Transceiver Reliability
TEST Report

Model name : SFP28-25G-BX40-I

Table of Contents

1. Introduction

This report presents the reliability test results for 1270nm/1310nm DFB laser based 25 Gb/s SFP28 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 40km transceiver meet the requirement of reliability.

3. Sample Description

The sample is transmit and receiver optical data up to 40km over single mode fiber. The type is （1270nm）、（1310nm）. The module’ s 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	Tx	λ_C	1300	1310	1320	nm
	Rx		1260	1270	1280	
Center Wavelength Range	Tx	λ_C	1260	1270	1280	nm
	Rx		1300	1310	1320	
Launch Optical Power		P_O	0	-	6	dBm
Extinction Ratio		E_R	4.0	-	-	dB
Receiver Sensitivity		S	-	-	-18	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	Optical/Electrical Characteristics	
	Group 1	Physical Dimensions Low Temperature Storage Temperature Cycle Mechanical Shock/Vibration Damp Heat High-temperature Storage ESD Threshold ESD Immunity Visual Inspection
	Group 2	Temperature Cycle(Power) Damp Heat(Power) Accelerating Aging

4.3 Failure Criterion

Table 3: Failure Criterion

Heading	Test Program	Failure Criteria
Functional Verification	Optical/Electrical 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.ΔS>1.0dB 3.ΔP>1.0dB
Environmental Endurance	Temperature Cycle	
	Temperature Cycle(Power)	
	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 Temperature 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(Power)	GR-468-CORE	85°C,85%RH, 1000 hrs	11/0	Passed
Temperature Cycle(Power)		-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.	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.	Po (dBm)	Sensitivity (dBm)	No.	Po (dBm)	Sensitivity (dBm)
	(1310)			(1270)	
1	2.8	-21	12	3.8	-21.7
2	2.9	-20.1	13	3.2	-20.8
3	3.4	-20.8	14	3.1	-21.9
4	3.6	-20.4	15	3.7	-21.1
5	2.5	-20.9	16	3.9	-21.2
6	3.2	-20.8	17	3.4	-21.3
7	3.0	-20.5	18	4.0	-20.9
8	3.1	-20.4	19	3.7	-21.2
9	2.8	-20.5	20	3.5	-21.1
10	2.9	-20.6	21	4.1	-21.4
11	3.1	-20.4	22	3.9	-21.3

5.2 Physical Dimensions

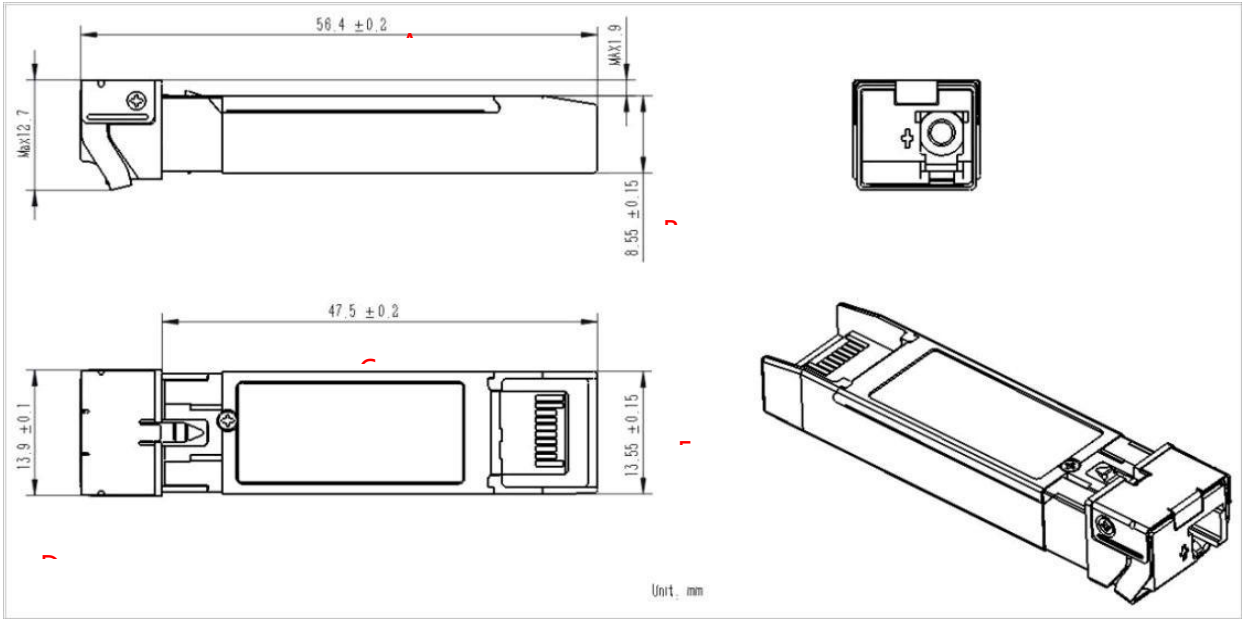

Figure 1: Package outline（unit: mm）

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

Projected Dimension	Designator				
	A	B	C	D	E
	56.4±0.2	8.55±0.15	47.50±0.2	13.9±0.1	13.55±0.15
1	56.50	8.52	47.47	13.93	13.58
2	56.48	8.50	47.45	13.94	13.51
3	56.48	8.59	47.55	13.94	13.52
4	56.53	8.58	47.54	13.93	13.50
5	56.47	8.51	47.57	13.95	13.49
6	56.50	8.57	47.56	13.92	13.48
7	56.48	8.50	47.42	13.93	13.50
8	56.51	8.49	47.57	13.91	13.51
9	56.49	8.48	47.43	13.92	13.52

