

Transceiver Performance **TEST Report**

Model name : SFP-10GLRM-31-I

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1. Introduction

This report presents the reliability test results for 10Gbps 2Km SFP+ 1310 nm Transceivers.

2. Purpose

The purpose of the test is to determine whether the O/E characteristics, mechanical integrity and endurance of 10Gbps 2Km SFP+ 1310 nm Transceiver module meet the requirement of reliability.

3. Sample Description

The sample is 10Gbps 2Km SFP+ 1310 nm Transceivers. The type is 10G LRM. The module's specification should fit the data in the Table 1.

Table 1: Specification

Parameter	Symbol	Specification			Unit
		Min.	Typ.	Max.	
Operating Voltage	VCC	+3.14	+3.3	+3.46	V
Output light Center Wavelength Range	λ_C	1260	1310	1355	nm
Launch Optical Power	PO	-8.2		0.5	dBm
Extinction ratio	EX	3.5			dB
Receiver Sensitivity	S			-12.6	dBm
Receive light Center Wavelength Range	λ_C	1260		1610	nm
Operating temperature Range	TC	-40		+85	°C
Storage temperature Range	TS	-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	<ol style="list-style-type: none"> 1. Physical Dimensions 2. Low-temperature Storage 3. Mechanical Shock/Vibration 4. Temperature Cycle 5. Damp Heat 6. high-temperature Storage
	Group 2	Accelerating Aging
	Group 3	<ol style="list-style-type: none"> 1. Power Temperature cycling test 2. Powered damp heat test 3. Visual Inspection 4. ESD Threshold 5. ESD Immunity

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	
	Accelerating Aging	
Special Tests	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	500g, 1ms, 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	2040hrs
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	-2.8	-16.2	23	-2.6	-16.5
2	-2.9	-16.4	24	-2.8	-16.6
3	-3.0	-16.5	25	-2.9	-16.4
4	-3.1	-16.1	26	-3.2	-16.3
5	-2.7	-16.5	27	-3.4	-16.2
6	-3.2	-16.5	28	-3.0	-16.6
7	-3.3	-16.6	29	-3.3	-16.3
8	-3.1	-16.3	30	-2.9	-16.6
9	-2.6	-16.4	31	-3.1	-16.4
10	-2.7	-16.5	32	-3.3	-16.4
11	-2.9	-16.2	33	-3.2	-16.3
12	-3.5	-16.3			

13	-3.4	-16.4			
14	-3.2	-16.3			
15	-3.5	-16.4			
16	-2.9	-16.6			
17	-2.8	-16.3			
18	-2.7	-16.5			
19	-3.2	-16.4			
20	-3.1	-16.6			
21	-3.3	-16.2			
22	-3.3	-16.3			

5.2 Physical Dimensions

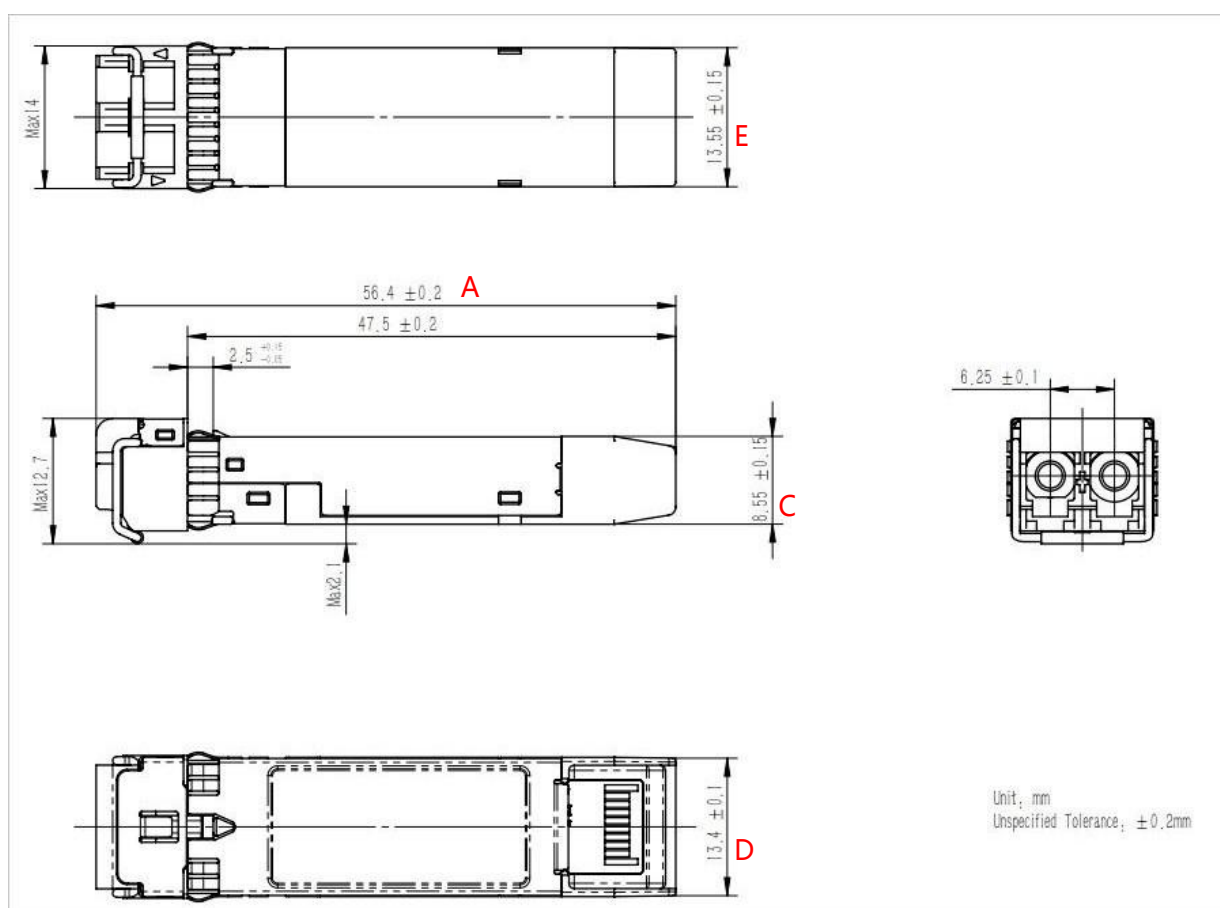


Figure 1: Package outline (unit: mm)

