

# Transceiver Reliability **TEST Report**

Model name : SFP-10GER-31-I

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## 1. Introduction

The This report presents the reliability test results for 10Gb/s 40KM 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 40KM SFP+ 1310 nm transceivers meet the requirement of reliability

## 3. Sample Description

The sample is 10Gb/s 40KM SFP+ 1310 nm transceivers. The type is 10G ER. Themodule' s specification should fit the data in the Table 1.

Table 1: Specification

Parameter	Symbol	Specification			Unit
		Min.	Typ.	Max.	
Operating Voltage	VCC	+3.13	+3.3	+3.47	V
Center Wavelength Range	$\lambda_C$	1260	1310	1360	nm
Launch Optical Power	PO			+3	dBm
Extinction ratio	EX	3			dB
Receiver Sensitivity	S			-15	dBm
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	Physical Dimensions Low-temperature Storage Mechanical Shock/Vibration Temperature Cycle Damp Heat ESD Threshold ESD Immunity 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	
	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	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	2088hrs
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,2000 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	2.5	-17.1	18	1.4	-17.0
2	1.3	-17.0	19	1.3	-16.8
3	1.0	-17.2	20	1.5	-16.9
4	2.8	-16.8	21	1.3	-16.7
5	1.3	-16.8	22	2.6	-17.2
6	1.3	-16.6	23	2.7	-17.2
7	1.5	-17.3	24	1.2	-16.9
8	1.1	-17.4	25	1.3	-16.8
9	2.7	-17.1	26	1.1	-17.2
10	1.2	-17.2	27	2.9	-16.8
11	1.4	-16.7	28	2.8	-16.9
12	1.7	-16.8	29	2.7	-17.0
13	1.1	-16.6	30	2.8	-16.7
14	1.0	-16.9	31	1.4	-17.3
15	2.8	-16.9	32	1.3	-17.2
16	1.0	-17.0	33	1.4	-17.3
17	1.1	-17.2			

## 5.2 Physical Dimensions

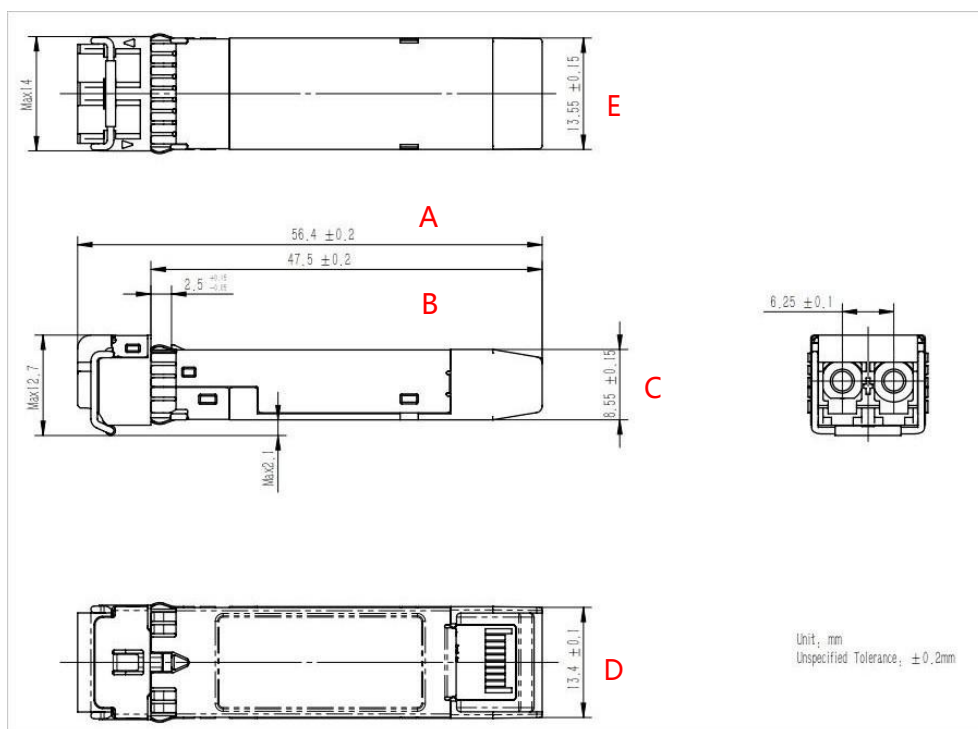


Figure 1: Package outline (unit: mm)

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

Projected Dimension	Designator				
	A	B	C	D	E
	$56.4 \pm 0.2$	$47.5 \pm 0.2$	$8.55 \pm 0.15$	$13.4 \pm 0.1$	$13.55 \pm 0.15$
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	-	-	-	-	-
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

