

# Transceiver Reliability

## **TEST Report**

Model name : QDD-DR4-400G-Si

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## 1. Overview

This document contains results of reliability tests for 400G QSFP-DD DR4 silicon photonics transceivers conducted under environmental conditions that are defined in Telcordia GR-468-CORE& MIL-STD-883.

Specifically, the following tests were carried out on the 400G QSFP-DD DR4 silicon photonics transceivers:

- Damp Heat Non Operation
- Temperature Cycling Non Operation
- Mechanical Shock
- Vibration
- High Temperature Operating Life
- Damp Heat Operation
- Thermal Shock
- Cyclic Moisture Resistance
- High Temperature Storage
- Low Temperature Storage
- ESD (HBM)

## 2. Test Conditions

The test conditions are stipulated by the Telcordia reliability testing recommendations and are shown below.

Environmental and Mechanical Tests	Test Conditions	Test Interval	Telcordia Standard
Damp Heat Non Operation	85°C, 85% RH Duration: 500hrs	Before, 168hrs, 500hrs,	GR-468-Core
Temperature Cycling Non Operation	-40°C to + 85°C, 500 cycles	Before, 100cycles, 250cycles, 500cycles	GR-468-Core
Mechanical Shock	500G, 1ms, 5 times/axis, 3 axes, 2 directions/axes	Before, After	MIL-STD-883
Vibration	Condition A (20g), 20 to 2000Hz, 4 min/cycle, 4ycle/axis, 3 axes	Before, After	MIL-STD-883
High Temperature Operating Life	70°C case Duration: 2000hrs	Before, 168hrs, 500hrs, 1000hrs, 2000hrs	GR-468-Core
Damp Heat Operation	70°C, 85%RH Duration: 1000hrs	Before, 168hrs, 500hrs, 1000hrs	GR-468-Core
Thermal Shock	-40°C to 85°C, 20 cycles	Before, After	MIL-STD-883
Cyclic Moisture Resistance	20 cycles	Before, After	MIL-STD-883
High Temperature Storage	85°C, Duration: 2000hrs	Before, 168hrs, 500hrs, 1000hrs, 2000hrs	GR-468-Core
Low Temperature Storage	-40°C, Duration: 72hrs	Before, After	GR-468-Core
ESD (HBM)	1kV HSL / 2kV LSL	Before, After	GR-468-Core

### 3. Sample Size and Group Description

All samples were grouped for different tests as shown in table below. No failure is allowed for each group.

Group	Quantity	Test
A	11pcs	Damp Heat Non Operation
B	11pcs	Temperature Cycling Non Operation
C	11pcs	Vibration
D	11pcs	Mechanical Shock
		Thermal Shock
		Low Temperature Storage
		Cyclic Moisture Resistance
		High Temperature Operating Life
E	11pcs	Damp Heat Operation
F	11pcs	High Temperature Storage
G	6pcs	ESD (HBM)

## 4. Equipment Used

Test	Equipment	Manufacturer
Damp Heat Non Operation	Temperature Humidity chamber	SUNTECK
Temperature Cycling Non Operation	Programmable temperature chamber	TOMILO
Mechanical Shock	Mechanical impact test bench	SUSHI
Vibration	Electromagnetic vibration test bench	SUSHI
High Temperature Operating Life	Temperature chamber	SUNTECK
Damp Heat Operation	Temperature Humidity chamber	SUNTECK
Thermal Shock	Thermal shock tester	ESPEC
Cyclic Moisture Resistance	Programmable temperature humidity chamber	TERCHY
High Temperature Storage	Temperature chamber	SUNTECK
Low Temperature Storage	Temperature chamber	SUNTECK
ESD (HBM)	ESD Simulator	ETS

## 5. Pass Criteria

All samples were tested for AOP, extinction ratio (ER) and Rx sensitivity (Sen). The following criteria were used for these parameters.

- $|\Delta AOP| \leq 1\text{dB}$
- $|\Delta ER| \leq 1\text{dB}$
- $|\Delta Sen| \leq 1\text{dB}$

## 6. Summary of Test Results

Group	Environmental & Mechanical Tests	Pass/Fail
A	Damp Heat Non Operation	Pass
B	Temperature Cycling Non Operation	Pass
C	Vibration	Pass
	Mechanical Shock	Pass
	Thermal Shock	Pass
	Low Temperature Storage	Pass
	Cyclic Moisture Resistance	Pass
D	High Temperature Operating Life	Pass
E	Damp Heat Operation	Pass
F	High Temperature Storage	Pass
G	ESD (HBM)	Pass