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	56.39	47.55	8.58	13.44	13.57
2	56.40	47.47	8.57	13.41	13.58
3	56.41	47.53	8.59	13.42	13.53
4	56.37	47.58	8.52	13.38	13.58
5	56.44	47.53	8.55	13.36	13.52
6	56.45	47.46	8.53	13.40	13.58
7	56.36	47.53	8.58	13.43	13.52
8	56.45	47.55	8.52	13.43	13.57
9	56.36	47.56	8.57	13.37	13.58
10	56.42	47.48	8.58	13.36	13.51
11	56.43	47.47	8.53	13.42	13.52
Statistics					
AVE	56.41	47.52	8.56	13.40	13.55
SD	0.03	0.04	0.03	0.03	0.03
MAX	56.45	47.58	8.59	13.44	13.58
MIN	56.36	47.46	8.52	13.36	13.51

5.3 Mechanical Shock /Vibration

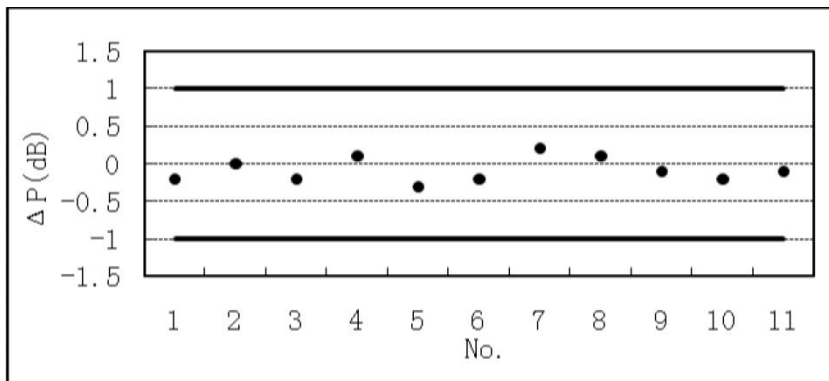


Figure 2: Optical Power Variation in Mechanical Shock /Vibration Test

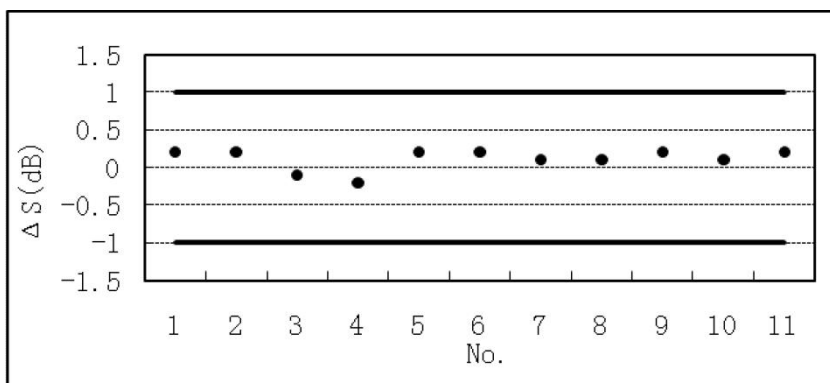


Figure 3: Receive Sensitivity Variation in Mechanical Shock /Vibration Test

Table 7: Data of Mechanical Shock /Vibration Test

No.	Before Test		After Test		Before and after test Variation	
	Po(dBm)	Sensitivity	Po(dBm)	Sensitivity	ΔPo	ΔS
		(dBm)		(dBm)	(dB)	(dB)

1	-2.8	-16.2	-3.0	-16.0	-0.2	0.2
2	-2.9	-16.4	-2.9	-16.2	0.0	0.2
3	-3.0	-16.5	-3.2	-16.6	-0.2	-0.1
4	-3.1	-16.1	-3.0	-16.3	0.1	-0.2
5	-2.7	-16.5	-3.0	-16.3	-0.3	0.2
6	-3.2	-16.5	-3.4	-16.3	-0.2	0.2
7	-3.3	-16.6	-3.1	-16.5	0.2	0.1
8	-3.1	-16.3	-3.0	-16.2	0.1	0.1
9	-2.6	-16.4	-2.7	-16.2	-0.1	0.2
10	-2.7	-16.5	-2.9	-16.4	-0.2	0.1
11	-2.9	-16.2	-3.0	-16.0	-0.1	0.2
Statistics						
AVE	-2.94	-16.38	-3.02	-16.27	-0.08	0.11
SD	0.21	0.15	0.17	0.18	0.15	0.13
MAX	-2.60	-16.10	-2.70	-16.00	0.20	0.20
MIN	-3.30	-16.60	-3.40	-16.60	-0.30	-0.20

