RF Exposure Report

Report No.: SA161222C05

FCC ID: 2AD8UFW2HBDPM01

Test Model: FW2HBDPM01

Received Date: Dec. 22, 2016

Test Date: Jan. 09, 2017

Issued Date: Feb. 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

Lab Address: No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan (R.O.C)

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Release Control Record

Issue No.	Description	Date Issued
SA161222C05	Initial release	Jan. 11, 2017

1   Certificate of Conformity

Product: Nokia FW2H LTE module

Brand: Nokia

Test Model: FW2HBDPM01

Sample Status: ENGINEERING SAMPLE

Applicant: Nokia Solutions and Networks

Test Date: Jan. 09, 2017

Standards: FCC Part 2 (Section 2.1091)

KDB 447498 D01 General RF Exposure Guidance v06

IEEE C95.1-1992

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 : _Gina Liu_   ,   **Date:**   Feb. 20, 2017

Gina Liu / Specialist

Approved by : _Eli Hsu_   ,   **Date:**   Feb. 20, 2017

Eli Hsu / Supervisor

2   Description of Host

The EUT, WLAN, and BT module are collocated in a host. The information of host and WLAN and BT module are listed as below.

Information of Host	
Product Name	**Model Name**
Flexi Zone Multiband indoor Pico BTS	FW2HHWD
Information of Module	
Model Name	**FCC ID**
WM22-AC210m	2AD8UFZCWM2A1
NBTM01	2AD8U NBTM01

3　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/cm^2)	Average Time (minutes)
Limits For General Population / Uncontrolled Exposure				
300-1500	…	…	F/300	6
1500-100,000	…	…	5.0	6
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 20cm 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

LTE Antenna Spec.				Antenna Gain (dBi)
Antenna No.	Brand	Model	Antenna Type	LTE B41
1	Galtronics	FW2HBDPM01	Slot Antenna	5.10
2				2.61
3				3.73
4				4.12

Cable Spec.				
Brand	Model	Connector Type	Cable Loss (dB)	Cable Length (mm)
N/A	N/A	Right angel MMCX Plug	Peak gain included	287

WLAN- 2.4GHz Antenna Spec.						
Antenna No.	PCB Chain No.	Brand	Model	Antenna Type	Antenna Gain (dBi)	Frequency (GHz to GHz)
1	U20	Galtronics	N/A	PIFA	5.17	2.4000-2.4835
2	U21	Galtronics	N/A	PIFA	4.27	2.4000-2.4835

Cable Spec.					
Antenna No.	Brand	Model	Connector Type	Cable Loss (dB)	Cable Length (cm)
1	N/A	N/A	MMCX	0	30.6
2	N/A	N/A	MMCX	0	9.1

WLAN- 5GHz Antenna Spec.						
Antenna No.	PCB Chain No.	Brand	Model	Antenna Type	Antenna Gain (dBi)	Frequency (GHz to GHz)
1	U20	Galtronics	N/A	PIFA	6.03	5.1500-5.2500
					6.17	5.2500-5.3500
					5.57	5.4700-5.7250
					5.18	5.7250-5.8500
2	U21	Galtronics	N/A	PIFA	5.10	5.1500-5.2500
					4.91	5.2500-5.3500
					5.23	5.4700-5.7250
					5.73	5.7250-5.8500

Cable Spec.					
Antenna No.	Brand	Model	Connector Type	Cable Loss (dB)	Cable Length (cm)
1	N/A	N/A	MMCX	0	30.6
2	N/A	N/A	MMCX	0	9.1

Bluetooth Antenna Spec.					
Antenna Condition	**Brand**	**Model**	**Antenna Type**	**Gain (dBi)**	**Frequency (MHz to MHz)**
Internal BT Ant	N/A	Fz PICO	PCB	1.45	2400-2500
Antenna Condition	**Brand**	**Model**	**Antenna Type**	**Gain (dBi) <Including cable loss>**	**Frequency (MHz to MHz)**
External BT Ant	N/A	Fz PICO	Dipole	0	2400-2500

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

2.5 Calculation Result Of Maximum Conducted Power

For General Population

For WLAN

Frequency Band (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
2412-2462	199.526	7.74	35	0.07703	1
5180-5240, 5745-5825	398.107	8.47	35	0.18183	1

NOTE:

1. For 2.4GHz Band: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 7.74$

2. For 5.0GHz Band: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 8.47$

For Bluetooh

Frequency Band (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
2402-2480	10.000	1.45	35	0.001	1

For LTE

Frequency Band (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
2501-2685	535.797	10	35	0.34806	1

NOTE:

1. For LTE Band: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + 10^{G3/20} + 10^{G4/20})^2 / 4] = 10$

For Occupational Population

For WLAN

Frequency Band (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
2412-2462	199.526	7.74	20	0.23590	5
5180-5240, 5745-5825	398.107	8.47	20	0.55684	5

NOTE:

1. For 2.4GHz Band: Directional gain = $10 \log[(10^{G1/10} + 10^{G2/10})/N_2]= 7.74$

2. For 5.0GHz Band: Directional gain = $10 \log[(10^{G1/10} + 10^{G2/10})/N_2]= 8.47$

For Bluetooh

Frequency Band (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
2402-2480	10.000	1.45	20	0.00278	5

For LTE

Frequency Band (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
2501-2685	535.797	10	20	1.06593	5

NOTE:

1. For LTE Band: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + 10^{G3/20} + 10^{G4/20})^2 / 4]= 10$

Conclusion:

The formula of calculated the MPE is:

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

CPD = Calculation power density

LPD = Limit of power density

For General Population

There, the worst-case situation is 0.07703/1 + 0.18183/1 + 0.001/1 + 0.34806/1 + 0.34806/1= 0.95598, which is less than "1". This confirmed that device comply with FCC 1.1310 MPE limit.

For Occupational Population

There, the worst-case situation is 0.23590/5 + 0.55684/5 + 0.00278/5 + 1.06593/5 + 1.06593/5= 0.58548, which is less than "1". This confirmed that device comply with FCC 1.1310 MPE limit.

4   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
2501~2685	0.20	0.35

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