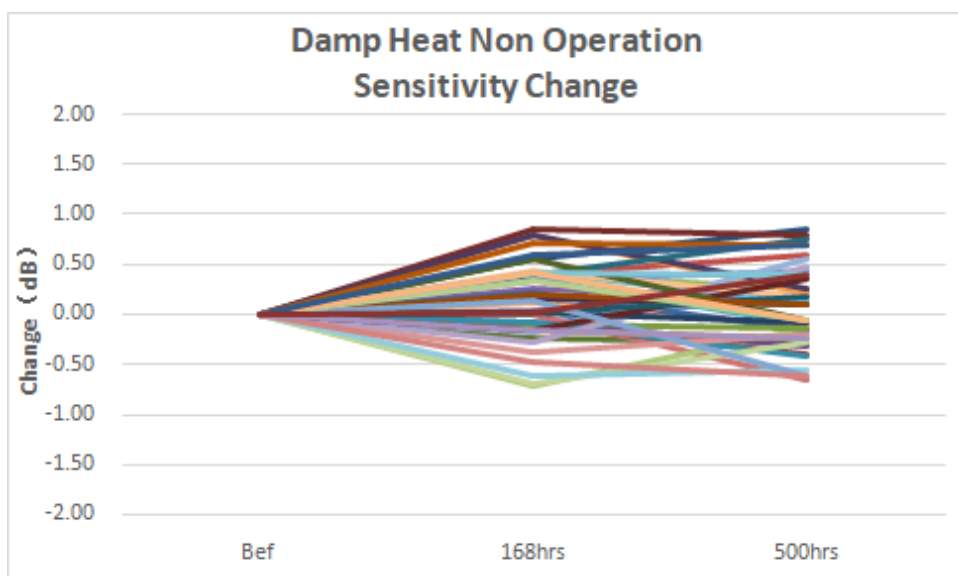
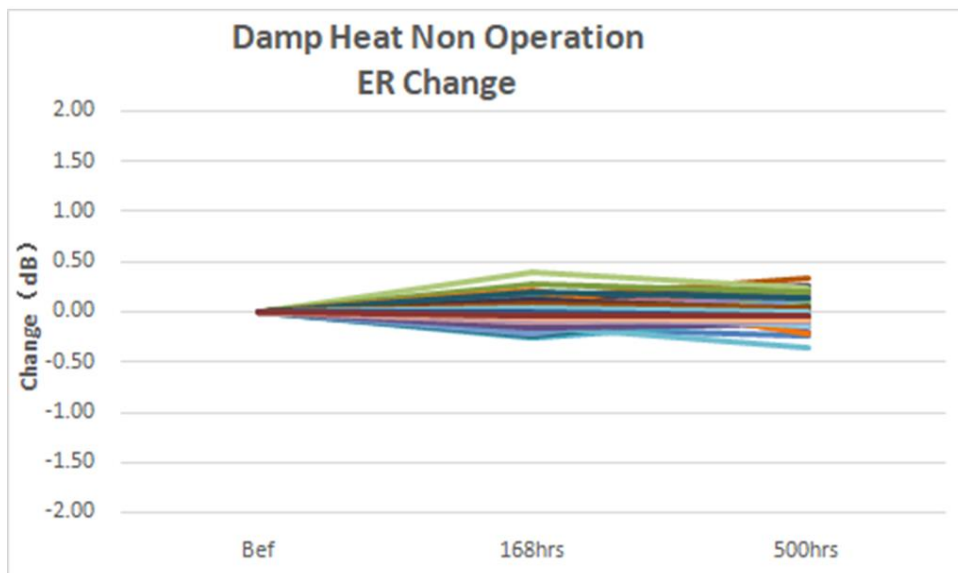
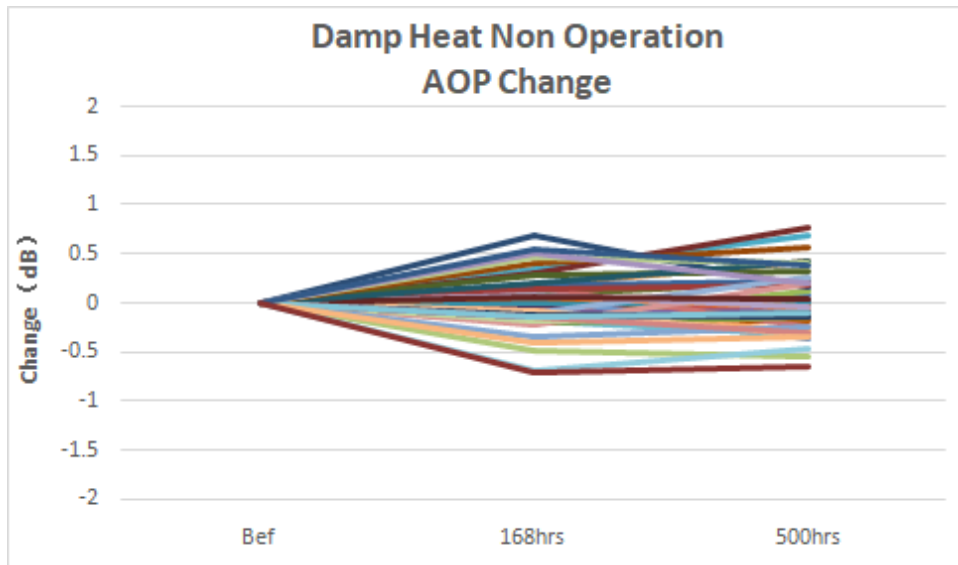
## 7. Conclusions

The 400G QSFP-DD DR4 silicon photonics transceivers were subjected to Telcordia GR-468-CORE& MIL-STD-883 tests, which included damp heat non operation, temperature cycling non operation, mechanical shock, vibration, high temperature operating