



Test report No:
NIE: 58741REM.002

Test report

FCC Rules and Regulations CFR 47, Part 15, Subpart B (10-1-16 Edition) & ICES-003 Issue 6 (Updated 2017-04)

| | |
|---|--|
| Identification of item tested | IOT Module |
| Trademark | nRF91 |
| Model and /or type reference | nRF9160 |
| Other identification of the product | FCC ID: 2ANPO00NRF9160 IC: 24529-NRF9160 IMEI TAC: 35265610 HW Version: DEV2.1.6 SW Version: mfw-m1_nRF9160_0.6.7.31 |
| Features | LTE Cat-M1, LTE-NB1, GPS |
| Manufacturer | NORDIC SEMICONDUCTOR ASA P.O. Box 436, 0213 Oslo, Norway. |
| Test method requested, standard | FCC CFR 47, Part 15, Subpart B (10-1-16 Edition) & ICES-003 Issue 6 (Updated 2017-04) |
| Summary | IN COMPLIANCE |
| Approved by (name / position & signature) | Rafael López EMC LAB Manager |
| Date of issue | 2018-11-15 |
| Report template No | FDT08_21 |

Index

| | |
|-----------------------------------|---|
| Competences and guarantees | 3 |
| General conditions | 3 |
| Uncertainty | 3 |
| Data provided by the client..... | 4 |
| Usage of samples | 4 |
| Test sample description | 4 |
| Identification of the client..... | 6 |
| Testing period and place..... | 6 |
| Document history | 6 |
| Environmental conditions | 7 |
| Remarks and comments | 8 |
| Testing verdicts..... | 8 |
| Summary | 8 |
| Appendix A: Test results | 9 |

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.

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.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Testing and Certification.

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.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification and the Accreditation Bodies.

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 30 MHz to 1000 MHz is $I = \pm 4,9$ dB for quasi-peak measurements, $I = \pm 4,6$ dB for peak measurements ($k = 2$)

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 1000 MHz to 26 GHz is $I = \pm 2,6$ dB for peaks and average measurements ($k = 2$)

Data provided by the client

The sample is an IOT Module that has Application CPU, LTE Cat-M1, Cat-NB1 Radio and GPS Receiver.

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

Usage of samples

Samples under test have been selected by: The client.

Sample S/01 is composed of the following elements:

| Control N° | Description | Model | Serial N° | Date of reception |
|------------|-------------|---------|-----------|-------------------|
| 58741C/025 | IOT Module | nRF9160 | --- | 2018-10-25 |

Test sample description

| Ports..... : | Port name and description | Cable | | | | |
|---|---------------------------|--------------------------|-------------------------------------|-------------------------------------|--------------------------|--------------------------|
| | | Specified length [m] | Attached during test | Shielded | | |
| | LTE RF | 2 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | |
| | GPS | 2 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | | |
| | | | <input type="checkbox"/> | <input type="checkbox"/> | | |
| | | | <input type="checkbox"/> | <input type="checkbox"/> | | |
| | | | <input type="checkbox"/> | <input type="checkbox"/> | | |
| | | | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Supplementary information to the ports..... : | | | | | | |
| Rated power supply | Voltage and Frequency | Reference poles | | | | |
| | | L1 | L2 | L3 | N | PE |
| <input type="checkbox"/> | AC: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | AC: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | DC: 3.8 – 5.5Vdc. | | | | | |
| <input type="checkbox"/> | DC: | | | | | |

| | | | |
|---|-------------------------------------|--|--------------|
| Rated Power | 1W | | |
| Clock frequencies | 32kHz, 32MHz | | |
| Other parameters..... | --- | | |
| Software version | TBD | | |
| Hardware version..... | DEV2.1.6 | | |
| Dimensions in cm (W x H x D)..... | 11x16x1.1mm | | |
| Mounting position..... | <input type="checkbox"/> | Table top equipment | |
| | <input type="checkbox"/> | Wall/Ceiling mounted equipment | |
| | <input type="checkbox"/> | Floor standing equipment | |
| | <input type="checkbox"/> | Hand-held equipment | |
| | <input checked="" type="checkbox"/> | 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_1177-0.3.1-20180905-140910-nRF9160_Objective_Product_Spec | 23-Oct-2018 |
| | Cover markings | SiP marking | 23-Oct-2018 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Copy of marking plate:



Identification of the client

Nordic Semiconductor ASA
Yrttpellontie 1 90230 Oulu. Finland.

