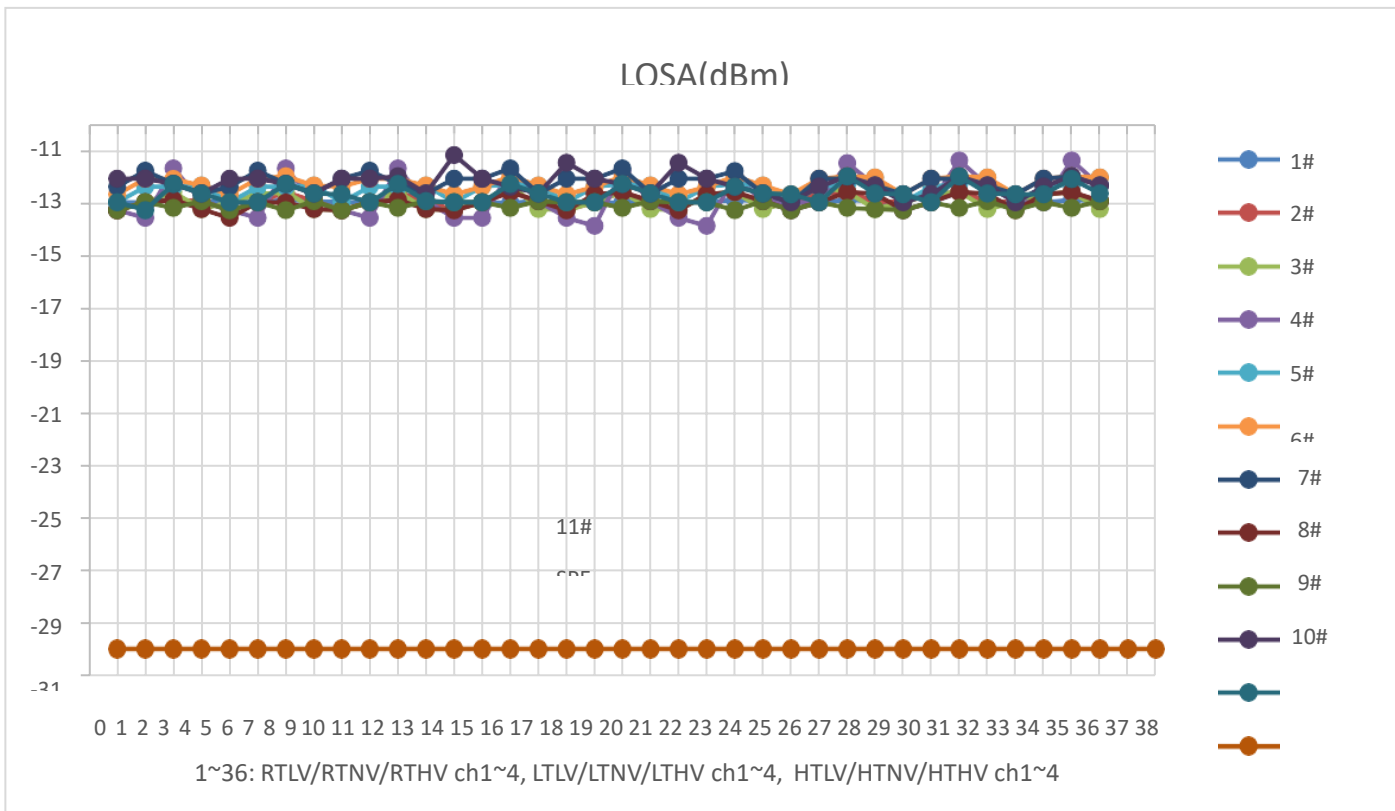


Figure 2-22 RX LOS Assert test results for nine corners

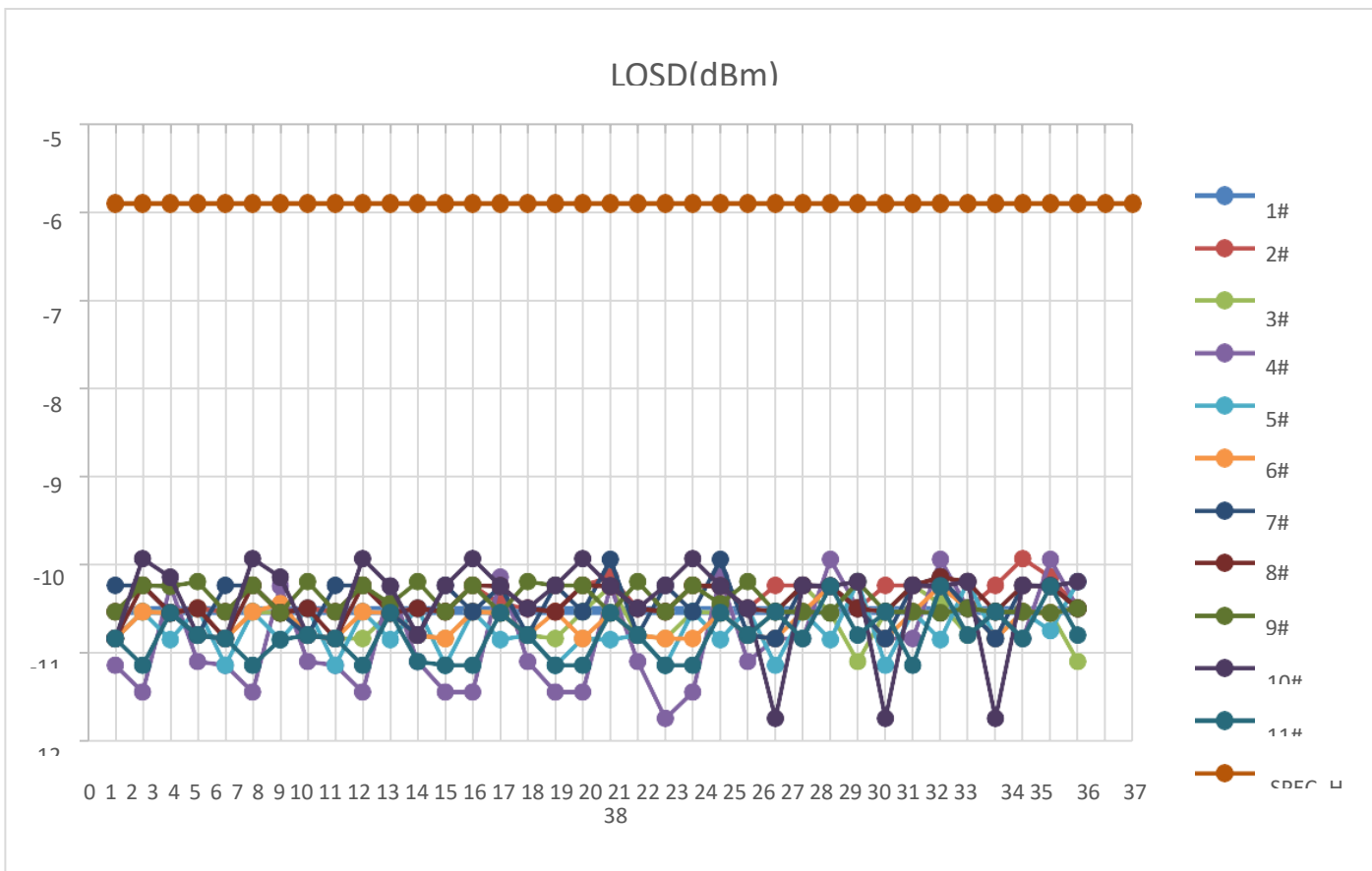


Figure 2-23 RX LOS De-Assert test results for nine corners

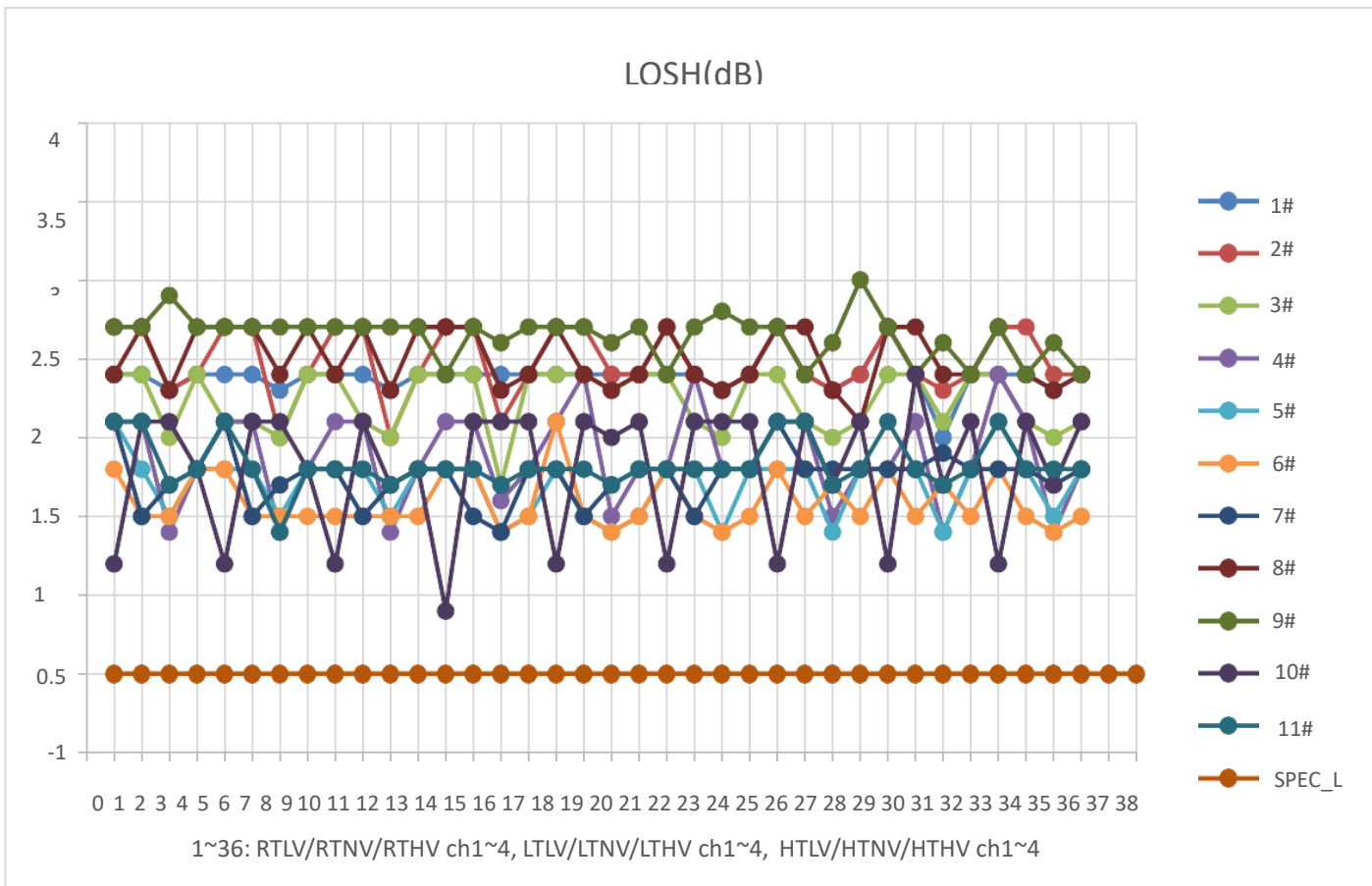


Figure 2-24 RX LOS Hysteresis test results for nine corners

3. Electrical Performance

3.1 Test Result Summary

ParameterNOTE[1]	Specification		Test Data		Unit	Pass/Total
	Min	Max	Min	MAX		
Power Consumption		12	8.51	9.94	W	11/11
RX Output Voltage pk-pk(diff)		900	365	409	mVpp	3/3
RX Eye TDECQ			1.02	3.97	dBm	3/3
RX Eye Linearity			0.916	0.959		3/3
Power Consumption_LPMoDe			0.86	1	W	3/3
Sustained peak current at hot plug			2620	2690	mA	3/3
Sustained peak current at hot plug_LPMoDe			266	304	mA	3/3

