GomSpace A/S
Langagervej 6
9220 Aalborg E

NANOCOM LINK SX

Qualification Certificate

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Prepared / Owned by:	Dannie Toft Nielsen	Test Engineer	DTN	2023-08-23
Verified / Reviewed by:	Poul Hove Kristensen	Project Manager	PHK	2024-05-01
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Revision	Date	Initials	Description
0.1	2023-01-25	DTN	Initial draft
1.0	2023-08-25	DTN	Reviewed and approved
1.1	2024-05-01	PHK	Updated to cover NanoCom Link IS1 product and updated certificate for ANT2150 to new include vibration, shock, irradiation, thermal stress test results.
1.2	2025-08-29	LAV	Updated with Flight Heritage information

References

Reference	Document title	Document number	Revision, Date
[RD-1]	GomSpace Qualification Program	1012670	Rev. 2.3, 2023-03-24
[RD-2]	gs-qtct-nanocom-sdr-hp-mk3 Qualification Certificate	1047305	Rev. 1.3, 2025-08-22
[RD-3]	gs-qtct-NanoCom ANT2150 Qualification Certificate	1028496	Rev. 1.2, 2024-05-01
[RD-4]	gs-qtct ANT8250 Qualification Certificate	1027864	Rev. 1.1, 2022-08-11
[RD-5]	NanoCom Link X vibration test report	1049923	Rev. 2.0, 2023-05-15
[RD-6]	NanoCom Link X and SX, RF filter option	1048153	Rev. 1.2, 2023-06-12

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1. Qualification Tests

1.1 Purpose

This document describes the environmental qualification tests which is carried out on these specific products. In the following sections, the tests and the corresponding test results are described.

1.2 Product

Manufacturer Name: GomSpace
Product Name: NanoCom Link SX
Product Number: 110409

Included below products:

Product Name	Product Number	Certificate Number
NanoCom SDR HP MK3	107903	1047305
NanoCom ANT2150-DUP / ISL	200346 / 200347	1028496
NanoCom ANT8250 X-Band Antenna	107689	1027864

Option NanoCom Link X DSN Filter is described in section, 1.8 DSN Filter option.

1.3 Vibration Tests

The products have been subjected to the following tests.

Tests: Random Vibration
Sinusoidal Vibration
Quasi-static / Sine burst

Conditions: Product is mounted in a 6U GomSpace structure which is mounted inside a GomSpace Qualification POD. It is tested under the following test conditions.

NanoCom SDR HP MK3 + NanoCom ANT2150:

Test Description	Test Conditions
Random Vibration	20Hz, 0.026G2/Hz 20-50Hz, +6 dB/oct 50-800Hz, 0.16G2/Hz 800-2000Hz, -6 dB/oct 2000Hz, 0.026G2/Hz Overall, 14.1Grms
Sinusoidal Vibration	5-8Hz, 20mm pp 8-100Hz, 4.5G
Quasi-static / Sine burst	30Hz, 15G, 19 cycles / 7 loaded cycles

NanoCom ANT8250:

Test Description	Test Conditions
Random Vibration	20Hz, 0.026G2/Hz 20-50Hz, +6 dB/oct 50-800Hz, 0.16G2/Hz 800-2000Hz, -6 dB/oct 2000Hz, 0.026G2/Hz Overall, 14.1Grms
Sinusoidal Vibration	5-11.5Hz, 17-20mm pp 11.5-100Hz, 4.5G
Quasi-static / Sine burst	30Hz, 15G, 19 cycles / 7 loaded cycles

Remarks: The ANT2150 the has been re-qualified according to conditions above.

For details see the certificate for NanoCom SDR HP MK3 [RD-2], NanoCom ANT2150 [RD-3] and ANT8250 [RD-4].

Conclusion: The products are tested according to the above-mentioned conditions. The visual mechanical inspection and electrical / functional tests are passed. This certificate ensures that performance, test condition and test equipment are according to GomSpace quality.

1.4 Shock Tests

The products have been subjected to the following tests.

Tests: Mechanical Shock

Conditions: Product is mounted in the shock bench.
The device is exposed to three impacts* at each axis, X, Y and Z.
It is tested under the following test conditions.

