**DEKRA Testing and Certification, S.A.U.**
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DEKRA

ENAC ENSAYOS Nº 51/LE147

Test report No:
NIE: 64610REM.002A2

# Test report

**ETSI EN 301 908-1 V13.1.1 (2019-11):** IMT cellular networks; Harmonised Standard for access to radio spectrum; Part 1: Introduction and common requirements

| | |
|---|---|
| (*) Identification of item tested | nRF9160 IOT Module |
| (*) Trademark | nRF91 |
| (*) Model and /or type reference | nRF9160 |
| Other identification of the product | HW Version: nRF9160-SICA-B1A<br>SW Version: mfw_nrf9160_1.1.2-148<br>IMEI TAC: 35265610 |
| (*) Features | LTE Cat-M1, LTE-NB1, GPS |
| Manufacturer | NORDIC SEMICONDUCTOR ASA<br>Otto Nielsens Vel 12,<br>7052 Trondheim, Norway. |
| Test method requested, standard | ETSI EN 301 908-1 V13.1.1 (2019-11) |
| Summary | IN COMPLIANCE |
| Approved by (name / position & signature) | Rafael López Martín<br>EMC Consumer & RF Lab. Manager<br>  2022.01.24 10:22:43 +01'00' |
| Date of issue | 2022-01-24 |
| Report template No | FDT08_22<br>(*) "Data provided by the client" |

# Index

# Competences and guarantees

DEKRA Testing and Certification is a testing laboratory accredited by the National Accreditation Body (ENAC - Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification at the time of performance of the test.

DEKRA Testing and Certification is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.



# General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification.
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# Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Testing and Certification internal document PODT000.

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 180 MHz to 1000 MHz is I = ± 2,9 dB for peak & average measurements.

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 1 GHz to 12.75 GHz is I = ± 2,9 dB for peak & average measurements (k = 2).

# Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample consists of an IOT Module that has Application CPU, LTE Cat-M1 Radio and GPS Receiver.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

# Usage of samples

Samples undergoing test have been selected by: The client.

Sample S/01 is composed of the following elements:

| Control Nº | Description | Model | Serial Nº | Date of reception |
|---|---|---|---|---|
| 64610/002 | nRF9160 IOT Module | nRF9160 | 352656102628230 | 2020-04-14 |

# Test sample description

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Ports…… : | Port name and description | | Cable | | | | |
| | | | Specified length [m] | Attached during test | Shielded | | |
| | LTE RF | | 2 | ☒ | ☒ | | |
| | GPS | | 2 | ☐ | ☐ | | |
| | BTLE | | | ☐ | ☐ | | |
| Supplementary information to the ports…… : | *N/A* | | | | | | |
| Rated power supply .....: | Voltage and Frequency | | Reference poles | | | | |
| | | | L1 | L2 | L3 | N | PE |
| | ☐ | AC: | ☐ | ☐ | ☐ | ☐ | ☐ |
| | ☐ | AC: | ☐ | ☐ | ☐ | ☐ | ☐ |
| | ☒ | DC: 3.0 – 5.5Vdc | | | | | |
| | ☐ | DC: | | | | | |

| | | | | |
|---|---|---|---|---|
| Rated Power .....: | 1W | | | |
| Clock frequencies.....: | 32kHz, 32MHz. | | | |
| Other parameters .....: | Not provided data. | | | |
| Software version .....: | mfw_nrf9160_1.1.2-148 | | | |
| Hardware version .....: | nRF9160-SICA-B1A | | | |
| Dimensions in cm (L x W x D).....: | 11x16x1.1mm | | | |
| Mounting position .....: | ☐ | Table top equipment | | |
| | ☐ | Wall/Ceiling mounted equipment | | |
| | ☐ | Floor standing equipment | | |
| | ☐ | Hand-held equipment | | |
| | ☒ | Other: SMD Module | | |
| Modules/parts.....: | Module/parts of test item | | Type | Manufacturer |
| | N/A | | | |
| | | | | |
| Accessories (not part of the test item) .....: | Description | | Type | Manufacturer |
| | N/A | | | |
| | | | | |
| Documents as provided by the applicant.....: | Description | | File name | Issue date |
| | User manual | | 4418_1315-v1.2 /2020-04-30-nRF9160_Objective_Product_Spec | 30-Apr-2020 |
| | Cover markings | | nRF9160_SiP marking | 15-Jun-2020 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

# Identification of the client

NORDIC SEMICONDUCTOR ASA
Otto Nielsens Vel 12,
7052 Trondheim, Norway.

