RF Exposure Report

Report No.: SA170123E07

FCC ID: 2AD8UFW2PADPM01

Test Model: FW2PADPM01

Received Date: Jan. 23, 2017

Test Date: Feb. 07, 2017

Issued Date: Apr. 20, 2017

Applicant: Nokia Solutions and Networks

Address: 1455 West Shure Drive, Arlington Heights, IL 60004, USA

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory

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Release Control Record

Issue No.	Description	Date Issued
SA170123E07	Original release.	Apr. 20, 2017

1   Certificate of Conformity

Product:	Nokia FW2P LTE module
Brand:	Nokia
Test Model:	FW2PADPM01
Test Sample S/N:	EB160810030
Hardware Version:	A101
Sample Status:	MASS-PRODUCTION
Applicant:	Nokia Solutions and Networks
Test Date:	Feb. 07, 2017
Standards:	FCC Part 2 (Section 2.1091) KDB 447498 D01 GENERAL RF EXPOSURE GUIDANCE V06 IEEE STD C95.1 FCC Part 1 (Section 1.1310)
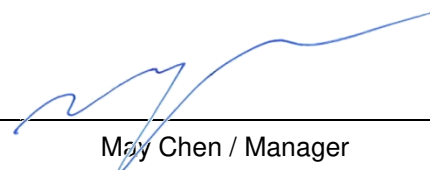
The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : _____ ,   **Date:** _____Apr. 20, 2017_____

Claire Kuan / Specialist

Approved by : _____ ,   **Date:** _____Apr. 20, 2017_____

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

F = Frequency in MHz

2.2   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

2.3   Classification

The antenna of this product, under normal use condition, is at least 33cm away from the body of the user.

So, this device is classified as fixed device and installations by professional service personnel.

2.4   Antenna Gain

BT

Antenna Spec.					
Antenna Condition	Brand	Model	Antenna Type	Gain(dBi)	Frequency (MHz)
Internal BT Ant	NA	Fz PICO	PCB	1.45	2400~2500
Antenna Condition	Brand	Model	Antenna Type	Gain(dBi) <Including cable loss>	Frequency (MHz)
External BT Ant	NA	NA	Dipole	0	2400~2500

Cable Spec.					
Brand	Model	Connector Type	Cable Loss(dB)	Cable Length (cm)	Note
NA	NA	U.FL to RP SMA type (M)	1	10	This cable will be equipped with dipole antenna

LTE Band 4

Antenna Spec.					
Antenna No	Brand	Model	Antenna Type	Gain(dBi)	Frequency (GHz)
LTE Ant1(Main)	Nokia	FW2IADPM01	Slot Antenna	6.03	1.7~2.7
Antenna No	Brand	Model	Antenna Type	Gain(dBi)	Frequency (GHz)
LTE Ant2(Aux)	Nokia	FW2IADPM01	Slot Antenna	4.64	1.7~2.7

Cable Spec.				
Brand	Model	Connector Type	Cable Loss(dB)	Cable Length (mm)
NA	NA	Right angle MMCX Plug	peak gain included	287

LAA

Antenna spec.

Antenna No	Brand	Model	Antenna Type	Gain(dBi)	Frequency range (MHz)
1	Nokia	NA	Loop (LAA#4(Main))	4.53	5150 ~ 5250, 5725 ~ 5825
2	Nokia	NA	Loop (LAA#2(DIV))	6.77	5150 ~ 5250, 5725 ~ 5825

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

Directional gain(composite gain) :

Directional Gain.

Frequency range (MHz)	Max Gain(dBi)
5150 ~ 5250, 5725 ~ 5825	7.66

Note:
1.   Directional gain calculation is based on FCC document KDB662911

   Directional gain = GANT MAX + 10 log(NANT/NSS) dBi,
   where
   NSS = the number of independent spatial streams of data ;
   GANT MAX is.the gain of the antenna having the highest gain (in dBi).

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

LTE Band 13

Antenna Spec.

Gain(dBi)	Frequency (MHz)
6	746~787

2.5   Calculation Result

Calculation for Maximum EIRP

For General Population

Bluetooth module (FCC ID: 2AD8UNBTM01)

Frequency Band (MHz)	Max. Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
2402-2480	9.099	1.45	33	0.00093	1

LAA module (FCC ID: 2AD8UFW2RADPM01)

Frequency Band (MHz)	Max EIRP Power (dBm)	Max EIRP Power (mW)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
5180-5240 & 5745-5825	27.66	582.879	33	0.24851	1

LTE Band 4 module (FCC ID: 2AD8UFW2IADPM01)

Frequency Band (MHz)	Max EIRP Power (dBm)	Max EIRP Power (mW)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
2112.5-2177.5	29.60	912.011	33	0.06664	1

LTE Band 13

Frequency Band (MHz)	Max EIRP Power (dBm)	Max EIRP Power (mW)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
748.5 ~753.5	35.35	3427.68	33	0.25047	0.499

Conclusion:

The formula of calculated the MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + ……etc. < 1

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is 0.00093 / 1 + 0.24851 / 1 + 0.06664 / 1 + 0.25047 / 0.499 = 0.81802, which is less than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.

For Occupational Population

Bluetooth module (FCC ID: 2AD8UNBTM01)

Frequency Band (MHz)	Max. Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
2402-2480	9.099	1.45	20	0.00253	5

LAA module (FCC ID: 2AD8UFW2RADPM01)

Frequency Band (MHz)	Max EIRP Power (dBm)	EIRP Power (mW)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
1932.5-1987.5	27.66	582.879	20	0.67656	5

LTE Band 4 module (FCC ID: 2AD8UFW2IADPM01)

Frequency Band (MHz)	Max EIRP Power (dBm)	EIRP Power (mW)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
2112.5-2177.5	29.60	912.011	20	0.18144	5

LTE Band 13

Frequency Band (MHz)	Max EIRP Power (dBm)	EIRP Power (mW)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
748.5 ~753.5	35.35	3427.68	20	0.68191	2.495

Conclusion:

The formula of calculated the MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + ……etc. < 1

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is 0.00253 / 5 + 0.67656 / 5 + 0.18144 / 5 + 0.68191 / 2.495 = 0.44542, which is less than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.

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
2.4GHz WiFi + 5GHz WiFi + Bluetooth + LAA + LTE Band 4 + LTE Band 13	0.2	0.33

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