

Transceiver Performance **TEST Report**

Model name : SFP-10GLR-31-I

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1. Introduction

This report presents the reliability test results for 10Gb/s 10Km SFP+ 1310 nm transceivers.

2. Purpose

The purpose of the test is to determine whether the O/E characteristics, mechanical integrity and endurance of 10Gb/s 10Km SFP+ 1310 nm transceivers meet the requirement of reliability.

3. Sample Description

The sample is 10Gb/s 10Km SFP+ 1310 nm transceivers. The type is RTX228-402. The modules specification should fit the data in the Table 1.

Table 1: Specification

Parameter	Symbol	Specification			Unit
		Min.	Typ.	Max.	
Operating Voltage	V _{CC}	+3.13	+3.3	+3.47	V
Center Wavelength Range	λ_c	1260	1310	1355	nm
Launch Optical Power	P _O	-8.2		+0.5	dBm
Extinction ratio	EX	3.5			dB
Receiver Sensitivity	S			-12.6	dBm
Operating temperature Range	T _C	-40		+85	°C
Storage temperature Range	T _S	-40		+85	°C

4. Procedure

4.1 Sampling

All the samples are selected randomly from storeroom.

4.2 Sample Grouping and Test Sequence

Table 2: Sample Grouping and Test Sequence

Test Sequence	O/E Characteristics	
	Group 1	1. Physical Dimensions 2. Low-temperature Storage 3. Mechanical Shock/Vibration 4. Temperature Cycle 5. Damp Heat 6. ESD Threshold 7. ESD Immunity 8. Visual Inspection
	Group 2	1. high-temperature Storage 2. Power Temperature cycling test 3. Powered damp heat test
	Group 3	Accelerating Aging

4.3 Failure Criterion

Table 3: Failure Criterion

Heading	Test Program	Failure Criteria
Functional Verification	O/E Characteristics	1. Any key parameter is out of the specification Table 1.
	Visual Inspection	
	Physical Dimensions	
Mechanical Endurance	Mechanical Shock/Vibration	1. Any key parameter is out of the specification Table 1. 2. $\Delta S > 1.0\text{dB}$ 3. $\Delta P > 1.0\text{dB}$
Environmental Endurance	Temperature Cycle	
	Power Temperature cycling test	
	Damp Heat	
	Powered damp heat test	
	high-temperature Storage	
	Low-Temperature Storage	

Special Tests	Accelerating Aging	
	ESD Immunity	
	ESD Threshold	

4.4 Test Plan and Status

Table 4: Test Plan and Status

Test	Reference	Condition	SS/C	Status
O/E Characteristics	Specifications	Specifications	33/0	Passed
Mechanic Shock	MIL-STD-883	1500g, 0.5ms, 5times/axis	11/0	Passed
Vibration	MIL-STD-883	20g,20-2000Hz, 4minutes/cycle, 4cycles/axis	11/0	Passed
Accelerating Aging	GR-468-CORE	85°C,3.3V, >2000hrs	11/0	Passed
Low-Temp Storage	GR-468-CORE	-40°C, 72hrs	11/0	Passed
High-Temp Storage	GR-468-CORE	85°C, 2000hrs	11/0	Passed
Temperature Cycle	GR-468-CORE	-40°C to 85°C, 500 cycles	11/0	Passed
Power Temperature cycling test		-40°C to 85°C, 500 cycles	11/0	Passed
Damp Heat	MIL-STD-202	85°C,85%RH, 1000 hrs	11/0	Passed
Powered damp heat test	GR-468-CORE	85°C/85%RH,1000 hours Powered Environmental Stress Tests	11/0	Passed
ESD Immunity	IEC61000-4-2	4 Class, air discharge 15KV, contact discharge 8KV,Critirion: level B is required.	3/0	Passed
ESD Threshold	MIL-STD-883	HBM, least 500V, three positive pulses, three negative pulses, test to failure. (Beside Signal PIN:±2KV Signal PIN:±1KV)	6/0	Passed
Physical Dimensions	MIL-STD-883	Micrometers, calipers, gauges, contour projectors	11/0	Passed
Visual Inspection	MIL-STD-883,	1.5X to 10X(Devices)	11/0	Passed

5. Test Results

5.1 O/E Characteristic

Table 5: Optical/Electrical Characterization of thirty-three modules

No.	Po(dBm)	Sensitivity (dBm)	No.	Po(dBm)	Sensitivity (dBm)
1	-1.5	-17.1	18	-2.2	-17.0
2	-2.3	-17.0	19	-2.3	-16.8
3	-2.0	-17.2	20	-2.0	-16.9
4	-1.8	-16.8	21	-2.1	-16.7
5	-2.3	-16.8	22	-1.8	-17.2
6	-2.3	-16.6	23	-1.9	-17.2
7	-2.5	-17.3	24	-2.2	-16.9
8	-2.1	-17.4	25	-2.3	-16.8
9	-1.9	-17.1	26	-2.1	-17.2
10	-2.2	-17.2	27	-1.9	-16.8
11	-2.4	-16.7	28	-1.8	-16.9
12	-2.3	-16.8	29	-1.9	-17.0
13	-1.8	-16.6	30	-1.8	-16.7
14	-1.9	-16.9	31	-2.4	-17.3
15	-1.7	-16.9	32	-2.3	-17.2
16	-1.8	-17.0	33	-2.4	-17.3
17	-2.0	-17.2			