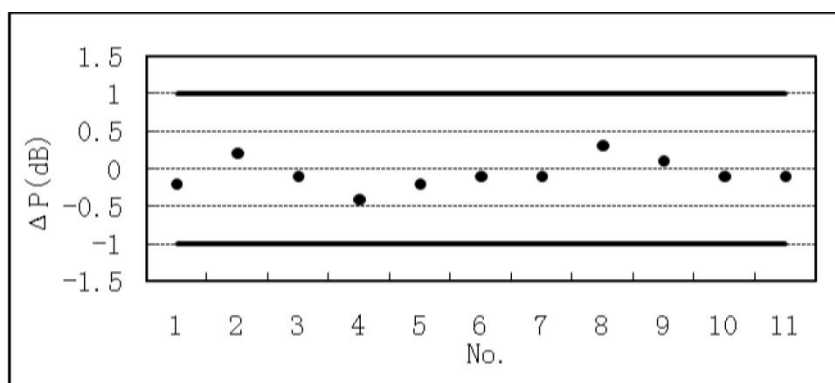


Figure 2: Optical Power Variation in Low Temperature Storage Test

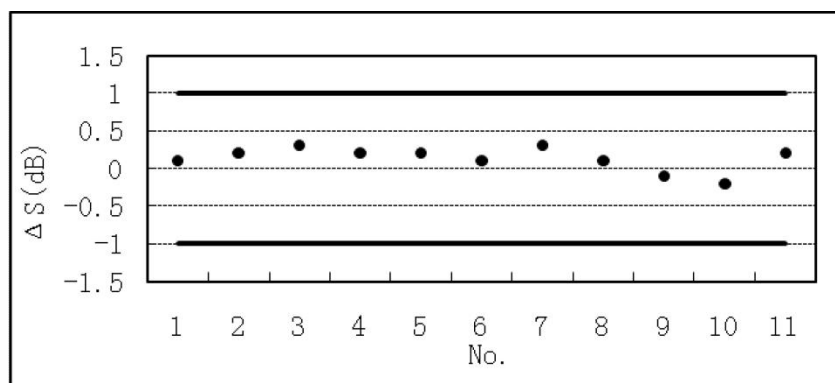


Figure 3: Receiver Sensitivity Variation in Low Temperature Storage Test

Table 7: Data of Low Temperature Storage Test

No.	Before Test		After Test		Before and after test Variation	
	Po (dBm)	Sensitivity (dBm)	Po (dBm)	Sensitivity (dBm)	ΔPo (dB)	ΔS (dB)
1	2.5	-17.1	2.4	-17.0	0.1	-0.1
2	1.3	-17.0	2.1	-16.8	0.2	-0.2

3	1.0	-17.2	1.1	-16.9	-0.1	-0.3
4	2.8	-16.8	2.7	-16.6	0.1	-0.2
5	1.3	-16.8	1.3	-16.6	0	-0.2
6	1.3	-16.6	1.2	-16.5	0.1	-0.1
7	1.5	-17.3	1.3	-17.0	0.2	-0.3
8	1.1	-17.4	1.0	-17.3	0.1	-0.1
9	2.7	-17.1	2.8	-17.2	-0.1	0.1
10	1.2	-17.2	1.3	-17.4	-0.1	0.2
11	1.4	-16.7	1.3	-16.5	0.1	-0.2
Statistics						
AVE	1.645	-17.02	1.68	-16.89	-0.05	-0.13
SD	-	-	-	-	-	-
MAX	2.8	-16.60	2.8	-16.50	0.2	0.20
MIN	1.0	-17.40	1.0	-17.40	-0.1	-0.30

