

QUALIFICATION CERTIFICATE

NanoPower DSP

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1. Introduction

1.1 Purpose

This document describes the environmental qualification tests carried out on the NanoPower DSP series, which includes the following products:

- 108222 - NanoPower DSP 135 deg
- 108224 - NanoPower DSP 135 deg - Reverse
- 108223 - NanoPower DSP 90 deg

The NanoPower DSPs are designed and produced after the same specifications and procedures, The only difference is the hinges. Therefore, the tests described below are performed on a representative solar panel and not on all three variants.

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		
Sine Sweep Vibration	Frequency [Hz]	Level
	5-11.5	8.5-10 mm(0-p)
	11.5-100	4,5 [g] (+/-10%)
Sweep rate: 2 Octaves per minute		

Random Vibration		
Sine Sweep Vibration	Frequency [Hz]	ASD Level [g^2/Hz]
	20	0.026
	20-50	+6 dB/Oct
	50-800	0.16
	800-2000	-6 dB/Oct
	2000	0.026
Duration: 120 Seconds on each axis		

Quasi static	
Test method: Sine burst	
Frequency [Hz]	30
Level [g]	15 (+/-10%)
No cycles/burst	19
No of full load cycles/burst	7
No of burst	1
Directions	X Y Z

Shock Response Spectrum (SRS) Qualification Levels	
Shock levels based on Q = 10 quality factor	
Frequency [Hz]	Level [g] (+/- 6db)
100	40
1000	1000
2000	1500
10000	1500

Remarks: None

2.2 Thermal Stress Test

Thermal Stress		
Temperature Range:		
Action	Temperature [°C]	Duration [Minutes]
Heat	120	(10°C/min)
Dwell	120	15
Cool	-40	(10°C/min)
Dwell	-40	15
Repeat	-	-
Repeats: 11000 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	

Remarks: None

2.4 Radiation TID Tests

Total Ionizing Dose		
Dose Rate:	24,6kRad/h	
Dose	54,8min	20 kRad (SI)
Annealing	>24 hours	25 degC
Aging	168 hours	85 degC

Remarks: None

2.5 Flight Heritage

The NanoPower DSP series is TRL 9 and has flight heritage from different customer missions.

3. Conclusion

The NanoPower DSP 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.