5.2 Physical Dimensions

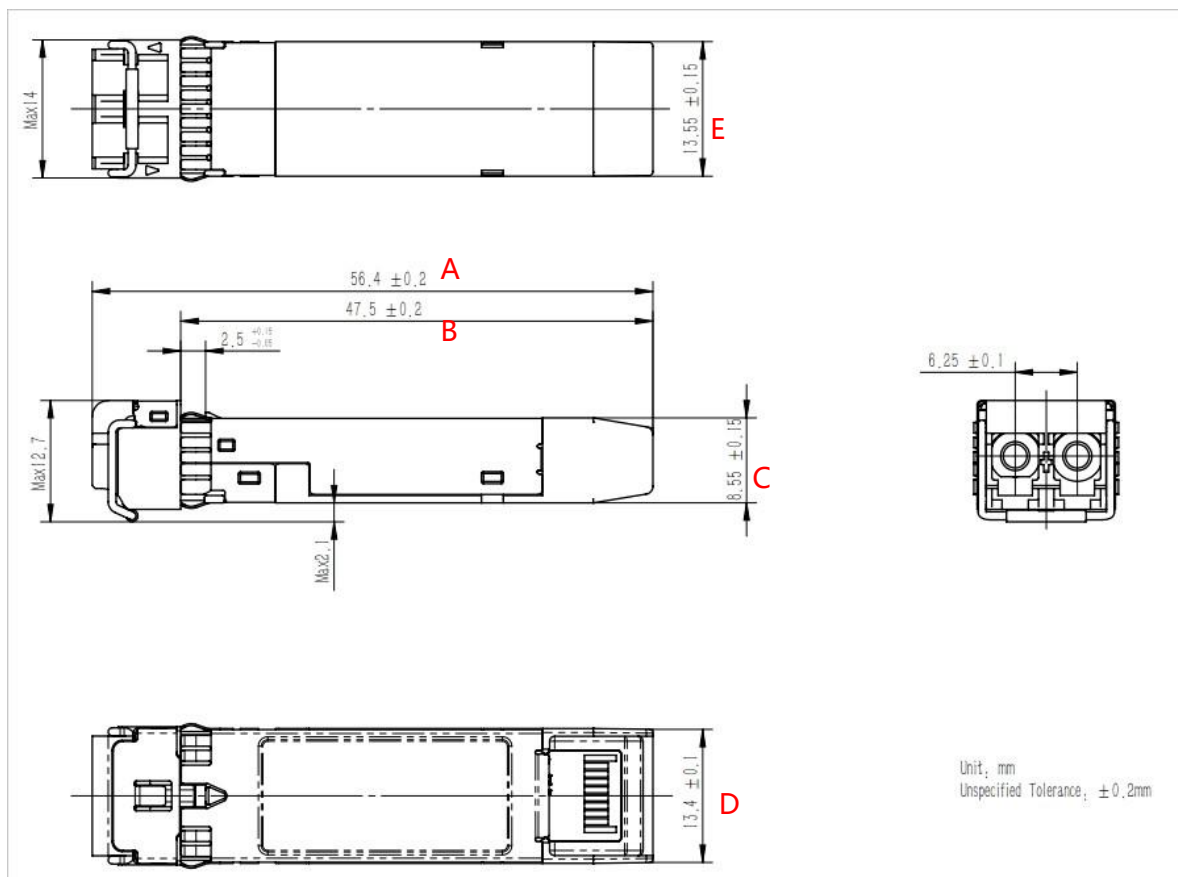


Figure 1: Package outline (unit: mm)

Table 6: Data of Dimension Test(unit: mm)

Projected Dimension	Designator				
	A	B	C	D	E
	56.4 ± 0.2	47.5 ± 0.2	8.55 ± 0.15	13.4 ± 0.1	13.55 ± 0.15
1	56.43	47.48	8.52	13.43	13.53
2	56.42	47.43	8.53	13.37	13.54
3	56.45	47.54	8.56	13.38	13.53
4	56.41	47.53	8.57	13.43	13.56
5	56.37	47.54	8.56	13.43	13.57
6	56.38	47.52	8.58	13.41	13.54
7	56.36	47.51	8.53	13.38	13.58
8	56.45	47.50	8.57	13.43	13.57
9	56.42	47.54	8.52	13.44	13.53

10	56.37	47.53	8.52	13.41	13.53
11	56.43	47.54	8.58	13.42	13.56
Statistics					
AVE	56.41	47.51	8.55	13.41	13.55
SD	0.03	0.03	0.02	0.02	0.02
MAX	56.45	47.54	8.58	13.44	13.58
MIN	56.36	47.43	8.52	13.37	13.53

Note:0.02mm precision vernier caliper.