10	56.47	8.52	47.58	13.93	13.52
11	56.48	8.50	47.42	13.92	13.50
Statistics					
AVE	56.49	8.52	47.51	13.93	13.51
SD	0.02	0.04	0.06	0.01	0.02
MAX	56.53	8.59	47.58	13.95	13.58
MIN	56.47	8.48	47.42	13.91	13.48

5.3 Low Temperature Storage

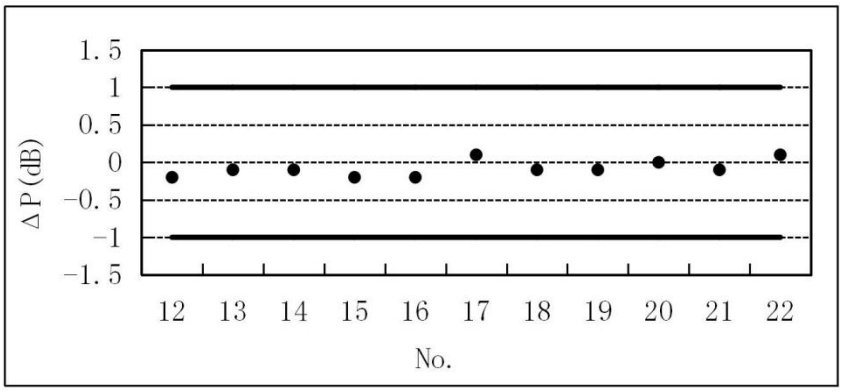

Figure 2: Optical Power Variation in Low Temperature Storage Test

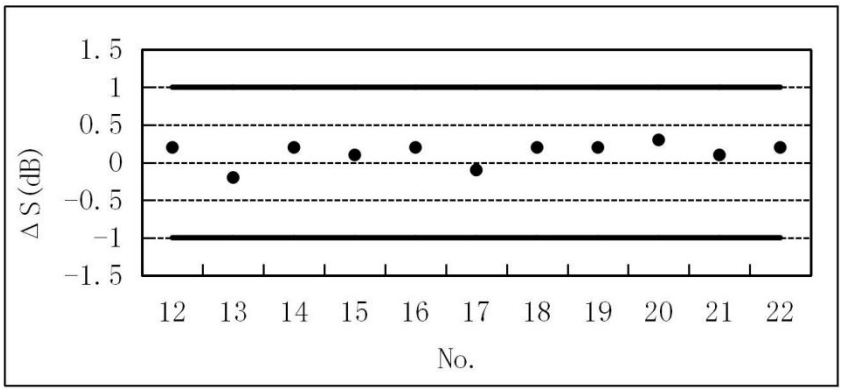

Figure 3: Receiver Sensitivity Variation in Low Temperature Storage Test

Table 7: Data of Low Temperature Storage Test

No.	Before Test		After Test		Before and After Test Variation	
	Po (dBm)	Sensitivity (dBm)	Po (dBm)	Sensitivity (dBm)	ΔPo (dB)	ΔS (dB)
1	3.8	-21.7	3.6	-21.5	-0.2	0.2
2	3.2	-20.8	3.1	-21.0	-0.1	-0.2
3	3.1	-21.9	3.0	-21.7	-0.1	0.2
4	3.7	-21.1	3.5	-21.0	-0.2	0.1
5	3.9	-21.2	3.7	-21.0	-0.2	0.2
6	3.4	-21.3	3.5	-21.4	0.1	-0.1
7	4.0	-20.9	3.9	-20.7	-0.1	0.2
8	3.7	-21.2	3.6	-21.0	-0.1	0.2
9	3.5	-21.1	3.5	-20.8	0.0	0.3
10	4.1	-21.4	4.0	-21.3	-0.1	0.1
11	3.9	-21.3	4.0	-21.1	0.1	0.2
Statistics						
AVE	3.66	-21.26	3.58	-21.14	-0.08	0.13
SD	0.31	0.31	0.31	0.29	0.10	0.14
MAX	4.10	-20.80	4.00	-20.70	0.10	0.30
MIN	3.10	-21.90	3.00	-21.70	-0.20	-0.20