life, damp heat operation, thermal shock, high temperature storage, low temperature storage, cyclic moisture resistance and ESD (HBM). All samples passed the criteria as outlined in Section 5 of this report.

## 8. Attachments

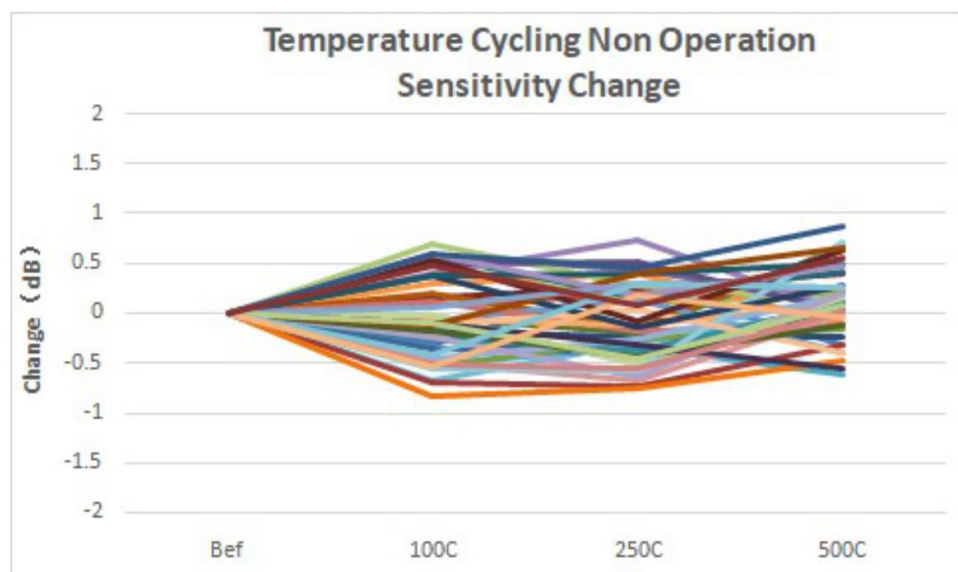
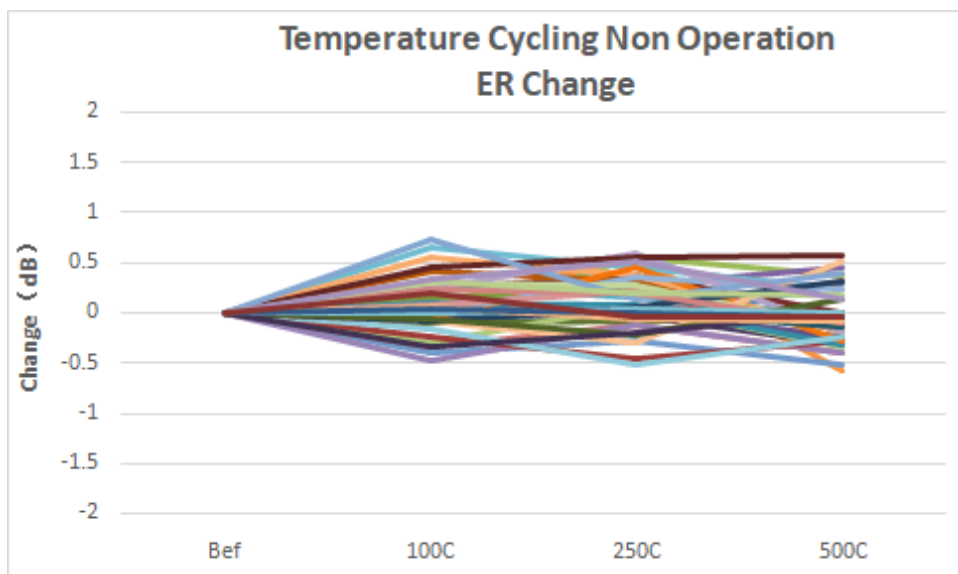
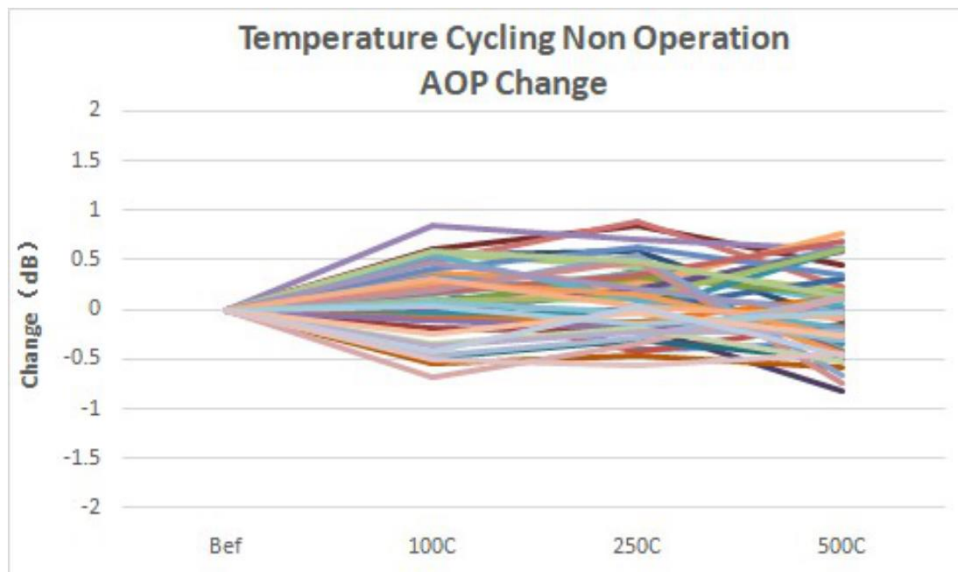
Test Data in Graphs are as follows.