Testing period and place

| | |
|---------------|--|
| Test Location | DEKRA Testing and Certification S.A.U. |
| Date (start) | 2018-11-09 |
| Date (finish) | 2018-11-09 |

Document history

| Report number | Date | Description |
|---------------|------------|---------------|
| 58741REM.002 | 2018-11-15 | First release |

Environmental conditions

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

| | |
|--------------------------|-------------------------------------|
| Temperature | Min. = 15 °C Max. = 35 °C |
| Relative humidity | Min. = 30 % Max. = 75 % |
| Air pressure | Min. = 860 mbar Max. = 1060 mbar |

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

| | |
|--------------------------|-------------------------------------|
| Temperature | Min. = 15 °C Max. = 35 °C |
| Relative humidity | Min. = 30 % Max. = 75 % |
| Air pressure | Min. = 860 mbar Max. = 1060 mbar |

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

| | |
|--------------------------|-------------------------------------|
| Temperature | Min. = 15 °C Max. = 35 °C |
| Relative humidity | Min. = 30 % Max. = 60 % |
| Air pressure | Min. = 860 mbar Max. = 1060 mbar |

Remarks and comments

The test have been performed by the technical personnel: Lorena Oviedo.

Testing verdicts

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

Summary

| Emission Test | | |
|---|---------|--------|
| Requirement – Test case | Verdict | Remark |
| Radiated emission. Electromagnetic field measure (30 KHz – 1000 MHz) | P | --- |
| Radiated emission. Electromagnetic field measure (1 GHz – 18 GHz) | P | --- |
| Radiated emission. Electromagnetic field measure (18 GHz – 26 GHz) | P | --- |
| Continuous conducted emission (150 KHz – 30 MHz) | N/A | See 1 |
| <u>Supplementary information and remarks:</u> | | |
| 1) EUT is not designed to be connected to the public utility (AC) power line. | | |

Appendix A: Test results

Appendix A Content

| | |
|--|----|
| DESCRIPTION OF THE OPERATION MODES | 11 |
| RADIATED EMISSION. ELECTROMAGNETIC FIELD MEASURE | 12 |

DESCRIPTION OF THE OPERATION MODES

The operation modes described in this paragraph constitute a functionality of the sample under test for itself. 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. Equipment in Reception operation mode. Power supply: 3.8Vdc. |

Note: Reception operation mode is equivalent to Idle operation mode

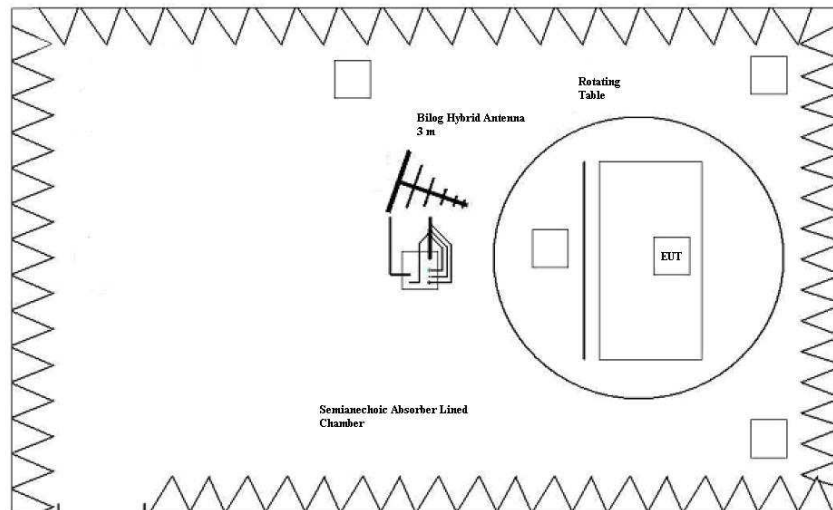
RADIATED EMISSION. ELECTROMAGNETIC FIELD MEASURE

| | | |
|----------------|-------------------|---|
| LIMITS: | Product standard: | FCC CFR 47, Part 15, Subpart B (10-1-16 Edition), Secs. 15.109 & ICES-003 Issue 6 (Updated 04-2017) |
| | Test standard: | FCC CFR 47, Part 15, Subpart B (10-1-16 Edition), Secs. 15.109 & ICES-003 Issue 6 (Updated 04-2017) |

