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Report No.: 1909TW0102-U2
Report Version: V02
Issue Date: 12-23-2019

RF Exposure Evaluation Declaration

FCC ID: 2AD8UAWHHA01

Application: Nokia Solutions and Networks, OY

Application Type: Certification

Product: AirScale Indoor Radio ASiR 5G-pRRH

Model No.:   AWHHA

Brand Name: Nokia

Test Procedure(s):   KDB 447498 D01v06

Reviewed By: *Paddy Chen*
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TAF
Testing Laboratory
3261

The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standards through the calibration of the equipment and evaluated measurement uncertainty herein.

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Revision History

Report No.	Version	Description	Issue Date	Note
1909TW0102-U2	Rev. 01	Initial Report	12-01-2019	Valid
1909TW0102-U1	Rev. 02	Increase the output power of 60MHz bandwidth	12-23-2019	Valid

General Information

Applicant:	Nokia Solutions and Networks, OY
Applicant Address:	2000 W. Lucent Lane, Naperville, Illinois, United States, 60563
Manufacturer:	Nokia Solutions and Networks, OY
Manufacturer Address:	2000 W. Lucent Lane, Naperville, Illinois, United States, 60563
Test Site:	MRT Technology (Taiwan) Co., Ltd
Test Site Address:	No. 38, Fuxing Second Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C)

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Fuxing Rd., Taoyuan, Taiwan (R.O.C)

- **MRT facility is a FCC registered (Reg. No. 153292) test facility with the site description report on file and is designated by the FCC as an Accredited Test Film.**

- **MRT facility is an IC registered (MRT Reg. No. 21723-1) test laboratory with the site description on file at Industry Canada.**

- **MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (TAF) under the American Association for Laboratory Accreditation Program (TAF Cert. No. 3261) in EMC, Telecommunications and Radio testing for FCC, Industry Taiwan, EU and TELEC Rules.**

1. PRODUCT INFORMATION

1.1. Equipment Description

Product Name:	AirScale Indoor Radio ASiR 5G-pRRH
Model No.:	AWHHA
Brand Name:	Nokia
Test Device Serial No.:	NH192400228
Hardware Version:	X22
Software Version:	474924A
Power Supply Rating	PoE (52 ~ 57Vdc)
LTE Operating Band (s):	5G NR Band n41
Carrier Bandwidth:	60MHz, 100MHz
Modulation Type:	QPSK, 16QAM, 64QAM, 256QAM
T_X Frequency Range:	2496 ~ 2690 MHz
R_X Frequency Range:	2496 ~ 2690 MHz
Max EIRP Power:	100MHz: 2*2 T_X Mode: 36.90dBm; 4*4 T_X Mode: 42.95dBm 60MHz: 2*2 T_X Mode: 36.11dBm; 4*4 T_X Mode: 42.04dBm
Antenna Specification:	Refer to Section 1.2

1.2. Antenna Information

Band Support	Antenna Type	Model	Antenna Gain (dBi)	Directional Gain (dBi)	
				2*2 MIMO	4*4 MIMO
n41 Band	Omni Internal Antenna	06814	6	9.01	12.02

Note 1: This device supports both 2*2 T_X & 4*4 T_X modes of operation, configured by SW. When operating in 2*2 T_X mode, only Ant 0 & 1 transmit ports are actively transmitting.

Note 2: The directional gain = G_{ANT} + 10 log (N_{ANT}/N_{SS}) dBi, where NSS = the number of independent spatial streams of data and GANT is the antenna gain in dBi.

2. RF Exposure Evaluation

2.1. 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				
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/ Uncontrolled Exposures				
300-1500	--	--	f/1500	6
1500-100,000	--	--	1	30

f= Frequency in MHz

Calculation Formula: Pd = (Pout*G)/(4*pi*r2)

Where

Pd = power density in mW/cm2

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

Pd is the limit of MPE, 1mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

2.2. Test Result of RF Exposure Evaluation

Product	AirScale Indoor Radio ASiR 5G-pRRH
Test Item	RF Exposure Evaluation (For General Population)

Test Mode	Frequency Band (MHz)	Maximum EIRP (dBm)	Safety Distance (cm)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
2*2 T$_X$ MIMO					
n41 Band	2496 ~ 2690	36.90	20	0.9744	1
4*4 T$_X$ MIMO					
n41 Band	2496 ~ 2690	42.95	40	0.9810	1

Note: The EIRP = Maximum Conducted Output Power + Directional Gain.

Product	AirScale Indoor Radio ASiR 5G-pRRH
Test Item	RF Exposure Evaluation (For Occupational)

Test Mode	Frequency Band (MHz)	Maximum EIRP (dBm)	Safety Distance (cm)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
2*2 T$_X$ MIMO					
n41 Band	2496 ~ 2690	36.90	20	0.9744	5
4*4 T$_X$ MIMO					
n41 Band	2496 ~ 2690	42.95	20	3.9240	5

Note: The EIRP = Maximum Conducted Output Power + Directional Gain.

2.3. Summary of Test Result

The maximum calculations of above situations

Model	Band	Configuration	The formula of calculated the MPE (mW/cm^2)	Limit	Result
General Population	n41	2*2 T$_X$ MIMO	0.9744	1	Pass
		4*4 T$_X$ MIMO	0.9810	1	Pass
Occupational		2*2 T$_X$ MIMO	0.9744	5	Pass
		4*4 T$_X$ MIMO	3.9240	5	Pass

The device described within this report has been shown to be capable of compliance with 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 specifications

Required Compliance Boundary (cm)			
General Population		Occupational	
2*2 T$_X$ MIMO	4*4 T$_X$ MIMO	2*2 T$_X$ MIMO	4*4 T$_X$ MIMO
20	40	20	20

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