RF Exposure Report

Report No.:	SA150326E02A
FCC ID:	2AD8UFZPFWIC01
Test Model:	FWIC
Received Date:	Mar. 26, 2015
Test Date:	Apr. 01 to May 22, 2015
Issued Date:	June 25, 2015
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
Lab Address:	No. 81-1, Lu Liao Keng, 9th Ling,Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan R.O.C.
Test Location (1):	No. 81-1, Lu Liao Keng, 9th Ling,Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan R.O.C.
Test Location (2):	No. 49, Ln. 206, Wende Rd., Shangshan Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan R.O.C.

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Release Control Record

Issue No.	Description	Date Issued
SA150326E02A	Original release.	June 25, 2015

1 Certificate of Conformity

Product:	Flexi Zone Indoor Pico BTS
Brand:	Nokia
Test Model:	FWIC
Test Sample S/N:	EA150710164
Hardware Version:	472942A.X33 (Confirmation that the hardware version 472942A.X33 is fully identical with 472942A.101)
Software Version:	Operating SW: FB_FZM_PS_LFS_OS_2014_05_59-0-g927a301 WiFi module SW: 9.8.1.0.14302702
Sample Status:	ENGINEERING SAMPLE
Applicant:	Nokia Solutions and Networks
Test Date:	Apr. 01 to May 22, 2015
Standards:	FCC Part 2 (Section 2.1091) KDB 447498 D03 IEEE C95.1 ICNIRP 1998 FCC 47 CFR § 1.13.10 Canada's RF safety code 6 Australian Radiation Protection Series Publication No. 3 EN 50385:2002

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:** June 25, 2015

Midoli Peng / Specialist

Approved by : _____ , **Date:** June 25, 2015

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/cm^2)	Average Time (minutes)
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 **Mobile Device**.

3 Antenna Gain

The antenna provided to the EUT, please refer to the following table:

LTE Antenna Spec.							
Antenna No	Brand	Model	Antenna Type	Antenna Connector	Gain(dBi) <Including cable loss>	Cable Length (mm)	Frequency (MHz)
Internal LTE (Main)	TongDa	T-543-8141050-6	PIFA	i-pex(MHF)	4.9	50	1710~2390 (Band 4)
Internal LTE (Aux)		T-543-8141050-7			4.6	190	1710~2390 (Band 4)
WLAN Antenna Spec.							
Antenna No	Brand	Model	Antenna Type	Antenna Connector	Gain(dBi) <Including cable loss>	Cable Length (mm)	Frequency (MHz)
Internal WIFI (Main)	TongDa	T-543-8141037-3	PIFA	i-pex(MHF)	3.3	90	2412~2472
					2.4		5150~5825
Internal WIFI (Aux)	TongDa	T-543-8141037-4	PIFA	i-pex(MHF)	3	70	2412~2472
					2.9		5150~5825
GPS Antenna Spec.							
Antenna No	Brand	Model	Antenna Type	Antenna Connector	Gain(dBi) <Including cable loss>	Cable Length (mm)	Frequency (MHz)
External GPS Ant	TongDa	T-543-8141037-9	ElecPatch	SMA Male	4.0	9140 ± 100	GPS：1575.42 ± 3 MHz Glonass：1602 ± 8 MHz
BT Antenna Spec.							
Antenna No	Brand	Model	Antenna Type	Antenna Connector	Gain(dBi) <Including cable loss>	Cable Length (mm)	Frequency (MHz)
Internal BT Ant	INPAQ	Fz PICO	Chip	NA	-1.22	NA	2400~2500

4 Calculation Result (For FCC)

Calculation for Maximum Conducted Power

For WLAN

Frequency Band (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
2412-2462	213.108	6.16	20	0.17512	1
5180-5240	94.858	5.66	20	0.06947	1
5260-5320	248.082	5.66	20	0.18169	1
5470-5725	250.058	5.66	20	0.18313	1
5745-5825	297.873	5.66	20	0.21815	1