5.4 Low Temperature Storage

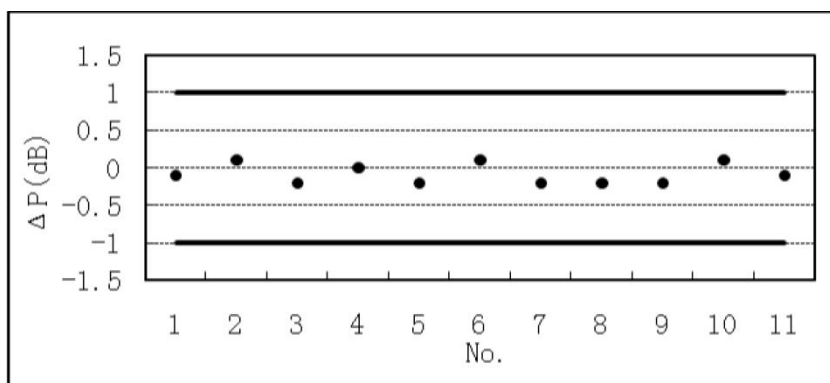


Figure 4: Optical Power variation in Low Temperature Storage

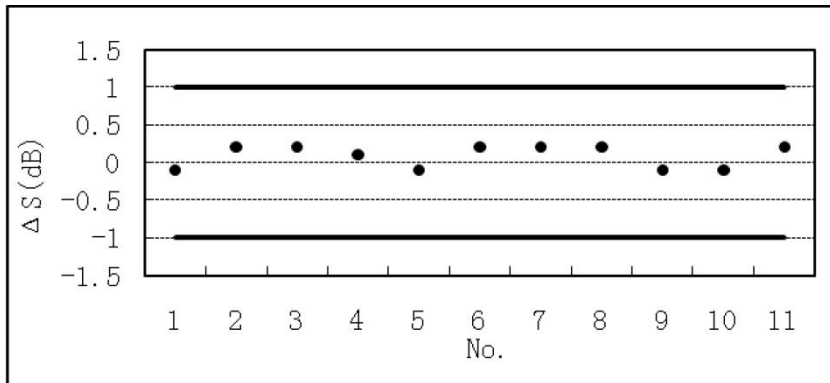


Figure 5: Receiver Sensitivity Variation in Low Temperature Storage

Table 8: Data of Low Temperature Storage

No.	Before Test		After Test		Before and after test Variation	
	Po(dBm)	Sensitivity (dBm)	Po(dBm)	Sensitivity (dBm)	ΔP_o (dB)	ΔS (dB)
1	-3.0	-16.0	-3.1	-16.1	-0.1	-0.1
2	-2.9	-16.2	-2.8	-16.0	0.1	0.2
3	-3.2	-16.6	-3.4	-16.4	-0.2	0.2
4	-3.0	-16.3	-3.0	-16.2	0.0	0.1
5	-3.0	-16.3	-3.2	-16.4	-0.2	-0.1
6	-3.4	-16.3	-3.3	-16.1	0.1	0.2
7	-3.1	-16.5	-3.3	-16.3	-0.2	0.2
8	-3.0	-16.2	-3.2	-16.0	-0.2	0.2
9	-2.7	-16.2	-2.9	-16.3	-0.2	-0.1
10	-2.9	-16.4	-2.8	-16.5	0.1	-0.1

11	-3.0	-16.0	-3.1	-15.8	-0.1	0.2
Statistics						
AVE	-3.02	-16.27	-3.10	-16.19	-0.08	0.08
SD	0.17	0.18	0.20	0.20	0.13	0.14
MAX	-2.70	-16.00	-2.80	-15.80	0.10	0.20
MIN	-3.40	-16.60	-3.40	-16.50	-0.20	-0.10