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

## 5.4 Temperature Cycle

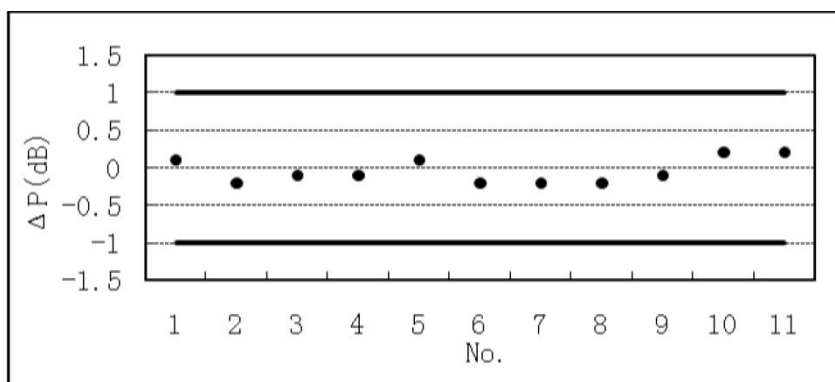


Figure 4: Optical Power Variation in Temperature Cycle Test

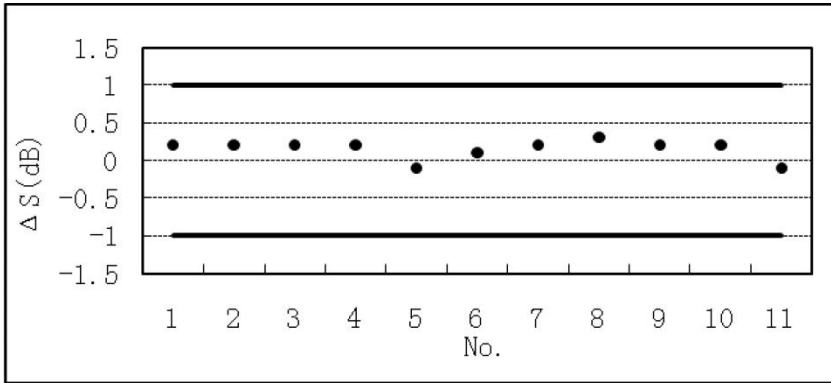


Figure 5: Receive Sensitivity Variation in Temperature Cycle Test

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	2.5	-17.0	2.4	-16.8	0.1	-0.2
2	1.3	-16.8	1.5	-16.6	-0.2	-0.2
3	1.0	-16.9	1.1	-16.7	-0.1	-0.2
4	2.8	-16.6	2.9	-16.4	-0.1	-0.2
5	1.3	-16.6	1.2	-16.7	0.1	0.1
6	1.3	-16.5	1.5	-16.4	-0.2	-0.1
7	1.5	-17.0	1.7	-16.8	-0.2	-0.2
8	1.1	-17.3	0.9	-17.0	-0.2	-0.3
9	2.7	-17.2	2.8	-17.0	-0.1	-0.2
10	1.2	-17.4	1.0	-17.2	0.2	-0.2
11	1.4	-16.5	1.2	-16.6	0.2	0.1
Statistics						
AVE	1.645	-16.89	1.65	-16.75	-0.05	-0.15
SD	-	-	-	-		-
MAX	2.8	-16.50	2.9	-16.40	0.20	0.10
MIN	1	-17.40	0.9	-17.20	-0.20	-0.30

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

## 5.5 Mechanical Shock /Vibration

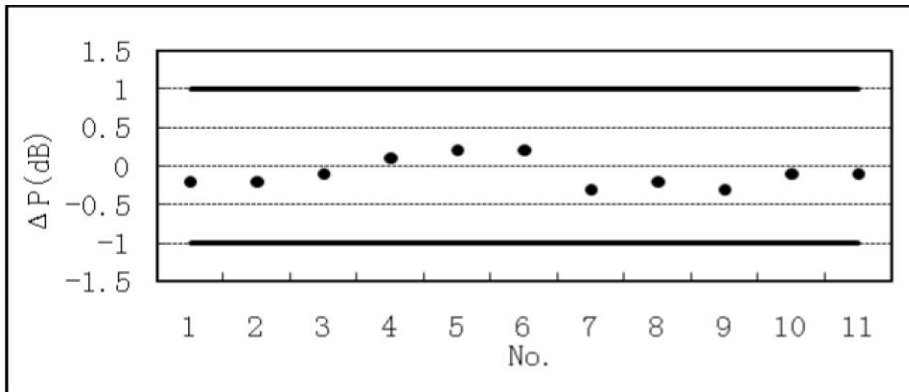


Figure 6: Optical Power Variation in Mechanical Shock /Vibration

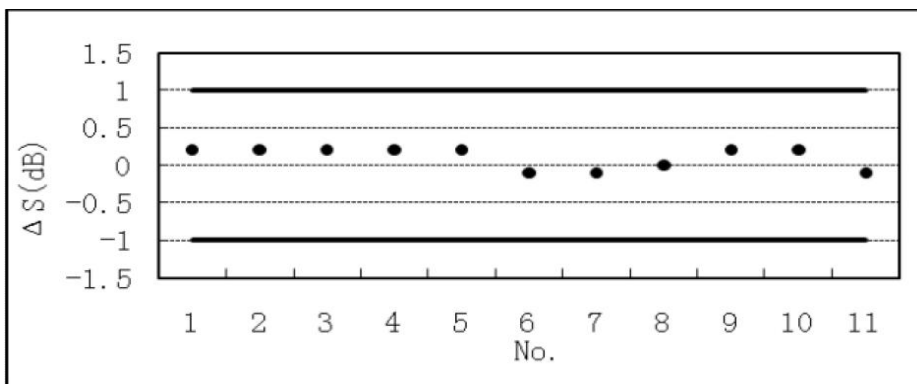


Figure 7: Receiver Sensitivity Variation in Mechanical Shock /Vibration Test

Table 9: Data of Mechanical Shock /Vibration Test

No.	Before Test		After Test		Before and after test Variation	
	Po	Sensitivity	Po	Sensitivity	ΔPo	ΔS
	(dBm)	(dBm)	(dBm)	(dBm)	(dB)	(dB)
1	2.5	-16.8	2.7	-16.6	-0.2	-0.2
2	1.3	-16.6	1.5	-16.4	-0.2	-0.2
3	1.0	-16.7	1.1	-16.5	-0.1	-0.2
4	2.8	-16.4	2.7	-16.2	0.1	-0.2
5	1.3	-16.7	1.1	-16.5	0.2	-0.2
6	1.3	-16.4	1.1	-16.5	0.2	0.1
7	1.5	-16.8	1.8	-16.9	-0.3	0.1
8	1.1	-17.0	1.3	-17.0	-0.2	0.0

9	2.7	-17.0	2.4	-16.8	0.3	-0.2
10	1.2	-17.2	1.3	-17.0	-0.1	-0.2
11	1.4	-16.6	1.5	-16.7	-0.1	0.1
Statistics						
AVE	1.645	-16.75	1.68	-16.65	-0.09	-0.10
SD	-	-	-	-	-	-
MAX	2.8	-16.40	2.7	-16.20	0.20	0.10
MIN	1	-17.20	1.1	-17.00	-0.30	-0.20