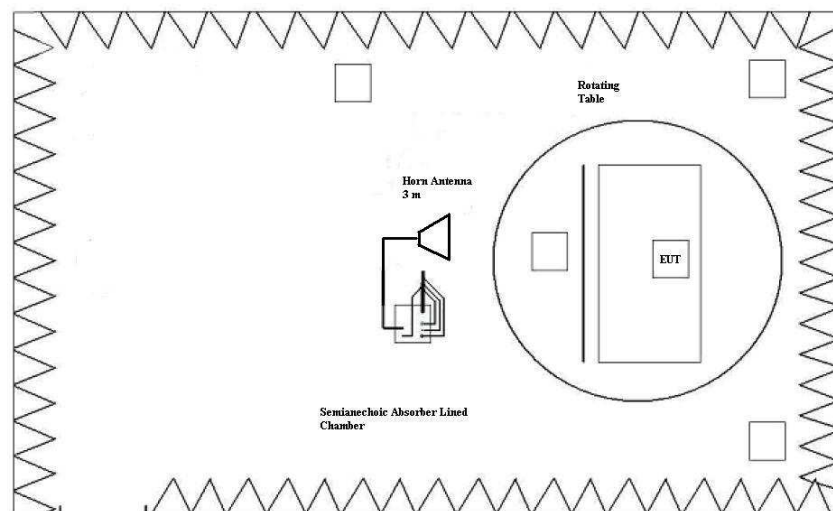
Limits of interference Class B

The applied limit for radiated emissions, 3 m distance, according with the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B (10-1-16 Edition), Secs. 15.109 & ICES-003 Issue 6 (Updated 04-2017) in the frequency range 30 MHz to 26 GHz for class B equipments.

| Frequency range (MHz) | QP Limit for 3 m | | PK Limit for 3 m |
|-----------------------|---------------------|------------------------------|------------------------------|
| | ($\mu\text{V/m}$) | ($\text{dB}\mu\text{V/m}$) | ($\text{dB}\mu\text{V/m}$) |
| 30 to 88 | 100 | 40 | --- |
| 88 to 216 | 150 | 43.5 | --- |
| 216 to 960 | 200 | 46 | --- |
| Above 960 | 500 | 54 | 74 |



Setup for measurements < 1GHz.



Setup for measurements > 1GHz.

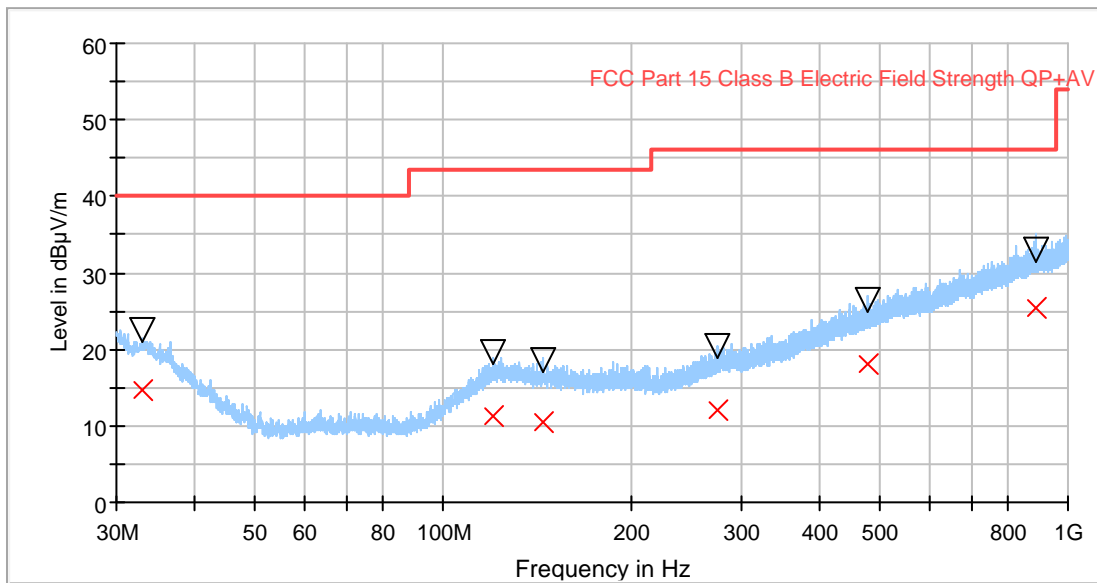
| | |
|--------------------------------|---|
| TESTED SAMPLE: | S/01 |
| TESTED OPERATION MODES: | OM#01 |
| TEST RESULTS: | CRmmnnRRPP: CR, Radiated Condition; mm: Sample number; nn: Operation mode; RR: Range; PP: Polarization. |

