

Transceiver Reliability TEST Report

Model name : SFP28-25GER-31-I

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1. Introduction

This report presents the reliability test results for 1300nm EML DFB laser based 25 Gb/s SFP28 , EML TOSA w/TEC and APD ROSA transceiver.

2. Purpose

The purpose of the test is to determine whether the O/E characteristics, mechanical integrity and endurance of 25 Gb/s SFP28 ER 30/40km transceiver module meet the requirement of reliability.

3. Sample Description

The sample transmits and receives optical data up to 30/40km over single mode fiber. The module' s specification should fit the data in Table 1.

Table 1: Specification

Parameter	Symbol	Specification			Unit
		Min.	Typ.	Max	
Operating Voltage	V_{CC}	3.135	3.3	3.465	V
Center Wavelength Range	λ_c	1295		1310	nm
Launch Optical Power	P_O	-1		+5	dBm
Extinction Ratio	EX	4.0			dB
Receiver OMA Sensitivity(@25.78Gb/s) (BER=5-5)	S			-19	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	Physical Dimensions Low-temperature Storage Mechanical Shock/Vibration Temperature Cycle Damp Heat High-Temperature Storage ESD Threshold ESD Immunity Visual Inspection
	Group 2	Temperature Cycle (Powered) Damp Heat Accelerating Aging

4.3 Failure Criterion

Table 3: Failure Criterion

Heading	Test Program	Failure Criteria
Functional Verification	O/E Characteristics	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	
	Damp Heat	
	Damp Heat(Power)	
	Low-Temperature Storage	
	High-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	22/0	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	2064hrs
Low-Temp Storage	GR-468-CORE	-40°C, 72hrs	11/0	Passed
High-Temperature 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
Damp Heat	MIL-STD-202	85°C,85%RH, 1000 hrs	11/0	Passed
Damp Heat Powered	GR-468-CORE	85°C,85%RH, 1000 hrs	11/0	Passed
Temperature Cycle (Powered)		-40°C to 85°C, 500 cycles	11/0	Passed
ESD Immunity	IEC61000-4-2	4 Class, air discharge 15KV, contact discharge 8KV	3/0	Passed
ESD Threshold	MIL-STD-883	HBM, least 500V, three positive pulses, three negative pulses, test to failure. (Signal Pin)	6/0	±1000V
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 Twenty-Two Modules

No.	P _o (dBm)	Sensitivity (dBm)	No.	P _o (dBm)	Sensitivity (dBm)
1	0.6	-25	12	0.6	-25
2	1.6	-24.6	13	1.4	-24.2
3	1.8	-24.4	14	0.7	-23.2
4	1.2	-25.6	15	0.7	-25.5
5	0.8	-22.8	16	0.5	-22.4
6	0.6	-24.2	17	0.7	-24.3
7	1.2	-24.3	18	0.6	-24.1
8	1.1	-23.5	19	1.8	-24.7
9	1.1	-25.6	20	0.7	-25.9
10	0.7	-24.5	21	0.9	-23.9
11	1.2	-25	22	0.9	-25.5

5.2 Physical Dimensions

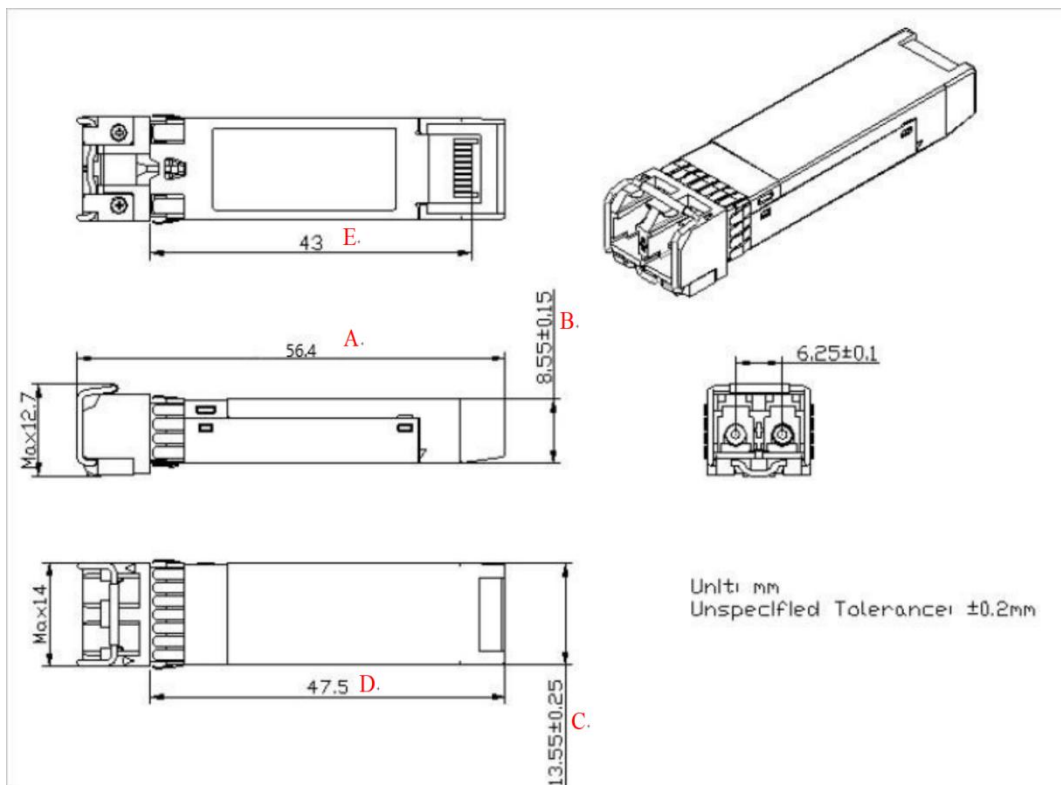


Figure 1: Package Outline(unit: mm)