3.2 Test Result Data

3.2.1 RX Output Electrical Eyes

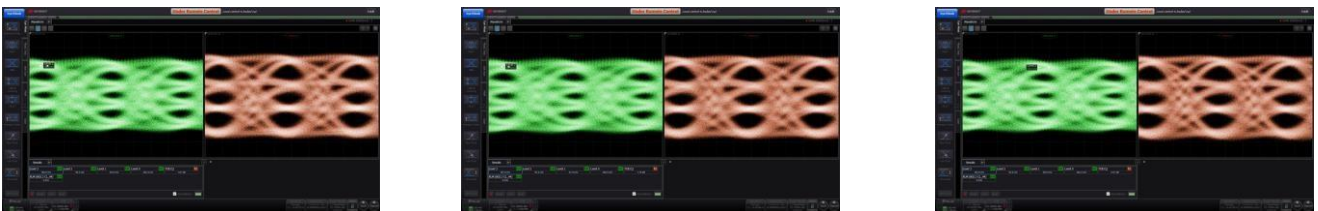


Figure 3-1 – 1# Sample output electrical eye, CH1 MSB, NV, RT/HT/LT

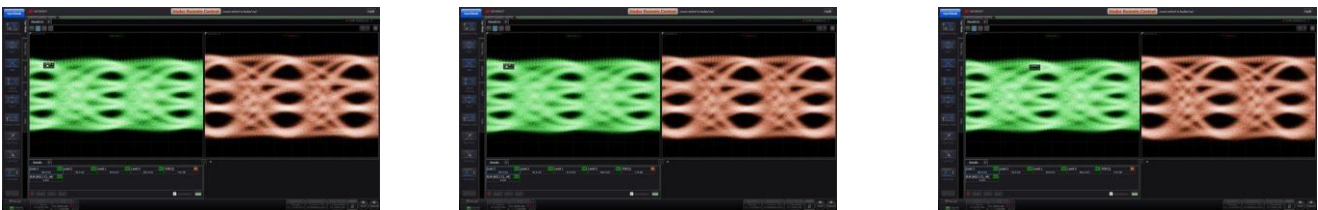


Figure 3-2 – 1# Sample output electrical eye, CH1 LSB, NV, RT/HT/LT

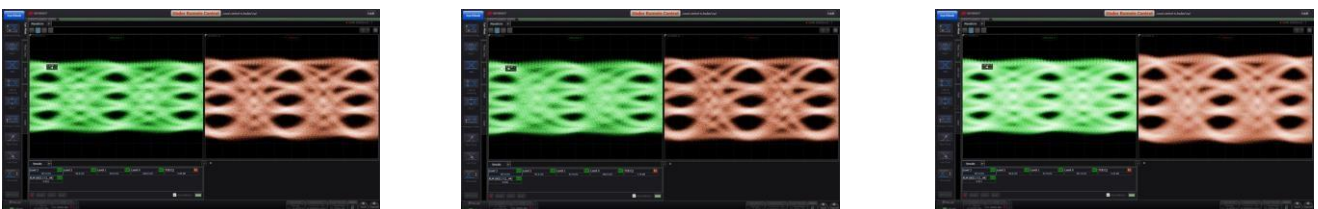


Figure 3-3 – 1# Sample output electrical eye, CH2 MSB, NV, RT/HT/LT

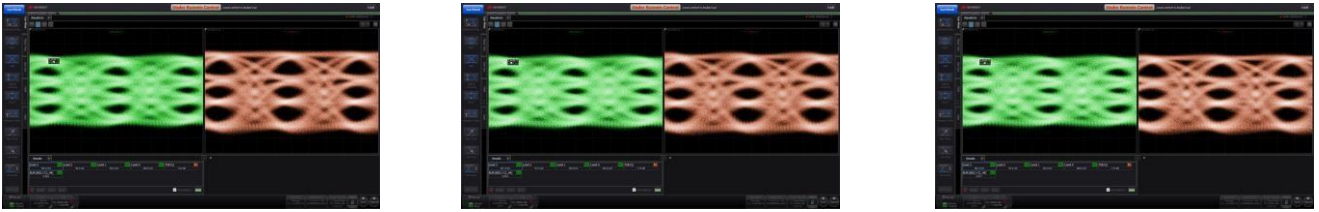


Figure 3-4 – 1# Sample output electrical eye, CH2 LSB, NV, RT/HT/LT

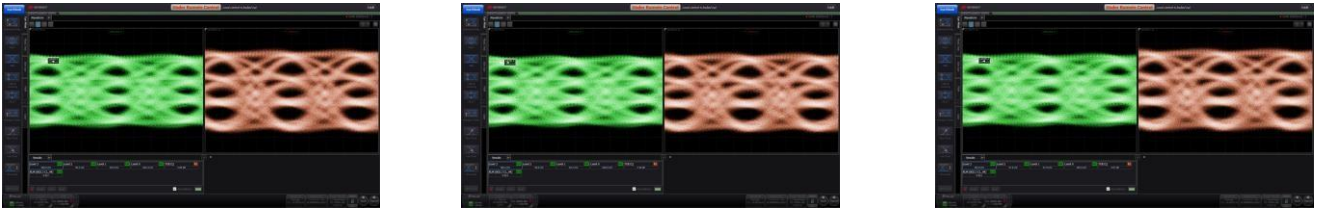