| CRmmnnRRPP | Description | Result |
|--------------|--|--------|
| CR0101LR | Range: 30 MHz - 1000 MHz. | P |
| CR0101HR1_PH | Range: 1 GHz - 18 GHz. Horizontal Polarization. | P |
| CR0101HR1_PV | Range: 1 GHz - 18 GHz. Vertical Polarization. | P |
| CR0101HR2_PH | Range: 18 GHz - 26 GHz. Horizontal Polarization. | P |
| CR0101HR2_PV | Range: 18 GHz - 26 GHz. Vertical Polarization. | P |

Radiated Emission. CR0101LR

Project: 58741REM.002
 Company: NORDIC SEMICONDUCTOR OY
 Sample: S/01
 Operation mode: OM#01
 Description: EUT ON. Equipment in Reception operation mode.
 Power supply: 3,8Vdc

Full Spectrum



- Peak Preview
- FCC Part 15 Class B Electric Field Strength QP+AV
- ▽ MaxPeak
- × QuasiPeak

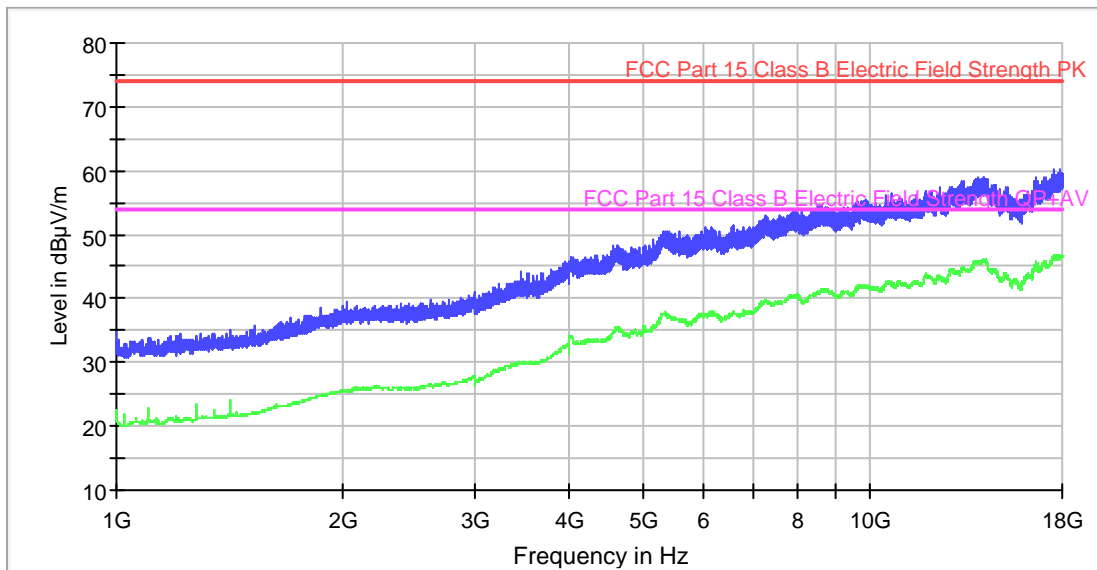
Maximizations

| Frequency (MHz) | MaxPeak (dBµV/m) | QuasiPeak (dBµV/m) | Height (cm) | Pol | Azimuth (deg) |
|-----------------|------------------|--------------------|-------------|-----|---------------|
| 33.085000 | 22.61 | 14.74 | 230.0 | H | 214.0 |
| 120.010000 | 19.57 | 11.34 | 329.0 | V | 62.0 |