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

Projected Dimension	Designator				
	A	B	C	D	E
	56.4±0.2	8.55±0.15	13.55±0.25	47.5±0.2	43±0.2
1	56.46	8.52	13.58	47.48	43.08
2	56.45	8.58	13.59	47.45	43.09
3	56.34	8.59	13.52	47.47	42.88
4	56.35	8.53	13.53	47.48	42.91
5	56.33	8.51	13.54	47.53	42.93
6	56.36	8.52	13.51	47.52	42.97
7	56.35	8.58	13.52	47.46	42.93
8	56.35	8.50	13.50	47.50	43.03
9	56.33	8.59	13.53	47.44	43.04
10	56.37	8.52	13.57	47.49	42.89
11	56.36	8.59	13.59	47.52	42.94
Statistics					
AVE	56.36	8.55	13.54	47.49	42.97
SD	0.04	0.04	0.03	0.03	0.07
MAX	56.46	8.59	13.59	47.53	43.09
MIN	56.33	8.50	13.50	47.44	42.88

5.3 Low Temperature Storage

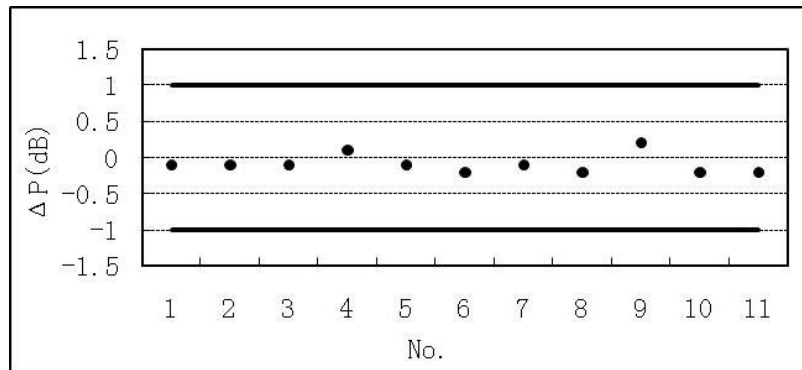


Figure 2: Optical Power Variation in Low Temperature Storage Test

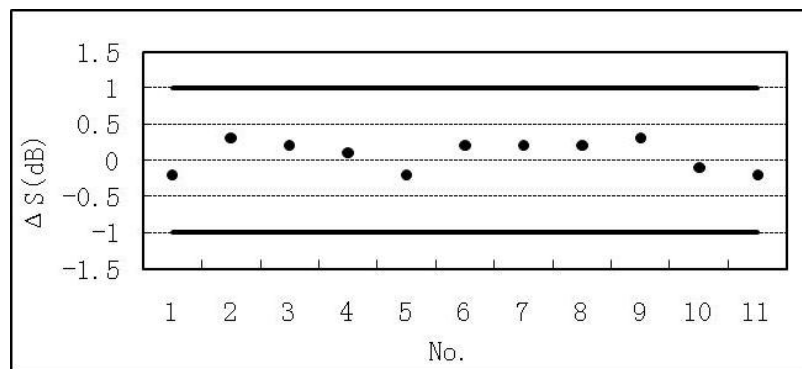


Figure 3: Receiver Sensitivity Variation in Low Temperature Storage Test

Table 7: Data of Low Temperature Storage Test

No.	Before Test		After Test		Before and After Test Variation	
	P _o (dBm)	Sensitivity (dBm)	P _o (dBm)	Sensitivity (dBm)	ΔP _o (dB)	ΔS (dB)
1	0.6	-25.0	0.5	-25.2	-0.1	-0.2
2	1.6	-24.6	1.5	-24.3	-0.1	0.3
3	1.8	-24.4	1.7	-24.2	-0.1	0.2
4	1.2	-25.6	1.3	-25.5	0.1	0.1
5	0.8	-22.8	0.7	-23.0	-0.1	-0.2
6	0.6	-24.2	0.4	-24.0	-0.2	0.2
7	1.2	-24.3	1.1	-24.1	-0.1	0.2
8	1.1	-23.5	0.9	-23.3	-0.2	0.2

9	1.1	-25.6	1.3	-25.3	0.2	0.3
10	0.7	-24.5	0.5	-24.6	-0.2	-0.1
11	1.2	-25.0	1.0	-25.2	-0.2	-0.2
Statistics						
AVE	1.08	-24.50	0.99	-24.43	-0.09	0.07
SD	0.37	0.80	0.41	0.79	0.12	0.20
MAX	1.80	-22.80	1.70	-23.00	0.20	0.30
MIN	0.60	-25.60	0.40	-25.50	-0.20	-0.20