Figure 3-5 – 1# Sample output electrical eye, CH3 MSB, NV, RT/HT/LT

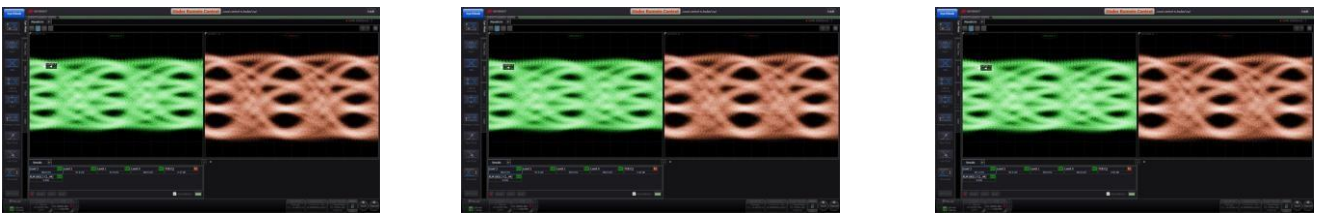


Figure 3-6 – 1# Sample output electrical eye, CH3 LSB, NV, RT/HT/LT

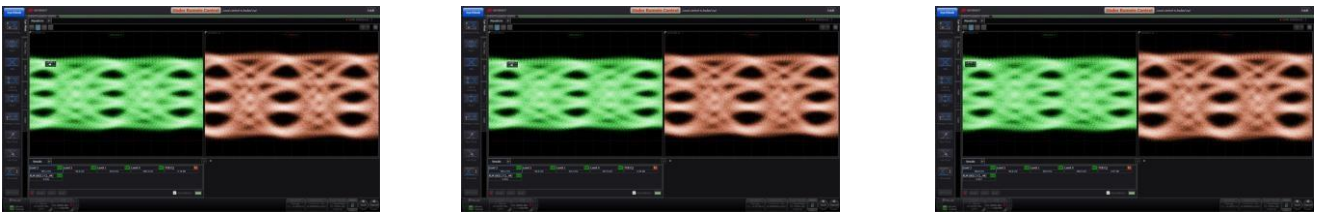


Figure 3-7 – 1# Sample output electrical eye, CH4 MSB, NV, RT/HT/LT

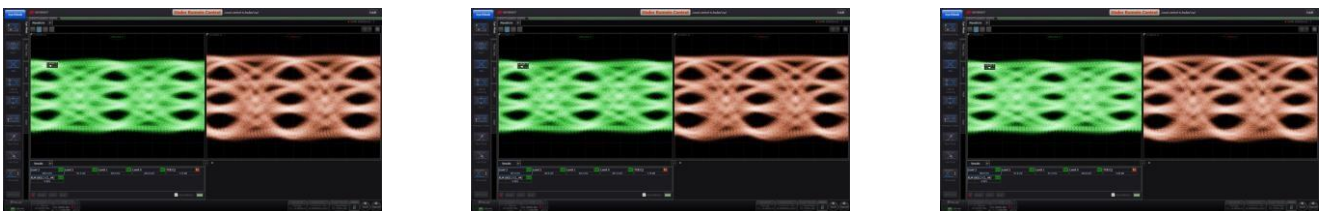


Figure 3-8 – 1# Sample output electrical eye, CH4 LSB, NV, RT/HT/LT

3.2.2 Power Consumption Test Result

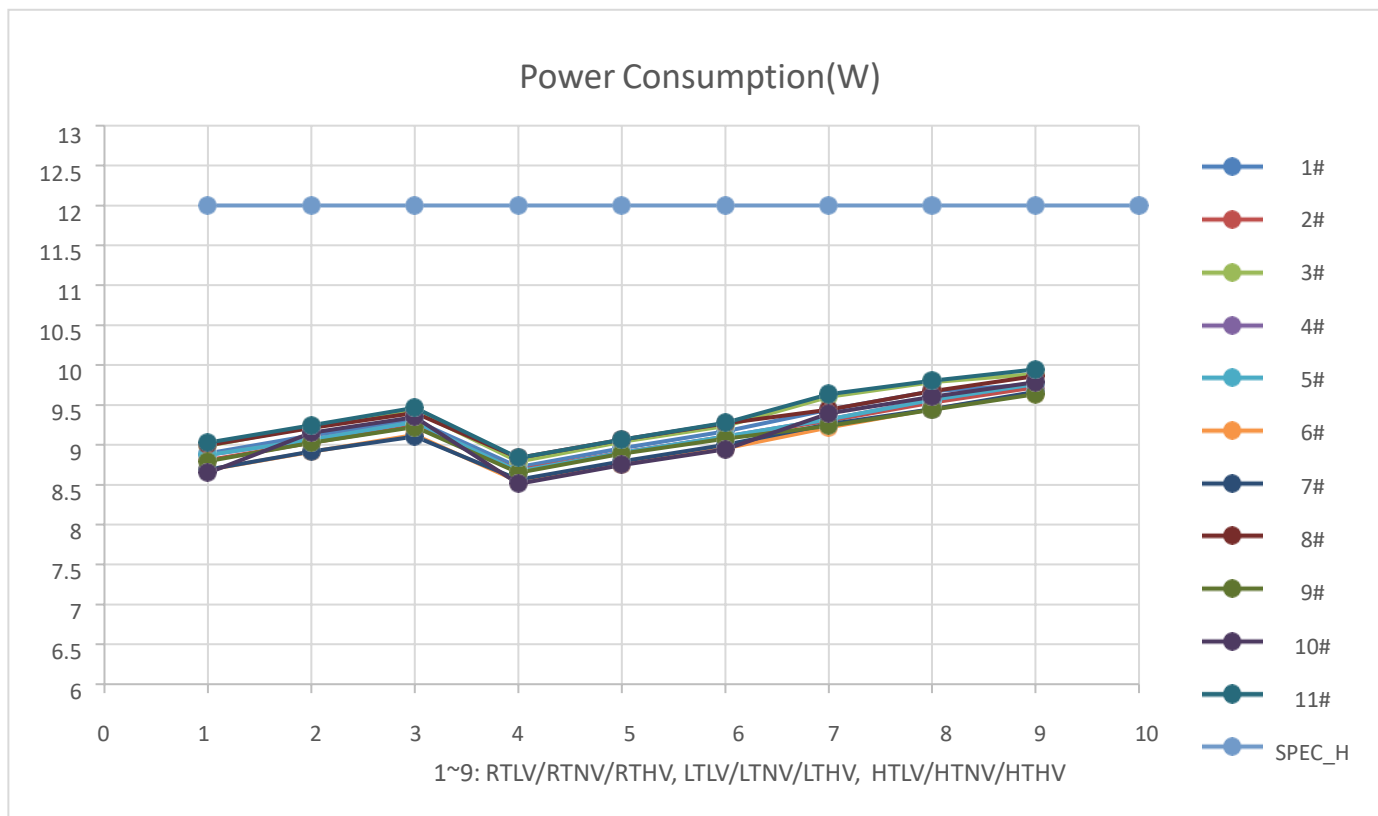


Figure 3-9 Power Consumption test results for nine corners

3.2.3 RX Electrical Eye Test Result