## 8.1 Damp Heat Non Operation

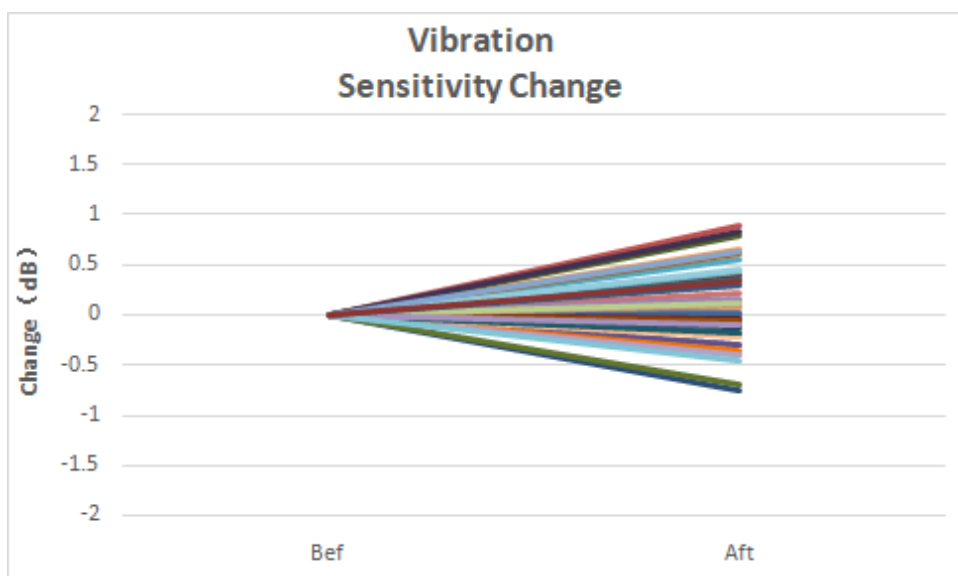
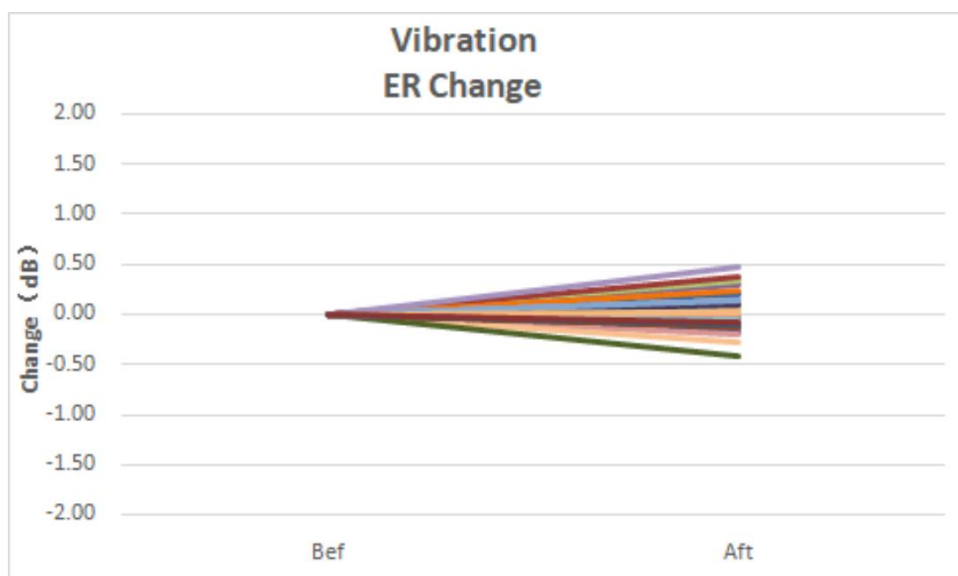
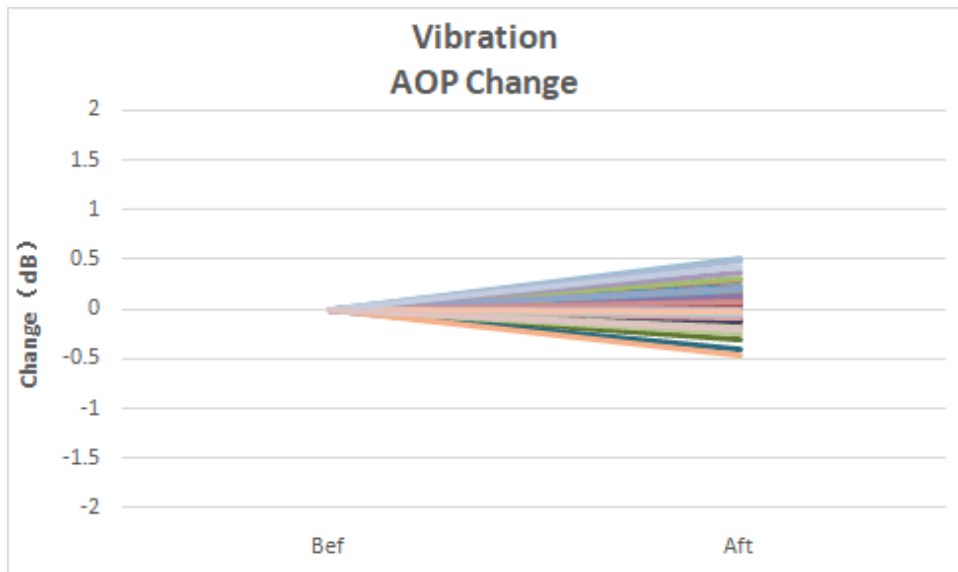