5.4 Temperature Cycle

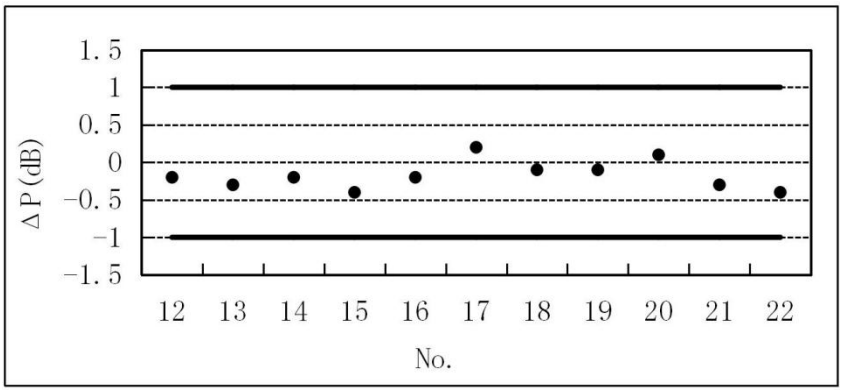

Figure 4: Optical Power Variation in Temperature Cycle Test

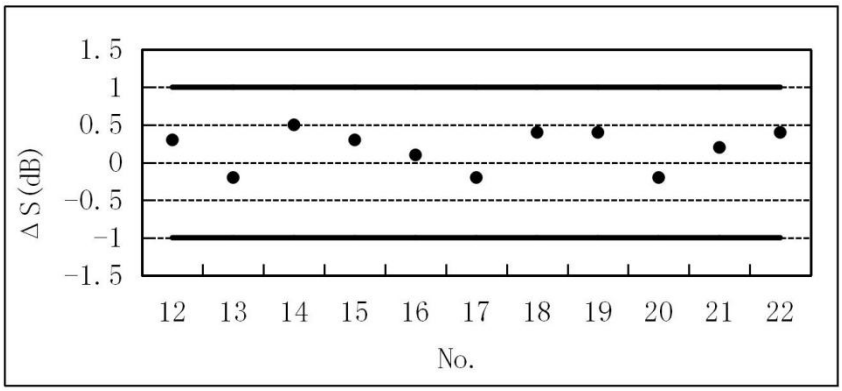

Figure 5: Receive Sensitivity Variation in Temperature Cycle Test

Table 8: Data of Temperature Cycle Test

No.	Before Test		After Test		Before and After Test Variation	
	Po (dBm)	Sensitivity (dBm)	Po (dBm)	Sensitivity (dBm)	ΔPo (dB)	ΔS (dB)
12	3.6	-21.5	3.4	-21.2	-0.2	0.3
13	3.1	-21.0	2.8	-21.2	-0.3	-0.2
14	3.0	-21.7	2.8	-21.2	-0.2	0.5
15	3.5	-21.0	3.1	-20.7	-0.4	0.3
16	3.7	-21.0	3.5	-20.9	-0.2	0.1
17	3.5	-21.4	3.7	-21.6	0.2	-0.2
18	3.9	-20.7	3.8	-20.3	-0.1	0.4
19	3.6	-21.0	3.5	-20.6	-0.1	0.4
20	3.5	-20.8	3.6	-21.0	0.1	-0.2
21	4.0	-21.3	3.7	-21.1	-0.3	0.2
22	4.0	-21.1	3.6	-20.7	-0.4	0.4
Statistics						
AVE	3.58	-21.14	3.41	-20.95	-0.17	0.18
SD	0.31	0.29	0.34	0.34	0.18	0.26
MAX	4.00	-20.70	3.80	-20.30	0.20	0.50
MIN	3.00	-21.70	2.80	-21.60	-0.40	-0.20

5.5 Mechanical Shock /Vibration

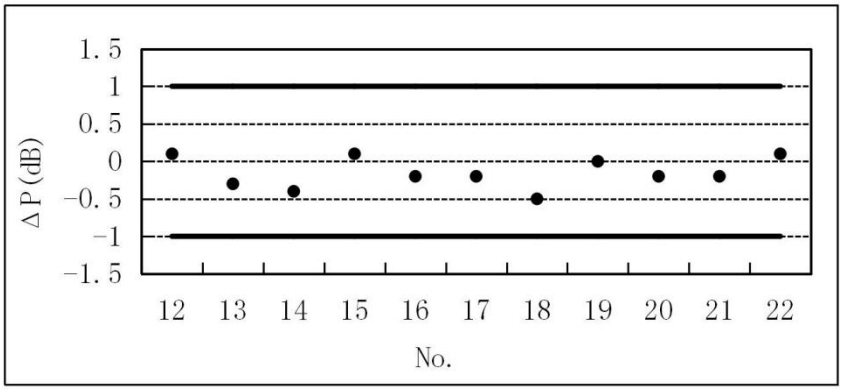

Figure 6: Optical Power Variation in Mechanical Shock /Vibration Test

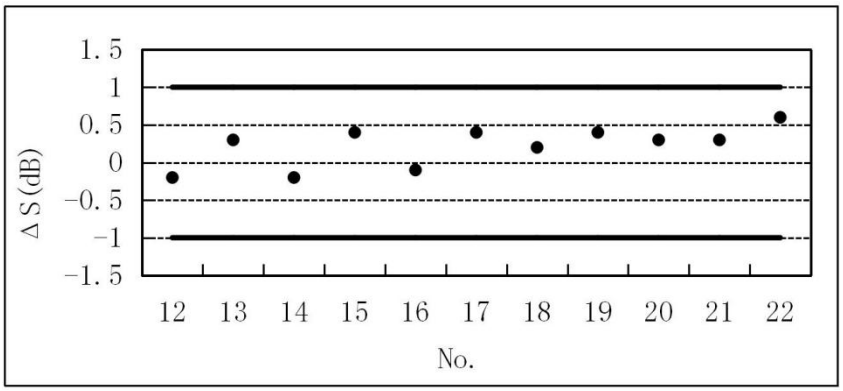

Figure 7: Receiver Sensitivity Variation in Mechanical Shock /Vibration Test

Table 9: Data of Mechanical Shock /Vibration Test

No.	Before Test		After Test		Before and After Test Variation	
	Po (dBm)	Sensitivity (dBm)	Po (dBm)	Sensitivity (dBm)	ΔPo (dB)	ΔS (dB)
12	3.4	-21.2	3.5	-21.4	0.1	-0.2
13	2.8	-21.2	2.5	-20.9	-0.3	0.3
14	2.8	-21.2	2.4	-21.4	-0.4	-0.2
15	3.1	-20.7	3.2	-20.3	0.1	0.4
16	3.5	-20.9	3.3	-21.0	-0.2	-0.1
17	3.7	-21.6	3.5	-21.2	-0.2	0.4
18	3.8	-20.3	3.3	-20.1	-0.5	0.2
19	3.5	-20.6	3.5	-20.2	0.0	0.4
20	3.6	-21.0	3.4	-20.7	-0.2	0.3
21	3.7	-21.1	3.5	-20.8	-0.2	0.3
22	3.6	-20.7	3.7	-20.1	0.1	0.6
Statistics						
AVE	3.41	-20.95	3.25	-20.74	-0.15	0.22
SD	0.34	0.34	0.40	0.48	0.20	0.26
MAX	3.80	-20.30	3.70	-20.10	0.10	0.60
MIN	2.80	-21.60	2.40	-21.40	-0.50	-0.20