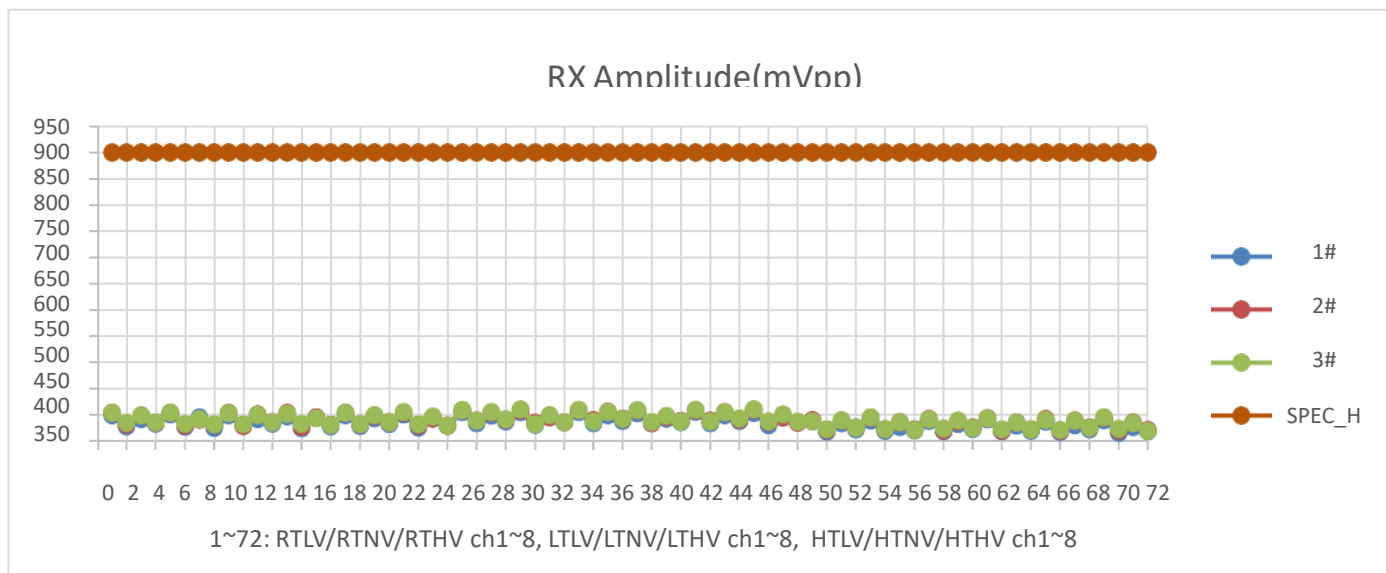


Figure 3-10 Electrical Eye Amplitude results for nine corners

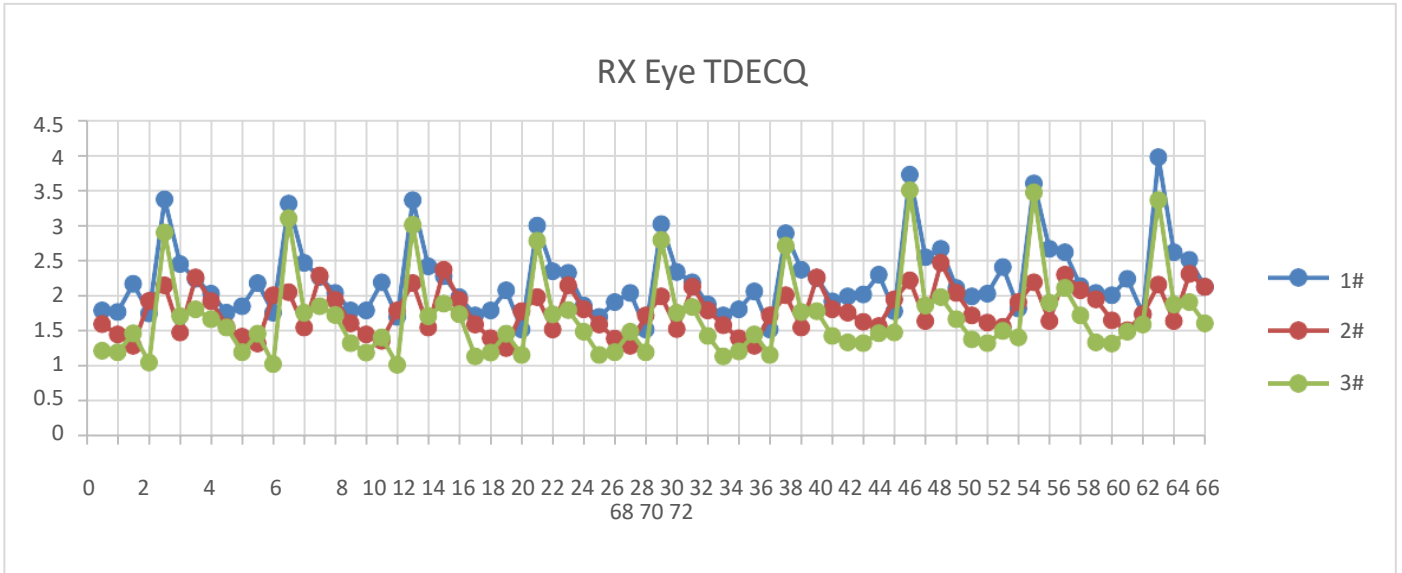


Figure 3-11 Electrical Eye TDECQ results for nine corners

3.2.4 Power On Overshoot

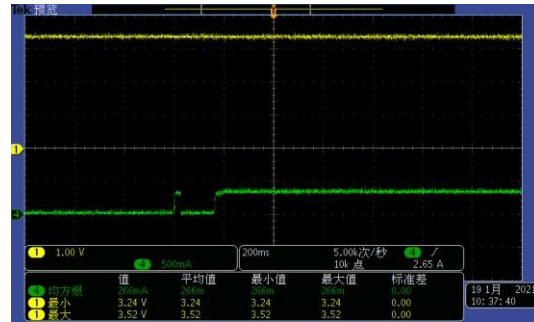
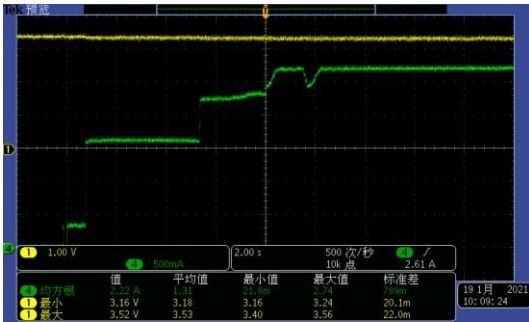


Figure 3-12 1# Power on LPMODE=Low/High

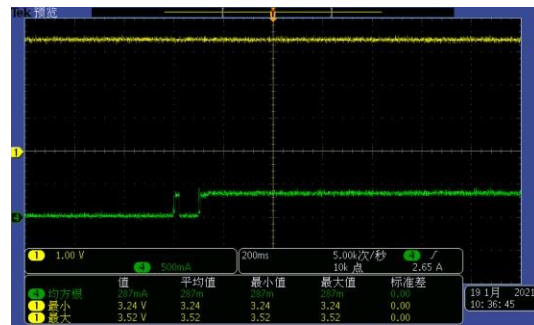
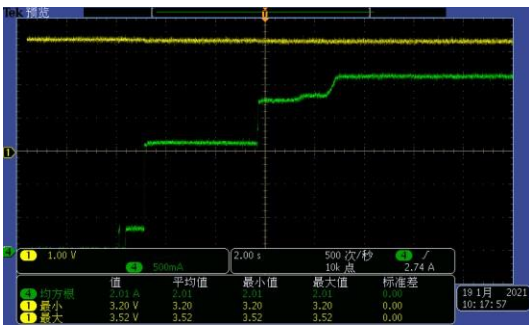


Figure 3-13 2# Power on LPMODE=Low/High

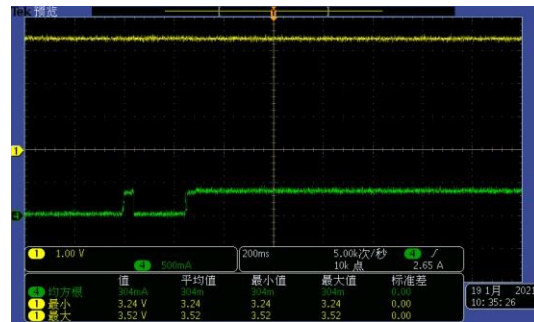
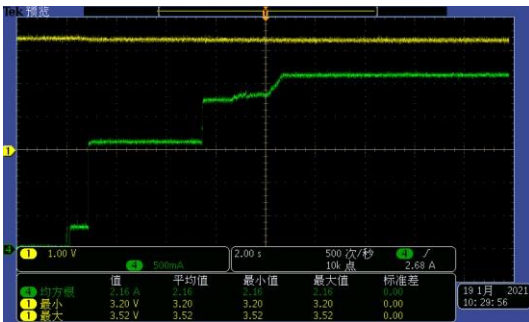