5.5 Temperature Cycle

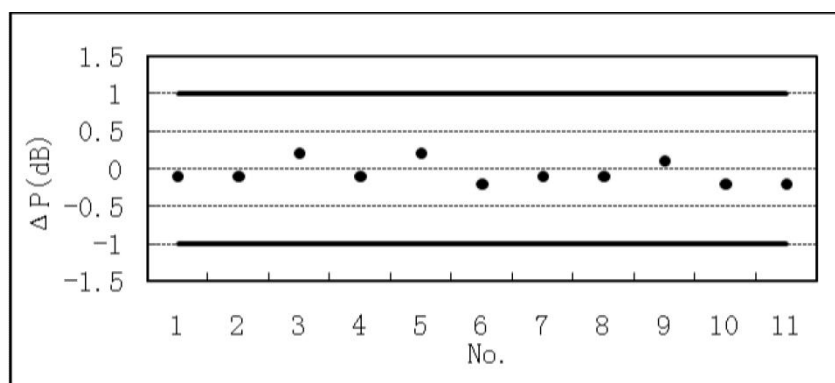


Figure 6: Optical Power Variation in Temperature Cycle Test

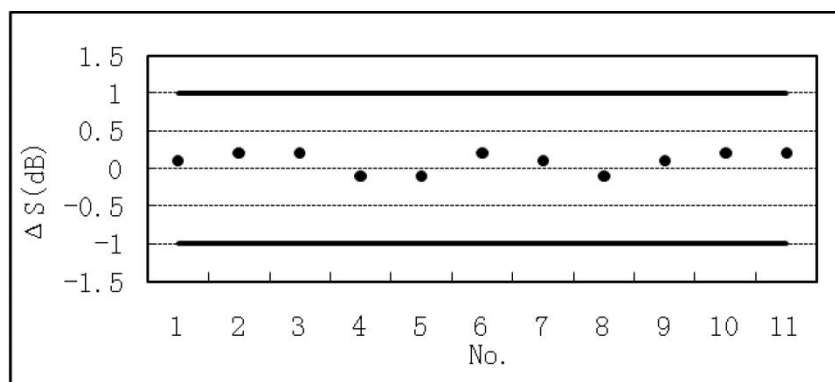


Figure 7: Receiver Sensitivity Variation in Temperature Cycle Test

Table 9: Data of Temperature Cycle 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)
1	-3.1	-16.1	-3.2	-16.0	-0.1	0.1
2	-2.8	-16.0	-2.9	-15.8	-0.1	0.2
3	-3.4	-16.4	-3.2	-16.2	0.2	0.2
4	-3.0	-16.2	-3.1	-16.3	-0.1	-0.1
5	-3.2	-16.4	-3.0	-16.5	0.2	-0.1
6	-3.3	-16.1	-3.5	-15.9	-0.2	0.2
7	-3.3	-16.3	-3.4	-16.2	-0.1	0.1
8	-3.2	-16.0	-3.3	-16.1	-0.1	-0.1
9	-2.9	-16.3	-2.8	-16.2	0.1	0.1
10	-2.8	-16.5	-3.0	-16.3	-0.2	0.2
11	-3.1	-15.8	-3.3	-15.6	-0.2	0.2
Statistics						
AVE	-3.10	-16.19	-3.15	-16.10	-0.05	0.09
SD	0.20	0.20	0.21	0.24	0.14	0.12
MAX	-2.80	-15.80	-2.80	-15.60	0.20	0.20
MIN	-3.40	-16.50	-3.50	-16.50	-0.20	-0.10

5.6 Damp Heat

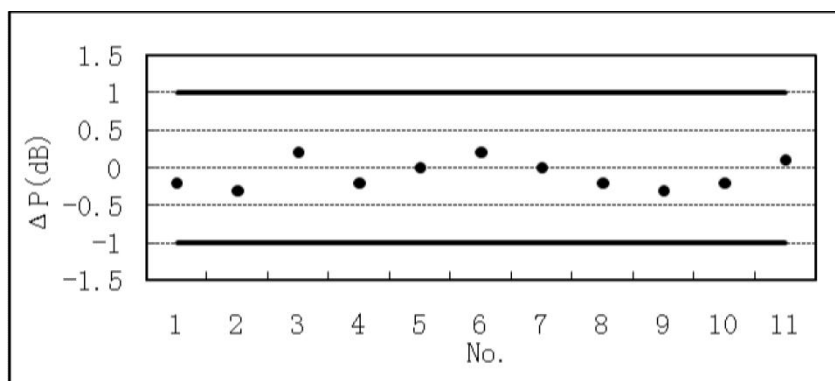


Figure 8: Optical Power variation in Damp Heat Test

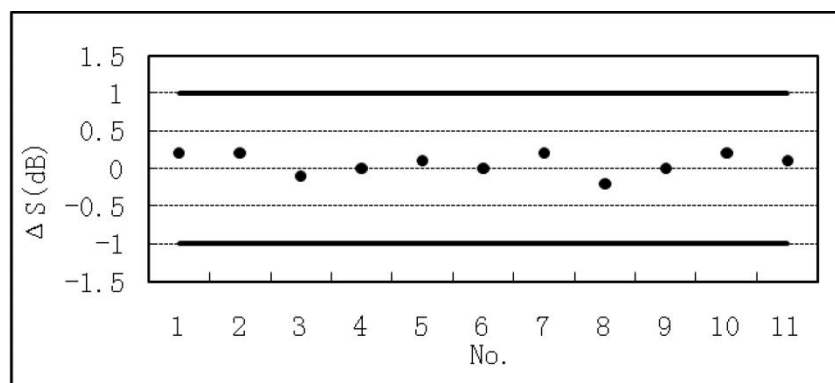


Figure 9: Receiver Sensitivity Variation in Damp Heat Test

Table 10: Data of Damp Heat Test

No.	Before Test		After Test		Before and after test Variation	
	Po(dBm)	Sensitivity	Po(dBm)	Sensitivity	ΔPo	ΔS
		(dBm)		(dBm)	(dB)	(dB)

1	-3.2	-16.0	-3.4	-15.8	-0.2	0.2
2	-2.9	-15.8	-3.2	-15.6	-0.3	0.2
3	-3.2	-16.2	-3.0	-16.3	0.2	-0.1
4	-3.1	-16.3	-3.3	-16.3	-0.2	0.0
5	-3.0	-16.5	-3.0	-16.4	0.0	0.1
6	-3.5	-15.9	-3.3	-15.9	0.2	0.0
7	-3.4	-16.2	-3.4	-16.0	0.0	0.2
8	-3.3	-16.1	-3.5	-16.3	-0.2	-0.2
9	-2.8	-16.2	-3.1	-16.2	-0.3	0.0
10	-3.0	-16.3	-3.2	-16.1	-0.2	0.2
11	-3.3	-15.6	-3.2	-15.5	0.1	0.1
Statistics						
AVE	-3.15	-16.10	-3.24	-16.04	-0.08	0.06
SD	0.21	0.24	0.16	0.29	0.18	0.13
MAX	-2.80	-15.60	-3.00	-15.50	0.20	0.20
MIN	-3.50	-16.50	-3.50	-16.40	-0.30	-0.20

