

QUALIFICATION CERTIFICATE

NanoPower BPX

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1. Introduction

1.1 Purpose

This document describes the environmental qualification tests carried out on the following product:

- 200239 – NanoPower BPX

In the following sections, the tests and the corresponding test results are described.

1.2 References Standards

Table 1 presents the tests included in the Qualification Program with reference to ECSS documentation.

Table 1: Reference Standards

Test		ECSS/ESCC Reference
Structural and Mechanical	Random Vibration	ECSS-E-ST-10-03C
	Sinusoidal Vibration	ECSS-E-ST-10-03C
	Mechanical Shock	ECSS-E-ST-10-03C
	Quasi static	ECSS-E-ST-10-03C
Thermal	Thermal Ambient	ECSS-E-ST-10-03C
	Thermal Vacuum	ECSS-E-ST-10-03C
Radiation TID		ESCC 22900
Thermal Stress		ECSS-Q-ST-70-38C

2. Qualification tests

It is hereby certified that the product mentioned above has been subjected to the tests executed in relation to the standards mentions in section 1.2

2.1 Structural and Mechanical tests

Sinusoidal Vibration		
	Frequency [Hz]	Level [g]
Sine Sweep Vibration	5-8	20mm peak-peak
	8-100	4,5
Sweep rate: 2 Octaves per minute		

Random Vibration		
	Frequency [Hz]	ASD Level [g^2/Hz]
Sine Sweep Vibration	20	0,026
	50	0,16
	800	0,16
	2000	0,026
	Overall	14,1G RMS
Duration: 120 Seconds on each axis		

Mechanical shock		
	Frequency [Hz]	Level [g]
Mechanical shock	2000 Hz	1500G
No. of test axis: X,Y,Z		

Mechanical Quasi-Static			
Sine Burst	Frequency [Hz]	Cycles	Level[g]
	15	19	11,2G
No. of burst: 8 ($\approx 10sec$)			

Remarks: None

2.2 Thermal Stress Test

Thermal Stress		
Temperature Range:		
Action	Temperature [°C]	Duration [Minutes]
Heat	100	(10°C/min)
Dwell	100	15
Cool	-55	(10°C/min)
Dwell	-55	15
Repeat	-	-
Repeats: 500 cycles		

Remarks: None

2.3 Thermal Vacuum Test

Thermal Vacuum Qualification levels		
Temperature range: -15°C to +48°C		
Pressure level: < 1.0 x 10 ⁻⁵ mbar		
Number of Cycles: 3		
Thermal Vacuum Test	CFT	Temperature [°C]
	1	48
	2	-15
	3	48
	4	-15
Dwell time 2h		

Thermal Vacuum Qualification levels		
Temperature range: -20°C to +35°C		
Pressure level: < 1.0 x 10 ⁻⁵ mbar		
Number of Cycles: 11		
Thermal Vacuum Test	CFT	Temperature [°C]
	1	20
	2	35
	3	-20
	4	35
	5	-20
	6	35
	7	-20
	8	35
	9	-20
	10	35
	11	-20
Test duration:		

Remarks: None

2.4 Radiation TID Tests

Total Ionizing Dose		
Dose Rate:	10 kRad/h	
Dose	60 min	10 kRad (SI)
Annealing	>24 hours	25 degC
Aging	168 hours	85 degC

Remarks: None

2.5 Flight Heritage

The NanoPower BPX is TRL 9 and has extensive flight heritage including GomSpace missions like GOMX4.

3. Conclusion

The NanoPower BPX is tested according to the above-mentioned conditions and is fully functional and have the expected performance.

This certificate ensures that performance, test condition and test equipment are according to GomSpace quality.