# Exposure Evaluation Declaration

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|---|---|
| **FCC ID:** | 2AD8UAWHHA01 |
| **Applicant:** | Nokia Solutions and Networks, OY |
| **Product:** | AirScale Indoor Radio ASiR 5G-pRRH |
| **Model No.:** | AWHHA |
| **Brand Name:** | Nokia |
| **FCC Rule Part(s):** | FCC Part 2.1091 |
| **Result:** | Complies |
| **Evaluation Date:** | 2023-10-10 |

**Reviewed By:** Sunny Sun

**Approved By:** Robin Wu

## Revision History

| Report No. | Version | Description | Issue Date | Note |
|---|---|---|---|---|
| 2309RSU055-U1 | V01 | Initial Report | 2023-10-10 | Valid |
| | | | | |

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# 1. General Information

## 1.1. Applicant

Nokia Solutions and Networks, OY

2000 W. Lucent Lane, Naperville, Illinois, United States, 60563

## 1.2. Manufacturer

Nokia Solutions and Networks, OY

2000 W. Lucent Lane, Naperville, Illinois, United States, 60563

## 1.3. Testing Facility

| | | | | | |
|---|---|---|---|---|---|
| ☒ | **Test Site – MRT Suzhou Laboratory** | | | | |
| | **Laboratory Location (Suzhou - Wuzhong)**<br>D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China<br>**Laboratory Location (Suzhou - SIP)**<br>4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China | | | | |
| | **Laboratory Accreditations** | | | | |
| | A2LA: 3628.01 | | CNAS: L10551 | | |
| | FCC: CN1166 | | ISED: CN0001 | | |
| | VCCI: | ☐R-20025 | ☐G-20034 | ☐C-20020 | ☐T-20020 |
| | | ☐R-20141 | ☐G-20134 | ☐C-20103 | ☐T-20104 |
| ☐ | **Test Site – MRT Shenzhen Laboratory** | | | | |
| | **Laboratory Location (Shenzhen)**<br>1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China | | | | |
| | **Laboratory Accreditations** | | | | |
| | A2LA: 3628.02 | | CNAS: L10551 | | |
| | FCC: CN1284 | | ISED: CN0105 | | |
| ☐ | **Test Site – MRT Taiwan Laboratory** | | | | |
| | **Laboratory Location (Taiwan)**<br>No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) | | | | |
| | **Laboratory Accreditations** | | | | |
| | TAF: 3261 | | | | |
| | FCC: 291082, TW3261 | | ISED: TW3261 | | |

### 1.4. Product Information

| | |
|---|---|
| Product Name | AirScale Indoor Radio ASiR 5G-pRRH |
| Model No. | AWHHA |
| Brand Name | Nokia |
| Operating Band (s) | 5G NR Band n41, LTE Band 41 |
| Power Supply Rating | PoE (52.0 ~ 57.0Vdc) |

Remark:

1. The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.

### 1.5. Description of Available Antennas

| Band Support | Antenna Type | Model | Antenna Gain (dBi) | Directional Gain (dBi) | |
|---|---|---|---|---|---|
| | | | | 2*2 MIMO | 4*4 MIMO |
| NR n41 & LTE Band 41 | Omni Internal Antenna | 06814 | 6.0 | 9.01 | 12.02 |

Remark:

1. The transmit signals are correlated, the directional gain = $G_{ANT}$ + 10 log ($N_{ANT}/N_{SS}$) dBi, where $N_{SS}$ = the number of independent spatial streams of data and $G_{ANT}$ is the antenna gain in dBi.
2. This device supports both 2*2 $T_X$ & 4*4 $T_X$ modes of operation, configured by SW. When operating in 2*2 TX mode, only Ant 0 & 1 transmit ports are actively transmitting.
3. All antenna information (Antenna type and Peak Gain) is provided by the manufacturer.

### 1.6. Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 2.1091 & KDB 447498 D04 Interim General RF Exposure Guidance v01

# 2. RF Exposure Evaluation

## 2.1. Test Limits

According to FCC §1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b)

Limits For Maximum Permissible Exposure (MPE)

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density ($mW/cm^2$) | Average Time (Minutes) |
|---|---|---|---|---|
| (A) Limits for Occupational/ Control Exposures | | | | |
| 0.3-3.0 | 614 | 1.63 | *(100) | ≤6 |
| 3.0-30 | 1842/f | 4.89/f | *($900/f^2$) | <6 |
| 30-300 | 61.4 | 0.163 | 1.0 | <6 |
| 300-1,500 | -- | -- | f/300 | <6 |
| 1,500-100,000 | -- | -- | 5 | <6 |
| (B) Limits for General Population/ Uncontrolled Exposures | | | | |
| 0.3-1.34 | 614 | 1.63 | *(100) | <30 |
| 1.34-30 | 824/f | 2.19/f | *($180/f^2$) | <30 |
| 30-300 | 27.5 | 0.073 | 0.2 | <30 |
| 300-1,500 | -- | -- | f/1500 | <30 |
| 1,500-100,000 | -- | -- | 1.0 | <30 |

f= frequency in MHz. * = Plane-wave equivalent power density.