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

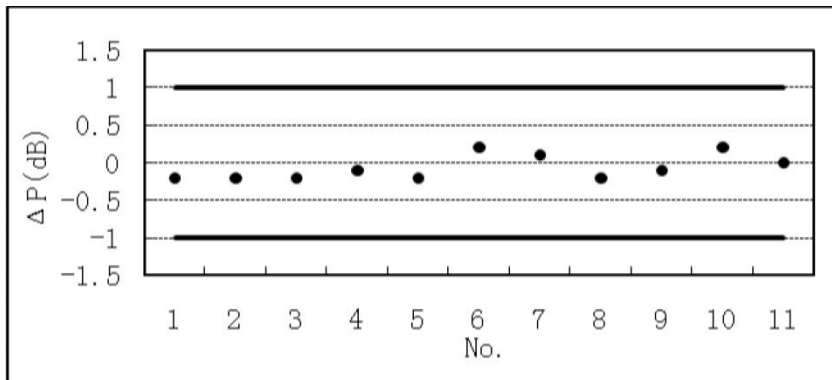


Figure 8: Optical Power variation in Damp Heat Test

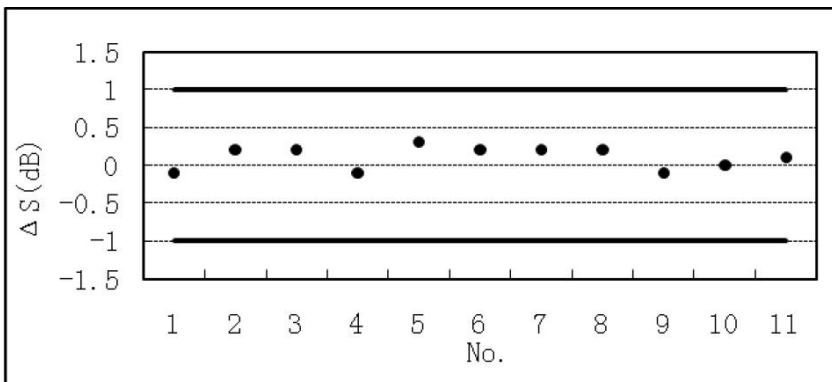


Figure 9: Receiver Sensitivity Variation in Damp Heat Test

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)	$\Delta P_o$ (dB)	$\Delta S$ (dB)
1	2.5	-16.6	2.7	-16.7	-0.2	0.1
2	1.3	-16.4	1.5	-16.2	-0.2	-0.2
3	1.0	-16.5	1.2	-16.3	-0.2	-0.2
4	2.8	-16.2	2.7	-16.3	0.1	0.1
5	1.3	-16.5	1.1	-16.2	0.2	-0.3
6	1.3	-16.5	1.1	-16.3	0.2	-0.2
7	1.5	-16.9	1.4	-16.7	0.1	-0.2
8	1.1	-17.0	1.3	-16.8	-0.2	-0.2
9	2.7	-16.8	2.8	-16.9	-0.1	0.1
10	1.2	-17.0	1.0	-17.0	0.2	0.0
11	1.4	-16.7	1.4	-16.6	0.0	-0.1
Statistics						
AVE	1.645	-16.65	1.65	-16.55	-0.06	-0.10
SD						
MAX	2.80	-16.20	2.8	-16.20	0.20	0.10
MIN	1	-17.00	1	-17.00	-0.20	-0.30