5.7 High Temperature Storage

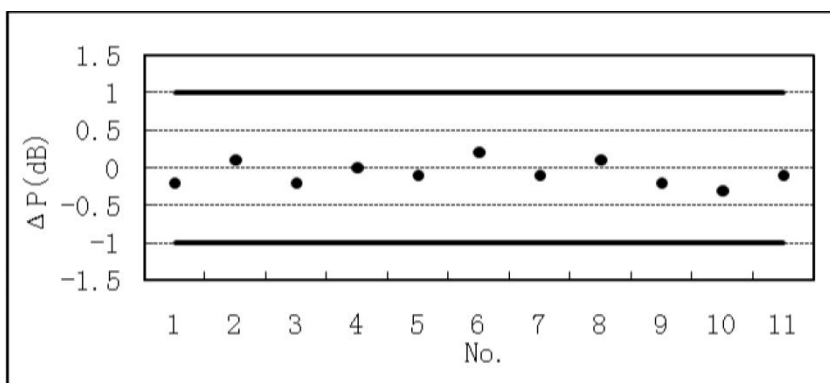


Figure 10: Optical Power Variation in High Temperature Storage Test

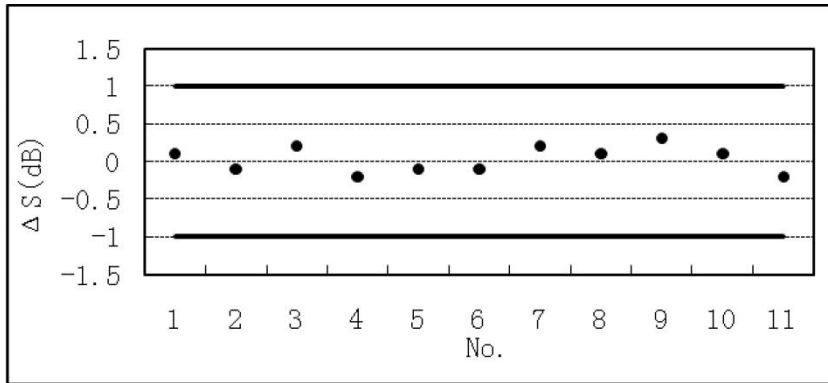


Figure 11: Receiver Sensitivity Variation in High Temperature Storage Test

Table 11: 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)
1	-3.4	-15.8	-3.6	-15.7	-0.2	0.1
2	-3.2	-15.6	-3.1	-15.7	0.1	-0.1
3	-3.0	-16.3	-3.2	-16.1	-0.2	0.2
4	-3.3	-16.3	-3.3	-16.5	0.0	-0.2
5	-3.0	-16.4	-3.1	-16.5	-0.1	-0.1
6	-3.3	-15.9	-3.1	-16.0	0.2	-0.1
7	-3.4	-16.0	-3.5	-15.8	-0.1	0.2
8	-3.5	-16.3	-3.4	-16.2	0.1	0.1
9	-3.1	-16.2	-3.3	-15.9	-0.2	0.3
10	-3.2	-16.1	-3.5	-16.0	-0.3	0.1
11	-3.2	-15.5	-3.3	-15.7	-0.1	-0.2

Statistics						
AVE	-3.24	-16.04	-3.31	-16.01	-0.07	0.03
SD	0.16	0.29	0.17	0.28	0.15	0.17
MAX	-3.00	-15.50	-3.10	-15.70	0.20	0.30
MIN	-3.50	-16.40	-3.60	-16.50	-0.30	-0.20

5.8 Power Temperature cycling test

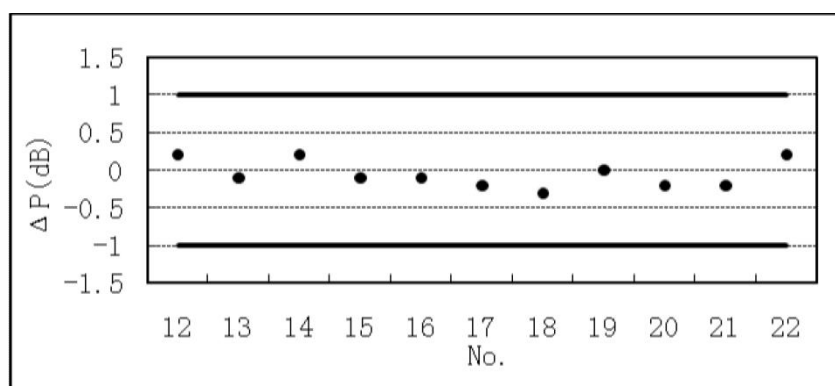


Figure 12: Optical Power Variation in Power Temperature cycling Test(500cycles)

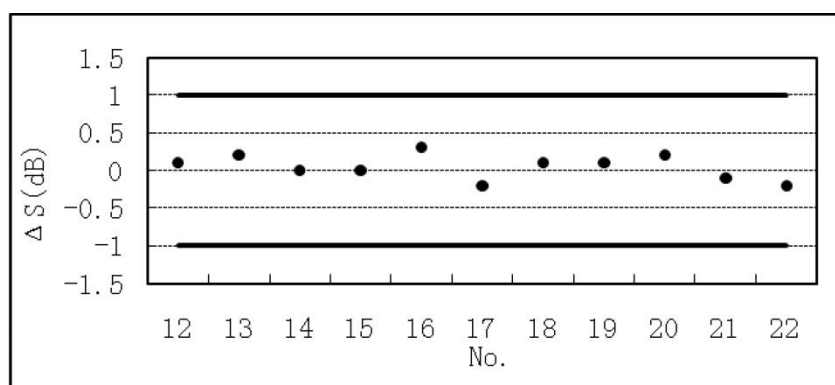


Figure 13: Receiver Sensitivity Variation in Power Temperature cycling Test(500cycles)