### 2.2. MPE Exemptions

**For single RF sources** (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph §1.1307(b)(2) of this section): A single RF source is exempt if:

**(Option A)** The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph §1.1307(b)(3)(ii)(A) of this section.
Medical implant devices may only use this exemption and that in paragraph §1.1307(b)(3)(ii)(A);

**(Option B)** Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P is given by:

$P\ th(mW) = \{ERP_{20cm}(d\ /\ 20cm)^x$ d ≤ 20cm

$P\ th(mW) = \{ERP_{20cm}$ 20cm < d ≤ 40cm

Where

$x = -log_{10}\left(\frac{60}{ERP_{20cm}\sqrt{f}}\right)$ and f is in GHz;

and

$ERP_{20cm}(mW) = \{2040f$ 0.3GHz ≤ f < 1.5GHz

$ERP_{20cm}(mW) = \{3060$ 1.5GHz ≤ f ≤ 6GHz

**(Option C)** Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least λ/2π, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of λ/4 or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Table 1 to §1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

| RF Source Frequency (MHz) | Threshold ERP (watts) |
|---|---|
| 0.3-1.34 | $1920R^2$ |
| 1.34-30 | $3450R^2/f^2$ |
| 30-300 | $3.83R^2$ |
| 300-1,500 | $0.0128R^2f$ |
| 1,500-100,000 | $19.2R^2$ |

**For multiple RF sources:** Multiple RF sources are exempt if:

(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those is paragraph §1.1307(b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph §1.1307(b)(3)(i)(A).

(B) in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

Where:

***a*** = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(B) of this section for $P_{th}$, including existing exempt transmitters and those being added.

***b*** = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added.

***c*** = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

$P_i$ = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source *i* at a distance between 0.5 cm and 40 cm (inclusive).

$P_{th,i}$ = the exemption threshold power ($P_{th}$) according to paragraph §1.1307(b)(3)(i)(B) of this section for fixed,

mobile, or portable RF source *i*.

***ERP$_j$*** = the ERP of fixed, mobile, or portable RF source *j*.

***ERP$_{th,j}$*** = exemption threshold ERP for fixed, mobile, or portable RF source *j*, at a distance of at least λ/2π according to the applicable formula of paragraph §1.1307(b)(3)(i)(C) of this section.

***Evaluated$_k$*** = the maximum reported SAR or MPE of fixed, mobile, or portable RF source *k* either in the device or at the transmitter site from an existing evaluation at the location of exposure.

***Exposure Limit$_k$*** = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source *k*, as applicable from §1.1310 of this chapter.

### 2.3. Device Classification

According to the user manual, the antenna of this device is at least 80cm away from the body of the user, this device is classified as a fixed Device. So, the RF exposure evaluation requirements of § 2.1091 for mobile device exposure conditions subject to MPE limits.

### 2.4. Calculated Result

| | |
|---|---|
| Product | AirScale Indoor Radio ASiR 5G-pRRH |
| Test Item | RF Exposure Evaluation |

| Test Mode | Frequency Band (MHz) | Max Tune-up Power (dBm) | Antenna Gain (dBi) | Max ERP (dBm) |
|---|---|---|---|---|
| NR n41& LTE B41 _4*4 $T_X$ MIMO | 2496 ~ 2690 | 31.02 | 12.02 | 40.89 |

Remark:

1. The Max Conducted power was extracted from the Modular tune-up power.
2. The Max ERP (dBm) = Max Conducted Total Power (dBm) + Antenna Gain (dBi) - 2.15.

**For single RF source, Option C**

| Test Mode | Frequency Band (MHz) | λ / 2 π (m) | R (m) | Max ERP (W) | Threshold ERP (W) |
|---|---|---|---|---|---|
| NR n41& LTE B41 _4*4 $T_X$ MIMO | 2496 ~ 2690 | 0.0109 | 0.80 | 12.2744 | 12.2880 |

Remark: R is from user manual.

The End