5.4 Temperature Cycle

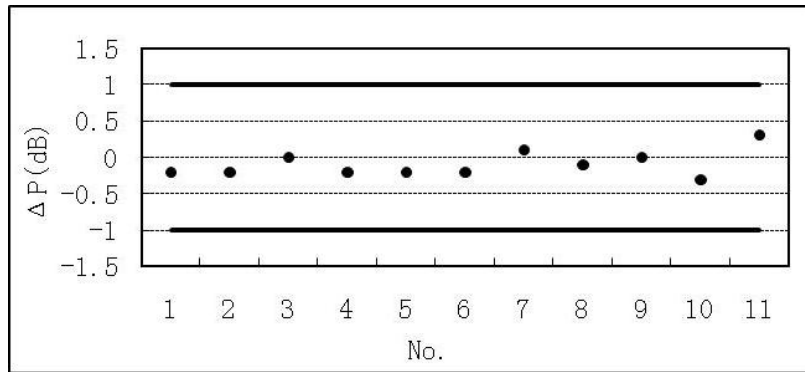


Figure 4: Optical Power Variation in Temperature Cycle Test

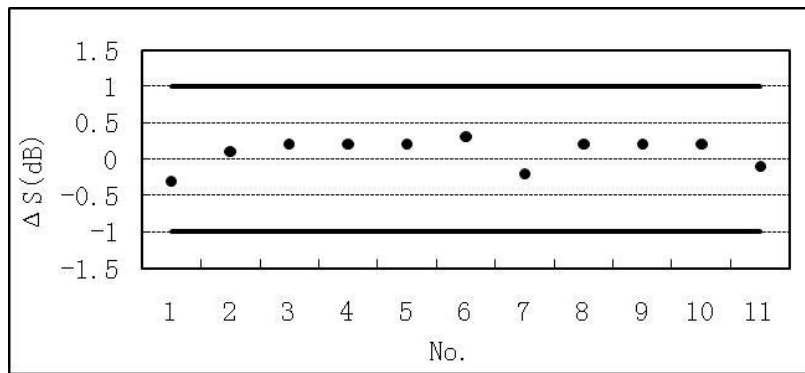


Figure 5: Receive Sensitivity Variation in Temperature Cycle Test

Table 8: Data of Temperature Cycle Test

No.	Before Test		After Test		Before and After Test Variation	
	P _o (dBm)	Sensitivity (dBm)	P _o (dBm)	Sensitivity (dBm)	ΔP _o (dB)	ΔS (dB)
1	0.5	-25.2	0.3	-25.5	-0.2	-0.3
2	1.5	-24.3	1.3	-24.2	-0.2	0.1
3	1.7	-24.2	1.7	-24.0	0.0	0.2
4	1.3	-25.5	1.1	-25.3	-0.2	0.2
5	0.7	-23.0	0.5	-22.8	-0.2	0.2
6	0.4	-24.0	0.2	-23.7	-0.2	0.3
7	1.1	-24.1	1.2	-24.3	0.1	-0.2
8	0.9	-23.3	0.8	-23.1	-0.1	0.2
9	1.3	-25.3	1.3	-25.1	0.0	0.2
10	0.5	-24.6	0.2	-24.4	-0.3	0.2
11	1.0	-25.2	1.3	-25.3	0.3	-0.1
Statistics						
AVE	0.99	-24.43	0.90	-24.34	-0.09	0.09
SD	0.41	0.79	0.50	0.86	0.17	0.19
MAX	1.70	-23.00	1.70	-22.80	0.30	0.30
MIN	0.40	-25.50	0.20	-25.50	-0.30	-0.30

5.5 Mechanical Shock /Vibration

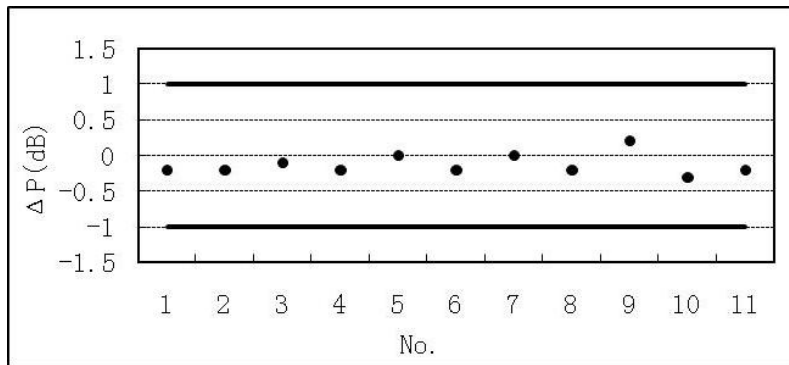


Figure 6: Optical Power Variation in Mechanical Shock /Vibration Test

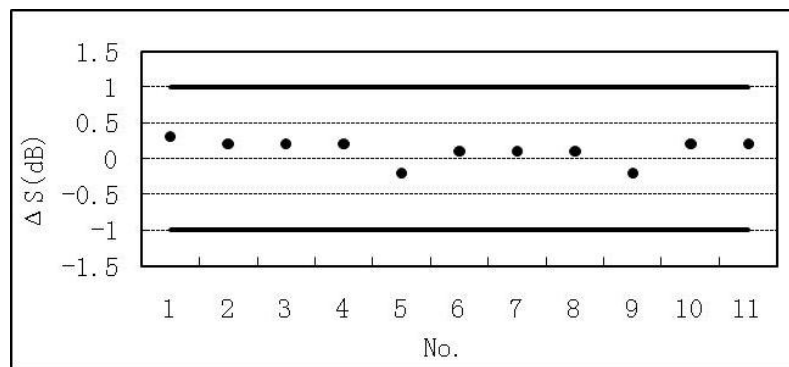


Figure 7: Receiver Sensitivity Variation in Mechanical Shock /Vibration Test

Table 9: Data of Mechanical Shock /Vibration Test

No.	Before Test		After Test		Before and After Test Variation	
	P _o (dBm)	Sensitivity (dBm)	P _o (dBm)	Sensitivity (dBm)	ΔP _o (dB)	ΔS (dB)
1	0.3	-25.5	0.1	-25.2	-0.2	0.3
2	1.3	-24.2	1.1	-24.0	-0.2	0.2
3	1.7	-24.0	1.6	-23.8	-0.1	0.2
4	1.1	-25.3	0.9	-25.1	-0.2	0.2
5	0.5	-22.8	0.5	-23.0	0.0	-0.2
6	0.2	-23.7	0.0	-23.6	-0.2	0.1
7	1.2	-24.3	1.2	-24.2	0.0	0.1
8	0.8	-23.1	0.6	-23.0	-0.2	0.1
9	1.3	-25.1	1.5	-25.3	0.2	-0.2
10	0.2	-24.4	-0.1	-24.2	-0.3	0.2
11	1.3	-25.3	1.1	-25.1	-0.2	0.2
Statistics						
AVE	0.90	-24.34	0.77	-24.23	-0.13	0.11
SD	0.50	0.86	0.57	0.81	0.14	0.16
MAX	1.70	-22.80	1.60	-23.00	0.20	0.30
MIN	0.20	-25.50	-0.10	-25.30	-0.30	-0.20