NanoCom SDR HP MK3, NanoCom ANT8250:

Test Description	Test Conditions
Shock Response Spectrum (SRS):	100Hz, 40G 1000Hz, 1000G 2000Hz, 1500G 10000Hz, 1500G +/- 6db from the nominal shock 50% of the measured shock shall be above nominal shock

Remarks: * For ANT8250 is has been exposed to only two impacts at each axis, X, Y and Z.

For details see the certificate for NanoCom SDR HP MK3 [RD-2] and ANT8250 [RD-4].

Conclusion: The products are tested according to the above-mentioned conditions. The visual mechanical inspection and electrical / functional tests are passed. This certificate ensures that performance, test condition and test equipment are according to GomSpace quality.

Tests: Mechanical Shock

Conditions: Product is mounted in the fixture for the GomSpace shock bench.
The device is exposed to three impacts at each axis, X, Y and Z.
It is tested under the following test conditions.

NanoCom ANT2150:

Test Description	Test Conditions
Shock Response Spectrum (SRS):	100Hz, 40G 1000Hz, 1000G 2000Hz, 1500G 10000Hz, 1500G +/- 6db from the nominal shock 50% of the measured shock shall be above nominal shock

Remarks: For details see the current certificate for ANT2150, [RD-3].

Conclusion: The product is tested according to the above-mentioned conditions. The visual mechanical inspection and electrical / functional tests are passed. This certificate ensures that performance, test condition and test equipment are according to GomSpace quality.

1.5 Thermal Vacuum Tests

The products have been subjected to the following tests.

Tests: Thermal Vacuum (TVAC)

Conditions: Products are mounted in a 6U GomSpace structure, prepared with thermocouples and harness, installed in the TVAC chamber for test. The temperature range defined in the table below refers to the interface of the product during test to ensure its operating temperatures are within specifications. It is tested under the following test conditions.

NanoCom SDR HP MK3:

Test Description	Test Conditions
Temperature	-40 to 53°C
Pressure	<1e-5 mbar
Cycles	8
Dwell time	2 hours

NanoCom ANT8250:

Test Description	Test Conditions
Temperature	-40 to 45°C
Pressure	<1e-5 mbar
Cycles	8
Dwell time	2 hours

Remarks: Certificate for individual products are listed as reference – NanoCom SDR MK3 [RD-2] and ANT8250 [RD-4].

Conclusion: The products are tested according to the above-mentioned conditions. The electrical / functional tests are passed. This certificate ensures that performance, test condition and test equipment are according to GomSpace quality.

Tests: Thermal Vacuum (TVAC)

Conditions: Product is mounted in a 6U GomSpace structure, prepared with thermocouples and harness, installed in the TVAC chamber for test. The temperature range defined in the table below refers to the thermal interface of the product during test to ensure its operating temperatures are within specifications. It is tested under the following test conditions.

NanoCom ANT2150:

Test Description	Test Conditions
Temperature	-40 to +85°C (Non-Operational + Power ON) -40 to +55°C (Operational, TX Full Power, 100% duty cycle)
Pressure	<1e-5 mbar
Cycles	8
Dwell time	≥2 hours

Remarks: TX high power (31.8dBm / 100%) up to +55°C interface temperature.
TX high power (31.8dBm / 50%) up to +65°C interface temperature.
(In both above conditions board temperature will be below 85°C)

For details see the certificate for ANT2150, [RD-3].

Conclusion: The product is tested according to the above-mentioned conditions. The electrical / functional tests are passed. This certificate ensures that performance, test condition and test equipment are according to GomSpace quality.

1.6 Radiation TID Tests

The products have been subjected to the following tests.

Tests: Radiation TID (Total Ionizing Dose)

Conditions: Products are mounted at a plate for TID testing, prepared with harness and necessary logging equipment, exposed to the beam of a Cobalt-60 source. It is tested under the following test conditions.

NanoCom SDR HP MK3, NanoCom ANT8250:

Test Description	Test Conditions
Method	Direct (Online)
Rate	Low dose – 36 to 360 rad(Si)/hour *
Total dose	>20 krad
Condition	Biased at room temperature
Annealing	>24 hours
Ageing	>168 hours

Remarks: * The ANT8250 has furthermore been exposed to High dose irradiation, non-operational, No metal cover at PCBA, Total dose of 20 krad within 1 hour and 9 minutes.

