

Transceiver Reliability **TEST Report**

Model name : SFP28-25G-BX-I

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1. Introduction

This report presents the reliability test results for 1330nm 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 transceiver meet the requirement of reliability.

3. Sample Description

The sample transmits and receives optical data up to 10km over single mode fiber. The type is 25G BIDI (1330nm). 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 (25G BIDI)	Tx	λ_c	1320	1330	1340	nm
	Rx		1260	1270	1280	
Launch Optical Power		P_O	-4.0	-	2.5	dBm
Extinction Ratio		EX	3.5	-	-	dB
Receiver Sensitivity		S	-	-	-11.4	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 (25G BIDI)	Physical Dimensions Low-Temperature Storage Temperature Cycle Mechanical Shock/Vibration High-Temperature Storage
	Group 2 (25G BIDI)	Temperature Cycle(Powered) Damp Heat (Powered) Accelerating Aging Cage/Connector & Transceiver Match Insertion/Extraction/Retention Test
	Group 3 (25G BIDI)	Damp Heat ESD Threshold ESD Immunity Visual Inspection

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	Any key parameter is out of the specification Table 1. $ \Delta S > 1.0\text{dB}$ $ \Delta P > 1.0\text{dB}$
	Cage/Connector & Transceiver Match	
Environmental Endurance	Temperature Cycle	
	Temperature Cycle(Powered)	
	Damp Heat	
	High-Temperature Storage	
	Damp Heat Powered	
	Low-Temperature Storage	
	Accelerating Aging	
Special Tests	ESD Immunity	
	ESD Threshold	
	Insertion Force	Insertion force $\leq 18\text{N}$
	Extraction Force	Extraction force $\leq 12.5\text{N}$
	Retention Force	$90\text{N} \leq \text{Retention force} \leq 170\text{N}$

4.4 Test Plan and Status

Table 4: Test Plan and Status

Test	Reference	Condition	SS/C	Status
O/E Characteristics	Specifications	Specifications	44/0	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	22/0	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, 2000 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
Cage/Connector & Transceiver Match	SFF-8432	200 mating	11/0	Passed
Insertion/Extraction /Retention Test	SFF-8432	Insertion force	11/0	Passed
		Extraction force	11/0	Passed
		Retention force	11/0	Passed

5. Test Results

5.1 O/E Characteristic

Table 5: Optical/Electrical Characterization of Forty-four Modules(25°C)

No.	P _o (dBm)	Sensitivity (dBm)	No.	P _o (dBm)	Sensitivity (dBm)
	25G BIDI (1330)				
1	-0.57	-18.8	23	-0.86	-18.4
2	-0.93	-17.6	24	-1.45	-18
3	-0.52	-17.2	25	-0.48	-17.6
4	-0.24	-18.4	26	0.01	-17.6
5	-1.71	-17.6	27	-0.24	-18
6	-0.39	-18.4	28	-0.33	-17.6
7	-1.11	-18	29	-0.15	-18.4
8	-0.6	-18.4	30	0.77	-18
9	-0.7	-18.4	31	0.09	-18
10	-0.96	-18.4	32	-0.59	-18
11	-1.53	-18	33	-0.94	-18.4
12	0.05	-18	34	0.42	-16.4
13	-0.39	-18.4	35	-1.19	-17.1
14	-1.1	-18.4	36	-0.37	-18.4
15	-1.48	-18	37	-1.12	-18
16	-0.8	-18	38	-0.85	-18.2
17	-1.05	-18.4	39	-1.12	-17.2
18	-0.27	-18	40	-0.57	-18.3
19	-0.95	-17.2	41	-0.45	-18.2
20	-0.58	-18	42	-1.01	-17.5
21	-1.09	-18	43	-0.37	-18.5
22	0.02	-18.4	44	-0.14	-16.8

Table 6: Optical/Electrical Characterization of Forty-four Modules(-40°C)

No.	P _O (dBm)	Sensitivity (dBm)	No.	P _O (dBm)	Sensitivity (dBm)
	25G BIDI (1330)				
1	0.8	-20.0	23	0.2	-18.0
2	0.4	-19.6	24	-0.3	-19.2
3	0.8	-19.2	25	0.6	-18.4
4	1.1	-19.2	26	1.7	-18.0
5	-0.1	-19.2	27	1.0	-18.4
6	1.2	-18.4	28	1.2	-18.4
7	0.3	-18.8	29	1.2	-18.8
8	1.2	-20.0	30	1.8	-18.4
9	1.1	-19.2	31	1.3	-18.4
10	0.1	-19.6	32	0.9	-18.4
11	0.0	-19.6	33	0.1	-18.8
12	1.7	-19.2	34	1.5	-17.0
13	0.8	-19.6	35	-0.1	-17.9
14	-0.3	-18.4	36	-1.6	-18.6
15	0.3	-19.2	37	0.9	-18.8
16	0.7	-19.2	38	0.3	-18.4
17	0.8	-19.2	39	0.5	-18.8
18	1.1	-19.2	40	0.0	-18.5
19	0.3	-18.4	41	-0.4	-19.2
20	0.9	-19.2	42	0.4	-18.7
21	-0.1	-19.2	43	1.2	-19.0
22	1.2	-19.6	44	0.9	-17.5

Table 7: Optical/Electrical Characterization of Forty-four Modules(85°C)

No.	P _o (dBm)	Sensitivity (dBm)	No.	P _o (dBm)	Sensitivity (dBm)
	25G BIDI (1330)				
1	-2.7	-17.6	23	-2.8	-17.2
2	-2.8	-16.0	24	-3.2	-16.8
3	-2.8	-16.0	25	-2.9	-15.6
4	-2.0	-17.2	26	-1.4	-16.4
5	-2.9	-16.8	27	-2.0	-16.8
6	-2.8	-17.6	28	-2.2	-16.4
7	-2.8	-16.8	29	-2.0	-17.2
8	-2.6	-17.2	30	-0.8	-16.8
9	-2.9	-17.2	31	-1.9	-16.4
10	-3.1	-17.2	32	-2.1	-16.8
11	-3.0	-16.8	33	-2.5	-17.2
12	-2.7	-16.8	34	-0.7	-15.5
13	-2.8	-17.2	35	-1.4	-16.6
14	-2.9	-17.2	36	-2.3	-17.2
15	-3.2	-16.8	37	-1.0	-16.8
16	-3.1	-17.2	38	-1.7	-16.6
17	-2.5	-17.6	39	-2.0	-16.0
18	-2.3	-16.8	40	-2.1	-17.1
19	-2.5	-16.0	41	-1.8	-17.1
20	-2.7	-16.8	42	-1.9	-16.3
21	-2.8	-16.8	43	-1.6	-17.3
22	-2.6	-17.2	44	-1.1	-16.0

5.2 Physical Dimensions

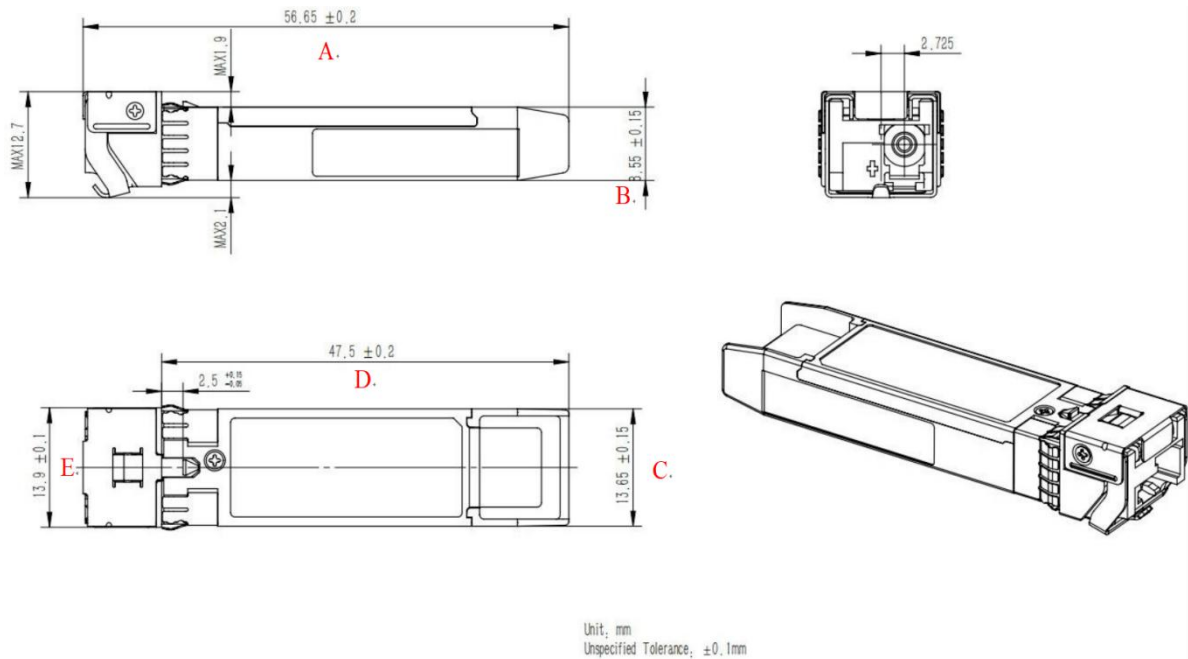


Figure 1: Package Outline(unit: mm)