5.6 High Temperature Storage

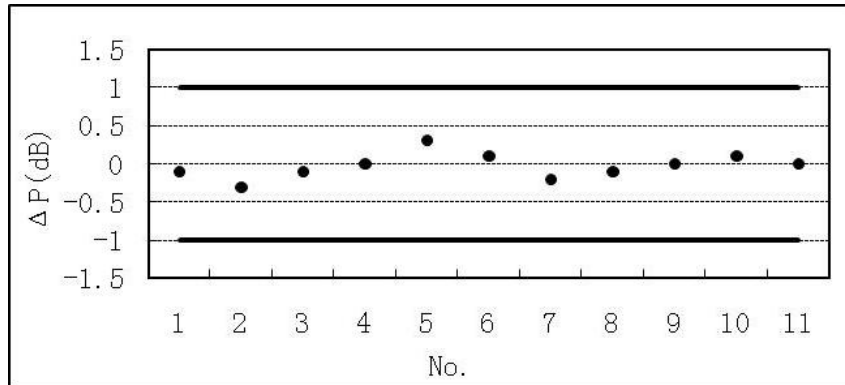


Figure 8: Optical Power Variation in High Temperature Storage Test

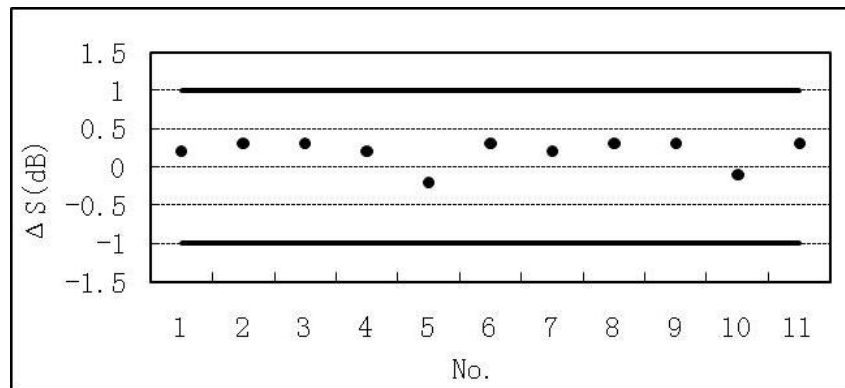


Figure 9: Receiver Sensitivity Variation in High Temperature Storage Test

Table 10: Data of High Temperature Storage Test

No.	Before Test		After Test		Before and After Test Variation	
	P _o (dBm)	Sensitivity (dBm)	P _o (dBm)	Sensitivity (dBm)	ΔP _o (dB)	ΔS (dB)
1	0.1	-25.2	0.0	-25.0	-0.1	0.2
2	1.1	-24.0	0.8	-23.7	-0.3	0.3
3	1.6	-23.8	1.5	-23.5	-0.1	0.3
4	0.9	-25.1	0.9	-24.9	0.0	0.2
5	0.5	-23.0	0.8	-23.2	0.3	-0.2
6	0.0	-23.6	0.1	-23.3	0.1	0.3
7	1.2	-24.2	1.0	-24.0	-0.2	0.2
8	0.6	-23.0	0.5	-22.7	-0.1	0.3
9	1.5	-25.3	1.5	-25.0	0.0	0.3
10	-0.1	-24.2	0	-24.3	0.1	-0.1
11	1.1	-25.1	1.1	-24.8	0.0	0.3
Statistics						
AVE	0.77	-24.23	0.75	-24.04	-0.03	0.19
SD	0.57	0.81	0.52	0.78	0.15	0.17
MAX	1.60	-23.00	1.50	-22.70	0.30	0.30
MIN	-0.10	-25.30	0.00	-25.00	-0.30	-0.20