Figure 3-13 3# Power on Icc vs LPMODE=Low/High

4. DDMI Performance

4.1 Test Result Summary

Parameter ^{NOTE[1]}	Specification		Test Data		Unit	Pass/Total
	Min	Max	Min	MAX		
Temperature Accuracy	-3	3	-2.83	-0.10	Deg C	11/11
Voltage Accuracy	-0.1	0.1	-0.05	0.06	V	11/11
Tx AOP Accuracy	3	3	-0.9	0.8	dB	11/11
Rx Power Accuracy	-3	3	-1.34	0.97	dB	11/11

4.2 Test Result Data

4.2.1 DDMI Accuracy Test Result

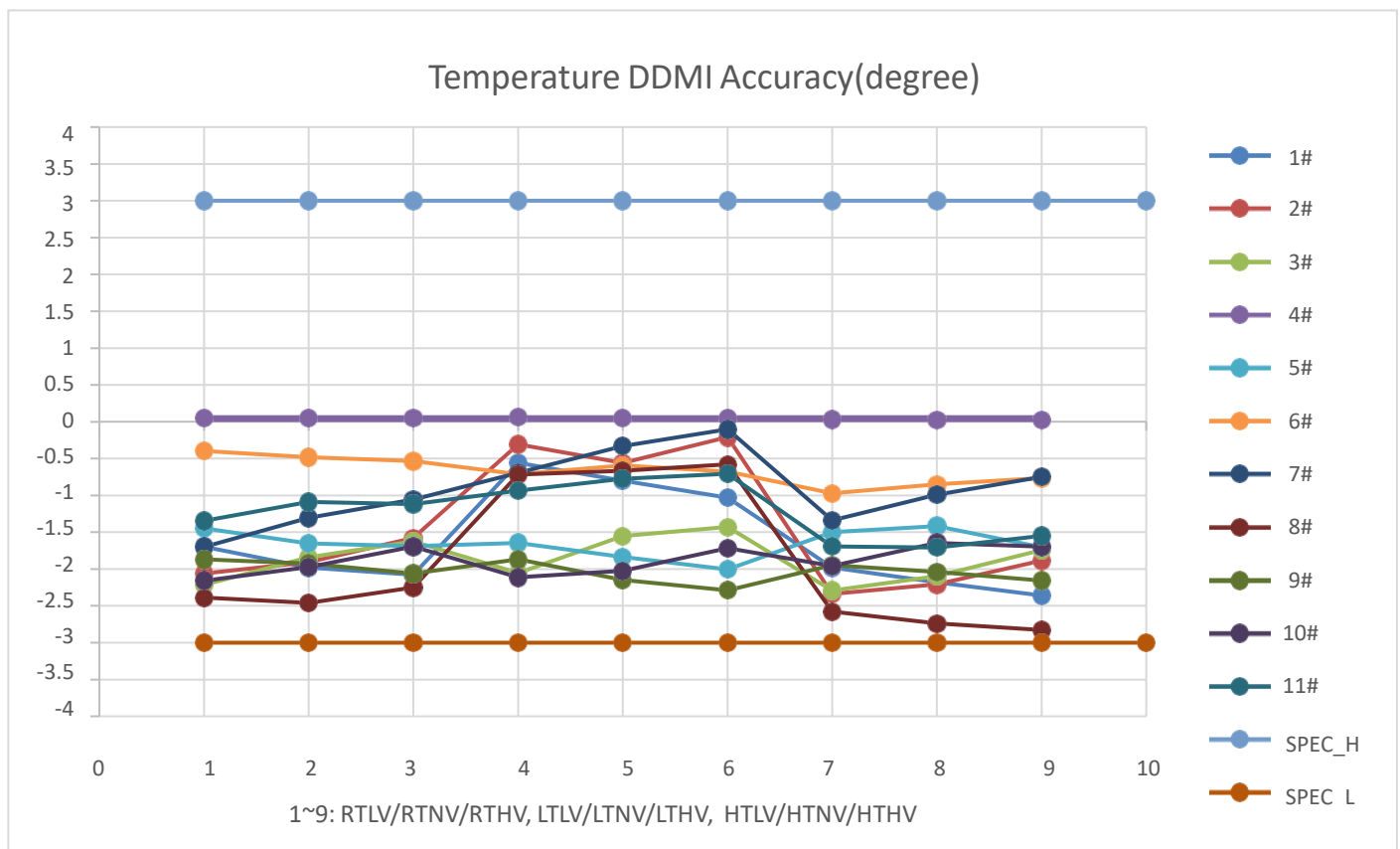


Figure 4-1 Temperature Accuracy test results for nine corners

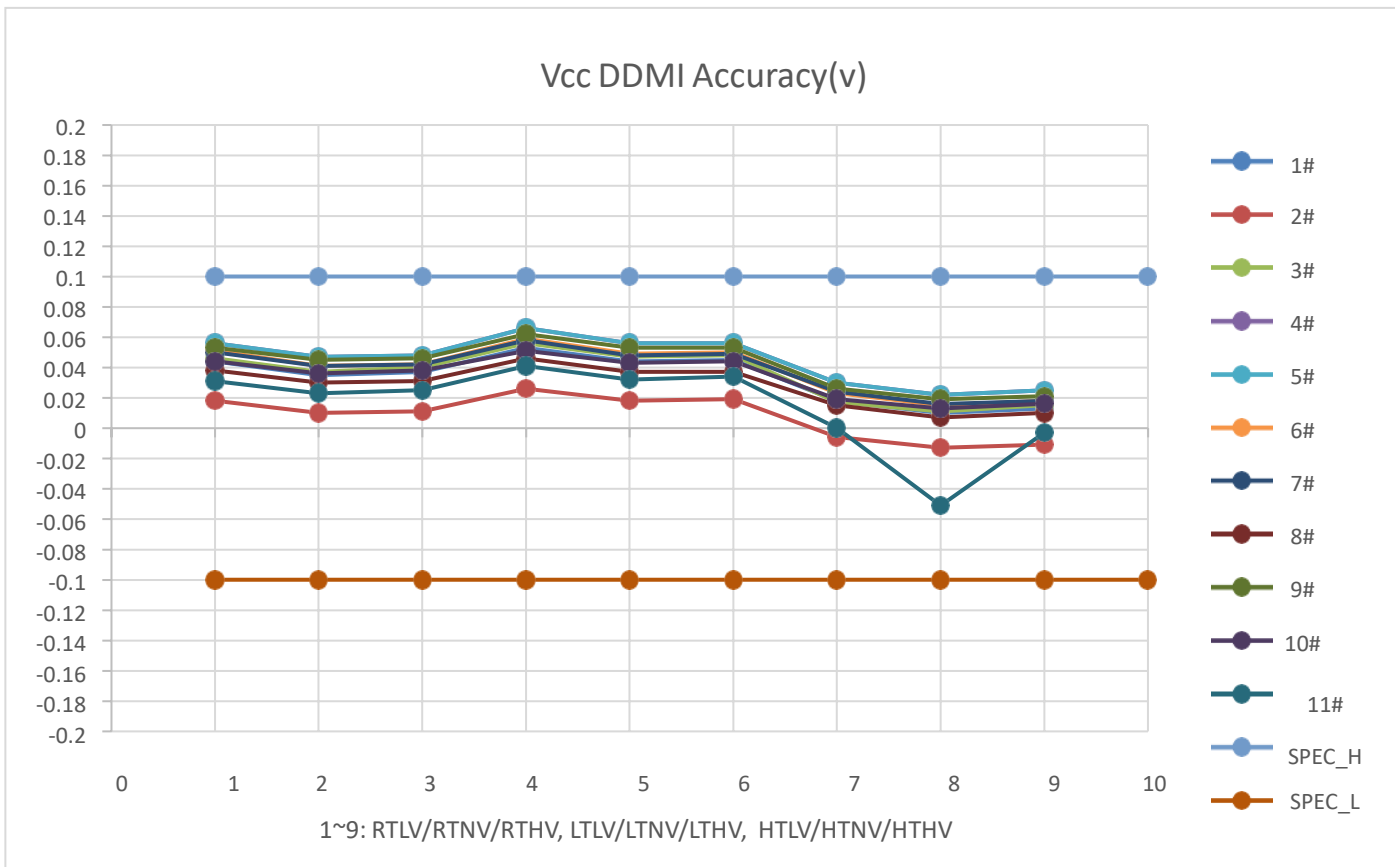


Figure 4-2 Voltage Accuracy test results for nine corners

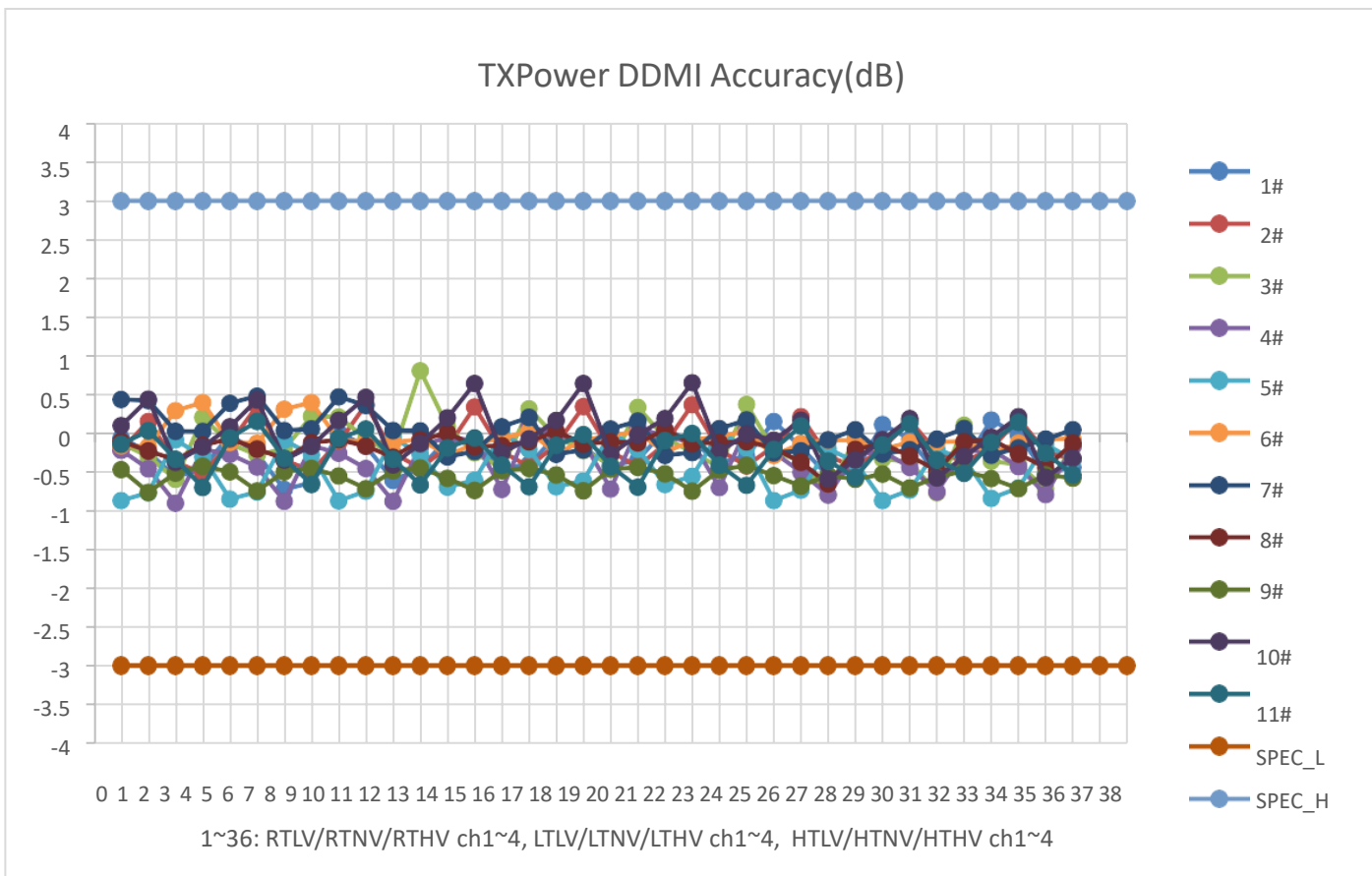


Figure 4-3 TX Power Accuracy test results for nine corners