Table 8: Data of Dimension Test(unit: mm)

Projected Dimension	Designator				
	A	B	C	D	E
	56.65 ± 0.2	8.55 ± 0.15	13.65 ± 0.15	47.5 ± 0.2	13.9 ± 0.1
1	56.55	8.58	13.59	47.56	13.92
2	56.61	8.59	13.58	47.54	13.93
3	56.58	8.54	13.61	47.46	13.87
4	56.63	8.48	13.70	47.43	13.93
5	56.57	8.51	13.68	47.54	13.86
6	56.67	8.49	13.62	47.56	13.92
7	56.66	8.51	13.72	47.58	13.88
8	56.65	8.50	13.69	47.51	13.93
9	56.70	8.51	13.71	47.46	13.92
10	56.69	8.59	13.72	47.47	13.86
11	56.62	8.58	13.59	47.46	13.88

Statistics					
AVE	56.63	8.53	13.66	47.51	13.90
SD	0.05	0.04	0.05	0.05	0.03
MAX	56.70	8.59	13.72	47.58	13.93
MIN	56.55	8.48	13.58	47.43	13.86

5.3 Low Temperature Storage

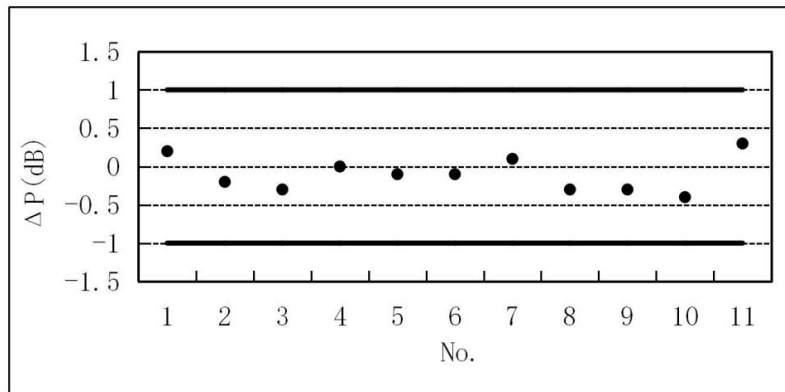


Figure 2: Optical Power Variation in Low Temperature Storage Test

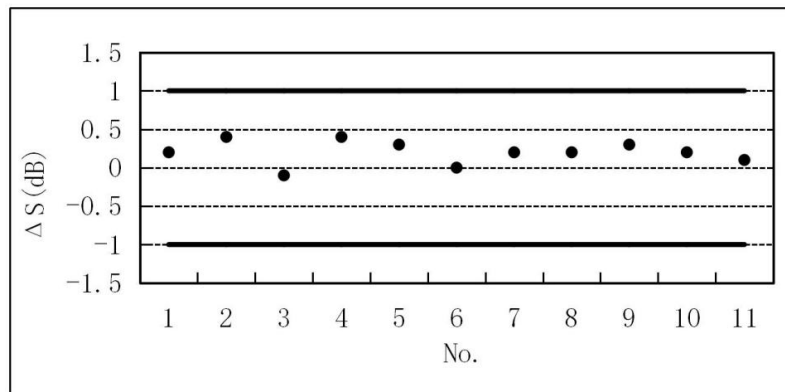


Figure 3: Receiver Sensitivity Variation in Low Temperature Storage Test

Table 9: Data of Low Temperature Storage Test (25°C)

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	-18.8	-0.4	-18.6	0.2	0.2
2	-0.9	-17.6	-1.1	-17.2	-0.2	0.4
3	-0.5	-17.2	-0.8	-17.3	-0.3	-0.1
4	-0.2	-18.4	-0.2	-18.0	0.0	0.4
5	-1.7	-17.6	-1.8	-17.3	-0.1	0.3
6	-0.4	-18.4	-0.5	-18.4	-0.1	0.0
7	-1.1	-18	-1.0	-17.8	0.1	0.2
8	-0.6	-18.4	-0.9	-18.2	-0.3	0.2
9	-0.7	-18.4	-1.0	-18.1	-0.3	0.3
10	-1.0	-18.4	-1.4	-18.2	-0.4	0.2
11	-1.5	-18	-1.2	-17.9	0.3	0.1
Statistics						
AVE	-0.84	-18.11	-0.94	-17.91	-0.10	0.20
SD	0.44	0.45	0.44	0.45	0.22	0.15
MAX	-0.20	-17.20	-0.20	-17.20	0.30	0.40
MIN	-1.70	-18.80	-1.80	-18.60	-0.40	-0.10

5.4 Temperature Cycle

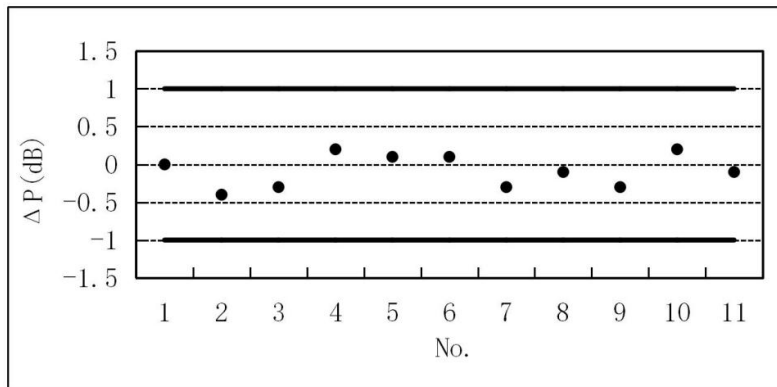


Figure 4: Optical Power Variation in Temperature Cycle Test

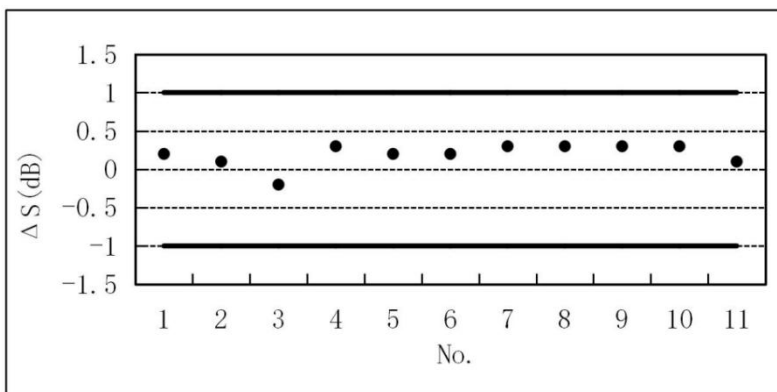


Figure 5: Receive Sensitivity Variation in Temperature Cycle Test

Table 10: Optical Output Power in Temperature Cycle Test (25°C)

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	-0.4	-18.6	-0.4	-18.4	0.0	0.2
2	-1.1	-17.2	-1.5	-17.1	-0.4	0.1
3	-0.8	-17.3	-1.1	-17.5	-0.3	-0.2
4	-0.2	-18.0	0.0	-17.7	0.2	0.3
5	-1.8	-17.3	-1.7	-17.1	0.1	0.2
6	-0.5	-18.4	-0.4	-18.2	0.1	0.2
7	-1.0	-17.8	-1.3	-17.5	-0.3	0.3
8	-0.9	-18.2	-1.0	-17.9	-0.1	0.3

9	-1.0	-18.1	-1.3	-17.8	-0.3	0.3
10	-1.4	-18.2	-1.2	-17.9	0.2	0.3
11	-1.2	-17.9	-1.3	-17.8	-0.1	0.1
Statistics						
AVE	-0.94	-17.91	-1.02	-17.72	-0.08	0.19
SD	0.44	0.45	0.50	0.39	0.21	0.14
MAX.	-0.20	-17.20	0.00	-17.10	0.20	0.30
MIN.	-1.80	-18.60	-1.70	-18.40	-0.40	-0.20