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

## 5.7 ESD Threshold

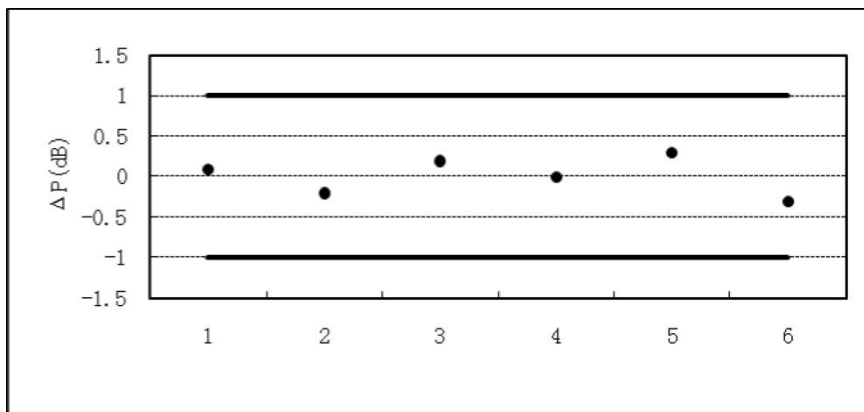


Figure 10: Optical Power Variation in ESD Threshold Test

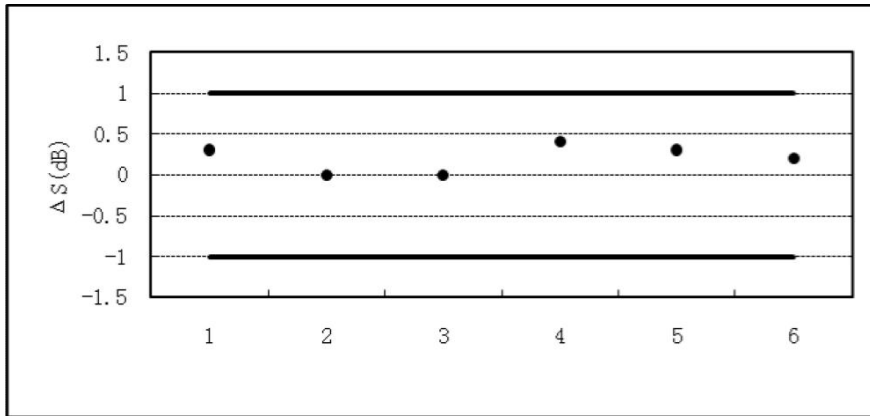


Figure 11: Receiver Sensitivity Variation in ESD Threshold Test

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

No.	Before Test		After Test		Before and after test Variation	
	Po (dBm)	Sensitivity (dBm)	Po (dBm)	Sensitivity (dBm)	ΔPo (dB)	ΔS (dB)
1	2.5	-16.7	2.6	-16.6	-0.1	-0.1
2	1.3	-16.2	1.1	-16.0	0.2	-0.2
3	1.0	-16.3	1.1	-16.2	-0.1	-0.1
4	2.8	-16.3	2.6	-16.4	0.2	0.1
5	1.3	-16.2	1.2	-16.3	0.1	0.1
6	1.3	-16.3	1.1	-16.2	0.2	-0.1
Statistics						
AVE	1.73	-16.33	1.61	-16.28	-0.08	-0.05
SD						
MAX	2.8	-16.20	2.6	-16.00	0.20	0.10
MIN	1.0	-16.70	1.1	-16.60	-0.10	-0.20

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

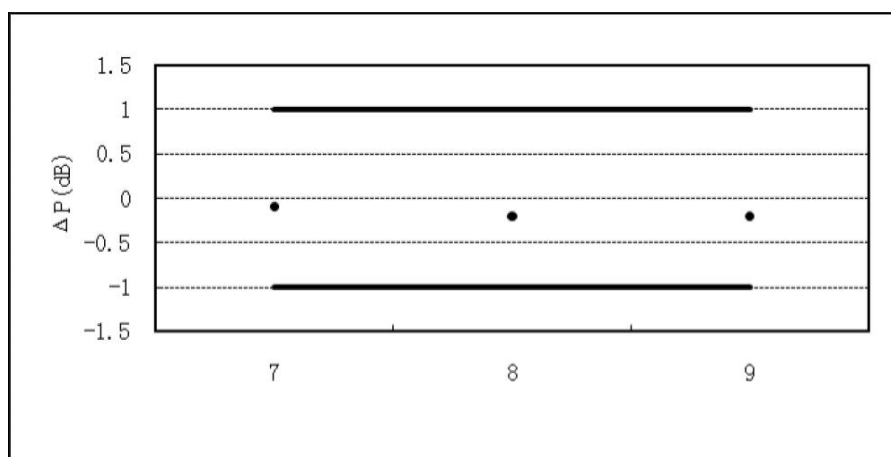


Figure 12: Optical Power Variation in ESD Immunity Test

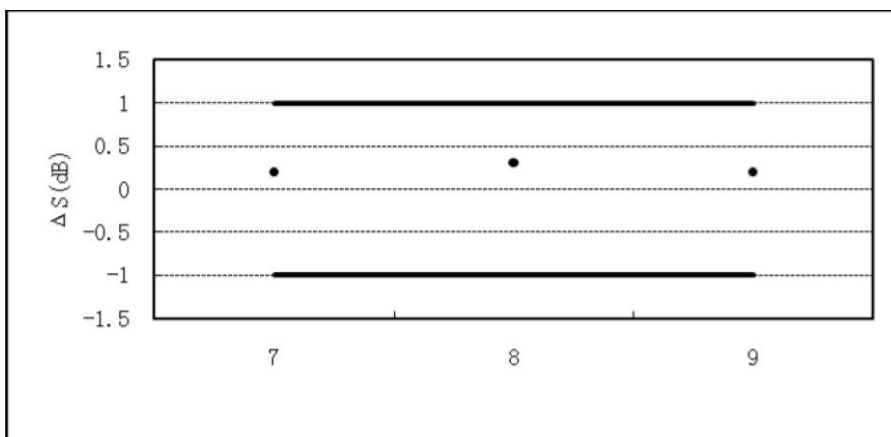


Figure 13: Receiver Sensitivity Variation in ESD Immunity Test

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)	ΔPo (dB)	ΔS (dB)
7	1.5	-16.7	1.4	-16.8	0.1	0.1
8	1.1	-16.8	0.9	-16.6	0.2	-0.2
9	2.7	-16.9	2.5	-16.7	0.2	-0.2
Statistics						
AVE	1.76	-16.80	1.6	-16.70	0.1	-0.10



SD						
MAX	2.7	-16.70	2.5	-16.60	0.2	0.10
MIN	1.1	-16.90	0.9	-16.80	0.1	-0.20

Note: ESD Immunity reference resources IEC61000-4-2 condition 4 Class, air discharge 15KV, contact discharge 8KV, Criterion: 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.