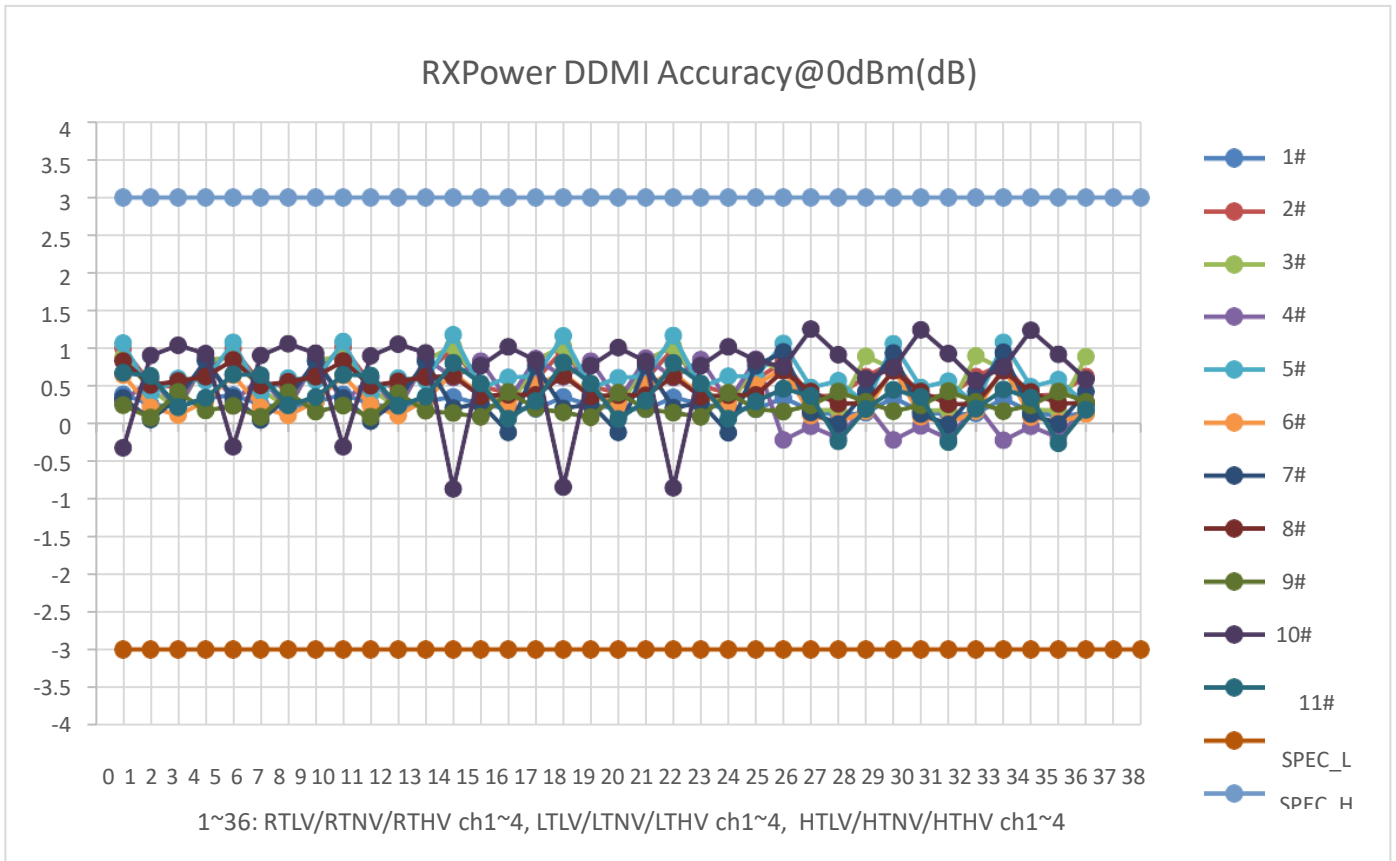


Figure 4-4 RX Power(@0dBm) Accuracy test results for nine corners

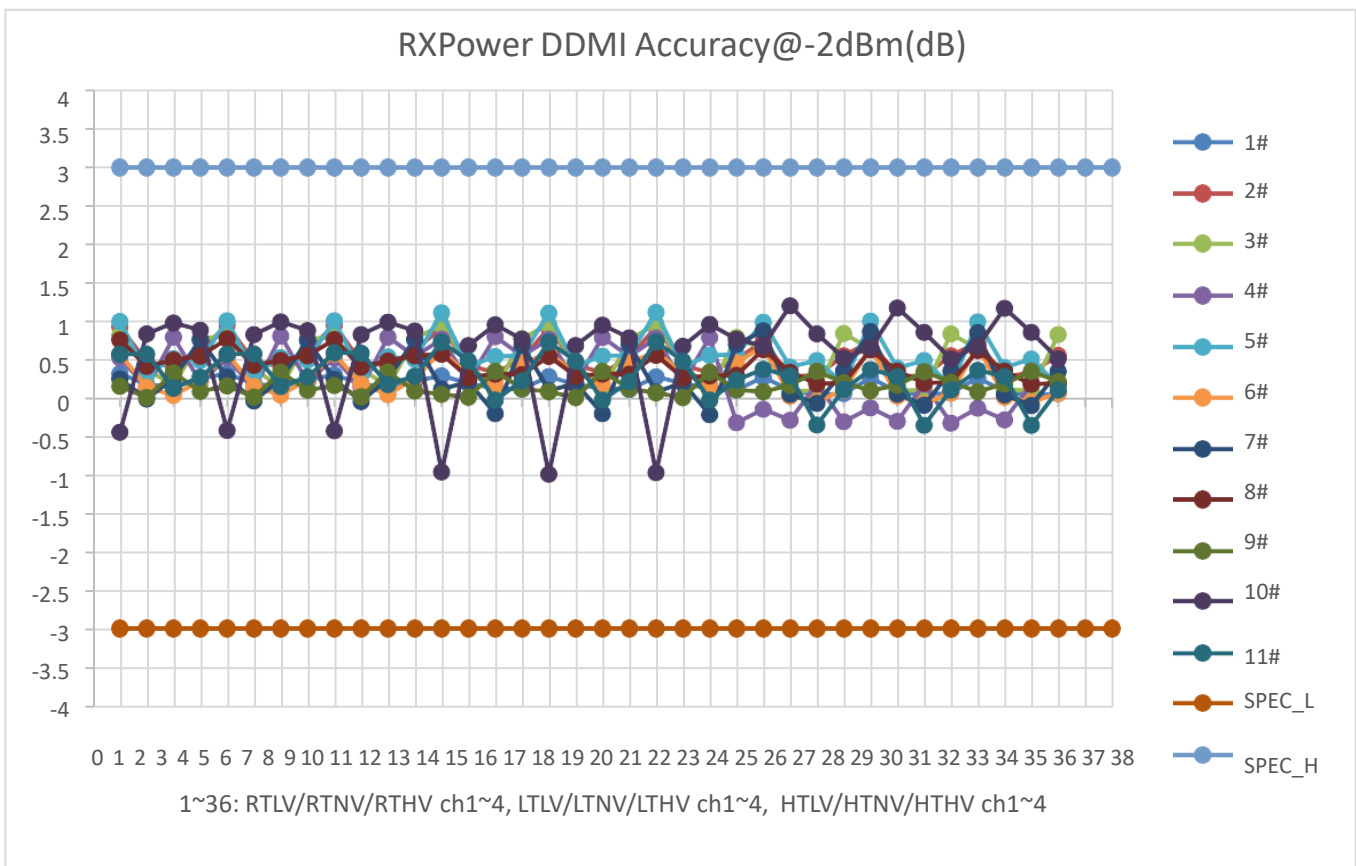


Figure 4-5 RX Power(@-2dBm) Accuracy test results for nine corners

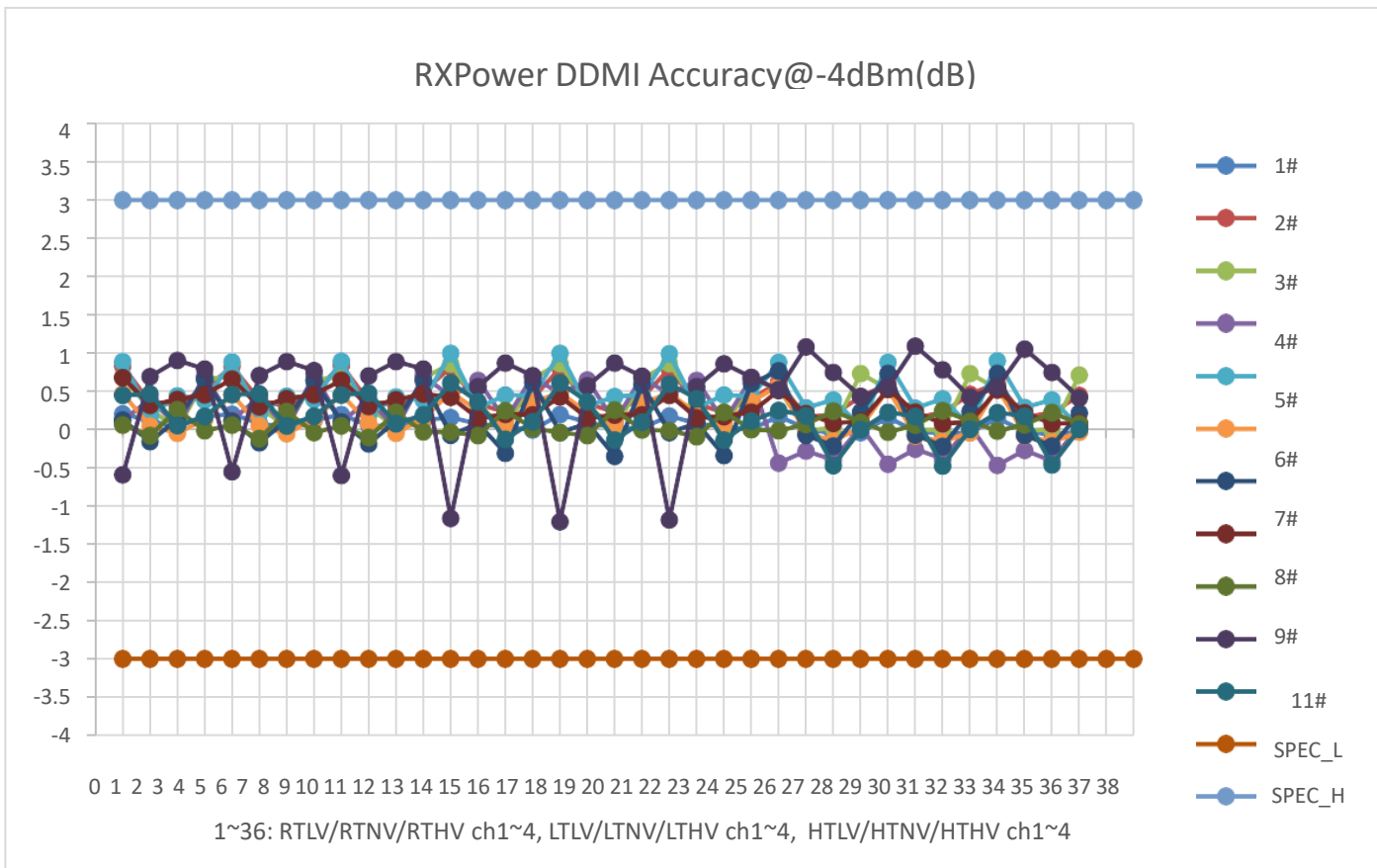


Figure 4-6 RX Power(@-4dBm) Accuracy test results for nine corners

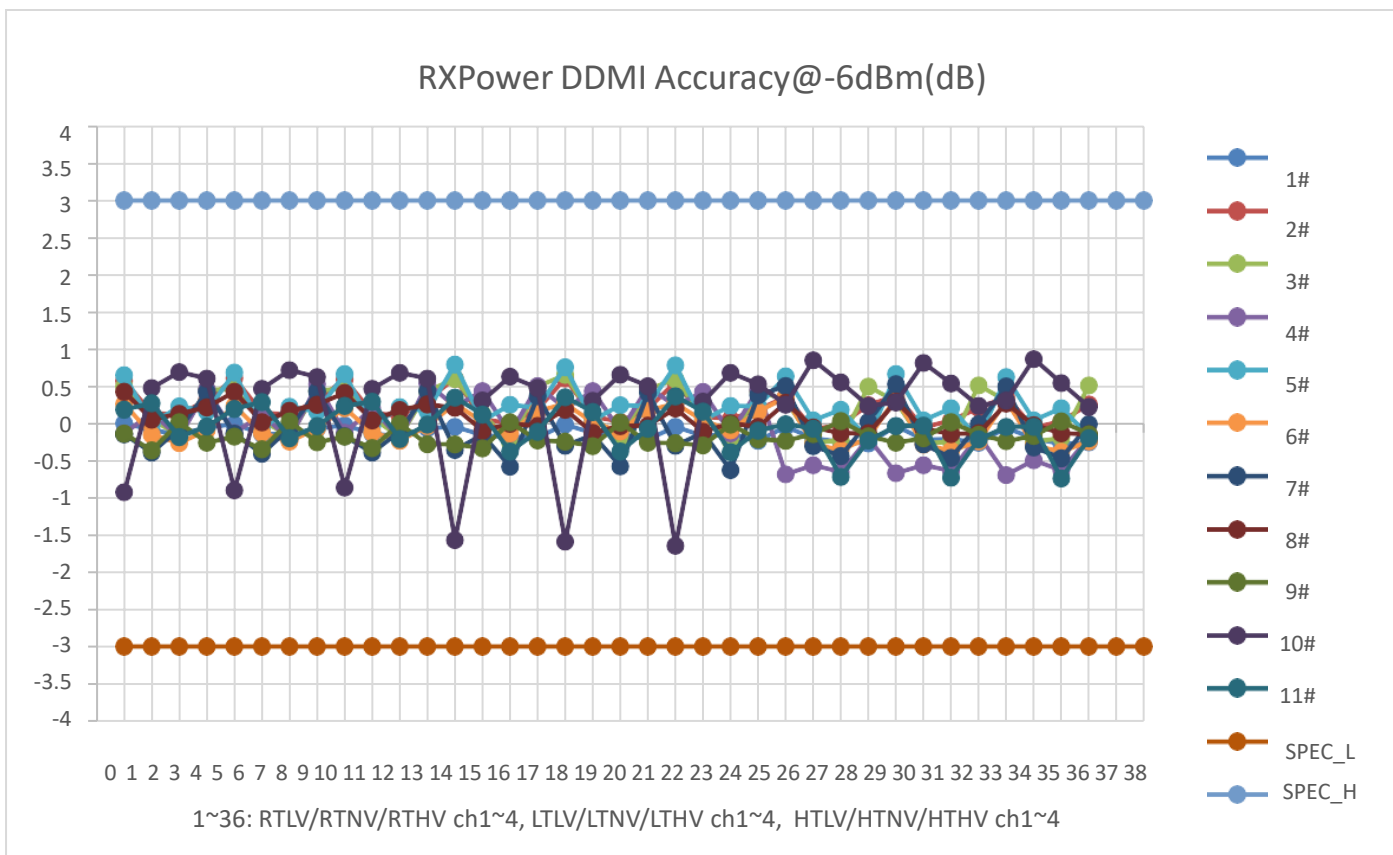


Figure 4-7 RX Power(@-6dBm) Accuracy test results for nine corners

5. Timing Performance

5.1 Test Result Summary

Parameter ^{NOTE[1]}	Specification		Test Data		Unit	Pass/Total
	Min	Max	Min	MAX		
Reset De-assert Time	0	2000	1100	1200	ms	3/3
Reset Assert Time			700	1100	ms	3/3
ModselL Assert Time			1.1	1.2	ms	3/3