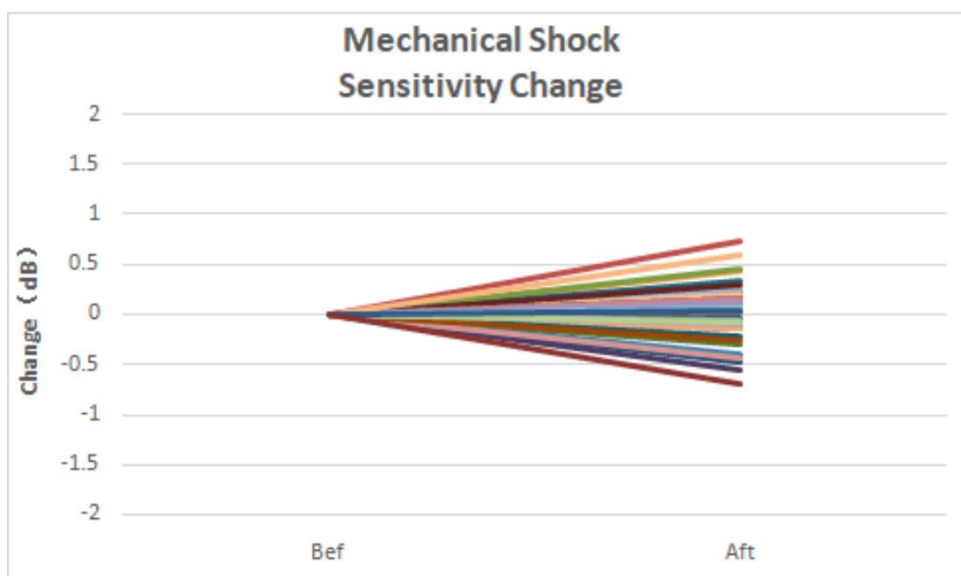
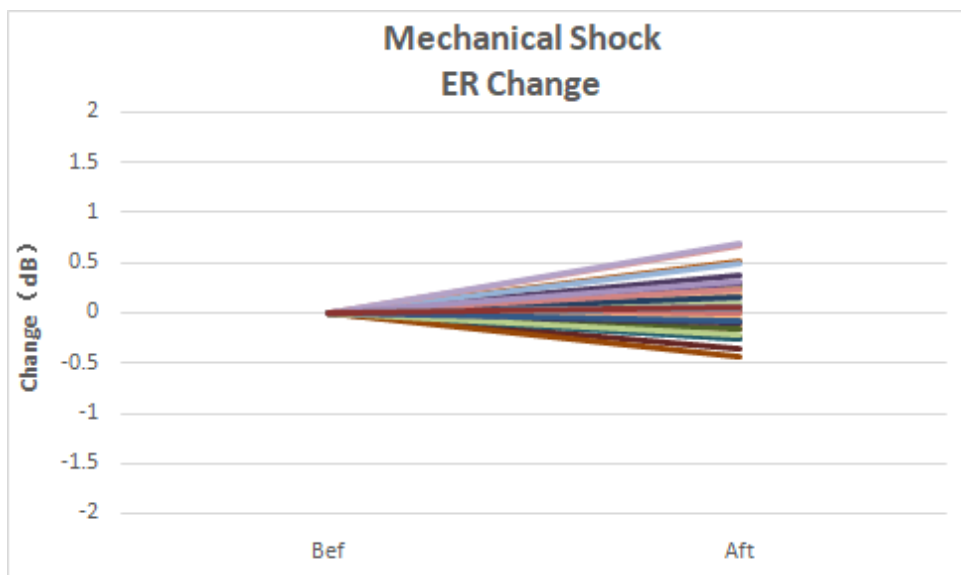
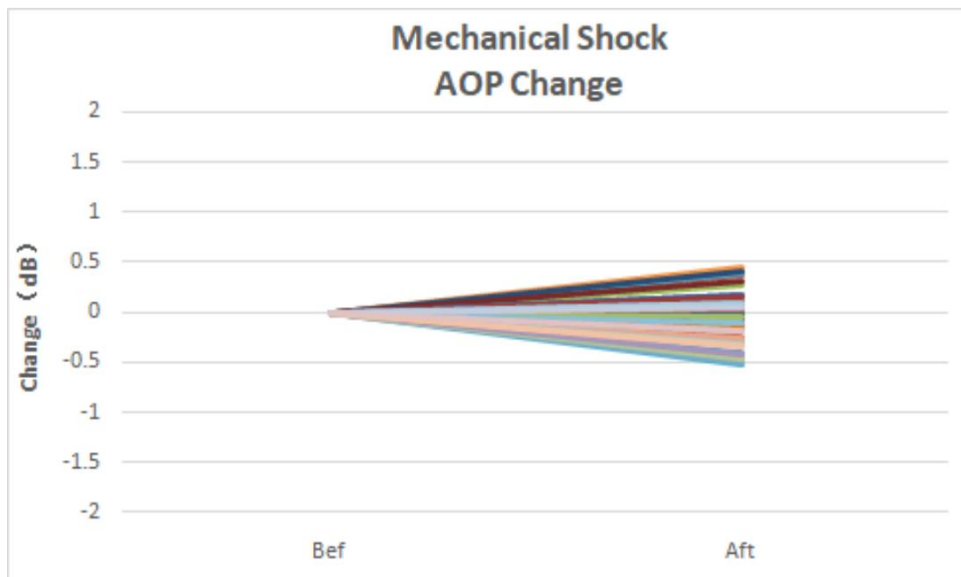
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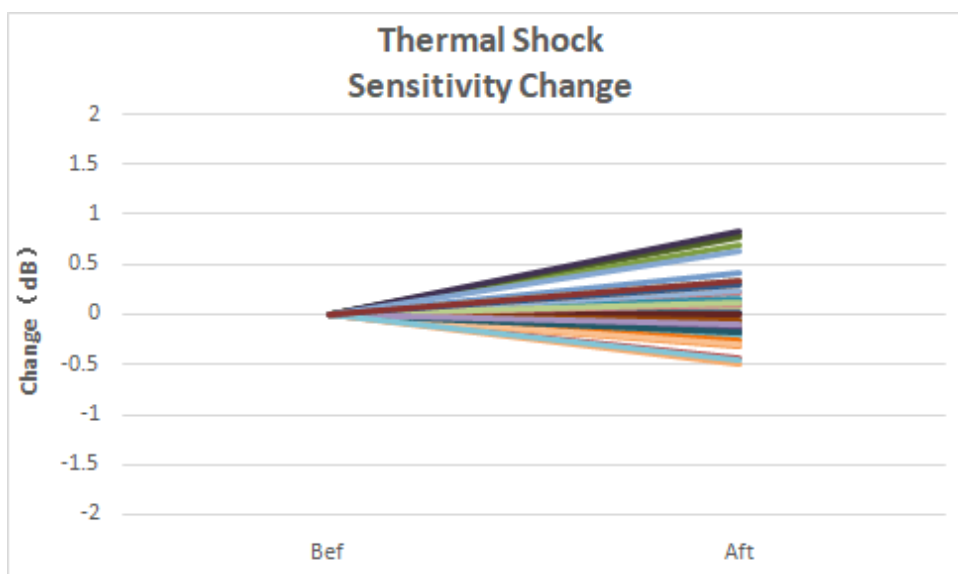
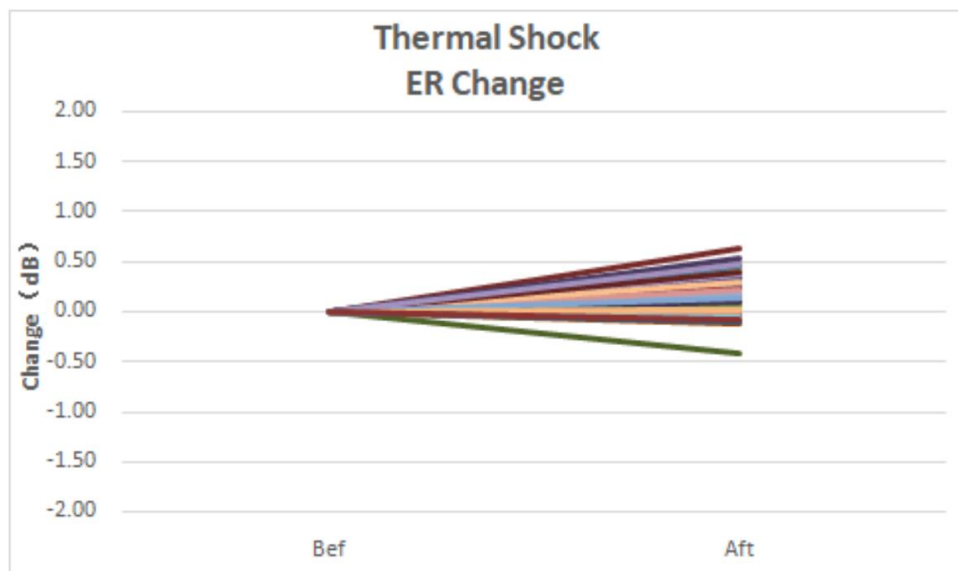
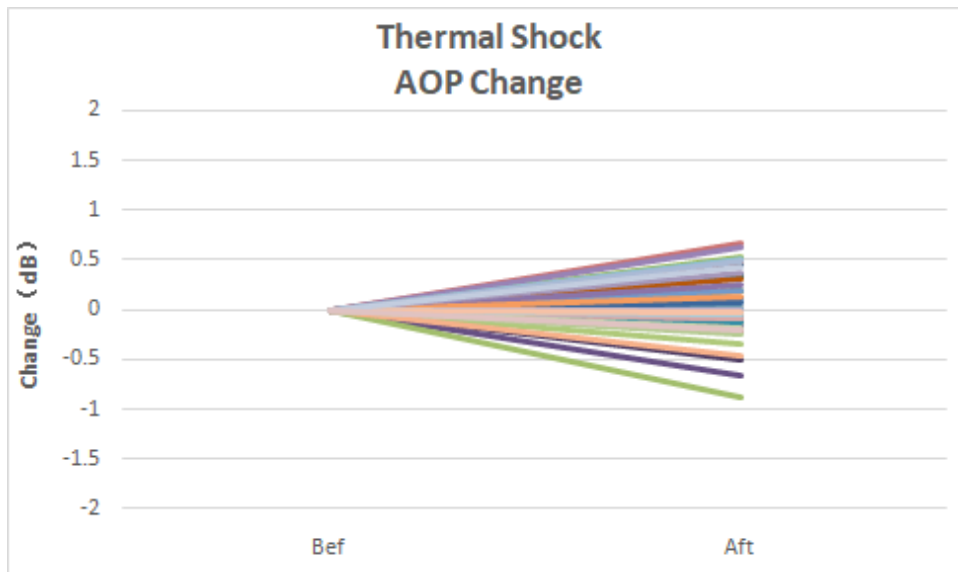
### 8.3 Vibration