5.6 High Temperature Storage

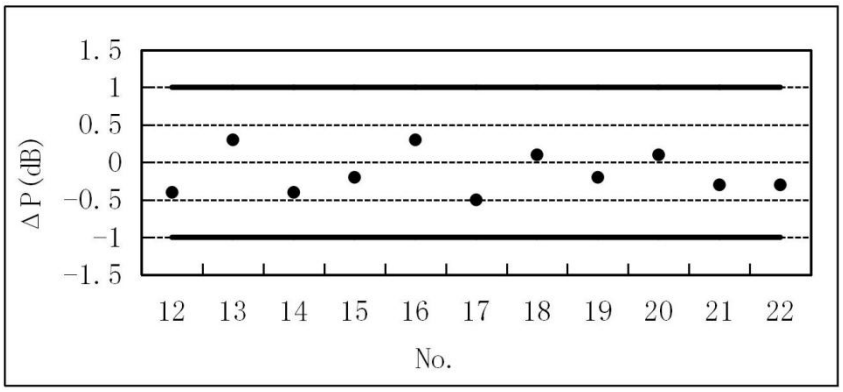

Figure 8: Optical Power Variation in High Temperature Storage Test

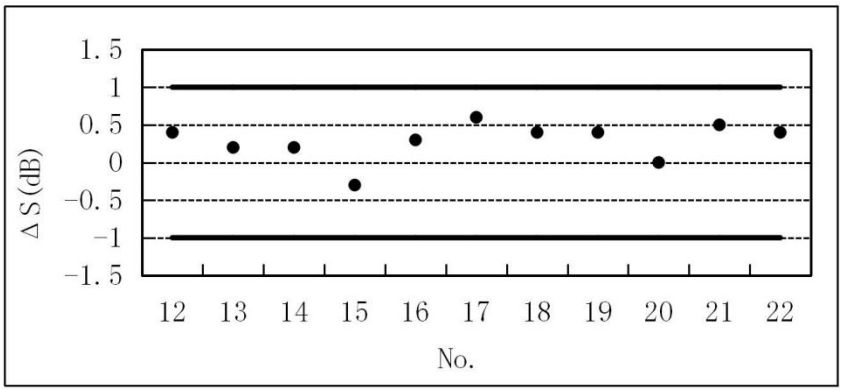

Figure 9: Receiver Sensitivity Variation in High Temperature Storage Test

Table 10: Data of Damp Heat 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	-21.4	3.1	-21.0	-0.4	0.4
13	2.5	-20.9	2.8	-20.7	0.3	0.2
14	2.4	-21.4	2.0	-21.2	-0.4	0.2
15	3.2	-20.3	3.0	-20.6	-0.2	-0.3
16	3.3	-21.0	3.6	-20.7	0.3	0.3
17	3.5	-21.2	3.0	-20.6	-0.5	0.6
18	3.3	-20.1	3.4	-19.7	0.1	0.4
19	3.5	-20.2	3.3	-19.8	-0.2	0.4
20	3.4	-20.7	3.5	-20.7	0.1	0.0
21	3.5	-20.8	3.2	-20.3	-0.3	0.5
22	3.7	-20.1	3.4	-19.7	-0.3	0.4
Statistics						
AVE	3.25	-20.74	3.12	-20.45	-0.14	0.28
SD	0.40	0.48	0.42	0.49	0.27	0.24
MAX	3.70	-20.10	3.60	-19.70	0.30	0.60
MIN	2.40	-21.40	2.00	-21.20	-0.50	-0.30