5.7 Damp Heat

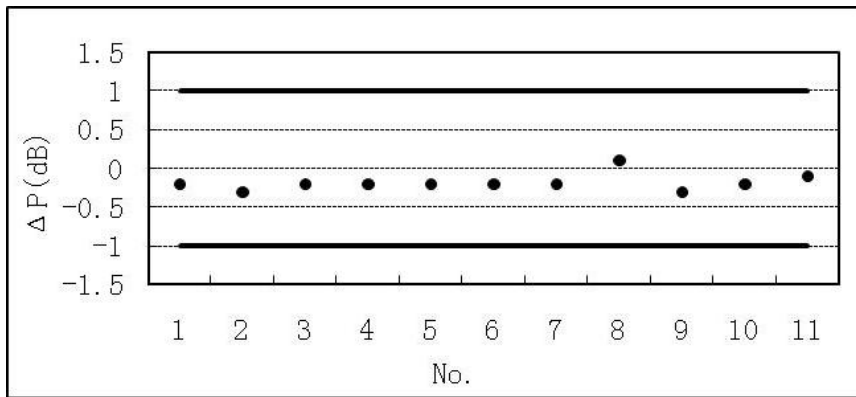


Figure 10: Optical Power Variation in ESD Threshold Test

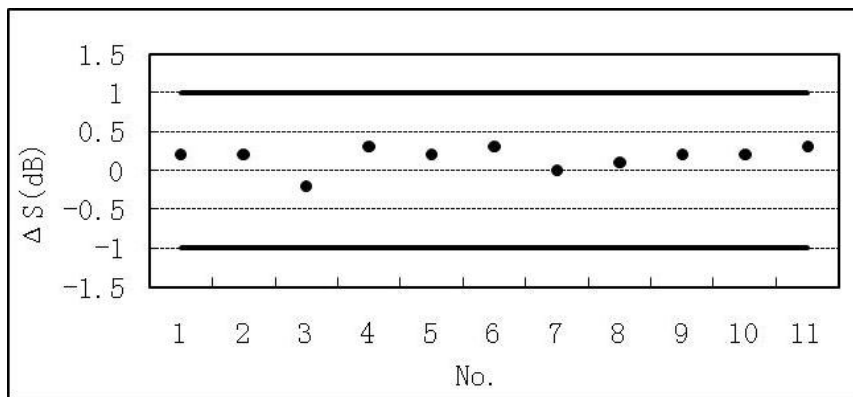


Figure 11: Receiver Sensitivity Variation in ESD Threshold Test

Table 11: Data of Damp Heat Test

No.	Before Test		After Test		Before and After Test Variation	
	P _o (dBm)	Sensitivity (dBm)	P _o (dBm)	Sensitivity (dBm)	ΔP _o (dB)	ΔS (dB)
1	0.0	-25.0	-0.2	-24.8	-0.2	0.2
2	0.8	-23.7	0.5	-23.5	-0.3	0.2
3	1.5	-23.5	1.3	-23.7	-0.2	-0.2
4	0.9	-24.9	0.7	-24.6	-0.2	0.3
5	0.8	-23.2	0.6	-23.0	-0.2	0.2
6	0.1	-23.3	-0.1	-23.0	-0.2	0.3
7	1.0	-24.0	0.8	-24.0	-0.2	0.0
8	0.5	-22.7	0.6	-22.6	0.1	0.1
9	1.5	-25.0	1.2	-24.8	-0.3	0.2
10	0	-24.3	-0.2	-24.1	-0.2	0.2
11	1.1	-24.8	1.0	-24.5	-0.1	0.3
Statistics						
AVE	0.75	-24.04	0.56	-23.87	-0.18	0.16
SD	0.52	0.78	0.51	0.74	0.10	0.14
MAX	1.50	-22.70	1.30	-22.60	0.10	0.30
MIN	0.00	-25.00	-0.20	-24.80	-0.30	-0.20

5.8 ESD Threshold

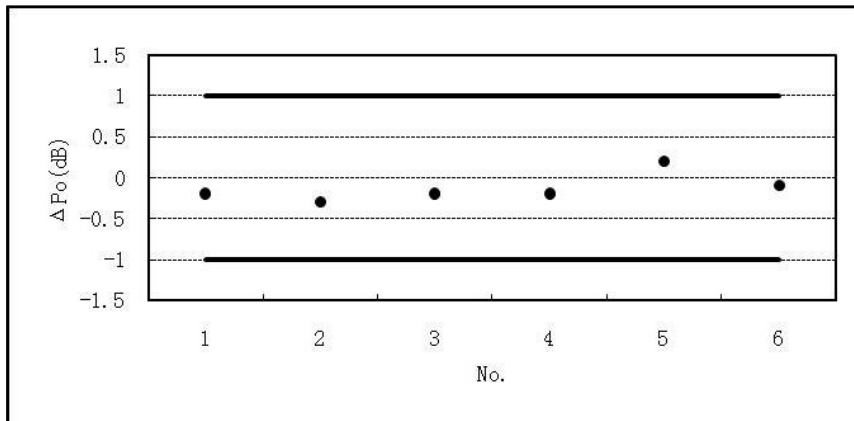


Figure 12: Optical Power Variation in ESD Threshold Test

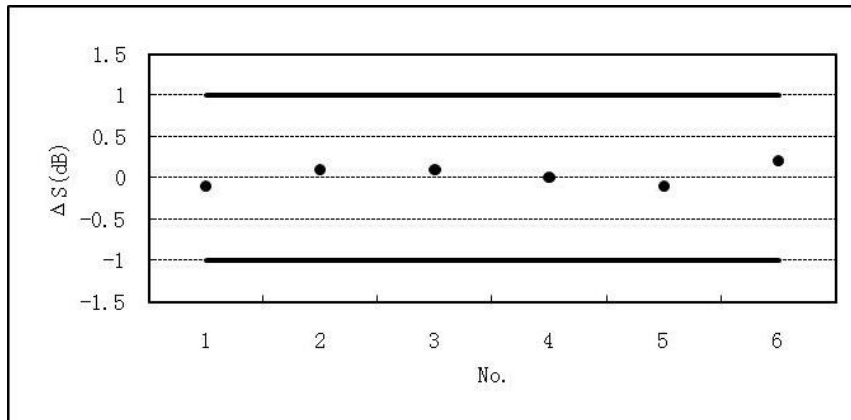


Figure 13: Receiver Sensitivity Variation in ESD Threshold Test

Table 12: Data of ESD Threshold Test (1KV Signal Pin)

No.	Before Test		After Test		Before and After Test Variation	
	P_o (dBm)	Sensitivity (dBm)	P_o (dBm)	Sensitivity (dBm)	ΔP_o (dB)	ΔS (dB)
1	-0.2	-24.8	-0.4	-24.9	-0.2	-0.1
2	0.5	-23.5	0.2	-23.4	-0.3	0.1
3	1.3	-23.7	1.1	-23.6	-0.2	0.1
4	0.7	-24.6	0.5	-24.6	-0.2	0.0
5	0.6	-23.0	0.8	-23.1	0.2	-0.1

6	-0.1	-23.0	-0.2	-22.8	-0.1	0.2
Statistics						
AVE	0.75	-24.04	0.56	-23.87	-0.18	0.16
SD	0.52	0.78	0.51	0.74	0.10	0.14
MAX	1.50	-22.70	1.30	-22.60	0.10	0.30
MIN	0.00	-25.00	-0.20	-24.80	-0.30	-0.20