## 8.4 Mechanical Shock

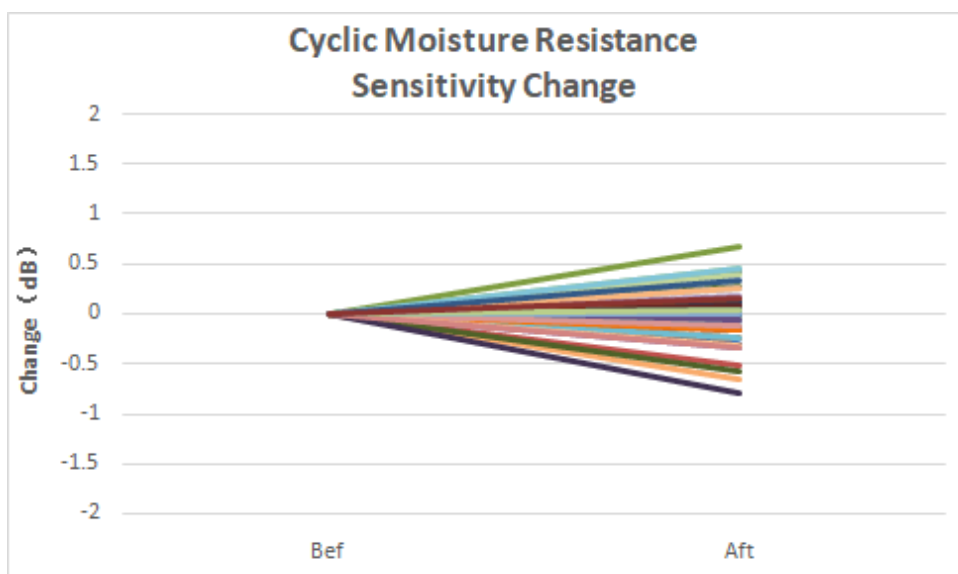
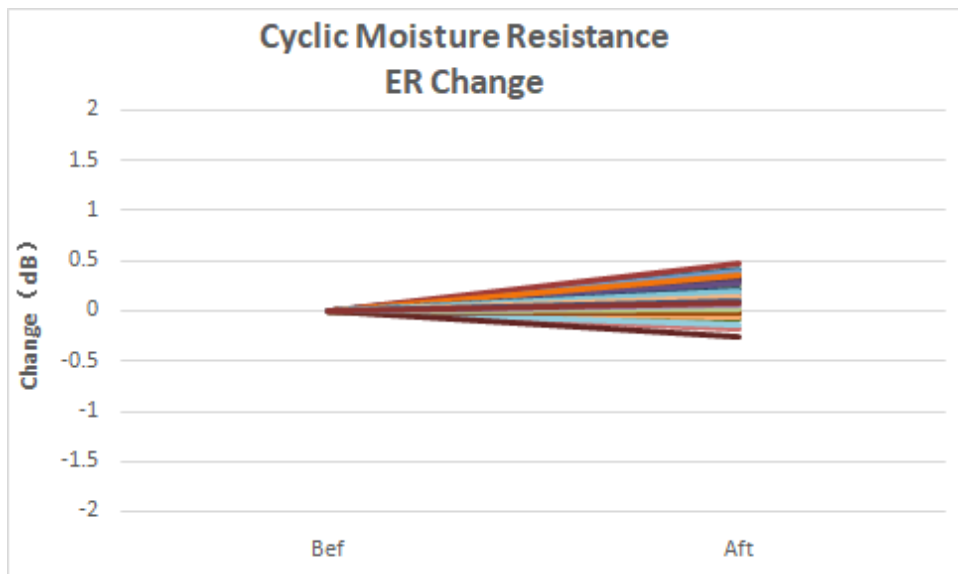
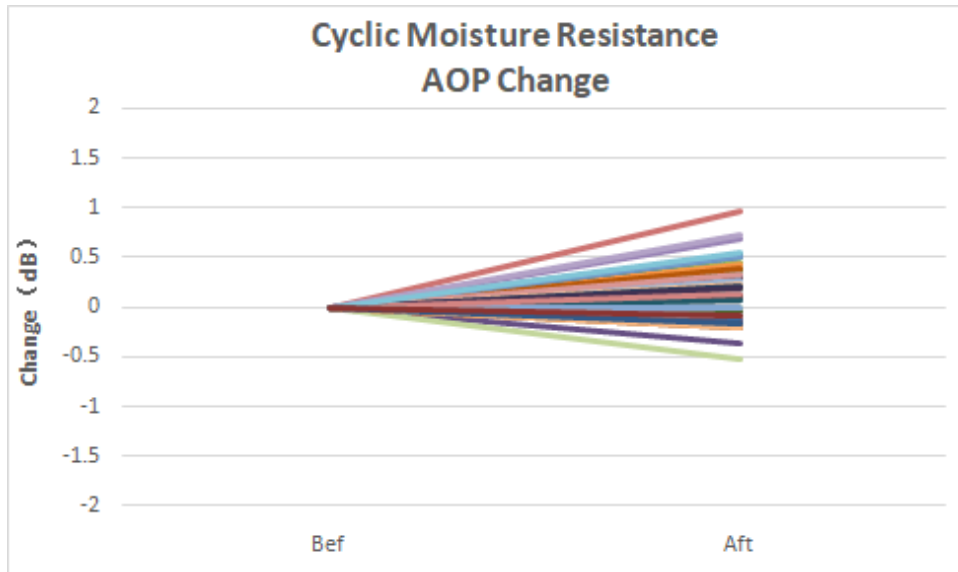


## 8.5 Thermal Shock

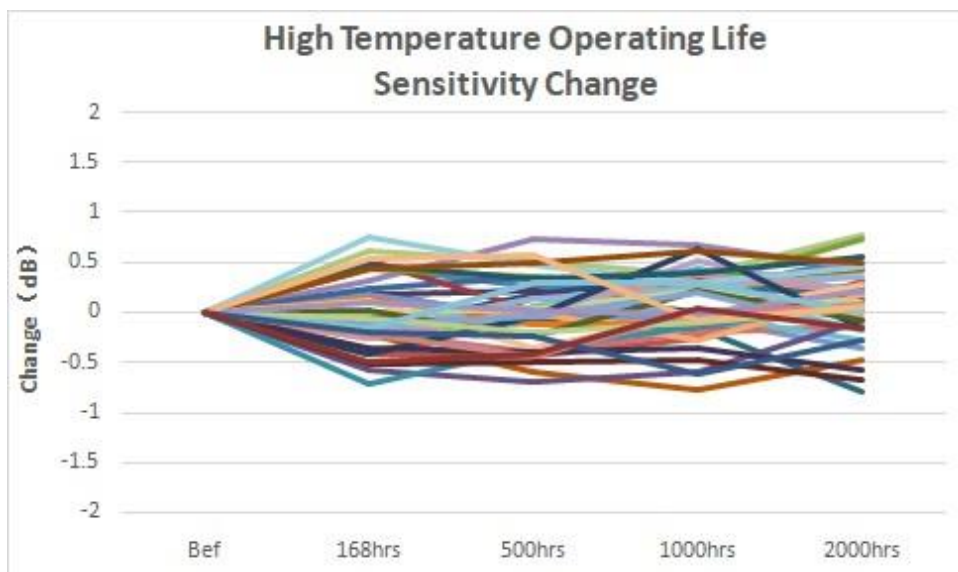
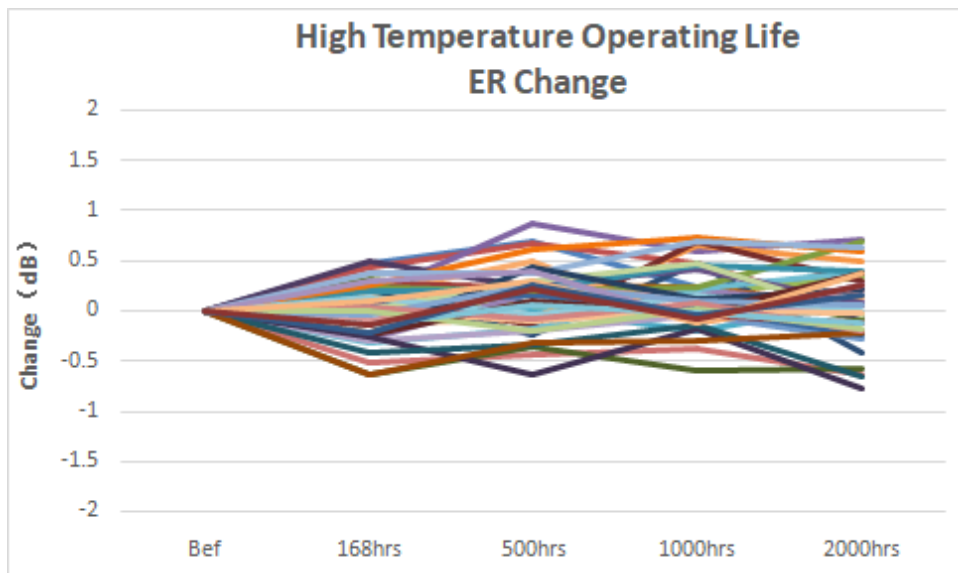
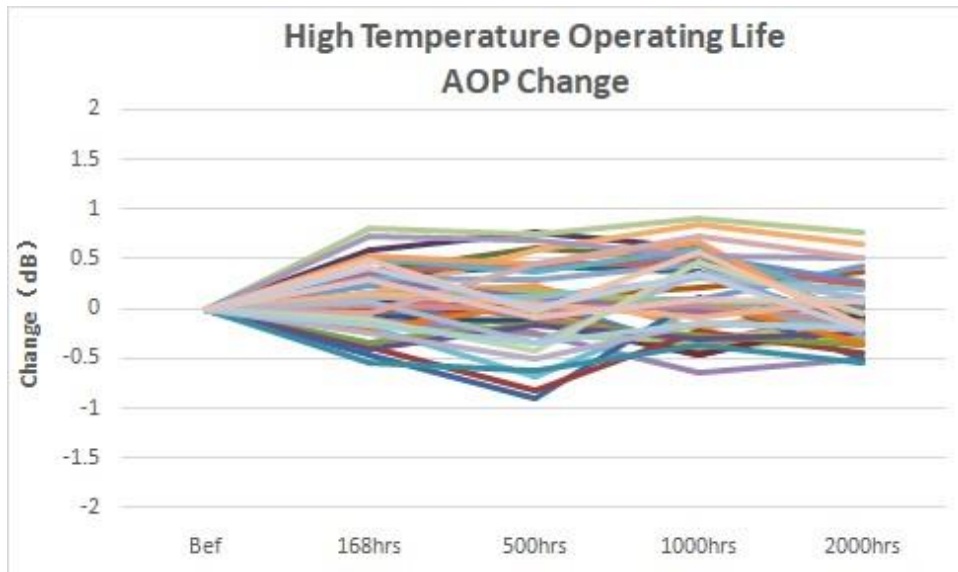