5.5 Mechanical Shock /Vibration

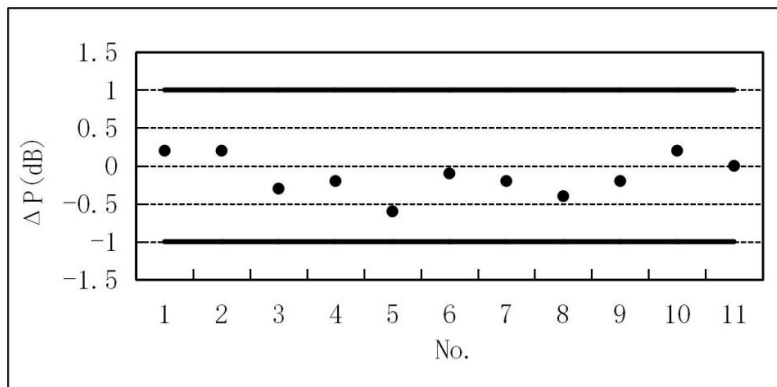


Figure 6: Optical Power Variation in Mechanical Shock /Vibration Test

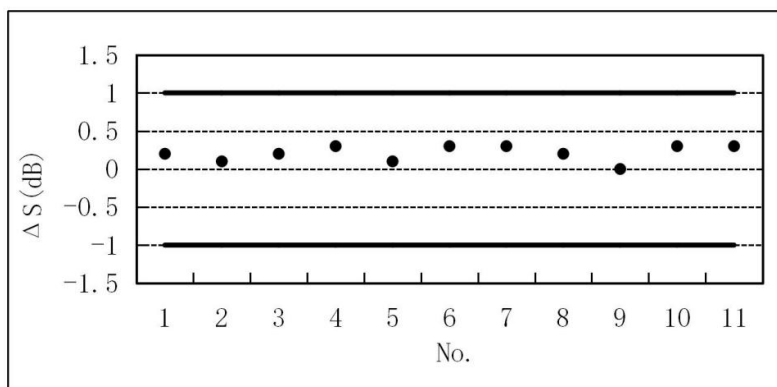


Figure 7: Receiver Sensitivity Variation in Mechanical Shock /Vibration Test

Table 11: Data of Mechanical Shock /Vibration Test (25°C)

No.	Before Test		After Test		Before and After Test Variation	
	P ₀ (dBm)	Sensitivity (dBm)	P ₀ (dBm)	Sensitivity (dBm)	ΔP ₀ (dB)	ΔS (dB)
1	-0.4	-18.4	-0.2	-18.2	0.2	0.2
2	-1.5	-17.1	-1.3	-17.0	0.2	0.1
3	-1.1	-17.5	-1.4	-17.3	-0.3	0.2
4	0.0	-17.7	-0.2	-17.4	-0.2	0.3
5	-1.7	-17.1	-2.3	-17.0	-0.6	0.1
6	-0.4	-18.2	-0.5	-17.9	-0.1	0.3
7	-1.3	-17.5	-1.5	-17.2	-0.2	0.3
8	-1.0	-17.9	-1.4	-17.7	-0.4	0.2
9	-1.3	-17.8	-1.5	-17.8	-0.2	0.0
10	-1.2	-17.9	-1.0	-17.6	0.2	0.3
11	-1.3	-17.8	-1.3	-17.5	0.0	0.3
Statistics						
AVE	-1.02	-17.72	-1.15	-17.51	-0.13	0.21
SD	0.50	0.39	0.60	0.36	0.25	0.10
MAX	0.00	-17.10	-0.20	-17.00	0.20	0.30
MIN	-1.70	-18.40	-2.30	-18.20	-0.60	0.00

5.6 High Temperature Storage

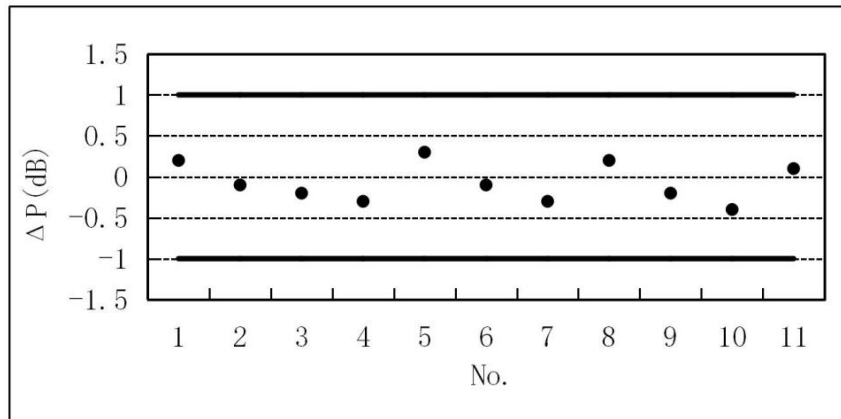


Figure 8: Optical Power Variation in High Temperature Storage Test

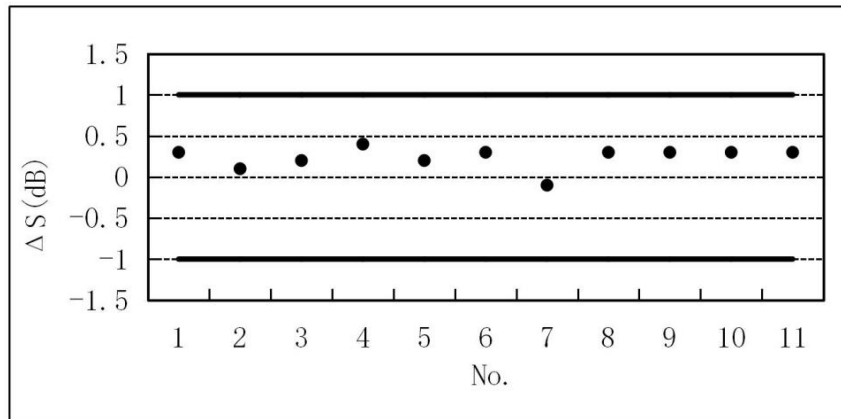


Figure 9: Receiver Sensitivity Variation in High Temperature Storage Test

Table 12: Data of High Temperature Storage Test (25°C)

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	-18.2	0.0	-17.9	0.2	0.3
2	-1.3	-17.0	-1.4	-16.9	-0.1	0.1
3	-1.4	-17.3	-1.6	-17.1	-0.2	0.2
4	-0.2	-17.4	-0.5	-17.0	-0.3	0.4
5	-2.3	-17.0	-2.0	-16.8	0.3	0.2
6	-0.5	-17.9	-0.6	-17.6	-0.1	0.3

7	-1.5	-17.2	-1.8	-17.3	-0.3	-0.1
8	-1.4	-17.7	-1.2	-17.4	0.2	0.3
9	-1.5	-17.8	-1.7	-17.5	-0.2	0.3
10	-1.0	-17.6	-1.4	-17.3	-0.4	0.3
11	-1.3	-17.5	-1.2	-17.2	0.1	0.3
Statistics						
AVE	-1.15	-17.51	-1.22	-17.27	-0.07	0.24
SD	0.60	0.36	0.59	0.31	0.23	0.13
MAX	-0.20	-17.00	0.00	-16.80	0.30	0.40
MIN	-2.30	-18.20	-2.00	-17.90	-0.40	-0.10

5.7 Damp Heat

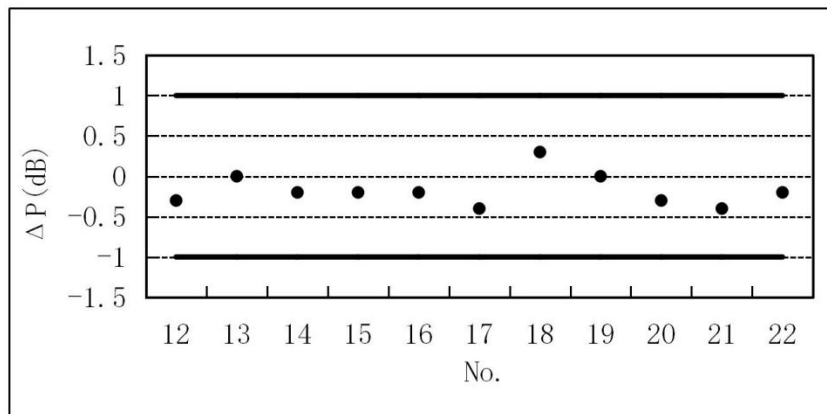


Figure 10: Optical Power Variation in Damp Heat Test

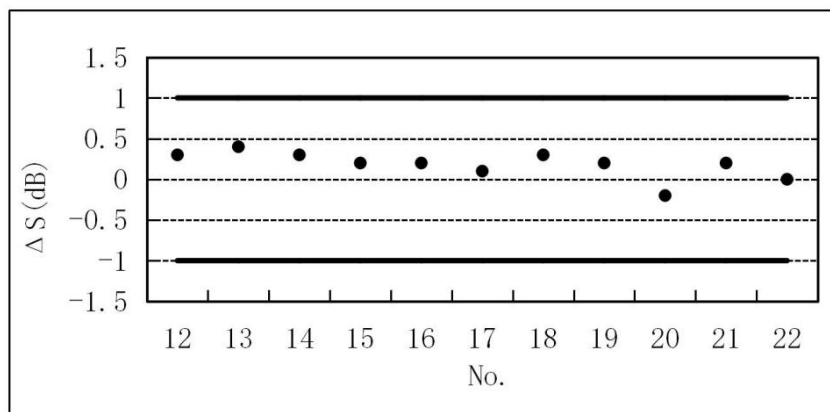


Figure 11: Receiver Sensitivity Variation in Damp Heat Test

Table 13: Data of Damp Heat Test (25°C)