10 times microscope examination.

## 5.10 High Temperature Storage

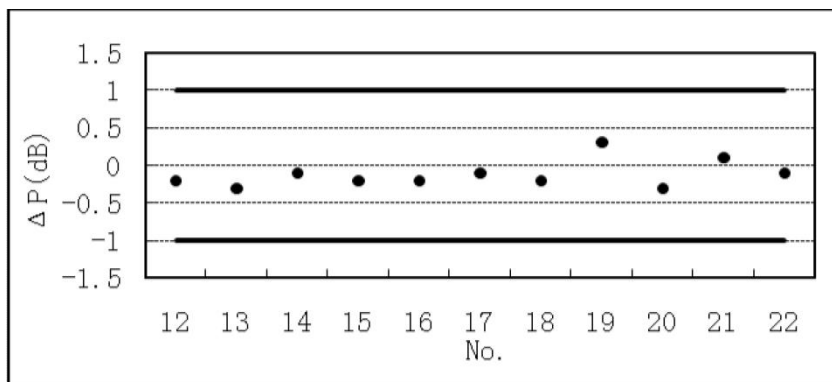


Figure 14: Optical Power Variation in High Temperature Storage Test

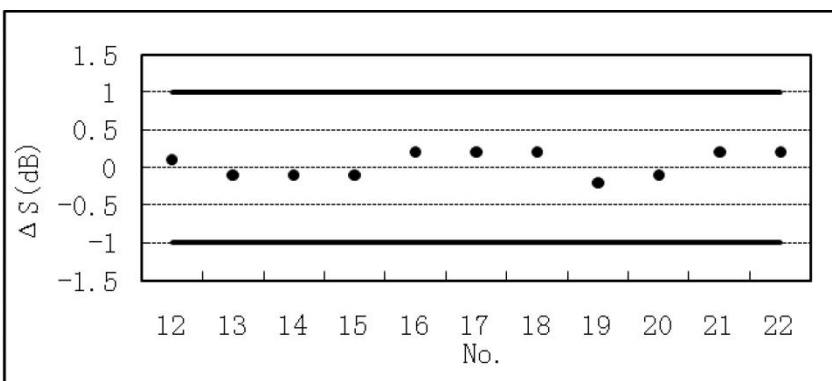


Figure 15: Receiver Sensitivity Variation in High Temperature Storage Test

Table 14: Data of High Temperature Storage Test

No.	Before Test		After Test		Before and after test Variation	
	Po	Sensitivity	Po	Sensitivity	$\Delta P_o$	$\Delta S$
	(dBm)	(dBm)	(dBm)	(dBm)	(dB)	(dB)
12	1.7	-16.8	1.5	-16.7	0.2	-0.1
13	1.1	-16.6	0.8	-16.7	0.3	0.1
14	1.0	-16.9	0.9	-17.0	0.1	0.1
15	2.8	-16.9	2.6	-17.0	0.2	0.1
16	1.0	-17.0	0.8	-16.8	0.2	-0.2
17	1.1	-17.2	1.0	-17.0	0.1	-0.2
18	1.4	-17.0	1.2	-16.8	0.2	-0.2
19	1.3	-16.8	1.0	-17.0	0.3	0.2
20	1.5	-16.9	1.2	-17.0	0.3	0.1
21	1.3	-16.7	1.2	-16.5	0.1	-0.2
22	2.6	-17.2	2.5	-17.0	0.1	-0.2
Statistics						
AVE	1.52	-16.91	1.34	-16.86	0.19	-0.05
SD						
MAX	2.8	-16.60	2.6	-16.50	0.30	0.20
MIN	1	-17.20	0.8	-17.00	0.10	-0.20