| 144.035000 | 18.50 | 10.43 | 400.0 | H | 19.0 |
| 274.925000 | 20.38 | 12.13 | 181.0 | H | 194.0 |
| 478.005000 | 26.35 | 18.04 | 392.0 | H | 152.0 |
| 886.655000 | 33.12 | 25.53 | 234.0 | H | 117.0 |

Radiated Emission. CR0101HR1_PH

Project: 58741REM.002
 Company: NORDIC SEMICONDUCTOR OY
 Sample: S/01
 Operation mode: OM#01
 Description: EUT ON. Equipment in Reception operation mode.
 Power supply: 3,8Vdc. Horizontal Polarization

FCC 1-18GHz class B



- Average Scan
- Peak Scan
- FCC Part 15 Class B Electric Field Strength PK
- FCC Part 15 Class B Electric Field Strength QP+AV

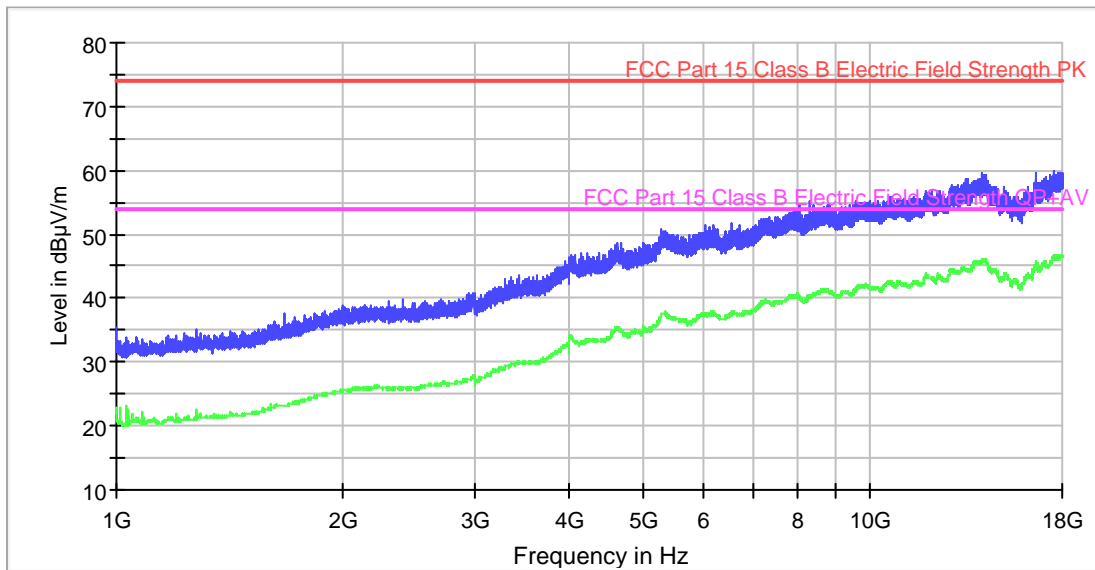
Subrange Maxima

| Frequency (MHz) | PK+ CLRWR (dBµV/m) | AVG CLRWR (dBµV/m) |
|-----------------|--------------------|--------------------|
| 1000.000000 | 34.7 | 21.0 |
| 1778.000000 | 37.3 | 24.1 |
| 2027.200000 | 39.5 | 25.6 |
| 3159.600000 | 41.8 | 28.5 |
| 4186.800000 | 46.6 | 33.1 |
| 5357.600000 | 50.5 | 37.6 |
| 7259.600000 | 52.9 | 39.7 |
| 9851.200000 | 55.5 | 42.1 |
| 13225.200000 | 58.3 | 44.3 |
| 17920.000000 | 60.1 | 46.5 |