5.3 Low Temperature Storage

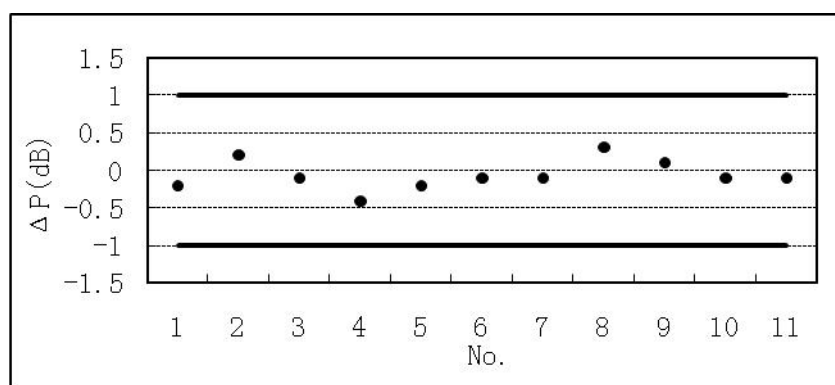


Figure 2: Optical Power Variation in Low Temperature Storage Test

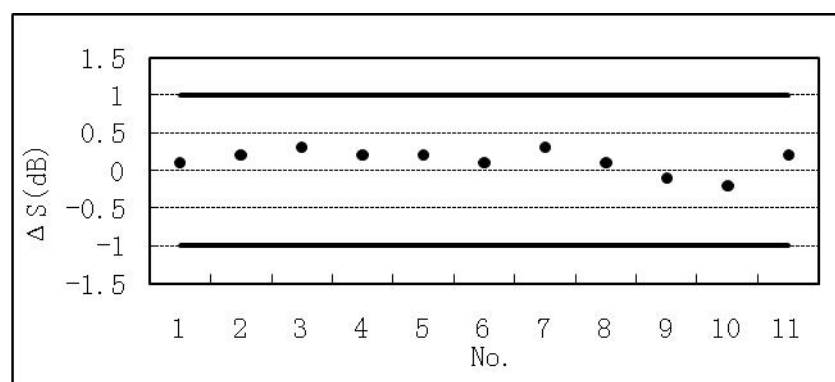


Figure 3: Receiver Sensitivity Variation in Low Temperature Storage Test

Table 7: Data of Low Temperature Storage Test

	Before Test	After Test	Before and after test
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No.					Variation	
	Po(dBm)	Sensitivity (dBm)	Po(dBm)	Sensitivity (dBm)	ΔP_o (dB)	ΔS (dB)
1	-1.5	-17.1	-1.7	-17.0	-0.2	0.1
2	-2.3	-17.0	-2.1	-16.8	0.2	0.2
3	-2.0	-17.2	-2.1	-16.9	-0.1	0.3
4	-1.8	-16.8	-2.2	-16.6	-0.4	0.2
5	-2.3	-16.8	-2.5	-16.6	-0.2	0.2
6	-2.3	-16.6	-2.4	-16.5	-0.1	0.1
7	-2.5	-17.3	-2.6	-17.0	-0.1	0.3
8	-2.1	-17.4	-1.8	-17.3	0.3	0.1
9	-1.9	-17.1	-1.8	-17.2	0.1	-0.1
10	-2.2	-17.2	-2.3	-17.4	-0.1	-0.2
11	-2.4	-16.7	-2.5	-16.5	-0.1	0.2
Statistics						
AVE	-2.12	-17.02	-2.18	-16.89	-0.06	0.13
SD	0.28	0.25	0.30	0.31	0.19	0.15
MAX	-1.50	-16.60	-1.70	-16.50	0.30	0.30
MIN	-2.50	-17.40	-2.60	-17.40	-0.40	-0.20

Note: Low-Temp Storage reference resources GR-468-CORE condition -40°C and 72hrs.

5.4 Temperature Cycle

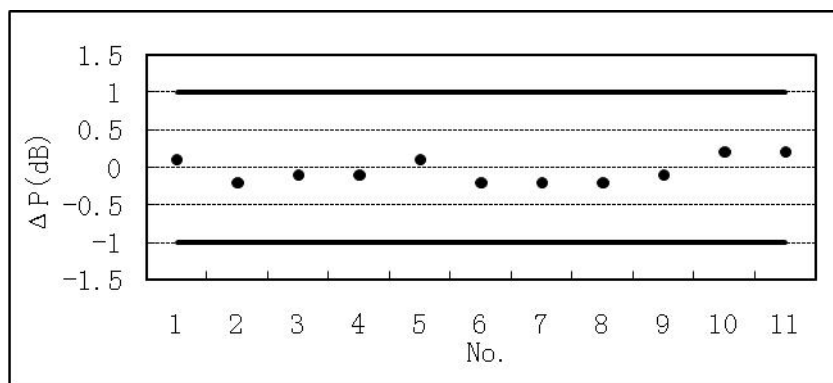


Figure 4: Optical Power Variation in Temperature Cycle Test

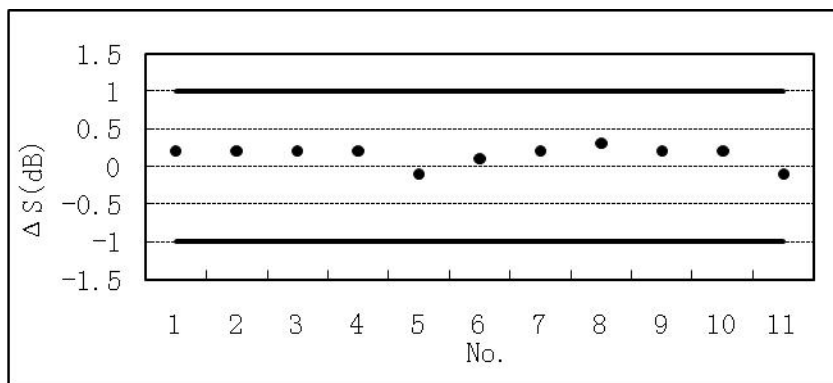


Figure 5: Receive Sensitivity Variation in Temperature Cycle Test

Table 8: Optical Output Power in Temperature Cycle Test

No.	Before Test		After Test		Before and after test Variation	
	Po(dBm)	Sensitivity (dBm)	Po(dBm)	Sensitivity (dBm)	ΔPo (dB)	ΔS (dB)
1	-1.7	-17.0	-1.6	-16.8	0.1	0.2
2	-2.1	-16.8	-2.3	-16.6	-0.2	0.2
3	-2.1	-16.9	-2.2	-16.7	-0.1	0.2
4	-2.2	-16.6	-2.3	-16.4	-0.1	0.2
5	-2.5	-16.6	-2.4	-16.7	0.1	-0.1
6	-2.4	-16.5	-2.6	-16.4	-0.2	0.1
7	-2.6	-17.0	-2.8	-16.8	-0.2	0.2
8	-1.8	-17.3	-2.0	-17.0	-0.2	0.3
9	-1.8	-17.2	-1.9	-17.0	-0.1	0.2
10	-2.3	-17.4	-2.1	-17.2	0.2	0.2
11	-2.5	-16.5	-2.3	-16.6	0.2	-0.1
Statistics						
AVE	-2.18	-16.89	-2.23	-16.75	-0.05	0.15
SD	0.30	0.31	0.31	0.24	0.16	0.12
MAX	-1.70	-16.50	-1.60	-16.40	0.20	0.30
MIN	-2.60	-17.40	-2.80	-17.20	-0.20	-0.10

Note: Temperature Cycle reference resources GR-468-CORE condition -40°C to +85°C and 500 cycles .