5.7 Damp Heat

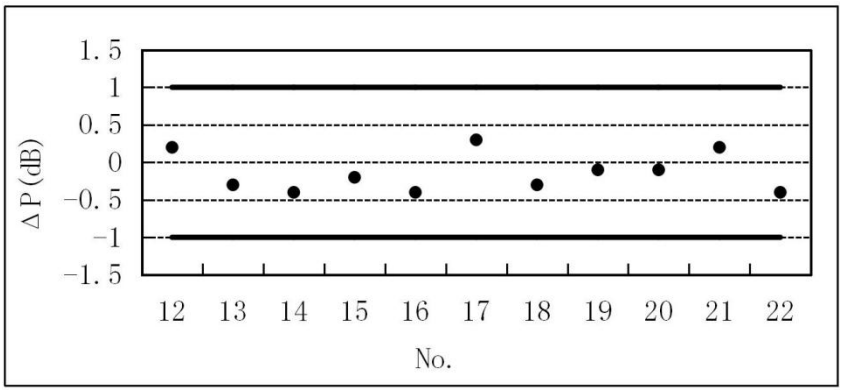

Figure 10: Optical Power Variation in Damp Heat Test

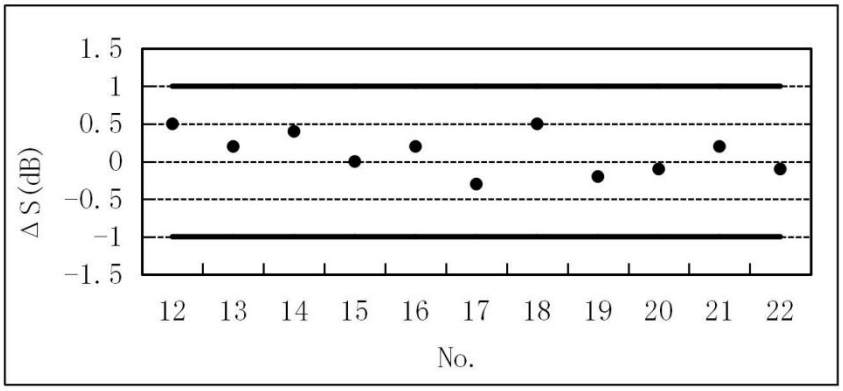

Figure 11: Receiver Sensitivity Variation in Damp Heat Test

Table 11: Data of Damp Heat Test

No.	Before Test		After Test		Before and After Test Variation	
	Po (dBm)	Sensitivity (dBm)	Po (dBm)	Sensitivity (dBm)	ΔPo (dB)	ΔS (dB)
12	3.1	-21.0	3.3	-20.5	0.2	0.5
13	2.8	-20.7	2.5	-20.5	-0.3	0.2
14	2.0	-21.2	1.6	-20.8	-0.4	0.4
15	3.0	-20.6	2.8	-20.6	-0.2	0.0
16	3.6	-20.7	3.2	-20.5	-0.4	0.2
17	3.0	-20.6	3.3	-20.9	0.3	-0.3
18	3.4	-19.7	3.1	-19.2	-0.3	0.5
19	3.3	-19.8	3.2	-20.0	-0.1	-0.2
20	3.5	-20.7	3.4	-20.8	-0.1	-0.1
21	3.2	-20.3	3.4	-20.1	0.2	0.2
22	3.4	-19.7	3.0	-19.8	-0.4	-0.1
Statistics						
AVE	3.12	-20.45	2.98	-20.34	-0.14	0.12
SD	0.42	0.49	0.51	0.49	0.25	0.27
MAX	3.60	-19.70	3.40	-19.20	0.30	0.50
MIN	2.00	-21.20	1.60	-20.90	-0.40	-0.30

5.8 ESD Threshold

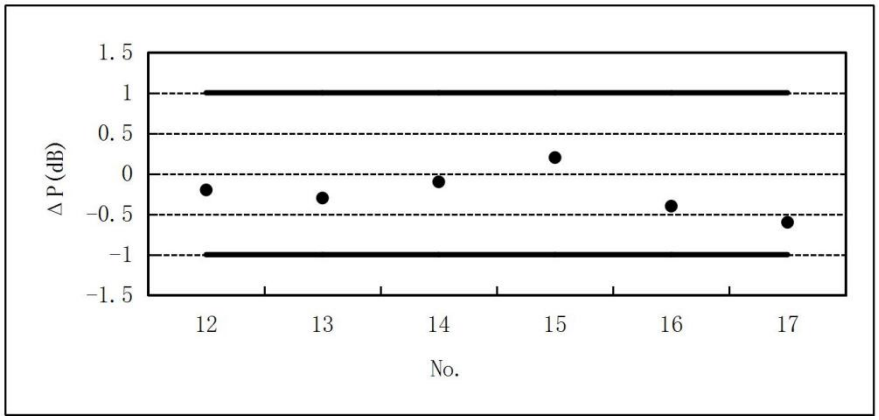

Figure 12: Optical Power Variation in ESD Threshold Test

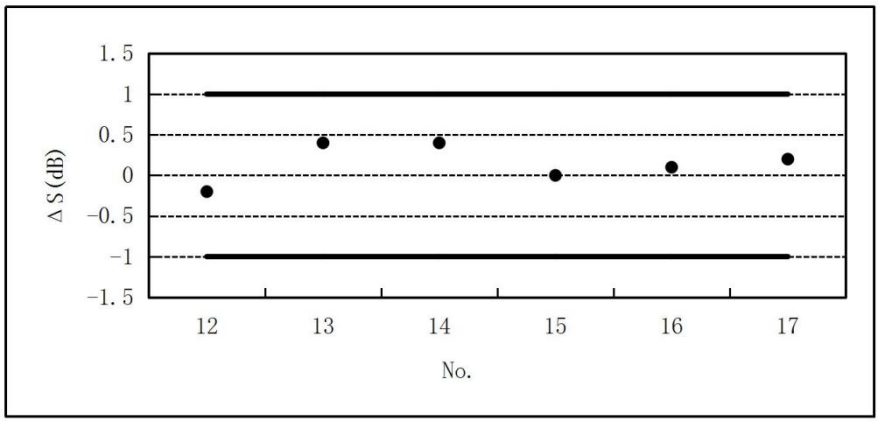

Figure 13: Receiver Sensitivity Variation in ESD Threshold Test

Table 12: Data of ESD Threshold Test (2.5KV)