5.9 ESD Immunity

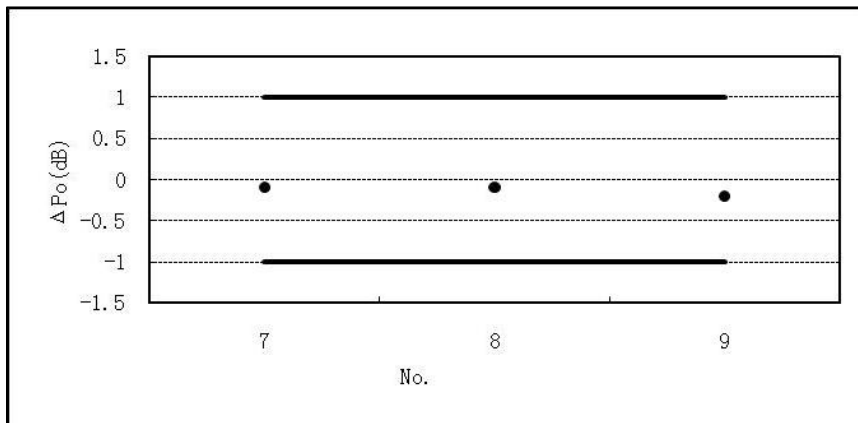


Figure 14: Optical Power Variation in ESD Immunity Test

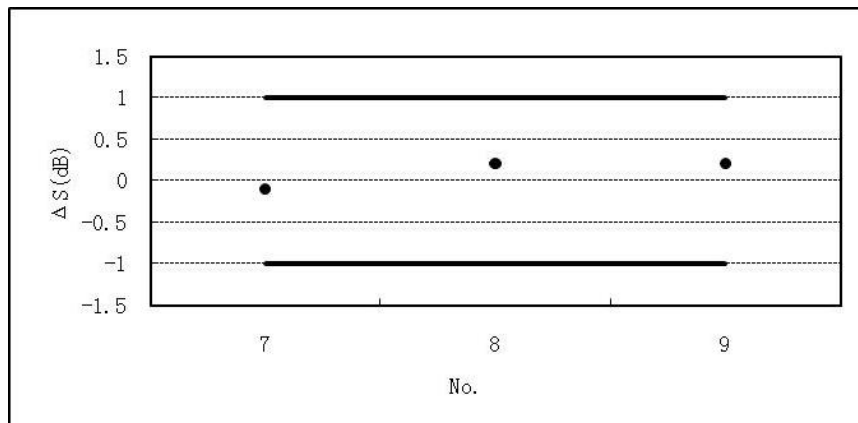


Figure 15: Receiver Sensitivity Variation in ESD Immunity Test

Table 13: Data of ESD Immunity Test (Class 4)

No.	Before Test	After Test	Before and After Test Variation
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	P_o (dBm)	Sensitivity (dBm)	P_o (dBm)	Sensitivity (dBm)	ΔP_o (dB)	ΔS (dB)
7	0.8	-24.0	0.7	-24.1	-0.1	-0.1
8	0.6	-22.6	0.5	-22.4	-0.1	0.2
9	1.2	-24.8	1.0	-24.6	-0.2	0.2
Statistics						
AVE	0.87	-23.80	0.73	-23.70	-0.13	0.10
SD	0.25	0.91	0.21	0.94	0.05	0.14
MAX	1.20	-22.60	1.00	-22.40	-0.10	0.20
MIN	0.60	-24.80	0.50	-24.60	-0.20	-0.10

5.10 Visual Inspection

Table 14: 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: OK* shows that the 11 samples meet the received criterion prescribed by MIL-STD-883