ModselL De-assert Time			1.0	1.4	ms	3/3
Txdisable Assert Time		100	49	65	ms	0/3
Txdisable De-assert Time		400	26	121	ms	0/3

5.2 Test Result Data

5.2.1 Reset Assert, De-assert Time

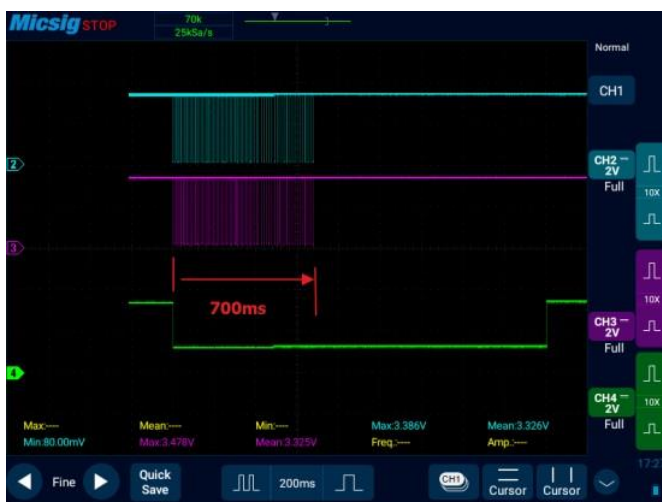


Figure 5-1 1# IIC Respond/Non-Respond Time vs ResetL=Low/High



Figure 5-2 2# IIC Respond/Non-Respond Time vs ResetL=Low/High



Figure 5-3 3# IIC Respond/Non-Respond Time vs ResetL=Low/High

5.2.2 Model Assert, De-assert Time



Figure 5-4 1# IIC Not Respond@Modsel=High



Figure 5-5 1# IIC Respond@Modsel=Low



Figure 5-6 2# IIC Not Respond@Modsel=High



Figure 5-7 2# IIC Respond@Modsel=Low



Figure 5-8 3# IIC Not Respond@Modsel=High



Figure 5-9 3# IIC Respond@Modsel=Low