Table 12: Data of Power Temperature cycling Test

No.	Before Test		After Test		Before and after test Variation	
	Po(dBm)	Sensitivity	Po(dBm)	Sensitivity	Δ Po	Δ S
		(dBm)		(dBm)	(dB)	(dB)
12	-3.5	-16.3	-3.3	-16.2	0.2	0.1
13	-3.4	-16.4	-3.5	-16.2	-0.1	0.2
14	-3.2	-16.3	-3.0	-16.3	0.2	0.0
15	-3.5	-16.4	-3.6	-16.4	-0.1	0.0
16	-2.9	-16.6	-3.0	-16.3	-0.1	0.3
17	-2.8	-16.3	-3.0	-16.5	-0.2	-0.2
18	-2.7	-16.5	-3.0	-16.4	-0.3	0.1
19	-3.2	-16.4	-3.2	-16.3	0.0	0.1
20	-3.1	-16.6	-3.3	-16.4	-0.2	0.2
21	-3.3	-16.2	-3.5	-16.3	-0.2	-0.1
22	-3.3	-16.3	-3.1	-16.5	0.2	-0.2
Statistics						
AVE	-3.17	-16.39	-3.23	-16.35	-0.05	0.05
SD	0.26	0.12	0.22	0.10	0.17	0.16
MAX	-2.70	-16.20	-3.00	-16.20	0.20	0.30
MIN	-3.50	-16.60	-3.60	-16.50	-0.30	-0.20

5.9 Powered damp heat test

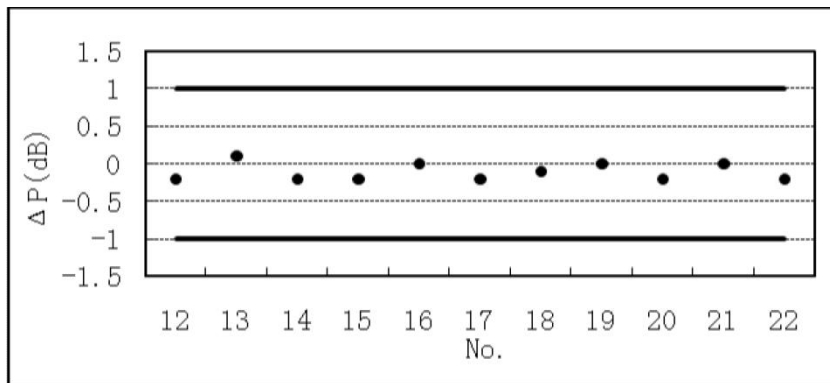


Figure 14: Optical Power Variation in Powered damp heat test Test

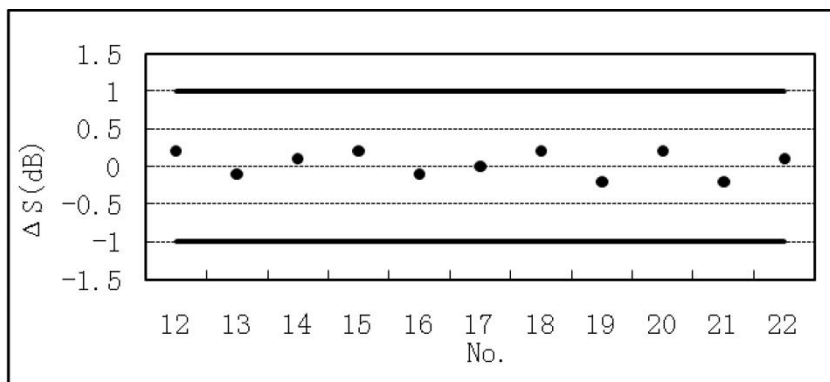


Figure 15: Receiver Sensitivity Variation in Powered damp heat test Test

Table 13: Data of Powered damp heat testTest

No.	Before Test		After Test		Before and after test Variation	
	Po(dBm)	Sensitivity	Po(dBm)	Sensitivity	ΔPo	ΔS
		(dBm)		(dBm)	(dB)	(dB)
12	-3.3	-16.2	-3.5	-16.0	-0.2	0.2

13	-3.5	-16.2	-3.4	-16.3	0.1	-0.1
14	-3.0	-16.3	-3.2	-16.2	-0.2	0.1
15	-3.6	-16.4	-3.8	-16.2	-0.2	0.2
16	-3.0	-16.3	-3.0	-16.4	0.0	-0.1
17	-3.0	-16.5	-3.2	-16.5	-0.2	0.0
18	-3.0	-16.4	-3.1	-16.2	-0.1	0.2
19	-3.2	-16.3	-3.2	-16.5	0.0	-0.2
20	-3.3	-16.4	-3.5	-16.2	-0.2	0.2
21	-3.5	-16.3	-3.5	-16.5	0.0	-0.2
22	-3.1	-16.5	-3.3	-16.4	-0.2	0.1
Statistics						
AVE	-3.23	-16.35	-3.34	-16.31	-0.11	0.04
SD	0.22	0.10	0.22	0.16	0.11	0.16
MAX	-3.00	-16.20	-3.00	-16.00	0.10	0.20
MIN	-3.60	-16.50	-3.80	-16.50	-0.20	-0.20