5.5 Mechanical Shock /Vibration

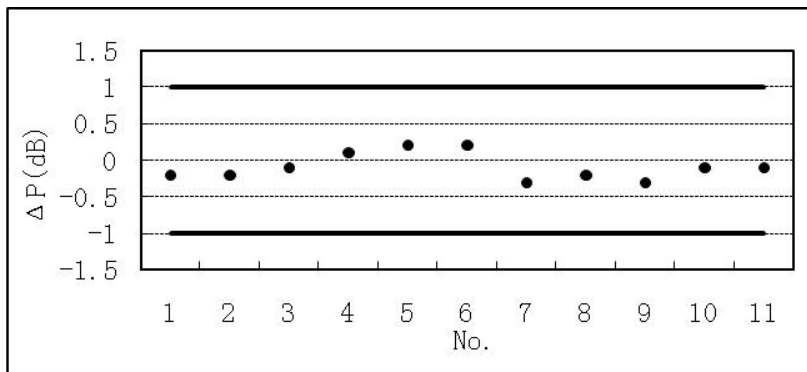


Figure 6: OpticalPower Variation in Mechanical Shock /Vibration Test

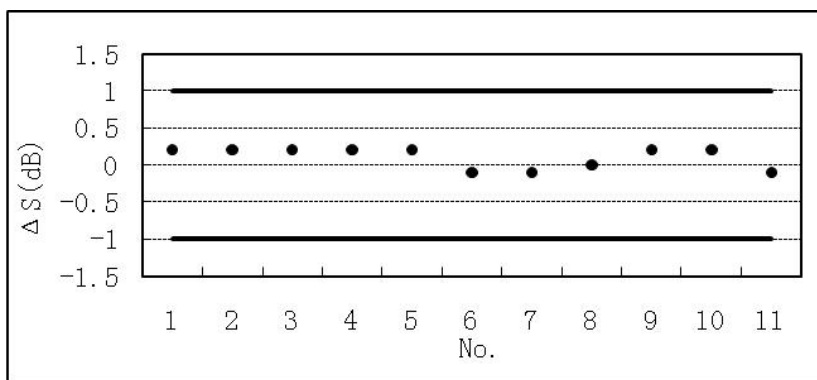


Figure 7: Receiver Sensitivity Variation in Mechanical Shock /Vibration Test

Table 9: Data of Mechanical Shock /Vibration Test

No.	Before Test		After Test		Before and after test Variation	
	Po(dBm)	Sensitivity (dBm)	Po(dBm)	Sensitivity (dBm)	ΔPo (dB)	ΔS (dB)
1	-1.6	-16.8	-1.8	-16.6	-0.2	0.2
2	-2.3	-16.6	-2.5	-16.4	-0.2	0.2
3	-2.2	-16.7	-2.3	-16.5	-0.1	0.2
4	-2.3	-16.4	-2.2	-16.2	0.1	0.2
5	-2.4	-16.7	-2.2	-16.5	0.2	0.2
6	-2.6	-16.4	-2.4	-16.5	0.2	-0.1
7	-2.8	-16.8	-3.1	-16.9	-0.3	-0.1

8	-2.0	-17.0	-2.2	-17.0	-0.2	0.0
9	-1.9	-17.0	-2.2	-16.8	-0.3	0.2
10	-2.1	-17.2	-2.2	-17.0	-0.1	0.2
11	-2.3	-16.6	-2.4	-16.7	-0.1	-0.1
Statistics						
AVE	-2.23	-16.75	-2.32	-16.65	-0.09	0.10
SD	0.31	0.24	0.30	0.25	0.17	0.13
MAX	-1.60	-16.40	-1.80	-16.20	0.20	0.20
MIN	-2.80	-17.20	-3.10	-17.00	-0.30	-0.10

Note: 1) Mechanic Shock reference resources MIL-STD-883 condition 1500g and 0.5ms and 5times/axis.
2) Vibration reference resources MIL-STD-883 condition 20g and 20-2000Hz and 4minutes/cycle,4cycles/axis.

5.6 Damp Heat

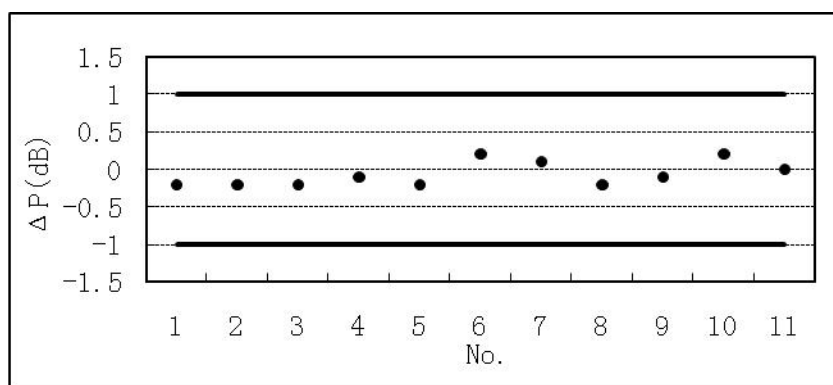


Figure 8: Optical Power variation in Damp Heat Test

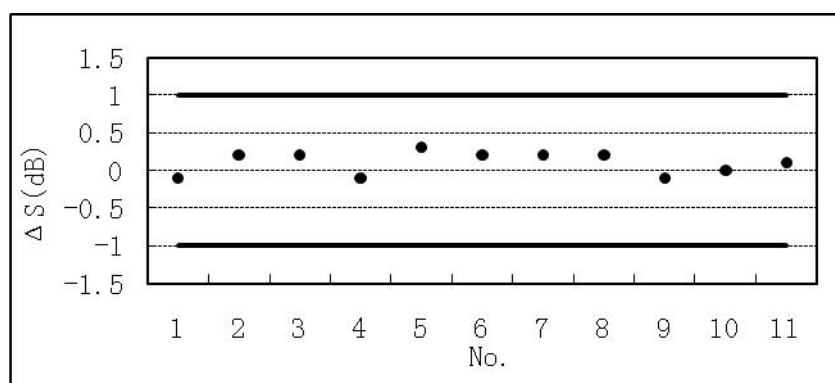


Figure 9: Receiver Sensitivity Variation in Damp Heat Test

Table 10: Data of Damp Heat Test

No.	Before Test		After Test		Before and after test Variation	
	Po(dBm)	Sensitivity (dBm)	Po(dBm)	Sensitivity (dBm)	ΔP_o (dB)	ΔS (dB)
1	-1.8	-16.6	-2.0	-16.7	-0.2	-0.1
2	-2.5	-16.4	-2.7	-16.2	-0.2	0.2
3	-2.3	-16.5	-2.5	-16.3	-0.2	0.2
4	-2.2	-16.2	-2.3	-16.3	-0.1	-0.1
5	-2.2	-16.5	-2.4	-16.2	-0.2	0.3
6	-2.4	-16.5	-2.2	-16.3	0.2	0.2
7	-3.1	-16.9	-3.0	-16.7	0.1	0.2
8	-2.2	-17.0	-2.4	-16.8	-0.2	0.2
9	-2.2	-16.8	-2.3	-16.9	-0.1	-0.1
10	-2.2	-17.0	-2.0	-17.0	0.2	0.0
11	-2.4	-16.7	-2.4	-16.6	0.0	0.1
Statistics						
AVE	-2.32	-16.65	-2.38	-16.55	-0.06	0.10
SD	0.30	0.25	0.28	0.28	0.16	0.14
MAX	-1.80	-16.20	-2.00	-16.20	0.20	0.30
MIN	-3.10	-17.00	-3.00	-17.00	-0.20	-0.10

Note: Damp Heat reference resources MIL-STD-202 condition 85°C and 85% humidity, 1000 hrs.