5.2.3 Soft Txdisable Assert, De-assert Time



Figure 5-10 1# ch1 IIC Txdisable On/Off



Figure 5-11 1# ch2 IIC Txdisable On/Off



Figure 5-12 1# ch3 IIC Txdisable On/Off



Figure 5-13 1# ch4 IIC Txdisable On/Off



Figure 5-14 2# ch1 IIC Txdisable On/Off



Figure 5-15 2# ch2 IIC Txdisable On/Off



Figure 5-16 2# ch3 IIC Txdisable On/Off



Figure 5-17 2# ch4 IIC Txdisable On/Off

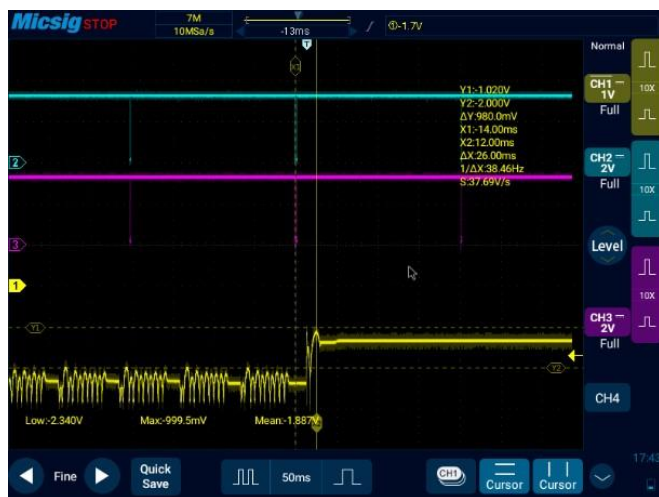


Figure 5-18 3# ch1 IIC Txdisable On/Off



Figure 5-19 3# ch2 IIC Txdisable On/Off



Figure 5-20 3# ch3 IIC Txdisable On/Off



Figure 5-21 3# ch4 IIC Txdisable On/Off

6. Conclusion

The QDD-DR4-400G-Si transceivers pass this Design Verification Test program.