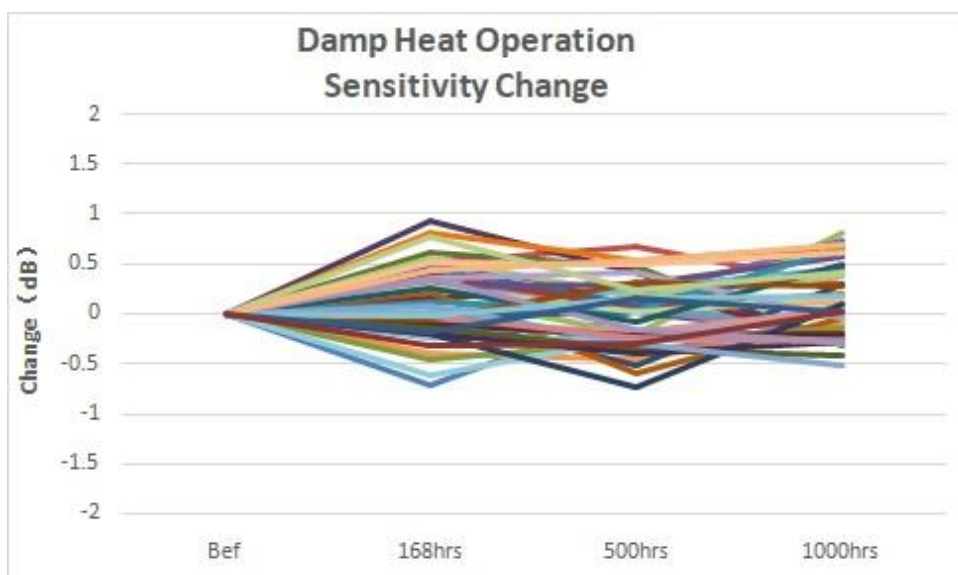
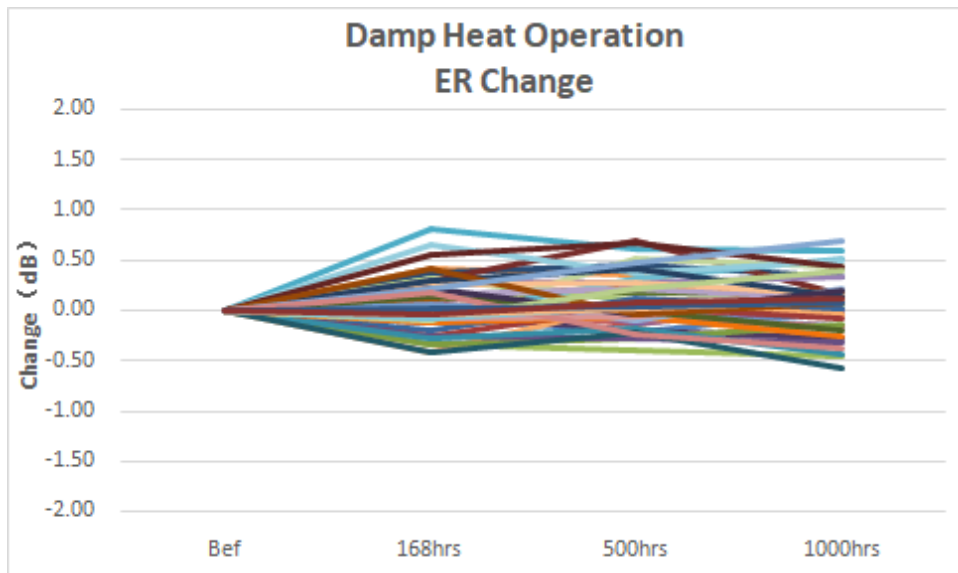
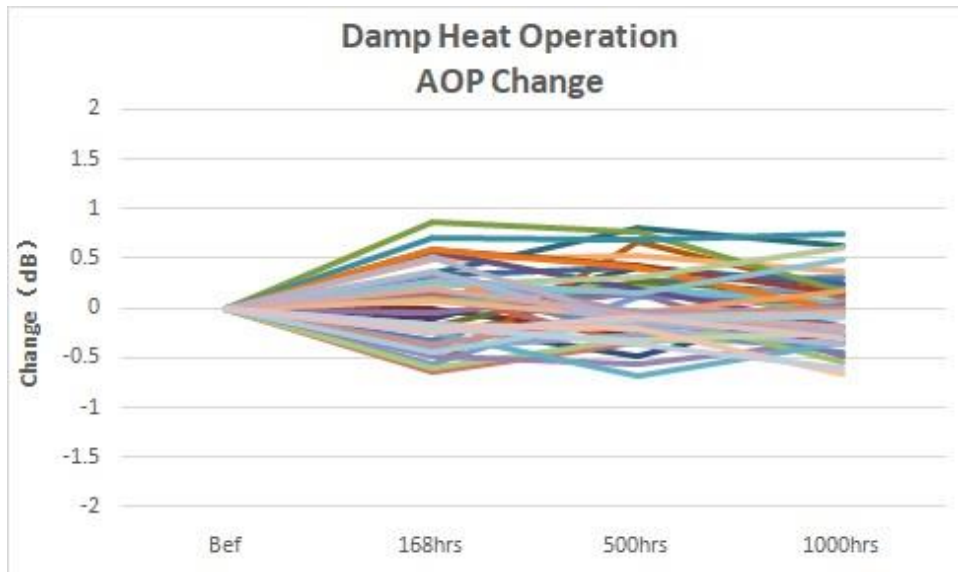
### 8.7 Cyclic Moisture Resistance