5.10 ESD Threshold

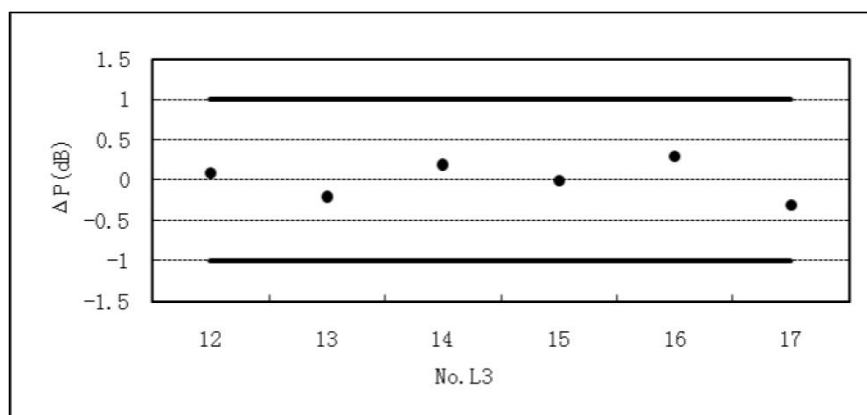


Figure 16: Optical Power Variation in ESD Threshold Test

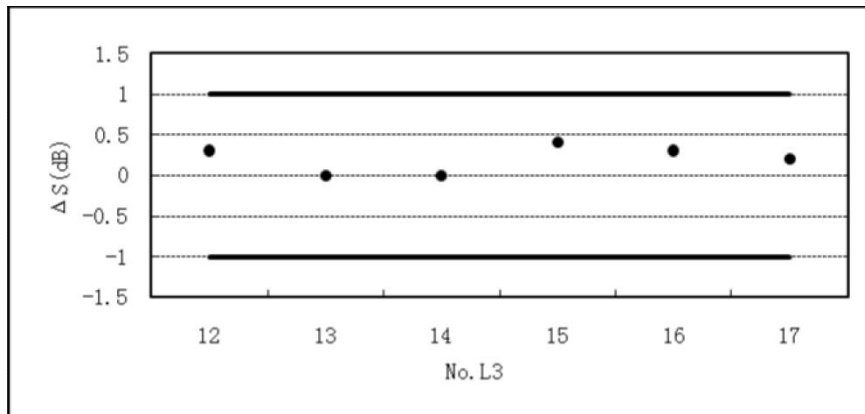


Figure 17: Receiver Sensitivity Variation in ESD Threshold Test

Table 14: Data of ESD Threshold Test

No.	Before Test		After Test		Before and after test Variation	
	Po(dBm)	Sensitivity (dBm)	Po(dBm)	Sensitivity (dBm)	ΔPo (dB)	ΔS (dB)
12	-3.5	-16.0	-3.7	-16.1	-0.2	-0.1
13	-3.4	-16.3	-3.4	-16.1	0.0	0.2
14	-3.2	-16.2	-3.4	-16.0	-0.2	0.2
15	-3.8	-16.2	-3.6	-16.3	0.2	-0.1
16	-3.0	-16.4	-3.2	-16.2	-0.2	0.2
17	-3.2	-16.5	-3.0	-16.3	0.2	0.2
Statistics						
AVE	-3.35	-16.27	-3.38	-16.17	-0.03	0.10
SD	0.26	0.16	0.23	0.11	0.18	0.14
MAX	-3.00	-16.00	-3.00	-16.00	0.20	0.20

MIN	-3.80	-16.50	-3.70	-16.30	-0.20	-0.10
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5.11 ESD Immunity

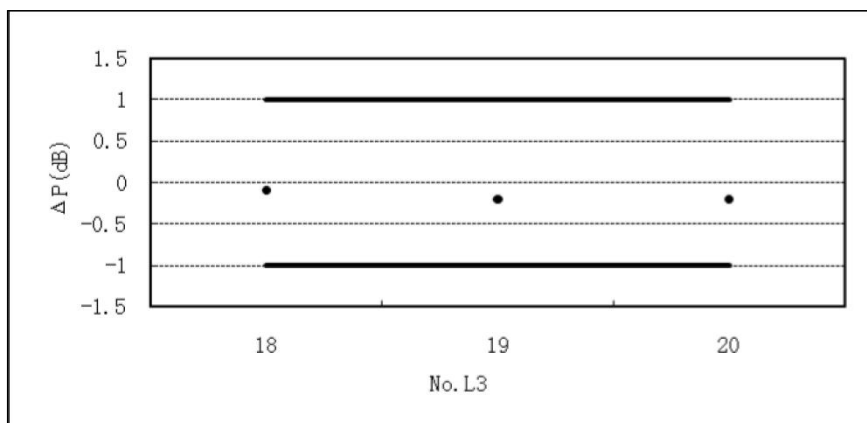


Figure 18: Optical Power Variation in ESD Immunity Test

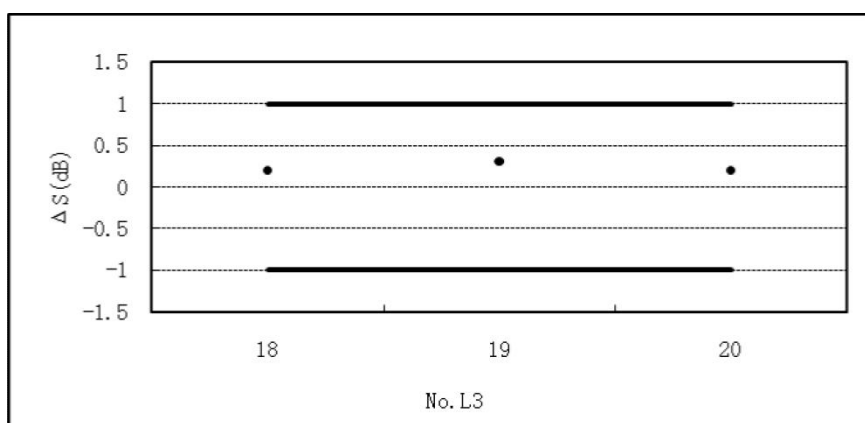


Figure 19: Receiver Sensitivity Variation in ESD Immunity Test

Table 15: Data of ESD Immunity Test (Class 4)

No.	Before Test		After Test		Before and after test Variation	
	Po(dBm)	Sensitivity	Po(dBm)	Sensitivity	ΔPo	ΔS