NOTE:
2.4GHz : Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 6.16$dBi
5GHz : Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 5.66$dBi

For BT

Frequency Band (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
2402-2480	8.974	-1.22	20	0.00135	1

For LTE

Frequency Band (MHz)	EIRP Power (mW)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
2112.5-2152.5	1242.6	20	0.247	1

Conclusion:

The formula of calculated the MPE is:

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

CPD = Calculation power density

LPD = Limit of power density

WLAN 2.4GHz + WLAN 5GHz + BT + LTE = 0.17512 + 0.21815 + 0.00135 + 0.247 = 0.642

Therefore the maximum calculations of above situations are less than the “1” limit.

5 Calculation Result (For Canada)

Calculation for Maximum Conducted Power

For WLAN

Frequency Band (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (m)	Power Density (W/m^2)	Limit (W/m^2)
2412-2462	213.108	6.16	0.2	1.7512	5.4039
5180-5240	94.858	5.66	0.2	0.6947	9.059
5260-5320	246.064	5.66	0.2	1.8021	9.1542
5500 -5580 & 5660 - 5720	250.058	5.66	0.2	1.8313	9.6235
5745-5825	297.873	5.66	0.2	2.1815	9.7103

NOTE:
2.4GHz : Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20})^2$ / 2] = 6.16dBi
5GHz : Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20})^2$ / 2] = 5.66dBi

For BT

Frequency Band (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (W/m^2)	Limit (W/m^2)
2402-2480	8.974	-1.22	0.2	0.0135	5.4100

For LTE

Frequency Band (MHz)	EIRP Power (mW)	Distance (cm)	Power Density (W/m^2)	Limit (W/m^2)
2112.5-2152.5	1107.4	0.2	2.20	4.9565

Conclusion:

The formula of calculated the MPE is:
CPD1 / LPD1 + CPD2 / LPD2 + ……etc. < 1
CPD = Calculation power density
LPD = Limit of power density

WLAN 2.4GHz + WLAN 5GHz + BT + LTE = 1.7512/5.4039 + 2.1815/9.7103 + 0.0135/5.4100 + 2.20/4.9565 = 0.995
Therefore the maximum calculations of above situations are less than the "1" limit.

6 Calculation Result (For Europe)

Calculation for maximum EIRP

2.4GHz

Output Power EIRP (dBm)	Output Power EIRP (mW)	E-Field Strength (V/m)	E-Field Strength Limit (V/m)	Pass / Fail
19.58	90.782	8.251	61	Pass

5GHz

Output Power EIRP (dBm)	Output Power EIRP (mW)	E-Field Strength (V/m)	E-Field Strength Limit (V/m)	Pass / Fail
29.87	970.510	26.979	61	Pass

BT

Output Power EIRP (dBm)	Output Power EIRP (mW)	E-Field Strength (V/m)	E-Field Strength Limit (V/m)	Pass / Fail
8.82	7.621	2.391	61	Pass

LTE

Output Power EIRP (dBm)	Output Power EIRP (mW)	E-Field Strength (V/m)	E-Field Strength Limit (V/m)	Pass / Fail
32.94	1967.886	38.418	61	Pass

Conclusion:

Both of the WLAN(2.4GHz, 5GHz) , BT and LTE can transmit simultaneously, the formula of calculated the exposure is:

$(CEF1 / LEF1)^2 + (CEF2 / LEF2)^2 + ……..etc. <1$

CEF = Calculation E-Field Strength

LEF = Limit of E-Field Strength

Therefore, the calculation of this situation is $(8.251 / 61)^{2+} (26.979 / 61)^2 + (2.391 / 61)^{2+} + (38.418 / 61)^2 =$ 0.611, which is less than the “1” limit.

7 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
LTE FDD Band 4+ Bluetooth + 2.4GHz WiFi + 5GHz WiFi	0.2	0.2

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