# Testing period and place

| | |
|---|---|
| **Test Location** | DEKRA Testing and Certification S.A.U. |
| **Date (start)** | 2020-05-13 |
| **Date (finish)** | 2020-05-14 |

# Document history

| Report number | Date | Description |
|---|---|---|
| 64610REM.002 | 2020-06-10 | First release |
| 64610REM.002A1 | 2020-08-25 | First modification due to typos. This modification test report cancels and replaces the test report 64610REM.002 |
| 64610REM.002A2 | 2022-01-24 | Second modification due to standard used and missing information. This modification test report cancels and replaces the test report 64610REM.002A1 |

# Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

| | |
|---|---|
| **Temperature** | Min. = 15 ºC<br>Max. = 35 ºC |
| **Relative humidity** | Min. = 30 %<br>Max. = 75 % |
| **Air pressure** | Min. = 860 mbar<br>Max. = 1060 mbar |

In the semianechoic chamber, the following limits were not exceeded during the test.

| | |
|---|---|
| **Temperature** | Min. = 15 ºC<br>Max. = 35 ºC |
| **Relative humidity** | Min. = 30 %<br>Max. = 75 % |
| **Air pressure** | Min. = 860 mbar<br>Max. = 1060 mbar |

In the chamber for conducted measurements, the following limits were not exceeded during the test:

| | |
|---|---|
| **Temperature** | Min. = 15 ºC<br>Max. = 35 ºC |
| **Relative humidity** | Min. = 30 %<br>Max. = 60 % |
| **Air pressure** | Min. = 860 mbar<br>Max. = 1060 mbar |

## Remarks and comments

The tests have been performed by the technical personnel: Antonio Ruiz.

## Testing verdicts

| | |
|---|---|
| Not applicable : | N/A |
| Pass : | P |
| Fail : | F |
| Not measured : | N/M |

## List of equipment used during the test

| Control Number | Description | Model | Manufacturer | Next Calibration |
|---|---|---|---|---|
| 2942 | EMI TEST RECEIVER 20Hz-40GHz | ESU40 | ROHDE AND SCHWARZ | 2021-09-17 |
| 4523 | EMI TEST RECEIVER 20Hz-26.5GHz | ESU26 | ROHDE AND SCHWARZ | 2022-05-27 |
| 4612 | HORN ANTENNA 1-18GHz | BBHA 9120 D | SCHWARZBECK MESS-ELEKTRONIK | 2021-06-14 |
| 5641 | HYBRID BILOG ANTENNA 30MHz-6GHz | 3142E | ETS LINDGREN | 2021-07-31 |
| 6064 | SEMIANECHOIC ABSORBER LINED CHAMBER | SAC-3 | Frankonia | --- |
| 6121 | PRE-AMPLIFIER G>40dB 10MHz-6GHz | BLNA 0160-01N | BONN ELEKTRONIK | --- |
| 6126 | ETHERNET TEMPERATURE AND HUMIDITY LOGGER | HWg-STE | HW GROUP | 2021-04-17 |
| 6132 | ETHERNET TEMPERATURE AND HUMIDITY LOGGER | HWg-STE | HW GROUP | 2021-04-20 |
| 6195 | PRE-AMPLIFIER G>55dB 1-18GHz | AMF-7D-01001800-22-10P | NARDA | 2021-05-19 |
| 6329 | SHIELDED ROOM | --- | FRANKONIA | --- |

# **Appendix A:** Test results

# Appendix A Content

# DESCRIPTION OF THE OPERATION MODES

The operation modes described in this paragraph constitute a functionality of the sample under test for itself. Every operation mode takes a failure criteria for the immunity test that they were applying to it and a monitoring to guarantee performance of the same ones.

The operation modes used by the samples to which the present report refers, are shown in the following table:

| OPERATION MODE | DESCRIPTION |
|---|---|
| OM#01 | EUT ON. MS in IDLE mode. NBiOT Band 1. Power supply: 3,8Vdc. |
| OM#02 | EUT ON. MS in IDLE mode. NBiOT Band 3. Power supply: 3,8Vdc. |
| OM#03 | EUT ON. MS in IDLE mode. NBiOT Band 8. Power supply: 3,8Vdc. |
| OM#04 | EUT ON. MS in IDLE mode. NBiOT Band 20. Power supply: 3,8Vdc. |
| OM#05 | EUT ON. MS in IDLE mode. NBiOT Band 28. Power supply: 3,8Vdc. |
| OM#06 | EUT ON. MS in traffic mode. NBiOT Band 1. Power supply: 3,8Vdc. |
| OM#07 | EUT ON. MS in traffic mode. NBiOT Band 3. Power supply: 3,8Vdc. |
| OM#08 | EUT ON. MS in traffic mode. NBiOT Band 8. Power supply: 3,8Vdc. |
| OM#09 | EUT ON. MS in traffic mode. NBiOT Band 20. Power supply: 3,8Vdc. |
| OM#10 | EUT ON. MS in traffic mode. NBiOT Band 28. Power supply: 3,8Vdc. |
| OM#11 | EUT ON. Control and monitoring function. Power supply: 3,8Vdc |

# RADIATED SPURIOUS EMISSIONS IDLE AND TRAFFIC MODE

| | | |
|---|---|---|
| **LIMITS:** | Product standard : | ETSI EN 301 908-1 V13.1.1 (2019-11) |
| | Test standard : | ETSI EN 301 908-1 V13.1.1 (2019-11) |

**LIMITS**

**Traffic mode spurious emission limits.**

Bellow, the limits for the measurement are stated in dBm.