Radiated Emission. CR0101HR1_PV

Project: 58741REM.002
 Company: NORDIC SEMICONDUCTOR OY
 Sample: S/01
 Operation mode: OM#01
 Description: EUT ON. Equipment in Reception operation mode.
 Power supply: 3,8Vdc. Vertical Polarization

FCC 1-18GHz class B



- Average Scan
- Peak Scan
- FCC Part 15 Class B Electric Field Strength PK
- FCC Part 15 Class B Electric Field Strength QP+AV

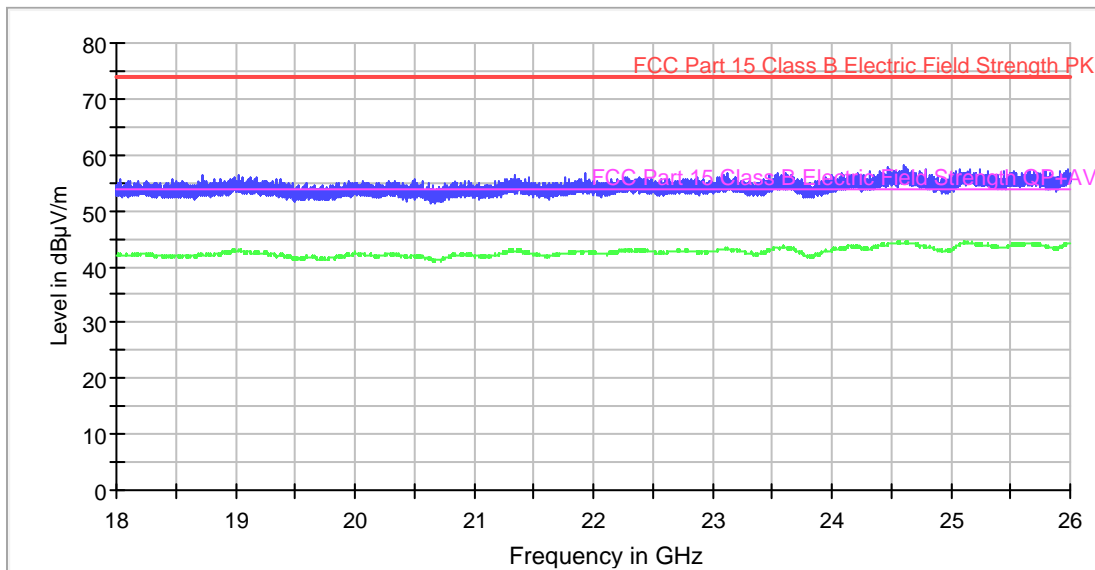
Subrange Maxima

| Frequency (MHz) | PK+ CLRWR (dBµV/m) | AVG CLRWR (dBµV/m) |
|-----------------|--------------------|--------------------|
| 1000.000000 | 35.3 | 22.0 |
| 1671.600000 | 37.5 | 23.2 |
| 2304.800000 | 39.4 | 25.7 |
| 3172.000000 | 41.8 | 28.7 |
| 4147.200000 | 47.0 | 33.1 |
| 5304.000000 | 50.8 | 37.6 |
| 7342.000000 | 52.7 | 39.4 |
| 9607.200000 | 55.2 | 41.5 |
| 13466.000000 | 58.7 | 44.6 |
| 17599.600000 | 59.9 | 46.6 |

Radiated Emission. CR0101HR2_PH

Project: 58741REM.002
 Company: NORDIC SEMICONDUCTOR OY
 Sample: S/01
 Operation mode: OM#01
 Description: EUT ON. Equipment in Reception operation mode.
 Power supply: 3,8Vdc. Horizontal Polarization

FCC 18-26GHz class B



- Average Scan
- Peak Scan
- FCC Part 15 Class B Electric Field Strength PK
- FCC Part 15 Class B Electric Field Strength QP+AV