No.	Before Test		After Test		Before and After Test Variation	
	Po (dBm)	Sensitivity (dBm)	Po (dBm)	Sensitivity (dBm)	ΔPo (dB)	ΔS (dB)
12	3.3	-20.5	3.1	-20.7	-0.2	-0.2
13	2.5	-20.5	2.2	-20.1	-0.3	0.4
14	1.6	-20.8	1.5	-20.4	-0.1	0.4
15	2.8	-20.6	3.0	-20.6	0.2	0.0
16	3.2	-20.5	2.8	-20.4	-0.4	0.1
17	3.3	-20.9	2.7	-20.7	-0.6	0.2
Statistics						
AVE	2.78	-20.63	2.55	-20.48	-0.23	0.15
SD	0.60	0.16	0.55	0.21	0.25	0.21
MAX	3.30	-20.50	3.10	-20.10	0.20	0.40
MIN	1.60	-20.90	1.50	-20.70	-0.60	-0.20

5.9 ESD Immunity

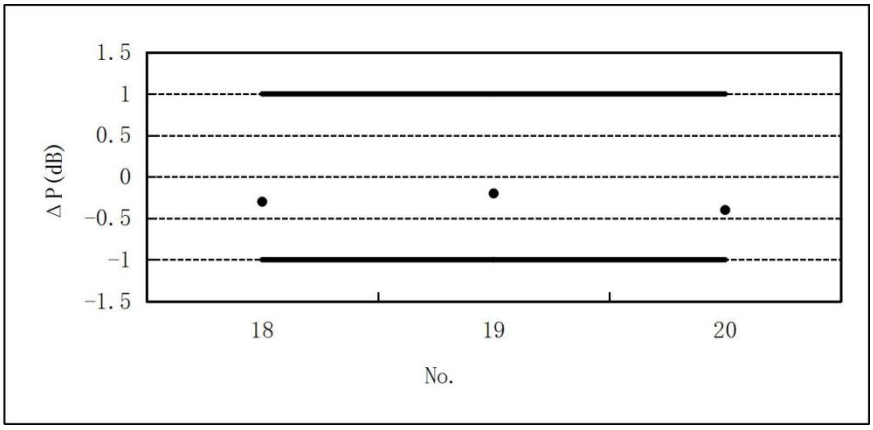

Figure 14: Optical Power variation in ESD Immunity Test

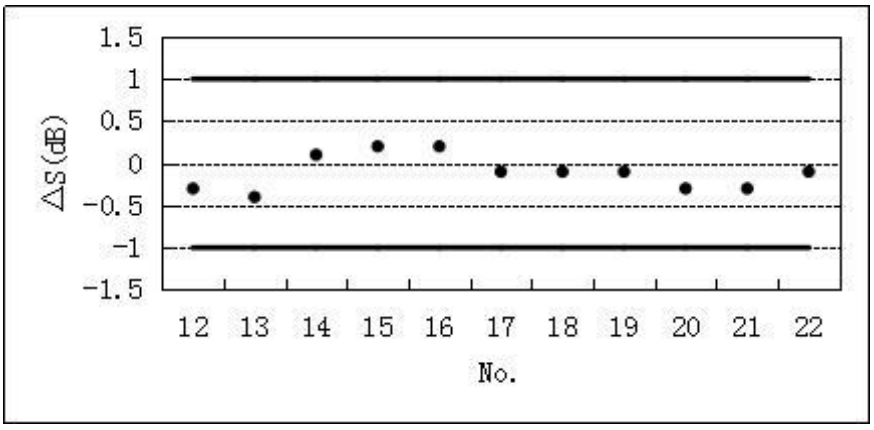

Figure 15: Receiver Sensitivity Variation in ESD Immunity Test

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

No.	Before Test		After Test		Before and After Test Variation	
	Po (dBm)	Sensitivity (dBm)	Po (dBm)	Sensitivity (dBm)	ΔPo (dB)	ΔS (dB)
18	3.1	-19.2	2.8	-19.0	-0.3	0.2
19	3.2	-20.0	3.0	-19.6	-0.2	0.4
20	3.4	-20.8	3.0	-20.5	-0.4	0.3
Statistics						
AVE	3.23	-20.00	2.93	-19.70	-0.30	0.30
SD	0.12	0.65	0.09	0.62	0.08	0.08
MAX	3.40	-19.20	3.00	-19.00	-0.20	0.40
MIN	3.10	-20.80	2.80	-20.50	-0.40	0.20

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 Damp Heat(Power)