5.11 Power Temperature Cycling Test

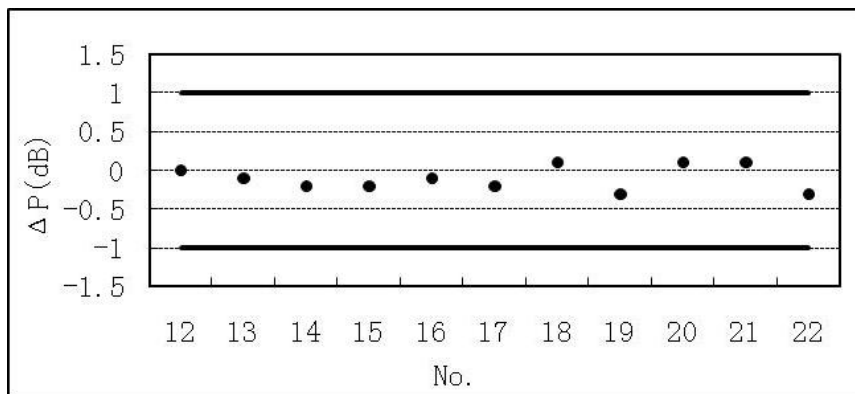


Figure 16: Optical Power Variation in Power Temperature Cycling Test

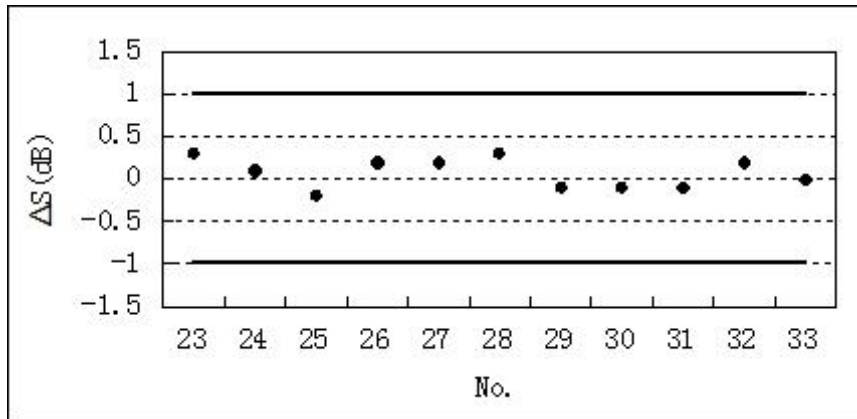


Figure 17: Receiver Sensitivity Variation in Power Temperature Cycling Test

Table 15: Data of Power Temperature Cycling Test

No.	Before Test		After Test		Before and After Test Variation	
	P _o (dBm)	Sensitivity (dBm)	P _o (dBm)	Sensitivity (dBm)	ΔP _o (dB)	ΔS (dB)
12	0.6	-25.0	0.6	-24.8	0.0	0.2
13	1.4	-24.2	1.3	-24.0	-0.1	0.2
14	0.7	-23.2	0.5	-23.0	-0.2	0.2
15	0.7	-25.5	0.5	-25.2	-0.2	0.3
16	0.5	-22.4	0.4	-22.5	-0.1	-0.1
17	0.7	-24.3	0.5	-24.3	-0.2	0.0
18	0.6	-24.1	0.7	-24.3	0.1	-0.2
19	1.8	-24.7	1.5	-24.4	-0.3	0.3
20	0.7	-25.9	0.8	-25.6	0.1	0.3
21	0.9	-23.9	1.0	-24.0	0.1	-0.1
22	0.9	-25.5	0.6	-25.3	-0.3	0.2
Statistics						
AVE	0.86	-24.43	0.76	-24.31	-0.10	0.12
SD	0.37	1.00	0.34	0.90	0.15	0.17
MAX	1.80	-22.40	1.50	-22.50	0.10	0.30
MIN	0.50	-25.90	0.40	-25.60	-0.30	-0.20

5.12 Powered Damp Heat Test

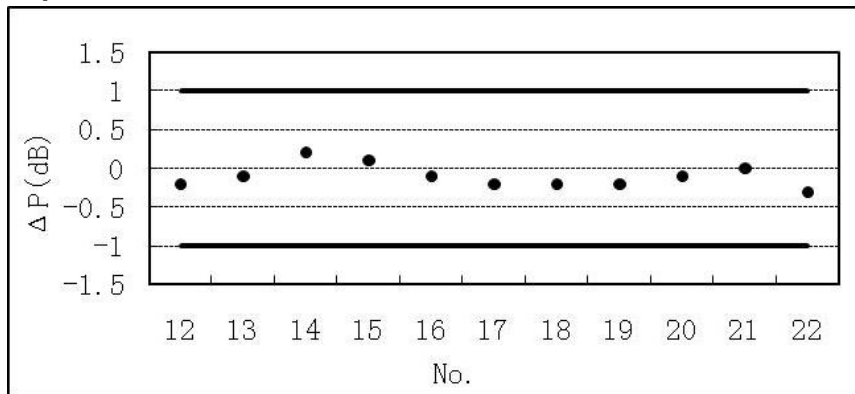


Figure 18: Optical Power Variation in Power Temperature Cycling Test

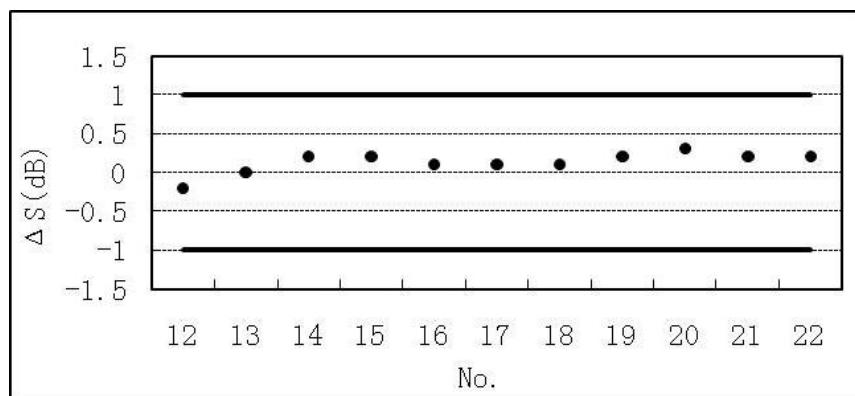


Figure 19: Receiver Sensitivity Variation in Power Temperature Cycling Test

Table 16: Data of Powered Damp Heat Test

No.	Before Test		After Test		Before and After Test Variation	
	P _o (dBm)	Sensitivity (dBm)	P _o (dBm)	Sensitivity (dBm)	ΔP _o (dB)	ΔS (dB)
12	0.6	-24.8	0.4	-25.0	-0.2	-0.2
13	1.3	-24.0	1.2	-24.0	-0.1	0.0
14	0.5	-23.0	0.7	-22.8	0.2	0.2
15	0.5	-25.2	0.6	-25.0	0.1	0.2
16	0.4	-22.5	0.3	-22.4	-0.1	0.1
17	0.5	-24.3	0.3	-24.2	-0.2	0.1
18	0.7	-24.3	0.5	-24.2	-0.2	0.1
19	1.5	-24.4	1.3	-24.2	-0.2	0.2

20	0.8	-25.6	0.7	-25.3	-0.1	0.3
21	1.0	-24.0	1.0	-23.8	0.0	0.2
22	0.6	-25.3	0.3	-25.1	-0.3	0.2
Statistics						
AVE	0.76	-24.31	0.66	-24.18	-0.10	0.13
SD	0.34	0.90	0.34	0.89	0.14	0.13
MAX	1.50	-22.50	1.30	-22.40	0.20	0.30
MIN	0.40	-25.60	0.30	-25.30	-0.30	-0.20