5.7 ESD Threshold

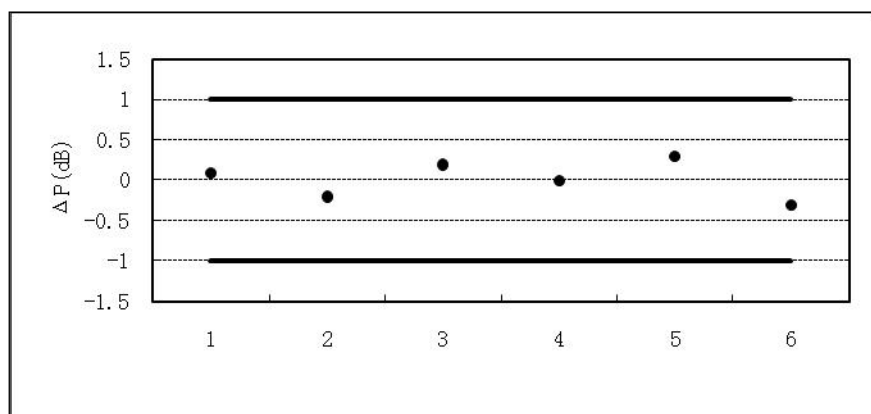


Figure 10: Optical Power Variation in ESD Threshold Test

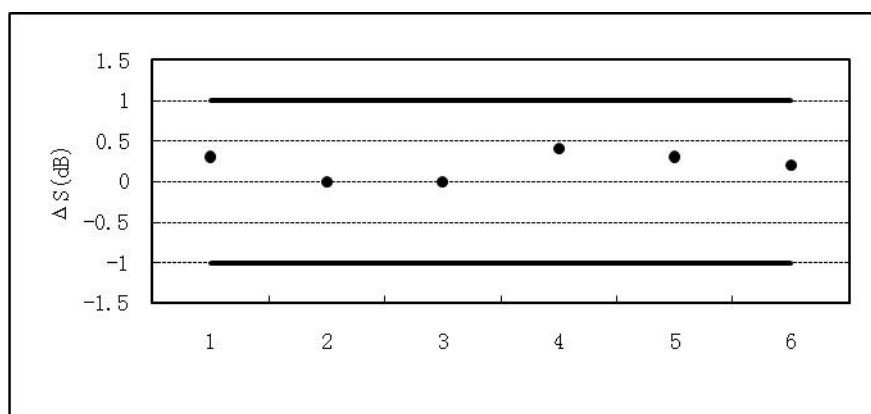


Figure 11: Receiver Sensitivity Variation in ESD Threshold Test

Table 11: Data of ESD Threshold Test(Besides Signal PIN : ± 2 KV; Signal PIN : ± 1.5 KV)

No.	Before Test		After Test		Before and after test Variation	
	Po(dBm)	Sensitivity (dBm)	Po(dBm)	Sensitivity (dBm)	ΔP_o (dB)	ΔS (dB)
1	-2.0	-16.7	-2.1	-16.6	-0.1	0.1
2	-2.7	-16.2	-2.5	-16.0	0.2	0.2
3	-2.5	-16.3	-2.6	-16.2	-0.1	0.1
4	-2.3	-16.3	-2.5	-16.4	-0.2	-0.1
5	-2.4	-16.2	-2.3	-16.3	0.1	-0.1

6	-2.2	-16.3	-2.4	-16.2	-0.2	0.1
Statistics						
AVE	-2.35	-16.33	-2.40	-16.28	-0.05	0.05
SD	0.22	0.17	0.16	0.19	0.15	0.11
MAX	-2.00	-16.20	-2.10	-16.00	0.20	0.20
MIN	-2.70	-16.70	-2.60	-16.60	-0.20	-0.10

Note: ESD Threshold reference resources MIL-STD-883 condition HBM(Human Body Model), least 500V,

three positive pulses, three negative pulses, test to failure.