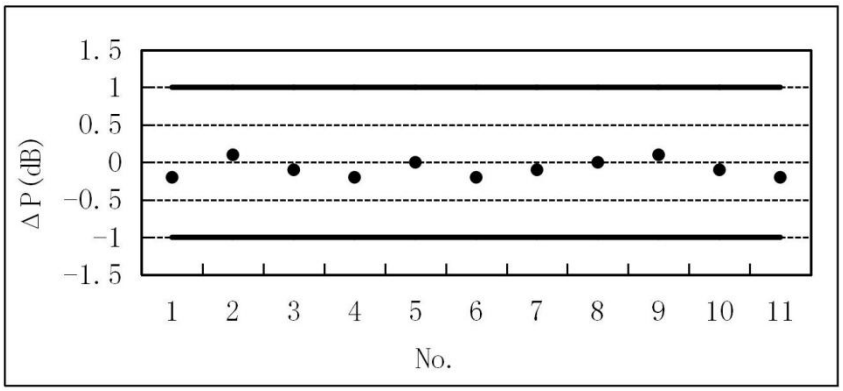

Figure 16: Optical Power variation in Damp Heat (Power) Test

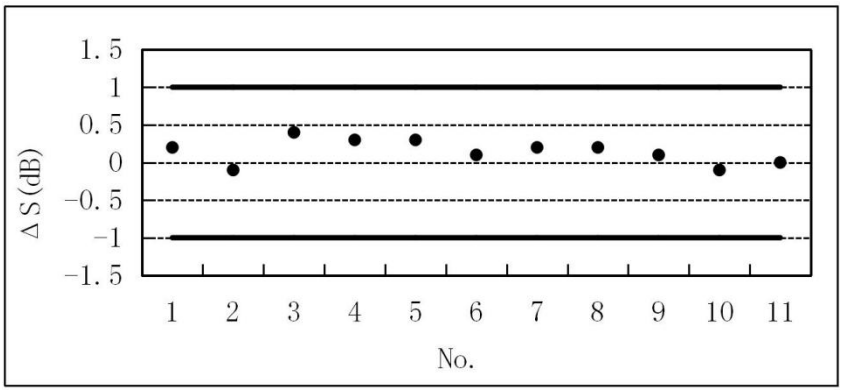

Figure 17: Receiver Sensitivity Variation in Damp Heat (Power) Test

Table 15: Data of Damp Heat (Power) Test

No.	Before Test		After Test		Before and After Test Variation	
	Po (dBm)	Sensitivity (dBm)	Po (dBm)	Sensitivity (dBm)	ΔPo (dB)	ΔS (dB)
1	2.8	-21	2.6	-20.8	-0.2	0.2
2	2.9	-20.1	3.0	-20.2	0.1	-0.1
3	3.4	-20.8	3.3	-20.4	-0.1	0.4
4	3.6	-20.4	3.4	-20.1	-0.2	0.3
5	2.5	-20.9	2.5	-20.6	0.0	0.3
6	3.2	-20.8	3.0	-20.7	-0.2	0.1
7	3.0	-20.5	2.9	-20.3	-0.1	0.2
8	3.1	-20.4	3.1	-20.2	0.0	0.2
9	2.8	-20.5	2.9	-20.4	0.1	0.1
10	2.9	-20.6	2.8	-20.7	-0.1	-0.1
11	3.1	-20.4	2.9	-20.4	-0.2	0.0
Statistics						
AVE	3.03	-20.58	2.95	-20.44	-0.08	0.15
SD	0.29	0.26	0.25	0.22	0.11	0.16
MAX	3.60	-20.10	3.40	-20.10	0.10	0.40
MIN	2.50	-21.00	2.50	-20.80	-0.20	-0.10

Note: Powered damp heat test reference resources GR-468-CORE condition 85°C/85%RH,1000 hours.

5.12 Temperature Cycle(Powered)

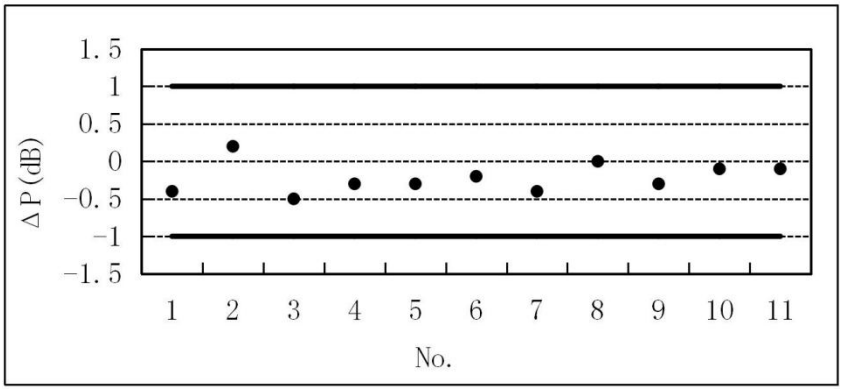

Figure 18: Optical Power Variation in Temperature Cycle（Powered）Test

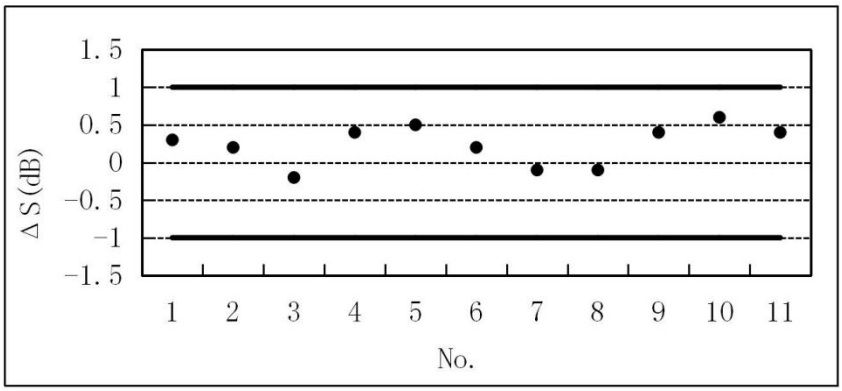

Figure 19: Receive Sensitivity Variation in Temperature Cycle（Powered）Test

Table 16: Optical Output Power in Temperature Cycle (Powered) Test

No.	Before Test		After Test		Before and After Test Variation	
	Po (dBm)	Sensitivity (dBm)	Po (dBm)	Sensitivity (dBm)	ΔPo (dB)	ΔS (dB)
1	2.6	-20.8	2.2	-20.5	-0.4	0.3
2	3.0	-20.2	3.2	-20.0	0.2	0.2
3	3.3	-20.4	2.8	-20.6	-0.5	-0.2
4	3.4	-20.1	3.1	-19.7	-0.3	0.4
5	2.5	-20.6	2.2	-20.1	-0.3	0.5
6	3.0	-20.7	2.8	-20.5	-0.2	0.2
7	2.9	-20.3	2.5	-20.4	-0.4	-0.1
8	3.1	-20.2	3.1	-20.3	0.0	-0.1
9	2.9	-20.4	2.6	-20.0	-0.3	0.4
10	2.8	-20.7	2.7	-20.1	-0.1	0.6
11	2.9	-20.4	2.8	-20.0	-0.1	0.4
Statistics						
AVE	1	2.6	-20.8	2.2	-20.5	-0.4
SD	2	3.0	-20.2	3.2	-20.0	0.2
MAX	3	3.3	-20.4	2.8	-20.6	-0.5
MIN	4	3.4	-20.1	3.1	-19.7	-0.3

Note: Condition -40°C to +85°C and 500 cycles.