5.13 Accelerating Aging

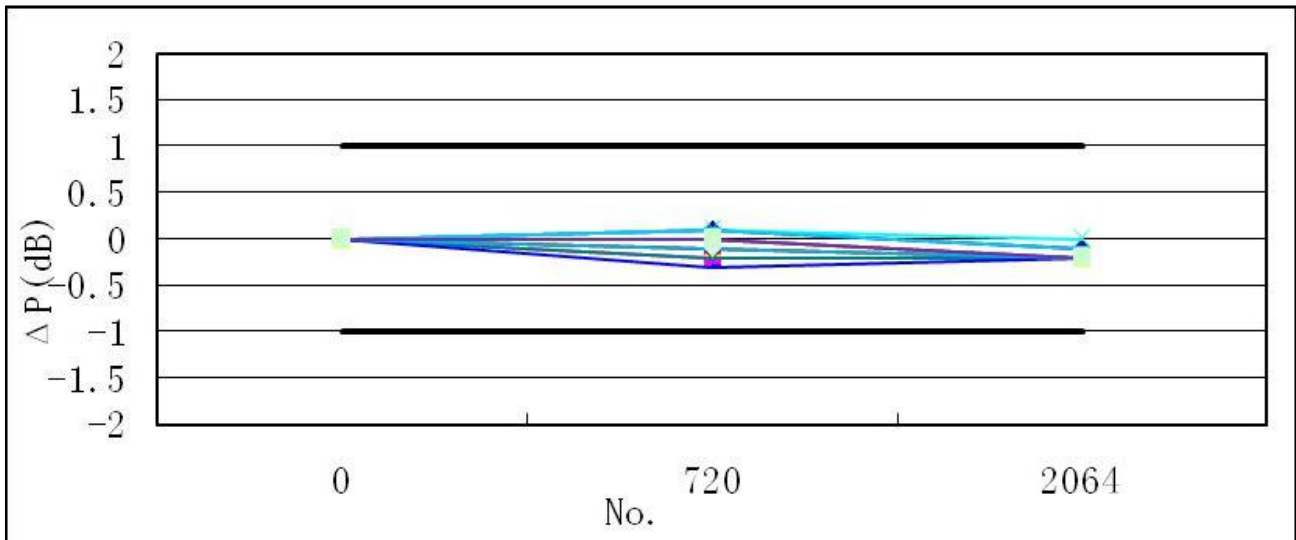


Figure 20: Optical Power Variation in Accelerating Aging Test

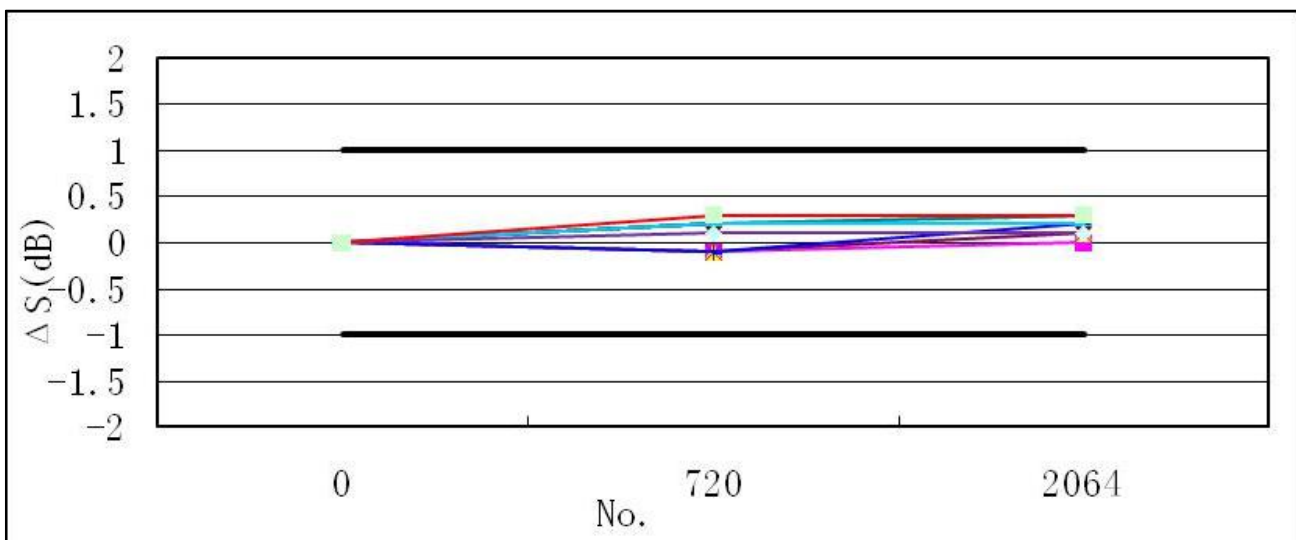


Figure 21: Receiver Sensitivity Variation in Accelerating Aging Test

Table 17: Optical Power of Accelerating Aging Test

Time (hrs)	23	24	25	26	27	28	29	30	31	32	33
0	0.4	1.2	0.7	0.6	0.3	0.3	0.5	1.3	0.7	1.0	0.3
720	0.5	1.0	0.6	0.7	0.3	0.2	0.3	1.0	0.8	0.9	0.3
2064	0.3	1.0	0.5	0.6	0.1	0.1	0.3	1.1	0.6	0.8	0.1

Table 18: Receiver Sensitivity of Accelerating Aging Test

Time (hrs)	23	24	25	26	27	28	29	30	31	32	33
0	-25	-24	-22.8	-25	-22.4	-24.2	-24.2	-24.2	-25.3	-23.8	-25.1
720	-24.8	-24.1	-22.9	-24.8	-22.5	-24.0	-24.0	-24.3	-25.1	-23.7	-24.8
2064	-24.8	-24.0	-22.7	-24.7	-22.3	-24.0	-23.9	-24.0	-25.1	-23.7	-24.8