5.8 ESD Immunity

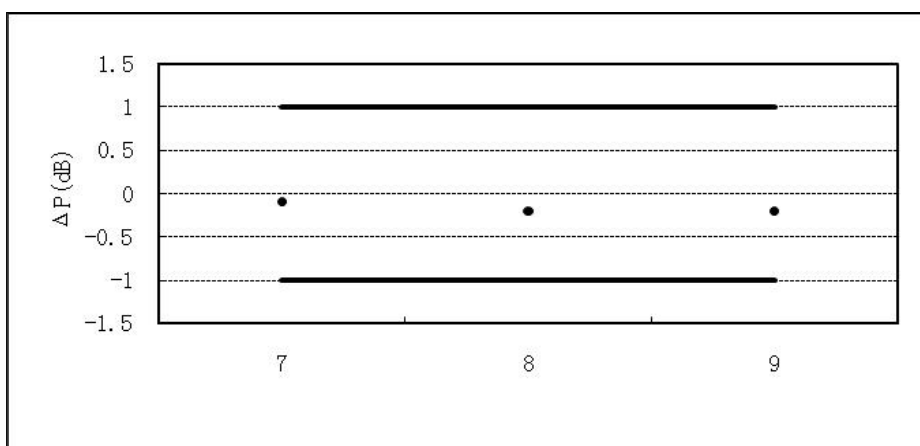


Figure 12: Optical Power Variation in ESD Immunity Test

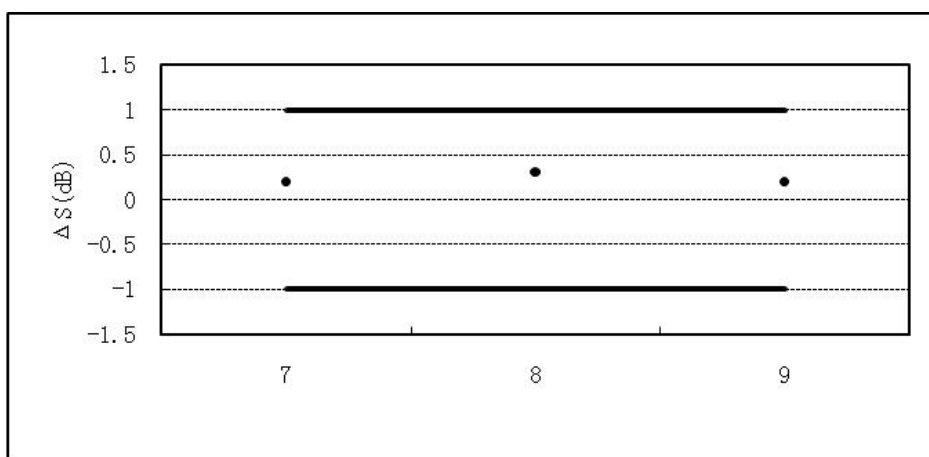


Figure 13: Receiver Sensitivity Variation in ESD Immunity Test

Table 12: Data of ESD Immunity Test (Class 4)

No.	Before Test		After Test		Before and after test Variation	
	Po(dBm)	Sensitivity (dBm)	Po(dBm)	Sensitivity (dBm)	ΔP_o (dB)	ΔS (dB)
7	-3.0	-16.7	-3.1	-16.8	-0.1	-0.1
8	-2.4	-16.8	-2.6	-16.6	-0.2	0.2
9	-2.3	-16.9	-2.5	-16.7	-0.2	0.2
Statistics						
AVE	-2.57	-16.80	-2.73	-16.70	-0.17	0.10
SD	0.31	0.08	0.26	0.08	0.05	0.14
MAX	-2.30	-16.70	-2.50	-16.60	-0.10	0.20
MIN	-3.00	-16.90	-3.10	-16.80	-0.20	-0.10

Note: ESD Immunity reference resources IEC61000-4-2 condition 4 Class, air discharge 15KV,contact discharge 8KV,Critirion: level B is required.

5.9 Visual Inspection

Table 13: Data of Visual Inspection Test

No.	01	02	03	04	05	06	07	08	09	10	11
End Inspection	OK*	OK*	OK*	OK*	OK*	OK*	OK*	OK*	OK*	OK*	OK*

Note: 1) OK* shows that the 11 samples meet the received criterion prescribed by MIL-STD-883.

2) 10 times microscope examination.

5.10 High Temperature Storage

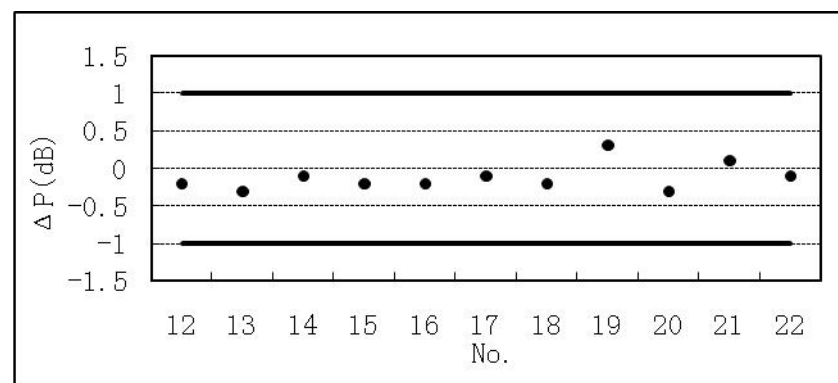


Figure 14: Optical Power Variation in High Temperature Storage Test

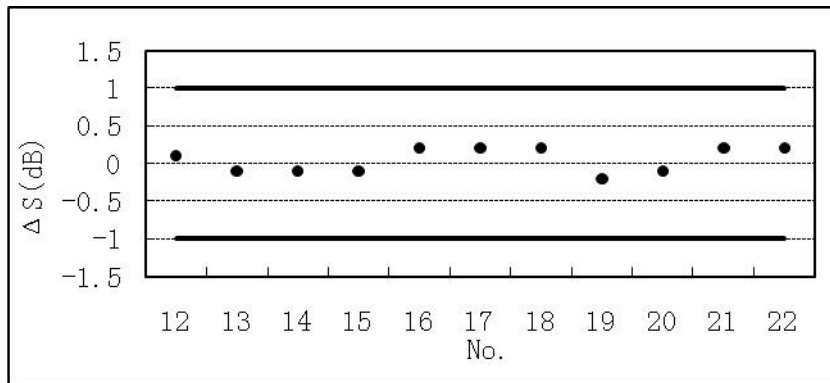


Figure 15: Receiver Sensitivity Variation in High Temperature Storage Test

Table 14: Data of High Temperature Storage Test

No.	Before Test		After Test		Before and after test Variation	
	Po(dBm)	Sensitivity (dBm)	Po(dBm)	Sensitivity (dBm)	ΔPo (dB)	ΔS (dB)
12	-2.3	-16.8	-2.5	-16.7	-0.2	0.1
13	-1.8	-16.6	-2.1	-16.7	-0.3	-0.1
14	-1.9	-16.9	-2.0	-17.0	-0.1	-0.1
15	-1.7	-16.9	-1.9	-17.0	-0.2	-0.1
16	-1.8	-17.0	-2.0	-16.8	-0.2	0.2
17	-2.0	-17.2	-2.1	-17.0	-0.1	0.2
18	-2.2	-17.0	-2.4	-16.8	-0.2	0.2
19	-2.3	-16.8	-2.0	-17.0	0.3	-0.2
20	-2.0	-16.9	-2.3	-17.0	-0.3	-0.1
21	-2.1	-16.7	-2.0	-16.5	0.1	0.2
22	-1.8	-17.2	-1.9	-17.0	-0.1	0.2
Statistics						
AVE	-1.99	-16.91	-2.11	-16.86	-0.12	0.05
SD	0.20	0.18	0.19	0.17	0.17	0.16
MAX	-1.70	-16.60	-1.90	-16.50	0.30	0.20
MIN	-2.30	-17.20	-2.50	-17.00	-0.30	-0.20