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	0.1	-18	-0.2	-17.7	-0.3	0.3
13	-0.4	-18.4	-0.4	-18.0	0.0	0.4
14	-1.1	-18.4	-1.3	-18.1	-0.2	0.3
15	-1.5	-18	-1.7	-17.8	-0.2	0.2
16	-0.8	-18	-1.0	-17.8	-0.2	0.2
17	-1.1	-18.4	-1.5	-18.3	-0.4	0.1
18	-0.3	-18	0.0	-17.7	0.3	0.3
19	-1.0	-17.2	-1.0	-17.0	0.0	0.2
20	-0.6	-18	-0.9	-18.2	-0.3	-0.2
21	-1.1	-18	-1.5	-17.8	-0.4	0.2
22	0.0	-18.4	-0.2	-18.4	-0.2	0.0
Statistics						
AVE	-0.71	-18.07	-0.88	-17.89	-0.17	0.18
SD	0.49	0.33	0.57	0.37	0.20	0.16
MAX.	0.10	-17.20	0.00	-17.00	0.30	0.40
MIN.	-1.50	-18.40	-1.70	-18.40	-0.40	-0.20

5.8 ESD Threshold

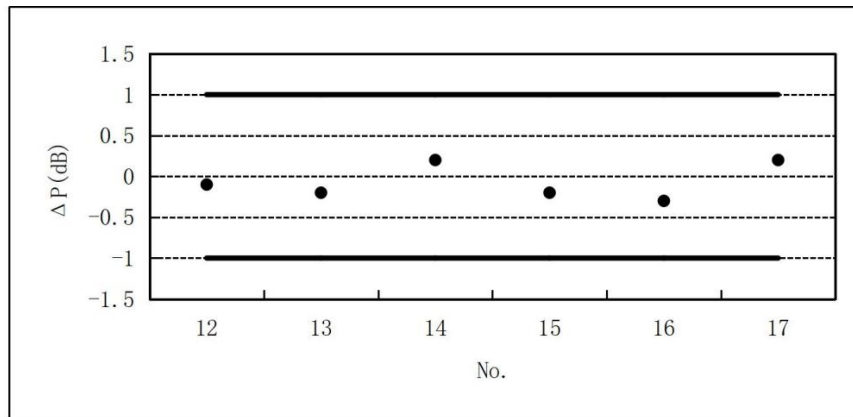


Figure 12: Optical Power Variation in ESD Threshold Test

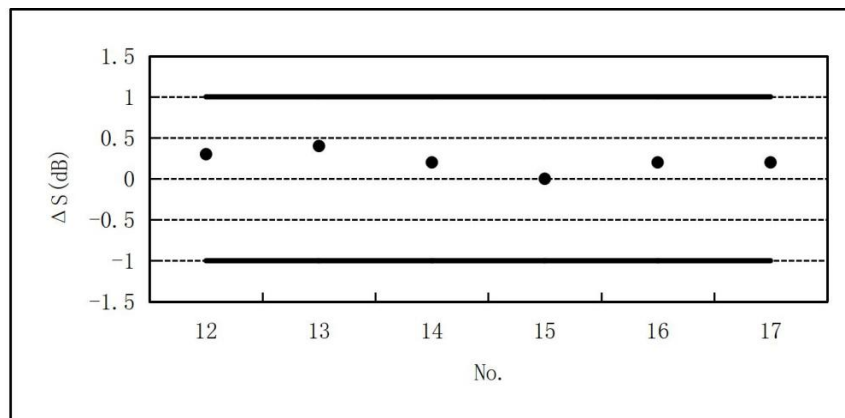


Figure 13: Receiver Sensitivity Variation in ESD Threshold Test

Table 14: Data of ESD Threshold Test (1KV Signal Pin) (25°C)

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	-0.2	-17.7	-0.3	-17.4	-0.1	0.3
13	-0.4	-18.0	-0.6	-17.6	-0.2	0.4
14	-1.3	-18.1	-1.1	-17.9	0.2	0.2
15	-1.7	-17.8	-1.9	-17.8	-0.2	0.0
16	-1.0	-17.8	-1.3	-17.6	-0.3	0.2
17	-1.5	-18.3	-1.3	-18.1	0.2	0.2

Statistics						
AVE	-1.02	-17.95	-1.08	-17.73	-0.07	0.22
SD	0.55	0.21	0.52	0.23	0.20	0.12
MAX	-0.20	-17.70	-0.30	-17.40	0.20	0.40
MIN	-1.70	-18.30	-1.90	-18.10	-0.30	0.00

5.9 ESD Immunity

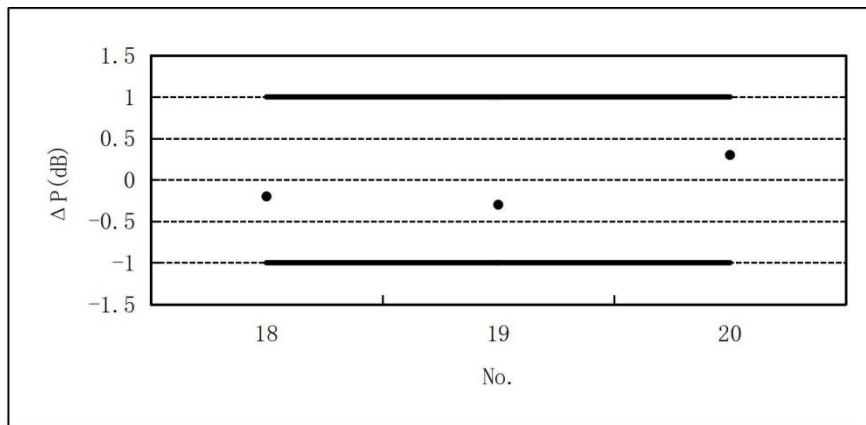


Figure 14: Optical Power Variation in ESD Immunity Test

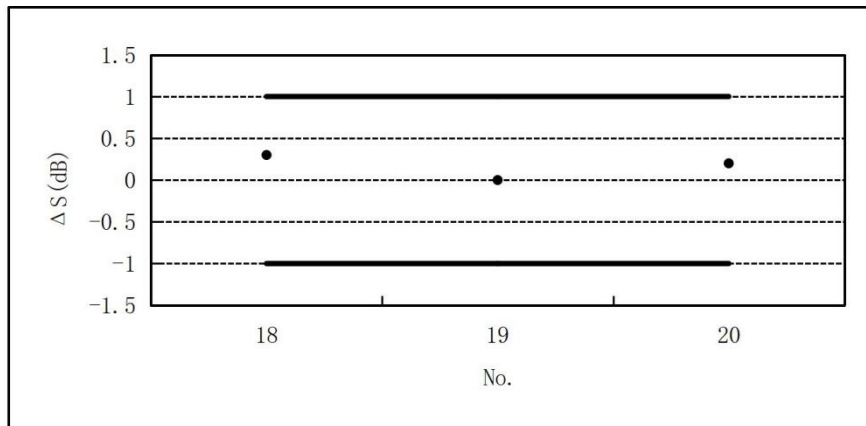


Figure 15: Receiver Sensitivity Variation in ESD Immunity Test

Table 15: Data of ESD Immunity Test (Class 4) (25°C)

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)
18	0.0	-17.7	-0.2	-17.4	-0.2	0.3
19	-1.0	-17.0	-1.3	-17.0	-0.3	0.0
20	-0.9	-18.2	-0.6	-18.0	0.3	0.2
Statistics						
AVE	-0.63	-17.63	-0.70	-17.47	-0.07	0.17
SD	0.45	0.49	0.45	0.41	0.26	0.12
MAX	0.00	-17.00	-0.20	-17.00	0.30	0.30
MIN	-1.00	-18.20	-1.30	-18.00	-0.30	0.00