		(dBm)		(dBm)	(dB)	(dB)
18	-3.1	-16.2	-3.3	-16.0	-0.2	0.2
19	-3.2	-16.5	-3.4	-16.3	-0.2	0.2
20	-3.5	-16.2	-3.4	-16.2	0.1	0.0
Statistics						
AVE	-3.27	-16.30	-3.37	-16.17	-0.10	0.13
SD	0.17	0.14	0.05	0.12	0.14	0.09
MAX	-3.10	-16.20	-3.30	-16.00	0.10	0.20
MIN	-3.50	-16.50	-3.40	-16.30	-0.20	0.00

5.12 Visual Inspection

Table 16: Data of Visual Inspection Test

No.	1	2	3	4	5	6	7	8	9	10	11
End Inspection	OK*	OK*	OK*	OK*	OK*	OK*	OK*	OK*	OK*	OK*	OK*

5.13 Accelerating Aging

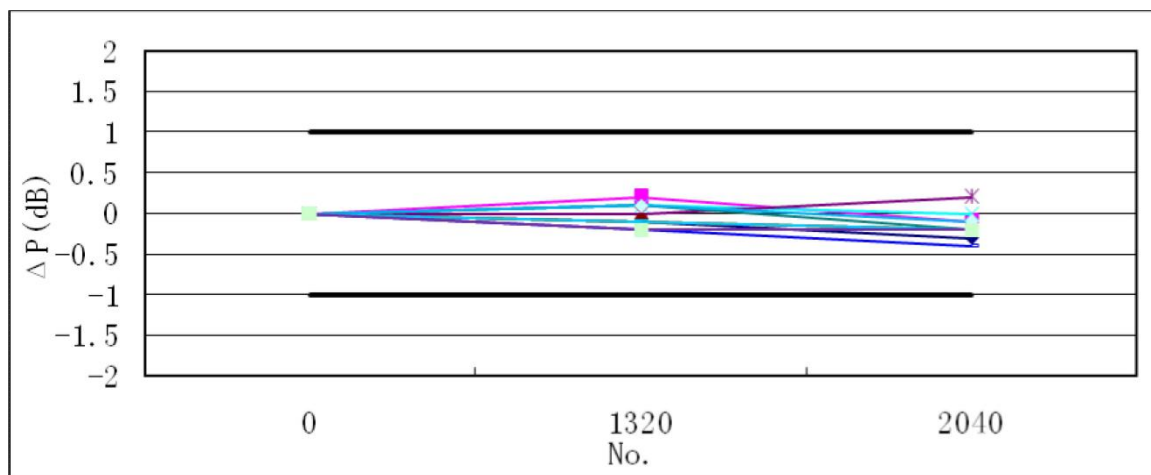


Figure 20: Optical Power Variation in Accelerating Aging Test

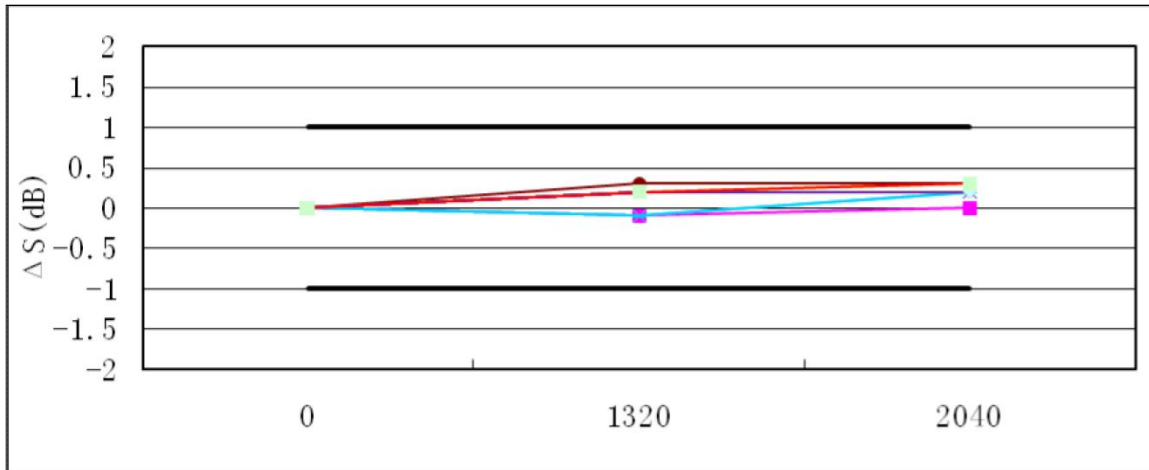


Figure 21: Receiver Sensitivity Variation in Accelerating Aging Test

Table 17: Optical Power of Accelerating Aging Test

Time (hrs)	23	24	25	26	27	28	29	30	31	32	33
0	-2.6	-2.8	-2.9	-3.2	-3.4	-3	-3.3	-2.9	-3.1	-3.3	-3.2
1320	-2.7	-2.6	-3.0	-3.1	-3.4	-3.1	-3.2	-3.1	-3.2	-3.2	-3.4
2040	-2.9	-2.9	-3.1	-3.2	-3.2	-3.2	-3.5	-3.3	-3.3	-3.4	-3.4

Table 18: Receiver Sensitivity of Accelerating Aging Test

Time (hrs)	23	24	25	26	27	28	29	30	31	32	33
0	-16.5	-16.6	-16.4	-16.3	-16.2	-16.6	-16.3	-16.6	-16.4	-16.4	-16.3
1320	-16.3	-16.7	-16.2	-16.4	-16.0	-16.3	-16.1	-16.4	-16.5	-16.2	-16.1
2040	-16.3	-16.6	-16.1	-16.1	-16.0	-16.3	-16.1	-16.4	-16.2	-16.2	-16.0