### 5.11 Powered damp heat test

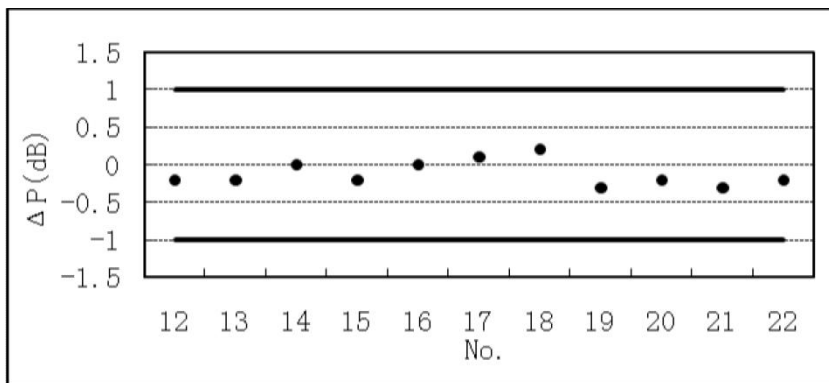


Figure 16: Optical Power Variation in Powered damp heat test Test

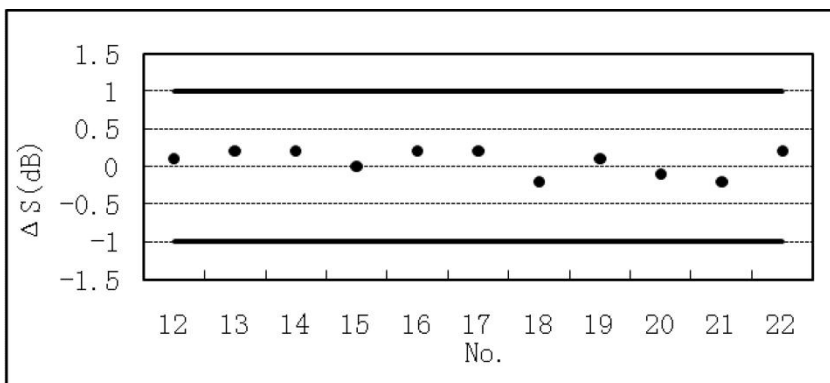


Figure 17: Receiver Sensitivity Variation in Powered damp heat test Test

Table 15: Data of Powered damp heat test

No.	Before Test		After Test		Before and after test Variation	
	Po	Sensitivity	Po	Sensitivity	ΔPo	ΔS
	(dBm)	(dBm)	(dBm)	(dBm)	(dB)	(dB)
12	1.7	-16.7	1.5	-16.6	0.2	-0.1

13	1.1	-16.7	1.3	-16.5	-0.2	-0.2
14	1.0	-17.0	1.0	-16.8	0.0	-0.2
15	2.8	-17.0	2.5	-17.0	0.3	0.0
16	1.0	-16.8	1.0	-16.6	0.0	-0.2
17	1.1	-17.0	1.0	-16.8	0.1	-0.2
18	1.4	-16.8	1.2	-17.0	0.2	0.2
19	1.3	-17.0	1.0	-16.9	0.3	-0.1
20	1.5	-17.0	1.3	-17.1	0.2	0.1
21	1.3	-16.5	1.1	-16.7	0.2	0.2
22	2.6	-17.0	2.4	-16.8	0.2	-0.2
Statistics						
AVE	1.52	-16.86	1.39	-16.80	-0.14	-0.06
SD						
MAX	2.8	-16.50	2.5	-16.50	0.30	0.20
MIN	1.0	-17.00	1	-17.10	-0.20	-0.20

Note: 85°C/85%RH,2000 hours Powered Environmental Stress Tests

## 5.12 Power Temperature cycling test

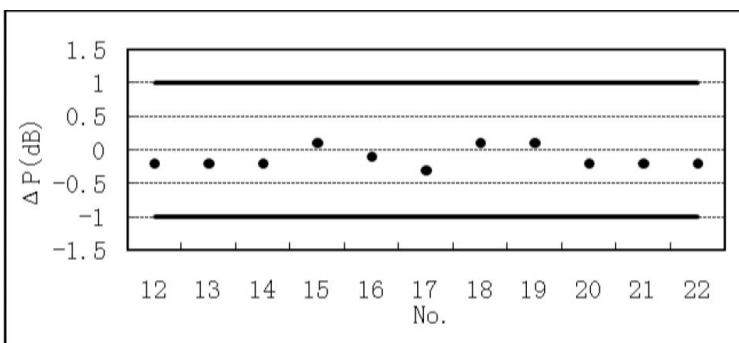


Figure 18: Optical Power Variation in Power Temperature cycling Test(500cycles)

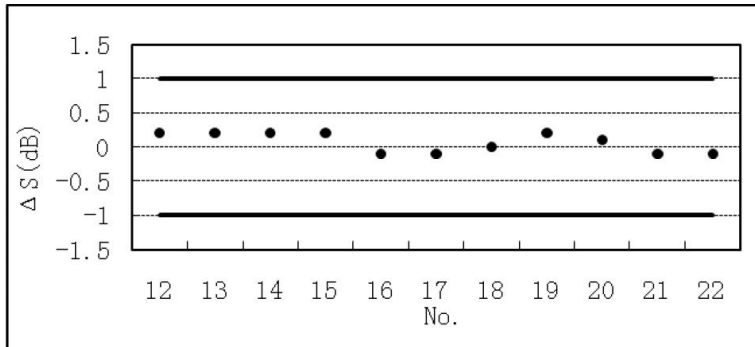


Figure 19: Receiver Sensitivity Variation in Power Temperature cycling Test(500cycles)

Table 16: Data of Power Temperature cycling Test

No.	Before Test		After Test		Before and after test Variation	
	Po	Sensitivity	Po	Sensitivity	ΔPo	ΔS
	(dBm)	(dBm)	(dBm)	(dBm)	(dB)	(dB)
12	1.7	-16.6	1.5	-16.4	0.2	-0.2
13	1.1	-16.5	0.9	-16.3	0.2	-0.2
14	1.0	-16.8	0.8	-16.6	0.2	-0.2
15	2.8	-17.0	2.7	-16.8	0.1	-0.2
16	1.0	-16.6	1.1	-16.7	-0.1	0.1
17	1.1	-16.8	0.8	-16.9	0.3	0.1
18	1.4	-17.0	1.3	-17.0	0.1	0.0
19	1.3	-16.9	1.2	-16.7	0.1	-0.2
20	1.5	-17.1	1.3	-17.0	0.2	-0.1
21	1.3	-16.7	1.1	-16.8	0.2	0.1
22	2.6	-16.8	2.4	-16.9	0.2	0.1