5.10 Visual Inspection

Table 16: 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

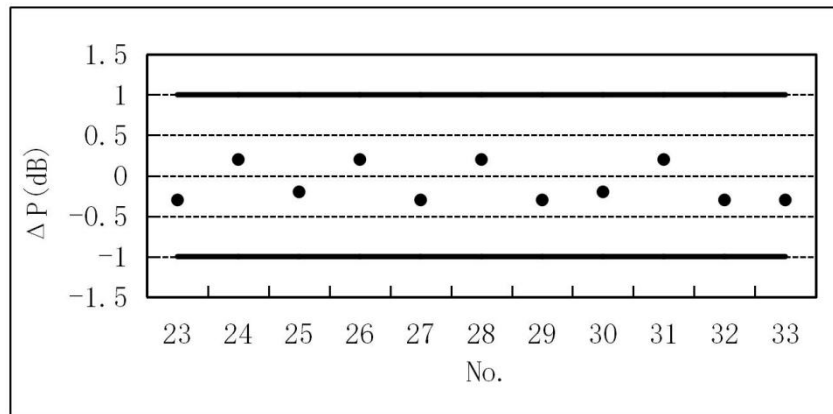


Figure 16: Optical Power Variation in Power Temperature Cycling Test(500cycles)

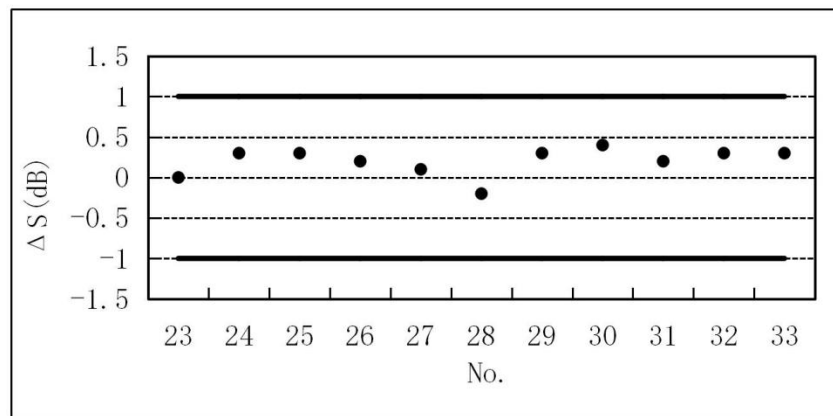


Figure 17: Receiver Sensitivity Variation in Power Temperature Cycling Test(500cycles)

Table 17: Data of Power Temperature Cycling Test (25°C)

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)
23	-0.9	-18.4	-1.2	-18.4	-0.3	0.0
24	-1.5	-18	-1.3	-17.7	0.2	0.3
25	-0.5	-17.6	-0.7	-17.3	-0.2	0.3
26	0.0	-17.6	0.2	-17.4	0.2	0.2
27	-0.2	-18	-0.5	-17.9	-0.3	0.1
28	-0.3	-17.6	-0.1	-17.8	0.2	-0.2
29	-0.2	-18.4	-0.5	-18.1	-0.3	0.3

30	0.8	-18	0.6	-17.6	-0.2	0.4
31	0.1	-18	0.3	-17.8	0.2	0.2
32	-0.6	-18	-0.9	-17.7	-0.3	0.3
33	-0.9	-18.4	-1.2	-18.1	-0.3	0.3
Statistics						
AVE	-0.38	-18.00	-0.48	-17.80	-0.10	0.20
SD	0.58	0.30	0.63	0.30	0.23	0.17
MAX	0.80	-17.60	0.60	-17.30	0.20	0.40
MIN	-1.50	-18.40	-1.30	-18.40	-0.30	-0.20

5.12 Powered Damp Heat Test

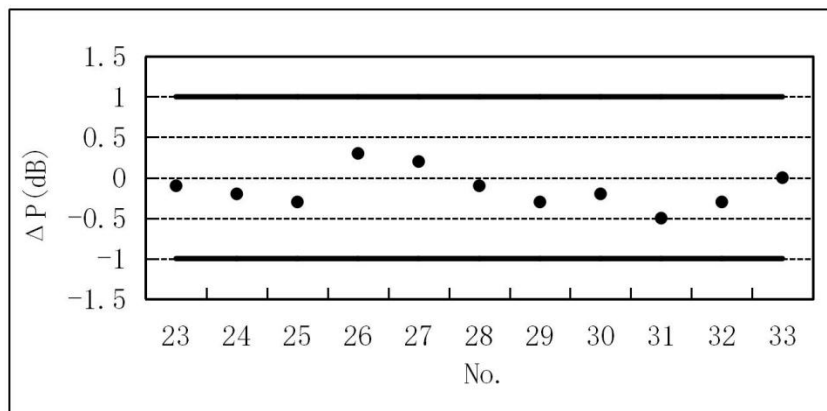


Figure 18: Optical Power Variation in Powered Damp Heat Test

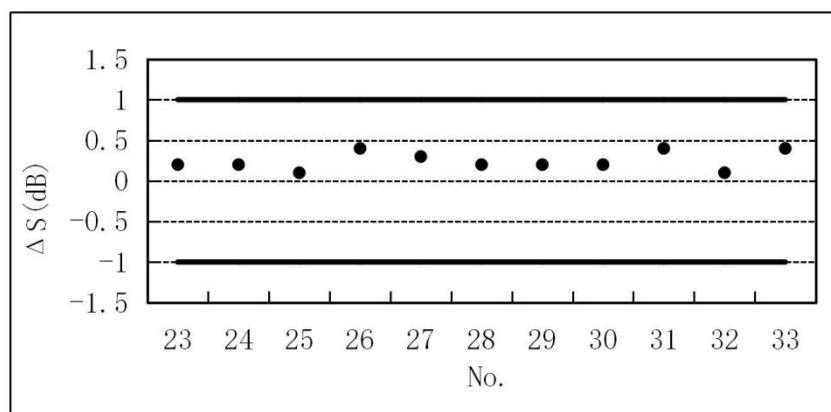


Figure 19: Receiver Sensitivity Variation in Powered Damp Heat Test

Table 18: Data of Powered Damp Heat Test (25°C)

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)
23	-1.2	-18.4	-1.3	-18.2	-0.1	0.2
24	-1.3	-17.7	-1.5	-17.5	-0.2	0.2
25	-0.7	-17.3	-1.0	-17.2	-0.3	0.1
26	0.2	-17.4	0.5	-17.0	0.3	0.4
27	-0.5	-17.9	-0.3	-17.6	0.2	0.3
28	-0.1	-17.8	-0.2	-17.6	-0.1	0.2
29	-0.5	-18.1	-0.8	-17.9	-0.3	0.2
30	0.6	-17.6	0.4	-17.4	-0.2	0.2
31	0.3	-17.8	-0.2	-17.4	-0.5	0.4
32	-0.9	-17.7	-1.2	-17.6	-0.3	0.1
33	-1.2	-18.1	-1.2	-17.7	0.0	0.4
Statistics						
AVE	-0.48	-17.80	-0.62	-17.55	-0.14	0.25
SD	0.63	0.30	0.66	0.31	0.22	0.11
MAX	0.60	-17.30	0.50	-17.00	0.30	0.40
MIN	-1.30	-18.40	-1.50	-18.20	-0.50	0.10

5.12 Accelerating Aging

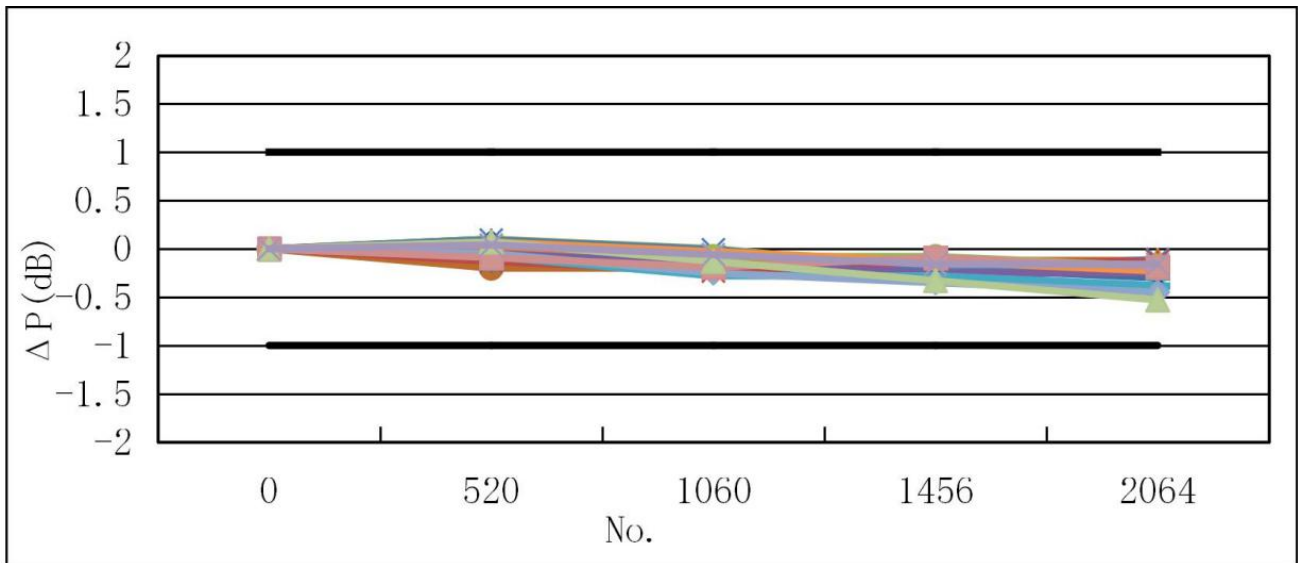


Figure 20: Optical Power Variation in Accelerating Aging Test (25°C)