5.13 Accelerating Aging

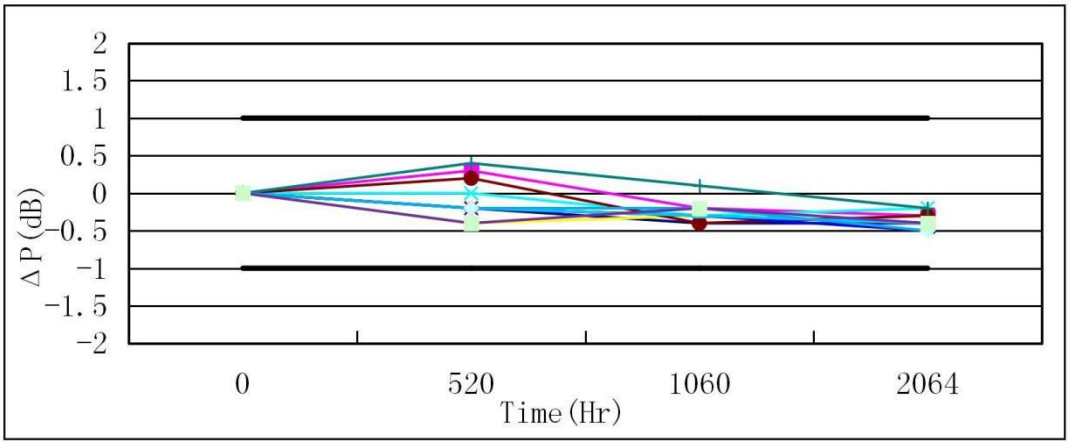

Figure 20: Optical Power Variation in Accelerating Aging Test

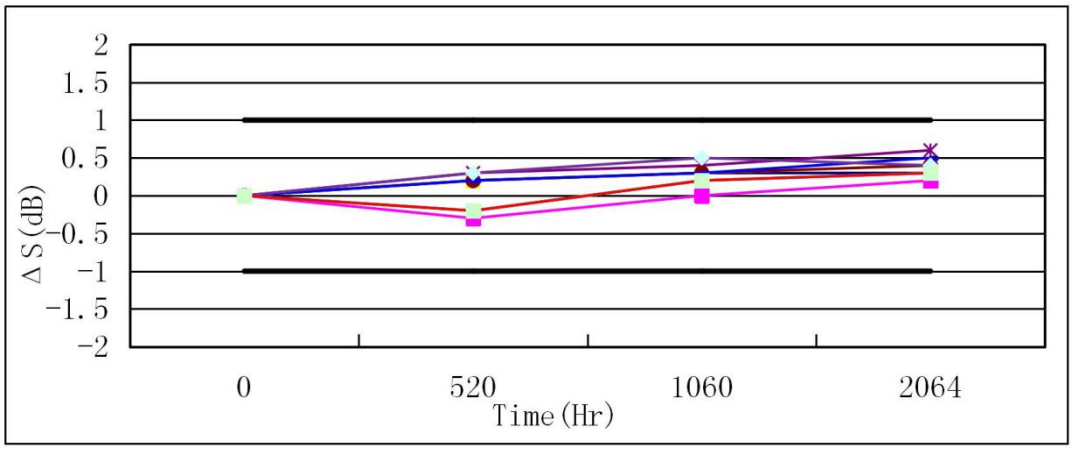

Figure 21: Receiver Sensitivity Variation in Accelerating Aging Test

Table 17: Optical Power of Accelerating Aging Test

Time (hrs)	1	2	3	4	5	6	7	8	9	10	11
0	2.2	3.2	2.8	3.1	2.2	2.8	2.5	3.1	2.6	2.7	2.8
520	2.0	3.5	2.4	3.1	2.0	3.0	2.9	2.9	2.4	2.5	2.4
1060	1.8	3.0	2.5	2.8	1.9	2.4	2.6	2.8	2.3	2.5	2.6
2064	1.8	2.9	2.4	2.9	1.8	2.5	2.3	2.6	2.2	2.2	2.4

Table 18: Receiver Sensitivity of Accelerating Aging Test

Time (hrs)	1	2	3	4	5	6	7	8	9	10	11
0	-20.5	-20	-20.6	-19.7	-20.1	-20.5	-20.4	-20.3	-20	-20.1	-20
520	-20.3	-20.3	-20.4	-19.9	-19.8	-20.3	-20.6	-20.1	-20.2	-19.8	-20.2
1060	-20.2	-20	-20.3	-19.5	-19.7	-20.2	-20.2	-20.0	-19.8	-19.6	-19.8
2064	-20.2	-19.8	-20.2	-19.4	-19.5	-20.1	-20.1	-19.8	-19.7	-19.7	-19.7