**GENERAL SPURIOUS EMISSIONS REQUIREMENTS**

| Frequency bandwidth | Measurement bandwidth | Minimum requirement |
|---|---|---|
| 30 MHz ≤ f < 1000 MHz | 100 kHz | -36 dBm |
| 1 GHz ≤ f < 12,75 GHz | 1 MHz | -30 dBm |

**IDLE mode spurious emission limits**

Bellow, the limits for the measurement are stated in dBm.

**GENERAL RECEIVER SPURIOUS EMISSIONS REQUIREMENTS**

| Frequency band | Measurement bandwidth | Maximum level |
|---|---|---|
| 30 MHz ≤ f < 1 GHz | 100 kHz | -57 dBm |
| 1 GHz ≤ f < 12,75 GHz | 1 MHz | -47 dBm |

| | |
|---|---|
| **TESTED SAMPLES:** | S/01 |
| **TESTED OPERATION MODES:** | OM#01 to OM#10 |
| **TEST RESULTS :** | **CR**mmnn: CR, Radiation Condition; mm: Sample number; nn: Operation mode. |

| CRmmnn | Description | Result |
|---|---|---|
| CR0101LR_PH | Range 30 - 1000 MHz. Horizontal Polarization. | P |
| CR0101LR_PV | Range 30 - 1000 MHz. Vertical Polarization. | P |
| CR0102LR_PH | Range 30 - 1000 MHz. Horizontal Polarization. | P |
| CR0102LR_PV | Range 30 - 1000 MHz. Vertical Polarization. | P |
| CR0103LR_PH | Range 30 - 1000 MHz. Horizontal Polarization. | P |
| CR0103LR_PV | Range 30 - 1000 MHz. Vertical Polarization. | P |
| CR0104LR_PH | Range 30 - 1000 MHz. Horizontal Polarization. | P |
| CR0104LR_PV | Range 30 - 1000 MHz. Vertical Polarization. | P |
| CR0105LR_PH | Range 30 - 1000 MHz. Horizontal Polarization. | P |
| CR0105LR_PV | Range 30 - 1000 MHz. Vertical Polarization. | P |
| CR0106LR_PH | Range 30 - 1000 MHz. Horizontal Polarization. | P |
| CR0106LR_PV | Range 30 - 1000 MHz. Vertical Polarization. | P |
| CR0107LR_PH | Range 30 - 1000 MHz. Horizontal Polarization. | P |
| CR0107LR_PV | Range 30 - 1000 MHz. Vertical Polarization. | P |
| CR0108LR_PH | Range 30 - 1000 MHz. Horizontal Polarization. | P |
| CR0108LR_PV | Range 30 - 1000 MHz. Vertical Polarization. | P |
| CR0109LR_PH | Range 30 - 1000 MHz. Horizontal Polarization. | P |
| CR0109LR_PV | Range 30 - 1000 MHz. Vertical Polarization. | P |
| CR0110LR_PH | Range 30 - 1000 MHz. Horizontal Polarization. | P |
| CR0110LR_PV | Range 30 - 1000 MHz. Vertical Polarization. | P |

| **TEST RESULTS :** | (Cont) |
|---|---|

| CRmmnn | Description | Result |
|---|---|---|
| CR0101HR_PH | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0101HR_PV | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0102HR_PH | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0102HR_PV | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0103HR_PH | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0103HR_PV | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0104HR_PH | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0104HR_PV | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0105HR_PH | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0105HR_PV | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0106HR_PH | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0106HR_PV | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0107HR_PH | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0107HR_PV | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0108HR_PH | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0108HR_PV | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0109HR_PH | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0109HR_PV | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0110HR_PH | Range 1 – 12,75 GHz. Horizontal Polarization. | P |
| CR0110HR_PV | Range 1 – 12,75 GHz. Horizontal Polarization. | P |

# CONTROL AND MONITORING FUNCTIONS

**Test method**

a) At the start of the test, the UE shall be switched off. The UE antenna connector shall be connected to a power measuring equipment

b) The UE shall be switched on for a period of approximately fifteen minutes, and then switched off.

c) The EUT shall remain switched off for a period of at least thirty seconds, and shall then be switched on for a period of approximately one minute.

d) The maximum power emitted from the UE throughout the duration of the test shall be recorded.

In order to prove compliance, the results obtained shall be compared with the following limit:

*Limits*

| Frequency range | Limit |
|---|---|
| 700 MHz ≤ f < 2,7 GHz | -30 dBm |

**Result**

| C&Mmmnn | Description | Result |
|---|---|---|
| C&M0111 | Maximum emission point detected at 2.4708 GHz. Level -61.82 dBm. | P |

C&Mmmnn: C&M: Control and monitoring function; mm: Sample number; nn: Operation mode;

*Verdict*

Pass

# **Appendix B:** Photographs