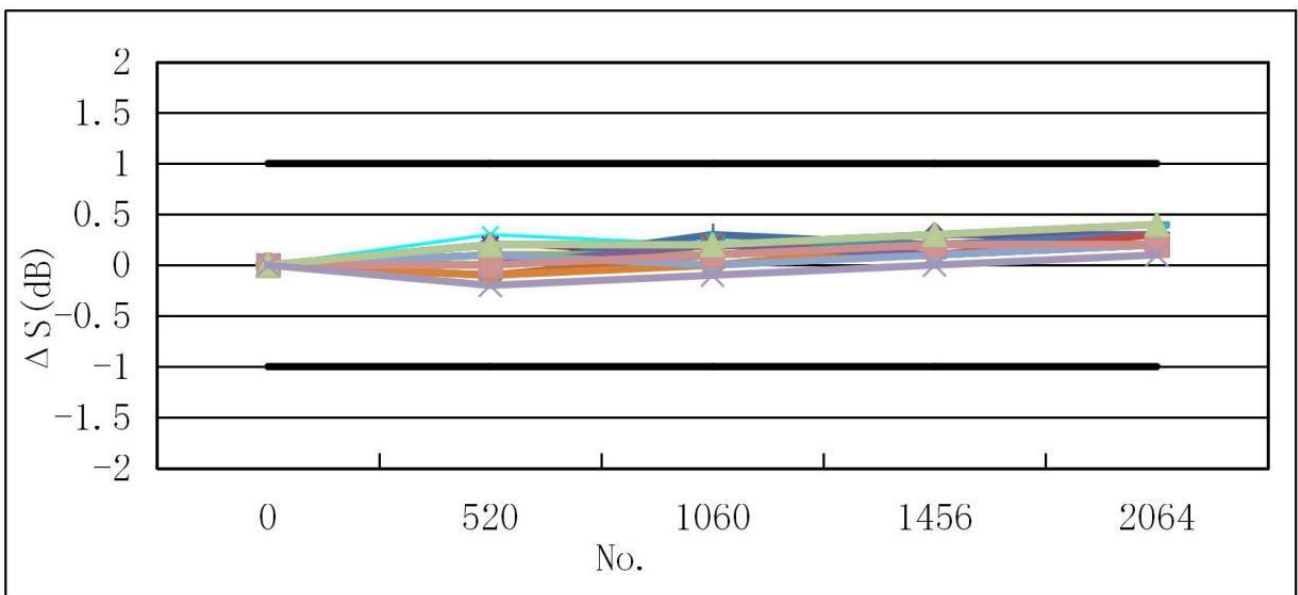


Figure 21: Receiver Sensitivity Variation in Accelerating Aging Test(25°C)

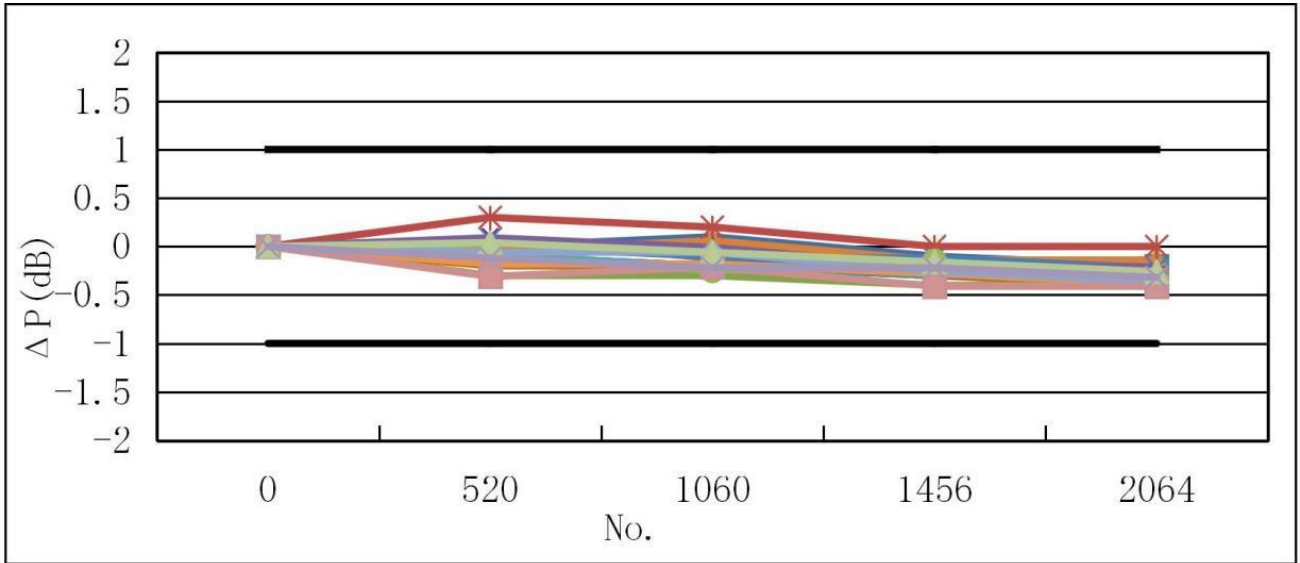


Figure 22: Optical Power Variation in Accelerating Aging Test (-40°C)

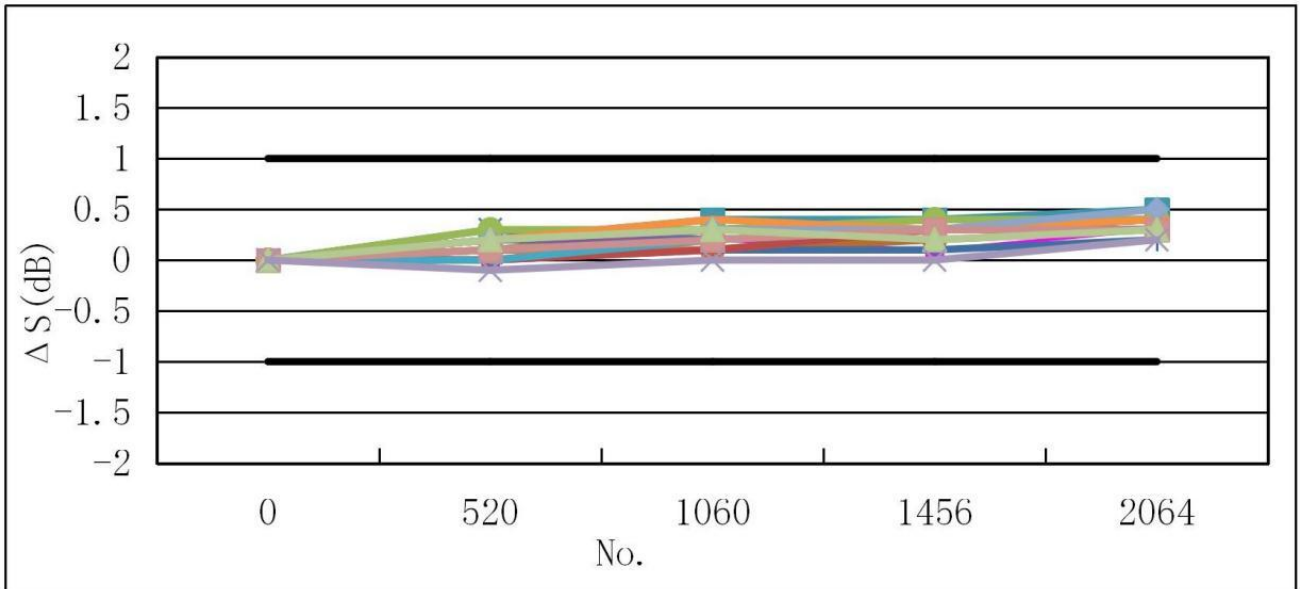


Figure 23: Receiver Sensitivity Variation in Accelerating Aging Test (-40°C)