5.11 Powered damp heat test

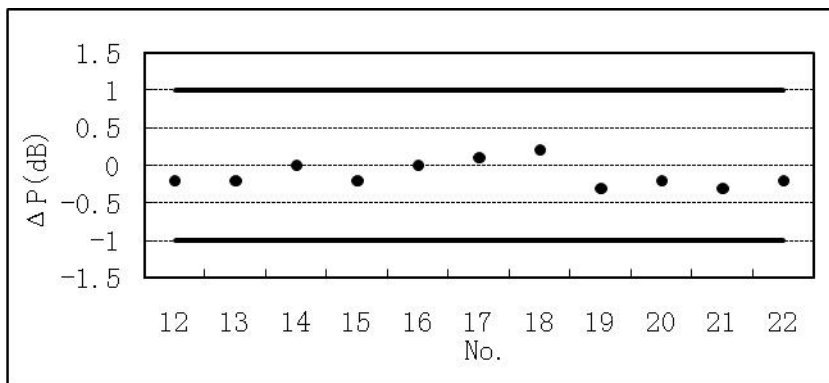


Figure 16: Optical Power Variation in Powered damp heat test Test

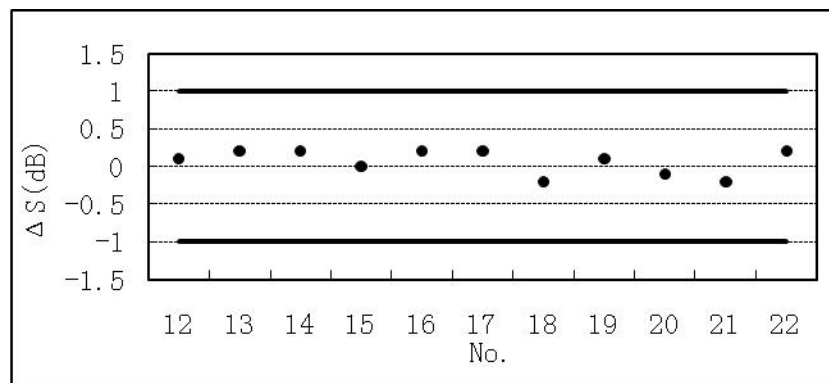


Figure 17: Receiver Sensitivity Variation in Powered damp heat test Test

Table 15: Data of Powered damp heat testTest

No.	Before Test		After Test		Before and after test Variation	
	Po(dBm)	Sensitivity (dBm)	Po(dBm)	Sensitivity (dBm)	ΔPo (dB)	ΔS (dB)
12	-2.5	-16.7	-2.7	-16.6	-0.2	0.1
13	-2.1	-16.7	-2.3	-16.5	-0.2	0.2
14	-2.0	-17.0	-2.0	-16.8	0.0	0.2
15	-1.9	-17.0	-2.1	-17.0	-0.2	0.0
16	-2.0	-16.8	-2.0	-16.6	0.0	0.2
17	-2.1	-17.0	-2.0	-16.8	0.1	0.2
18	-2.4	-16.8	-2.2	-17.0	0.2	-0.2

19	-2.0	-17.0	-2.3	-16.9	-0.3	0.1
20	-2.3	-17.0	-2.5	-17.1	-0.2	-0.1
21	-2.0	-16.5	-2.3	-16.7	-0.3	-0.2
22	-1.9	-17.0	-2.1	-16.8	-0.2	0.2
Statistics						
AVE	-2.11	-16.86	-2.23	-16.80	-0.12	0.06
SD	0.19	0.17	0.21	0.18	0.16	0.16
MAX	-1.90	-16.50	-2.00	-16.50	0.20	0.20
MIN	-2.50	-17.00	-2.70	-17.10	-0.30	-0.20

Note: 85°C/85%RH,1000 hours Powered Environmental Stress Test

5.12 Power Temperature cycling test

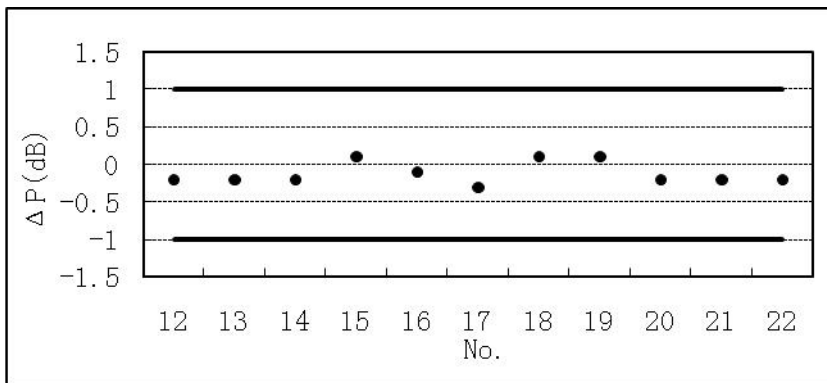


Figure 18: Optical Power Variation in Power Temperature cycling Test(500cycles)

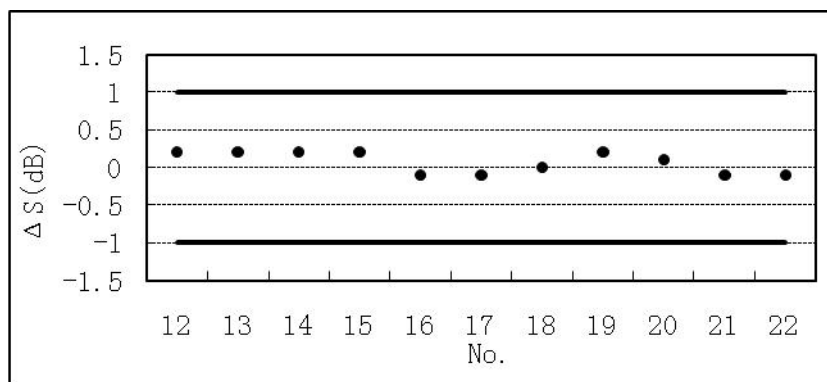


Figure 19: Receiver Sensitivity Variation in Power Temperature cycling Test(500cycles)