Statistics						
AVE	1.52	-16.80	1.37	-16.74	-0.12	-0.06
SD						
MAX	2.8	-16.50	2.7	-16.30	0.30	0.10
MIN	1.0	-17.10	0.8	-17.00	-0.10	-0.20

Note: -40°C to 85°C, 500 cycles

### 5.13 Accelerating Aging

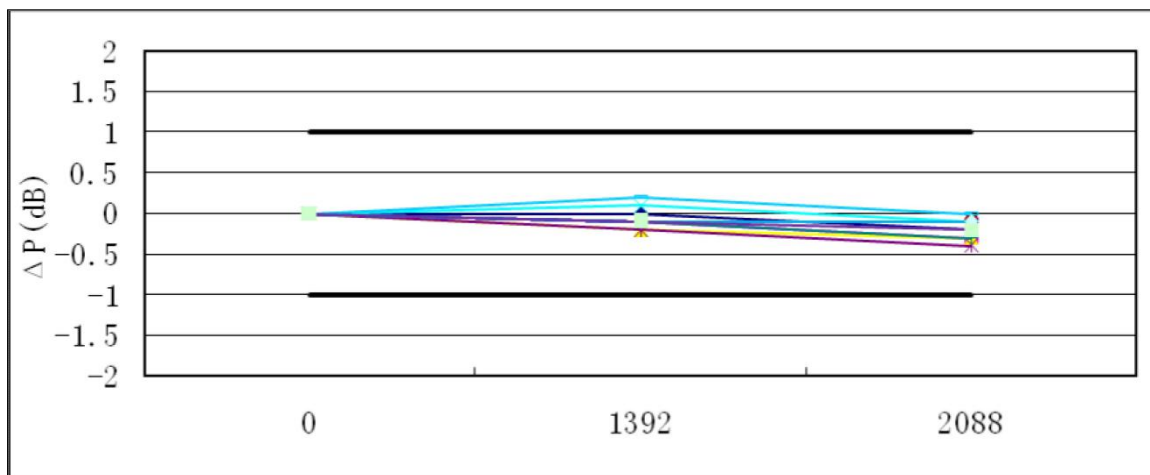


Figure 20: Optical Power Variation in Accelerating Aging Test

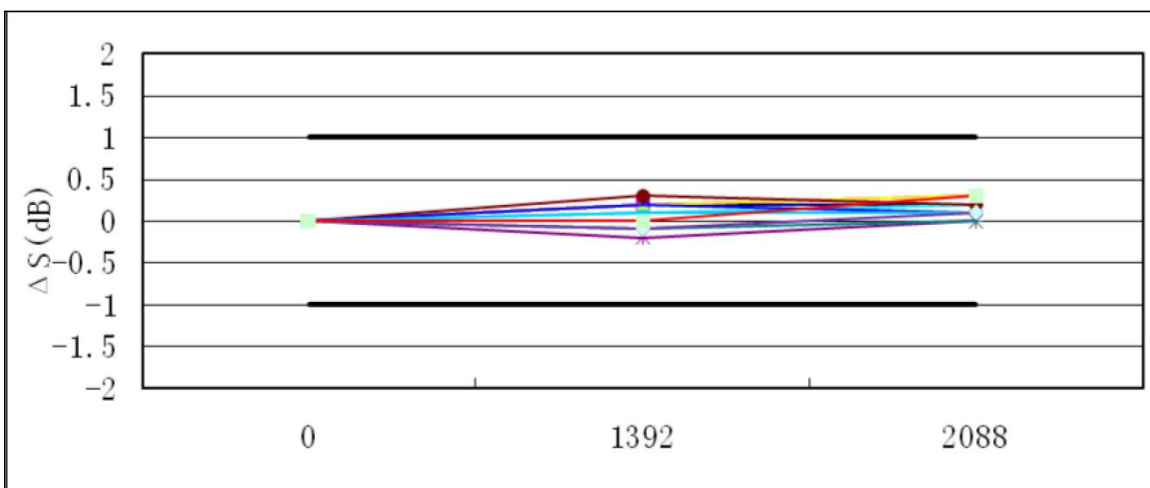


Figure 21: Receiver Sensitivity Variation in Accelerating Aging Test

Table 17: Optical Power of Accelerating Aging Test

Time (hrs)	23	24	25	26	27	28	29	30	31	32	33
0	2.7	1.2	1.3	1.1	2.9	2.8	2.7	2.8	1.4	1.3	1.4
1392	2.6	1.1	1.1	0.9	2.7	2.7	2.5	2.6	1.2	1.2	1.4
2088	2.6	1.0	1.1	1.0	2.8	2.6	2.5	2.5	1.2	1.2	1.3

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