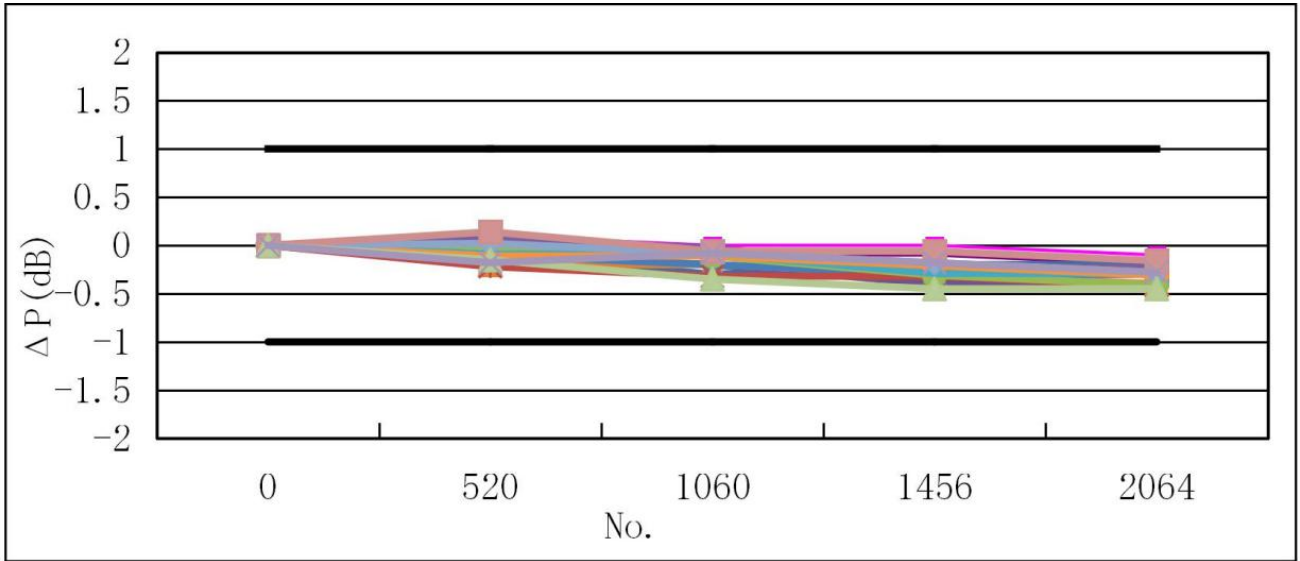


Figure 24: Optical Power Variation in Accelerating Aging Test (85°C)

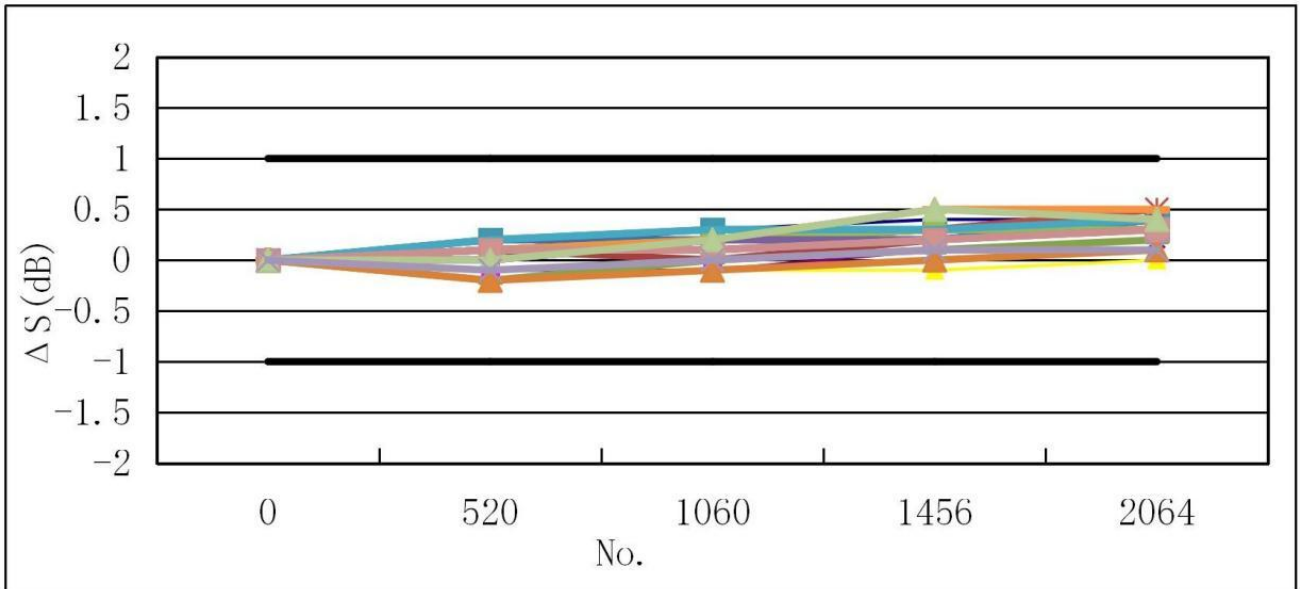


Figure 25: Receiver Sensitivity Variation in Accelerating Aging Test (85°C)

Table 19: Optical Power of Accelerating Aging Test (25°C)

Time (hrs)	23	24	25	26	27	28	29	30	31	32	33
0	-1.3	-1.5	-1	0.5	-0.3	-0.2	-0.8	0.4	-0.2	-1.2	-1.2
520	-1.2	-1.6	-1.1	0.3	-0.3	-0.4	-0.7	0.4	-0.1	-1.3	-1.3
1060	-1.4	-1.7	-1.1	0.3	-0.4	-0.4	-1	0.3	-0.2	-1.4	-1.3
1556	-1.4	-1.8	-1.2	0.2	-0.5	-0.3	-1	0.3	-0.4	-1.5	-1.4
2064	-1.5	-1.7	-1.2	0.1	-0.6	-0.4	-1.1	0.2	-0.4	-1.4	-1.4
Time (hrs)	34	35	36	37	38	39	40	41	42	43	44
0	0.4	-1.2	-0.4	-1.1	-0.9	-1.1	-0.6	-0.5	-1.0	-0.4	-0.1
520	0.4	-1.1	-0.5	-1.2	-0.9	-1.2	-0.5	-0.5	-1.1	-0.3	-0.1
1060	0.3	-1.2	-0.6	-1.2	-1.0	-1.4	-0.6	-0.7	-1.2	-0.5	-0.2
1056	0.3	-1.4	-0.5	-1.2	-1.1	-1.4	-0.7	-0.8	-1.1	-0.7	-0.3
2064	0.3	-1.3	-0.5	-1.3	-1.1	-1.5	-0.8	-0.9	-1.2	-0.9	-0.3

Table 20: Receiver Sensitivity of Accelerating Aging Test (25°C)

Time (hrs)	23	24	25	26	27	28	29	30	31	32	33
0	-18.2	-17.5	-17.2	-17	-17.6	-17.6	-17.9	-17.4	-17.4	-17.6	-17.7
520	-18	-17.6	-17.2	-16.7	-17.4	-17.7	-17.9	-17.4	-17.5	-17.4	-17.7
1060	-18	-17.5	-17	-16.8	-17.5	-17.5	-17.6	-17.2	-17.4	-17.4	-17.5
1556	-17.9	-17.3	-17	-16.8	-17.4	-17.4	-17.7	-17.2	-17.3	-17.3	-17.5
2064	-18	-17.3	-16.9	-16.7	-17.3	-17.4	-17.7	-17.1	-17.2	-17.3	-17.5
Time (hrs)	34	35	36	37	38	39	40	41	42	43	44
0	-16.4	-17.1	-18.4	-18.0	-18.2	-17.2	-18.3	-18.2	-17.5	-18.5	-16.8
520	-16.5	-17.0	-18.4	-17.9	-18.2	-17.0	-18.3	-18.1	-17.5	-18.3	-17.0
1060	-16.4	-17.0	-18.2	-17.9	-18.0	-17.0	-18.2	-18.2	-17.4	-18.3	-16.9
1556	-16.2	-16.9	-18.3	-17.8	-18.1	-16.9	-18.1	-18.1	-17.3	-18.2	-16.8
2064	-16.2	-16.8	-18.1	-17.8	-18.0	-16.8	-18.1	-18.0	-17.3	-18.1	-16.7

Table 21: Optical Power of Accelerating Aging Test (-40°C)