## 8.8 High Temperature Operating Life

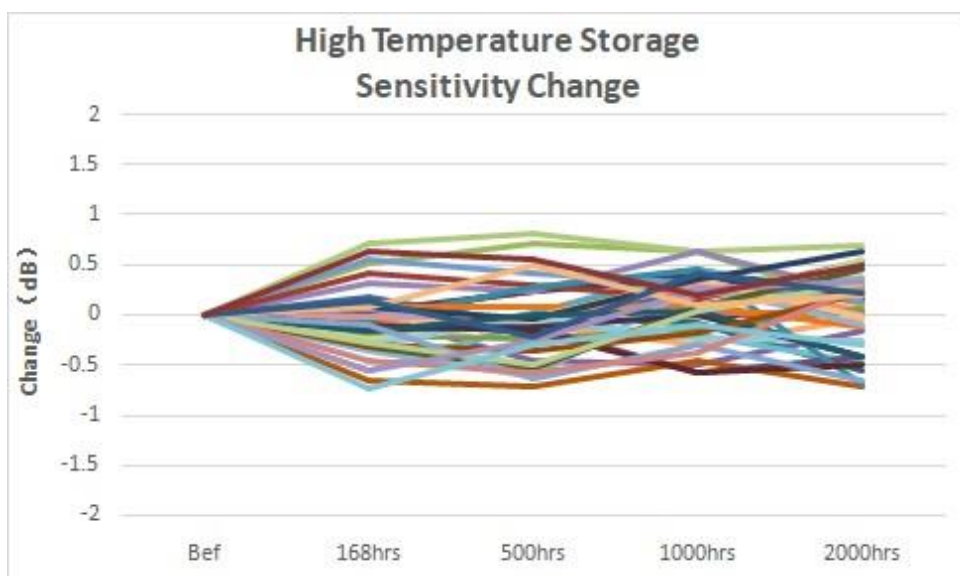
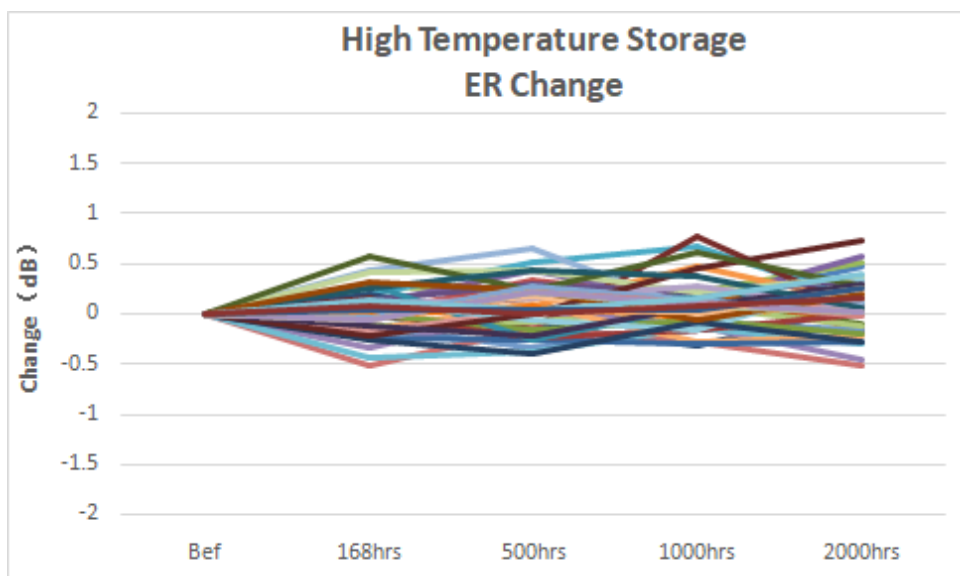
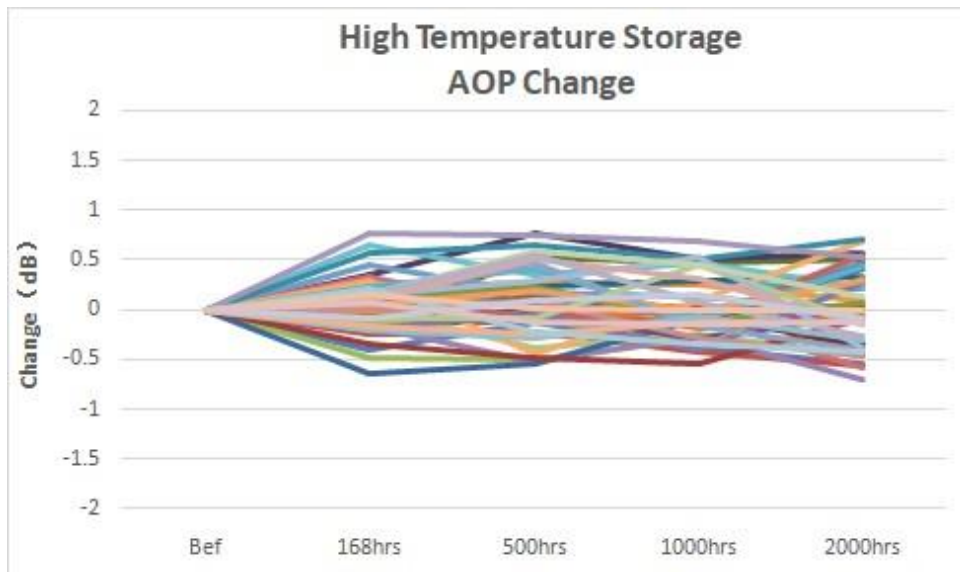


### 8.9 Damp Heat Operation





### 8.10 High Temperature Storage Test



### 8.11 ESD (HBM)