For details see the certificate for NanoCom SDR HP MK3, [RD-2] and ANT8250, [RD-4].

Conclusion: The products are tested according to the above-mentioned conditions. The electrical / functional tests are passed. This certificate ensures that performance, test condition and test equipment are according to GomSpace quality.

Tests: Radiation TID (Total Ionizing Dose)

Conditions: Product is mounted at plate for TID testing, prepared with harness and necessary logging equipment.
It is tested under the following test conditions.

NanoCom ANT2150:

Test Description	Test Conditions
Method	Direct (Online)
Rate	Low dose – 36 to 360 rad(Si)/hour
Total dose	≥20 krad
Condition	Biased at room temperature
Annealing	≥24 hours
Ageing	≥168 hours

Remarks: Re-flashing the MCU after TID exposure failed. The issue is most likely caused by the charge-pump. Please note that re-flashing of MCU is not possible in orbit and the product will be fully functional up to the 20krad.

After the TID test, the MCU was replaced and proven the remaining components of the product are fully functional and resilient to the level of 20krad. For details see the certificate for ANT2150, [RD-3].

Conclusion: The NanoCom ANT2150 is tested according to the above-mentioned conditions. The electrical / functional tests performed the are considered as conditionally passed.

An additional TID test without executing re-flashing after TID exposure is planned.

1.7 Thermal Stress Test

The products have been subjected to the following tests.

Tests: Thermal Stress (Accelerated Lifetime)

Conditions: Product is prepared with thermocouples and installed at the shelf of the Thermal Stress chamber. It is tested under the following test conditions.

NanoCom SDR HP MK3 and ANT2150:

Test Description	Test Conditions
Temperature – hot plateau	100°C +5 /-0°C
Temperature – cold plateau	-55°C +0 /-5°C
Cycles	150
Dwell time	15 minutes

NanoCom ANT8250:

Test Description	Test Conditions
Temperature – hot plateau	125°C +5 /-0°C
Temperature – cold plateau	-55°C +0 /-5°C
Cycles	500
Dwell time	15 minutes

Remarks: For details see the certificate for NanoCom SDR HP MK3 [RD-2] , ANT2150 [RD-3], and ANT8250 [RD-4].

Conclusion: The products are tested according to the above-mentioned conditions. The visual mechanical inspection and electrical / functional tests are passed. This certificate ensures that performance, test condition and test equipment are according to GomSpace quality.

1.8 DSN Filter option

The NanoCom Link X DSN Filters option, which is a part of the Link X solution has been subjected to below tests:

Tests: Random Vibration
Sinusoidal Vibration
Quasi-static / Sine burst

Conditions: Product is mounted in a 6U GomSpace structure which is mounted inside a GomSpace Qualification POD. It is tested under the following test conditions.

NanoCom Link X DSN filters:

Test Description	Test Conditions
Random Vibration	20Hz, 0.026G^2/Hz 20-50Hz, +6 dB/oct 50-800Hz, 0.16G^2/Hz 800-2000Hz, -6 dB/oct 2000Hz, 0.026G^2/Hz Overall, 14.1Grms
Sinusoidal Vibration	5-8Hz, 20mm pp 8-100Hz, 4.5G
Quasi-static / Sine burst	30Hz, 15G, 19 cycles / 7 loaded cycles

Remarks: For details see the vibration report for NanoCom Link X [RD-5].

A note for use of the DSN filter option are found in [RD-6].

Conclusion: The products are tested according to the above-mentioned conditions. The visual mechanical inspection and electrical / functional tests at system level are passed. This certificate ensures that performance, test condition and test equipment are according to GomSpace quality.

1.9 Flight Heritage

The subsystems in NanoCom Link SX are at TRL9 and have individually flight heritage. Furthermore, the NanoCom Link S and NanoCom Link X has flight heritage since 2024 and 2025 respectively.

The NanoCom Link SX consists of the products listed in the table below, which individually is described with TRL level and flight heritage

Product Name	Product Number	TRL	Flight Heritage
NanoCom SDR MK3	107903	9	Since August 2024
NanoCom ANT2150-DUP / ISL	200346 / 200347	9	Since 2018
NanoCom ANT8250 X-Band Antenna	107689	9	Since November 2020
NanoCom Link X DSN Filters	110162/109298	9	Since January 2025