Time (hrs)	23	24	25	26	27	28	29	30	31	32	33
0	0.0	-0.5	0.3	1.3	0.8	1.0	0.9	1.4	1.1	0.5	-0.3
520	-0.1	-0.7	0.3	1.1	0.9	0.8	0.9	1.3	0.8	0.5	-0.4
1060	-0.2	-0.7	0.2	1.1	0.7	0.8	1.0	1.2	0.8	0.4	-0.5
1556	-0.2	-0.8	0.1	0.9	0.6	0.7	0.8	1.1	0.7	0.2	-0.6
2064	-0.2	-0.9	0	1.0	0.6	0.6	0.7	1.1	0.7	0.2	-0.5
Time (hrs)	34	35	36	37	38	39	40	41	42	43	44
0	1.5	-0.1	-1.6	0.9	0.3	0.5	0.0	-0.4	0.4	1.2	0.9
520	1.5	0.0	-1.3	0.8	0.4	0.4	-0.2	-0.5	0.1	1.2	0.8
1060	1.6	-0.2	-1.4	0.6	0.3	0.3	-0.2	-0.5	0.2	1.1	0.7
1556	1.4	-0.2	-1.6	0.7	0.1	0.3	-0.3	-0.7	0.0	1.0	0.7
2064	1.4	-0.3	-1.6	0.5	0.1	0.2	-0.4	-0.8	0.0	0.9	0.6

Table 22: Receiver Sensitivity of Accelerating Aging Test (-40°C)

Time (hrs)	23	24	25	26	27	28	29	30	31	32	33
0	-17.4	-17.8	-17.8	-17.4	-17.9	-17.7	-18.3	-17.9	-17.7	-18.0	-18.0
520	-17.2	-17.8	-17.5	-17.3	-17.6	-17.6	-18.3	-17.7	-17.6	-18.0	-17.8
1060	-17.2	-17.6	-17.6	-17.2	-17.7	-17.6	-18.2	-17.7	-17.4	-17.8	-17.6
1556	-17.1	-17.7	-17.5	-17.0	-17.5	-17.5	-18.2	-17.6	-17.3	-17.7	-17.6
2064	-17.0	-17.5	-17.5	-17.0	-17.4	-17.4	-18.1	-17.5	-17.3	-17.7	-17.5
Time (hrs)	34	35	36	37	38	39	40	41	42	43	44
0	-17.0	-17.9	-18.6	-18.8	-18.4	-18.8	-18.5	-19.2	-18.7	-19.0	-17.5
520	-16.9	-17.6	-18.6	-18.5	-18.2	-18.8	-18.3	-19.0	-18.6	-18.8	-17.6
1060	-16.9	-17.7	-18.5	-18.5	-18.2	-18.6	-18.1	-18.9	-18.5	-18.7	-17.5
1556	-16.7	-17.6	-18.3	-18.4	-18.1	-18.5	-18.2	-18.9	-18.4	-18.8	-17.5
2064	-16.6	-17.5	-18.3	-18.4	-18.1	-18.4	-18.1	-18.7	-18.4	-18.7	-17.3

Table 23: Optical Power of Accelerating Aging Test (85°C)

Time (hrs)	23	24	25	26	27	28	29	30	31	32	33
0	-3.3	-3.7	-3.5	-2.0	-2.5	-2.6	-2.5	-1.4	-2.5	-2.4	-2.7
520	-3.4	-3.6	-3.7	-2.1	-2.4	-2.5	-2.6	-1.4	-2.4	-2.5	-2.7
1060	-3.5	-3.7	-3.8	-2.3	-2.6	-2.7	-2.8	-1.5	-2.6	-2.6	-2.8
1556	-3.5	-3.7	-3.8	-2.3	-2.6	-2.8	-2.7	-1.6	-2.7	-2.8	-2.9
2064	-3.6	-3.8	-3.9	-2.4	-2.7	-2.9	-2.7	-1.7	-2.8	-2.8	-3.0
Time (hrs)	34	35	36	37	38	39	40	41	42	43	44
0	-0.7	-1.4	-2.3	-1.0	-1.7	-2.0	-2.1	-1.8	-1.9	-1.6	-1.1
520	-0.9	-1.5	-2.5	-1.0	-1.6	-2.1	-2.2	-1.8	-1.8	-1.7	-1.3
1060	-0.9	-1.6	-2.6	-1.1	-1.7	-2.1	-2.2	-1.9	-2.0	-1.9	-1.2
1556	-1.0	-1.7	-2.6	-1.3	-1.9	-2.3	-2.3	-2.0	-2.0	-2.0	-1.3
2064	-1.1	-1.7	-2.7	-1.4	-1.9	-2.3	-2.4	-2.1	-2.1	-2.0	-1.4

Table 24: Receiver Sensitivity of Accelerating Aging Test (85°C)

Time (hrs)	23	24	25	26	27	28	29	30	31	32	33
0	-16.9	-16.3	-15.7	-15.9	-16.0	-15.9	-16.7	-16.5	-15.8	-16.3	-16.6
520	-16.8	-16.4	-15.9	-15.9	-16.1	-15.8	-16.5	-16.4	-16.0	-16.2	-16.4
1060	-16.6	-16.3	-15.8	-15.7	-16.1	-15.7	-16.5	-16.5	-15.8	-16.2	-16.3
1556	-16.5	-16.1	-15.8	-15.6	-15.9	-15.6	-16.4	-16.3	-15.7	-16.1	-16.3
2064	-16.5	-16.0	-15.7	-15.5	-15.8	-15.6	-16.3	-16.1	-15.6	-15.9	-16.2
Time (hrs)	34	35	36	37	38	39	40	41	42	43	44
0	-15.5	-16.6	-17.2	-16.8	-16.6	-16.0	-17.1	-17.1	-16.3	-17.3	-16.0
520	-15.7	-16.5	-17.2	-16.7	-16.6	-15.8	-17.0	-17.0	-16.2	-17.3	-16.1
1060	-15.6	-16.4	-17.0	-16.6	-16.4	-15.7	-16.9	-17.0	-16.2	-17.1	-16.0
1556	-15.5	-16.4	-16.9	-16.5	-16.4	-15.7	-16.6	-16.9	-16.1	-16.8	-15.9
2064	-15.4	-16.2	-16.7	-16.5	-16.3	-15.6	-16.6	-16.8	-16.0	-16.9	-15.9

5.14 Cage/Connector & Transceiver Match

Table 25: Optical Output Power in Cage/Connector & Transceiver Match

No.	Before Test	After Test				
		25times	50times	75times	100times	125times
23	-1.5	-1.3	-1.7	-1.7	-1.5	-1.7
24	-1.7	-1.9	-1.6	-2.0	-1.9	-2.0
25	-1.2	-1.4	-1.3	-1.5	-1.1	-1.4
26	0.8	0.9	0.7	0.6	0.6	0.5
27	-0.6	-0.7	-0.8	-0.6	-0.8	-0.8
28	-0.4	-0.3	-0.5	-0.6	-0.5	-0.7
29	-1.1	-1.2	-1.0	-1.3	-1.4	-1.2
30	0.2	0.2	0.0	0.1	0.1	0.0
31	-0.4	-0.6	-0.6	-0.4	-0.7	-0.5
32	-1.4	-1.4	-1.6	-1.7	-1.5	-1.5
33	-1.4	-1.3	-1.7	-1.5	-1.6	-1.8

No.	After Test			Before and After Test Variation		
	150times	175times	200times	MAX.	MIN.	$ \Delta P_O $ (dB)
23	-1.8	-1.9	-1.8	-1.3	-1.9	0.6
24	-2.1	-1.8	-2.0	-1.6	-2.1	0.5
25	-1.3	-1.3	-1.4	-1.1	-1.5	0.4
26	0.4	0.4	0.5	0.9	0.4	0.5
27	-0.7	-0.8	-0.9	-0.6	-0.9	0.3
28	-0.6	-0.7	-0.8	-0.3	-0.8	0.5
29	-1.4	-1.3	-1.2	-1.0	-1.4	0.4
30	-0.1	0	0	0.2	-0.1	0.3
31	-0.6	-0.7	-0.7	-0.4	-0.7	0.3
32	-1.7	-1.7	-1.8	-1.4	-1.8	0.4

33	-1.5	-1.8	-1.7	-1.3	-1.8	0.5
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5.15 Insertion/Extraction/Retention Test

No.	Insertion Force (N)	Extraction force (N)	Retention force (N)
23	11.0	8.0	110.0
24	10.1	6.8	110.9
25	9.0	6.1	109.1
26	9.2	6.2	107.8
27	10.1	6.3	111.9
28	10.4	6.5	110.5
29	9.2	6.1	112.1
30	9.8	7.4	100.90
31	8.7	6.2	113.2
32	9.4	6.7	114.2
33	10.5	7.2	110.1
AVE (N)	9.76	6.68	109.75
MAX (N)	0.69	0.59	3.38
MIN (N)	11.00	8.00	114.20