Table 16: Data of Power Temperature cycling Test

No.	Before Test		After Test		Before and after test Variation	
	Po(dBm)	Sensitivity (dBm)	Po(dBm)	Sensitivity (dBm)	Δ Po (dB)	Δ S (dB)
12	-2.7	-16.6	-2.9	-16.4	-0.2	0.2
13	-2.3	-16.5	-2.5	-16.3	-0.2	0.2
14	-2.0	-16.8	-2.2	-16.6	-0.2	0.2
15	-2.1	-17.0	-2.0	-16.8	0.1	0.2
16	-2.0	-16.6	-2.1	-16.7	-0.1	-0.1
17	-2.0	-16.8	-2.3	-16.9	-0.3	-0.1
18	-2.2	-17.0	-2.1	-17.0	0.1	0.0
19	-2.3	-16.9	-2.2	-16.7	0.1	0.2
20	-2.5	-17.1	-2.7	-17.0	-0.2	0.1
21	-2.3	-16.7	-2.5	-16.8	-0.2	-0.1
22	-2.1	-16.8	-2.3	-16.9	-0.2	-0.1
Statistics						
AVE	-2.23	-16.80	-2.35	-16.74	-0.12	0.06
SD	0.21	0.18	0.26	0.22	0.14	0.14
MAX	-2.00	-16.50	-2.00	-16.30	0.10	0.20
MIN	-2.70	-17.10	-2.90	-17.00	-0.30	-0.10

Note: -40°C to 85°C, 500 cycles

5.13 Accelerating Aging

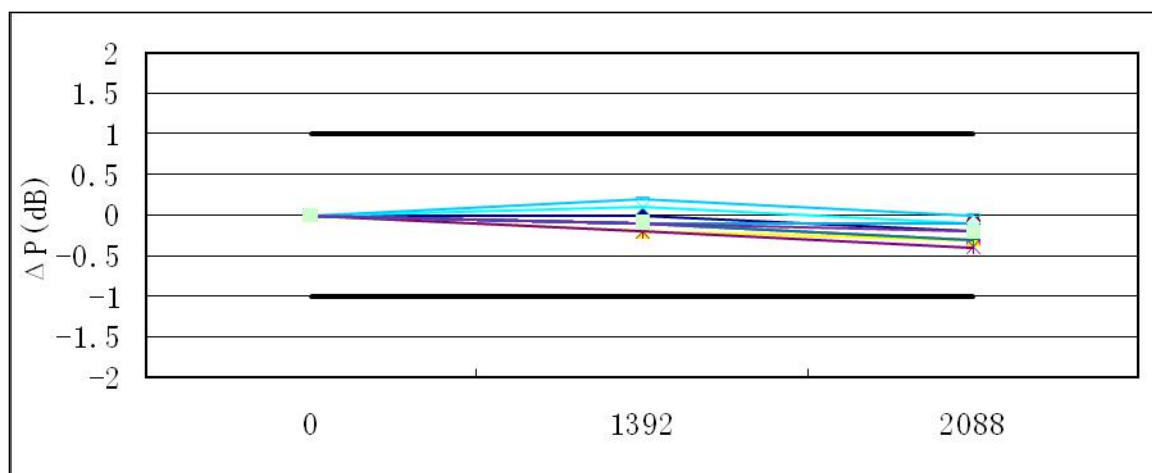


Figure 20: Optical Power Variation in Accelerating Aging Test

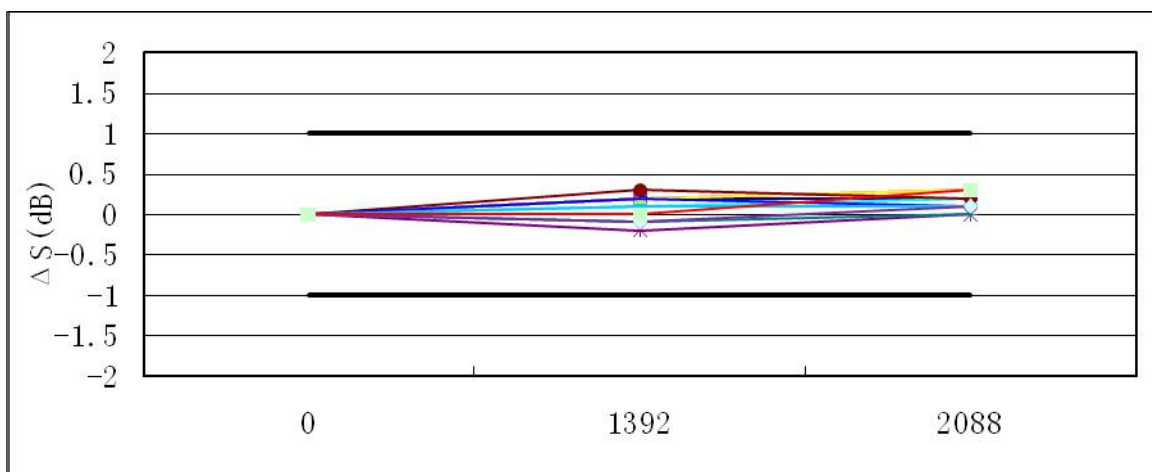


Figure 21: Receiver Sensitivity Variation in Accelerating Aging Test

Table 17: Optical Power of Accelerating Aging Test

Time (hrs)	23	24	25	26	27	28	29	30	31	32	33
0	-1.9	-2.2	-2.3	-2.1	-1.9	-1.8	-1.9	-1.8	-2.4	-2.3	-2.4
1392	-1.9	-2.3	-2.5	-2.0	-2.1	-1.9	-2.0	-1.9	-2.2	-2.4	-2.5
2088	-2.1	-2.5	-2.6	-2.2	-2.3	-1.9	-2.2	-1.9	-2.4	-2.4	-2.6

Table 18: Receiver Sensitivity of Accelerating Aging Test

Time (hrs)	23	24	25	26	27	28	29	30	31	32	33
0	-17.2	-16.9	-16.8	-17.2	-16.8	-16.9	-17	-16.7	-17.3	-17.2	-17.3
1392	-17.0	-16.7	-16.6	-17.1	-17.0	-16.6	-17.1	-16.5	-17.2	-17.3	-17.3
2088	-17.0	-16.6	-16.5	-17.0	-16.8	-16.7	-17.0	-16.6	-17.2	-17.1	-17.0