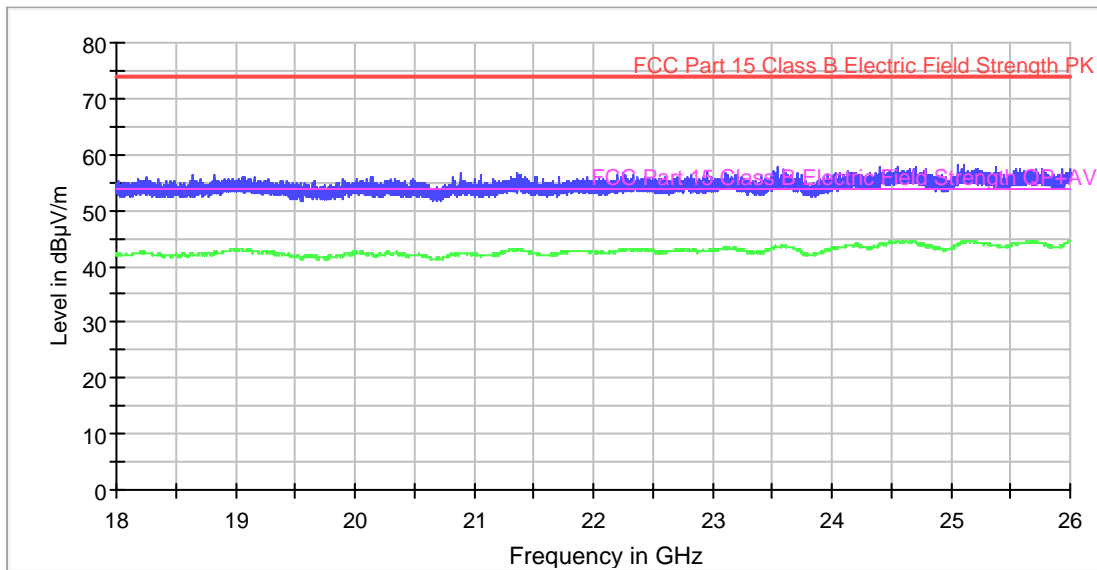
Subrange Maxima

| Frequency (MHz) | PK+ CLRWR (dBµV/m) | AVG CLRWR (dBµV/m) |
|-----------------|--------------------|--------------------|
| 18478.000000 | 55.6 | 41.9 |
| 18718.400000 | 56.3 | 42.0 |
| 19950.400000 | 55.4 | 42.1 |
| 20499.600000 | 55.5 | 42.0 |
| 21343.600000 | 56.5 | 42.8 |
| 21939.200000 | 56.5 | 42.7 |
| 23129.600000 | 56.5 | 43.1 |
| 23619.200000 | 56.7 | 43.4 |
| 24598.000000 | 57.9 | 44.1 |
| 25249.200000 | 57.3 | 44.0 |

Radiated Emission. CR0101HR2_PV

Project: 58741REM.002
 Company: NORDIC SEMICONDUCTOR OY
 Sample: S/01
 Operation mode: OM#01
 Description: EUT ON. Equipment in Reception operation mode.
 Power supply: 3,8Vdc. Vertical Polarization

FCC 18-26GHz class B



- Average Scan
- Peak Scan
- FCC Part 15 Class B Electric Field Strength PK
- FCC Part 15 Class B Electric Field Strength QP+AV

Subrange Maxima

| Frequency (MHz) | PK+ CLRWR (dBµV/m) | AVG CLRWR (dBµV/m) |
|-----------------|--------------------|--------------------|
| 18638.000000 | 56.2 | 42.2 |
| 18815.600000 | 56.3 | 42.3 |
| 19896.000000 | 55.5 | 41.9 |
| 20826.000000 | 56.1 | 42.2 |
| 21363.200000 | 56.7 | 43.0 |
| 22250.000000 | 56.6 | 42.8 |
| 22964.000000 | 57.1 | 42.7 |
| 23546.400000 | 57.6 | 43.5 |
| 24706.400000 | 57.8 | 44.3 |
| 25110.400000 | 58.2 | 44.4 |