# RF Exposure Report

| | |
|---|---|
| **Report No.:** | SA160815E05D |
| **FCC ID:** | 2AD8UFW2RADPM01 |
| **Test Model:** | FW2RADPM01 |
| **Received Date:** | Sep. 14, 2018 |
| **Test Date:** | Oct. 18, 2018 |
| **Issued Date:** | Mar. 08, 2019 |
| **Applicant:** | Nokia Solutions and Networks, OY |
| **Address:** | 2000 W. Lucent Lane, Naperville, IL 60563, USA |
| **Issued By:** | Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory |
| **Lab Address:** | E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C. |

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## Release Control Record

| Issue No. | Description | Date Issued |
|---|---|---|
| SA160815E05D | Original release. | Mar. 08, 2019 |

## 1 Certificate of Conformity

| | |
|---|---|
| **Product:** | Nokia FW2R LTE module |
| **Brand:** | Nokia |
| **Test Model:** | FW2RADPM01 |
| **Test Sample S/N:** | EB171810287 |
| **Hardware Version:** | 95.1659T00 X36 |
| **Sample Status:** | MASS-PRODUCTION |
| **Applicant:** | Nokia Solutions and Networks, OY |
| **Test Date:** | Oct. 18, 2018 |
| **Standards:** | FCC Part 2 (Section 2.1091)<br>KDB 447498 D01 General RF Exposure Guidance v06<br>IEEE C95.1-1992<br>FCC Part 1 (Section 1.1310) |

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**Prepared by :** _____ , **Date:** Mar. 08, 2019

Claire Kuan / Specialist

**Approved by :** _____ , **Date:** Mar. 08, 2019

May Chen / Manager

## 2 RF Exposure

2.1 Limits for Maximum Permissible Exposure (MPE)

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm2) | Average Time (minutes) |
|---|---|---|---|---|
| (A)Limits For Occupational / Control Exposures | | | | |
| 300-1500 | … | … | F/300 | 6 |
| 1500-100,000 | … | … | 5 | 6 |
| (B)Limits For General Population / Uncontrolled Exposure | | | | |
| 300-1500 | … | … | F/1500 | 30 |
| 1500-100,000 | … | … | 1.0 | 30 |

2 F = Frequency in MHz

2.1 MPE Calculation Formula

$Pd = (Pout*G) / (4*pi*r^2)$

where

Pd = power density in $mW/cm^2$

Pout = output power to antenna in mW

G = gain of antenna in linear scale

Pi = 3.1416

R = distance between observation point and center of the radiator in cm

2.2 Classification

The antenna of this product, under normal use condition, is at least 20cm away from the body of the user. So, this device is classified as **fixed device** and installations by professional service personnel.

## 2.3 Antenna Gain

1. The antennas provided to the EUT, please refer to the following table:

| Antenna spec. | | | | | |
|---|---|---|---|---|---|
| Antenna No | Brand | Model | Antenna Type | Gain(dBi) | Frequency range (MHz) |
| 1 | Nokia | NA | Loop (LAA#4(Main)) | 7.67 | 5250~ 5750 |
| 2 | Nokia | NA | Loop (LAA#2(DIV)) | 3.66 | 5250~ 5750 |

| Cable Spec. | | | | | | |
|---|---|---|---|---|---|---|
| Antenna No | Brand | Model | Connector Type | Cable Loss(dB) | Cable Length (mm) | Note |
| 1 | NA | NA | Right angle MMCX Plug | peak gain included | 263 | This cable will be equipped with Loop(LAA#4) antenna |
| 2 | NA | NA | Right angle MMCX Plug | peak gain included | 263 | This cable will be equipped with Loop(LAA#2) antenna |

2. Directional gain(composite gain) :

| Frequency range (MHz) | Directional Gain(dBi) |
|---|---|
| 5250 ~ 5750 | 6.11 |

Note:

1. Directional gain calculation is based on FCC document KDB662911

   all transmit signals are *completely uncorrelated*

   ***Directional gain*** = $10 \log[(10^{G1/10} + 10^{G2/10} + \ldots + 10^{GN/10})/N_{ANT}]$ dBi,

   where

   $N_{ANT}$ = the total number of antennas

2. Two directional gain values are calculated, directional gain values based on actual measurement data.

2.4 Calculation Result of Maximum Conducted Power

LAA Frequency 5180-5240 MHz & 5745-5825 MHz copied from the original test report (Report No.: SA160815E05B)

**For General Population**

| Operation Mode | Evaluation Frequency (MHz) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density ($mW/m^2$) | Limit ($mW/m^2$) |
|---|---|---|---|---|---|---|
| LAA | 5180-5240 | 581.477 | 7.66 | 20 | 0.67493 | 1 |
| LAA | 5299.8+5340 | 240.189 | 6.11 | 20 | 0.19511 | 1 |
| LAA | 5660+5699.9 | 218.794 | 6.11 | 20 | 0.04353 | 1 |
| LAA | 5745-5825 | 582.879 | 7.66 | 20 | 0.67656 | 1 |

Note:
1. For Frequency 5180-5240 MHz & 5745-5825 MHz: Directional gain = 7.66dBi
2. For Frequency 5299.8+5340 MHz & 5660+5699.9 MHz: Directional gain = 6.11dB

**For Occupational Population**

| Operation Mode | Evaluation Frequency (MHz) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density ($mW/m^2$) | Limit ($mW/m^2$) |
|---|---|---|---|---|---|---|
| LAA | 5180-5240 | 581.477 | 7.66 | 20 | 0.67493 | 5 |
| LAA | 5299.8+5340 | 240.189 | 6.11 | 20 | 0.19511 | 5 |
| LAA | 5660+5699.9 | 218.794 | 6.11 | 20 | 0.04353 | 5 |
| LAA | 5745-5825 | 582.879 | 7.66 | 20 | 0.67656 | 5 |

Note:
1. For Frequency 5180-5240 MHz & 5745-5825 MHz: Directional gain = 7.66dBi
2. For Frequency 5299.8+5340 MHz & 5660+5699.9 MHz: Directional gain = 6.11dB

## 3 Brief Summary of results

The wireless device described within this report has been shown to be capable of compliance with the basic restrictions related to human exposure to electromagnetic fields for both General public and Occupational. The calculations shown in this report were made in accordance the procedures specified in the applied test specification(s)

| Configuration | Required Compliance Boundary(m) | |
|---|---|---|
| | Occupational | General Population |
| 5GHz LAA | 0.2 | 0.2 |

**--- END ---**