# RF Exposure Report

**Report No.:** SA150820E01

**FCC ID:** 2AD8UFZPFWFE01; 2AD8UFZPFWFG01; 2AD8UFZPFWFF01

**Test Model:** FWFE; FWFG; FWFF

**Series Model:** FWFI

**Received Date:** Aug. 20, 2015

**Test Date:** Sep. 17 to Oct. 20, 2015

**Issued Date:** Jan. 15, 2016

**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:** E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.

**Test Location (1):** E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, 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 |
|---|---|---|
| SA150820E01 | Original release. | Jan. 15, 2016 |

## 1  Certificate of Conformity

**Product:** Flexi Zone Indoor Pico BTS

**Brand:** Nokia

**Test Model:** FWFE; FWFG; FWFF

**Series Model:** FWFI

**Hardware Version:** 473236A .101; 473238A.101; 473237A.101; 473771A.101

**Sample Status:** MASS-PRODUCTION

**Applicant:** Nokia Solutions and Networks

**Test Date:** Sep. 17 to Oct. 20, 2015

**Standards:** FCC Part 2 (Section 2.1091)
KDB 447498 D01 GENERAL RF EXPOSURE GUIDANCE V06
IEEE STD C95.1-2005
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:** _____ Jan. 15, 2016 _____
Lori Chung / Specialist

**Approved by :** _____ , **Date:** _____ Jan. 15, 2016 _____
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 20cm away from the body of the user. So, this device is classified as **fixed device** and installations by professional service personnel.

## 3    Antenna Gain

**WWAN Antenna Spec.**

| Antenna No | Brand | Model | Antenna Type | Antenna Connector | Gain(dBi) <Including cable loss> | Cable Length (mm) | Frequency (MHz) |
|---|---|---|---|---|---|---|---|
| Internal WWAN (Main) | TongDa | U81B045 | PIFA | i-pex(MHF) | 5.94 | 90 | 1930-1990 |
| Internal WWAN (Aux) | | | | | 4.5 | 225 | |
| External WWAN (Main & Aux) | Larsen | DASLTE500NFMIMO | 1/4 Wave monopoles on ground plane | N-Female/1/4" low loss, low PIM, plenum rated | 2 | NA | 698~960 |
| | | | | | 5 | | 1710~2170 |

**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(dBic) <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 |

The functions support of each model as below table:

| Model name | WWAN | | Wi-Fi | BT | GPS |
|---|---|---|---|---|---|
| | Internal antenna | External antenna | | | |
| FWFE | ✓ | - | ✓ | ✓ | ✓ |
| FWFI | ✓ | - | ✓ | ✓ | ✓ |
| FWFG | - | ✓ | - | ✓ | ✓ |
| FWFF | ✓ | - | - | ✓ | ✓ |

## 4　Calculation Result of Maximum Conducted Power

### For WLAN

(Model: FWFE & FWFI)

| Frequency Band (MHz) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density (mW/cm$^2$) | Limit (mW/cm$^2$) |
|---|---|---|---|---|---|
| 2412-2462 | 340.489 | 6.16 | 20 | 0.27979 | 1 |
| 5180-5240 | 293.463 | 5.66 | 20 | 0.21492 | 1 |
| 5745-5825 | 331.042 | 5.66 | 20 | 0.24244 | 1 |

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

(Model: FWFE & FWFI)

| Frequency Band (MHz) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density (mW/cm$^2$) | Limit (mW/cm$^2$) |
|---|---|---|---|---|---|
| 2402-2480 | 9.840 | -1.22 | 20 | 0.00148 | 1 |

(Model: FWFG & FWFF)

| Frequency Band (MHz) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density (mW/cm$^2$) | Limit (mW/cm$^2$) |
|---|---|---|---|---|---|
| 2402-2480 | 9.795 | -1.22 | 20 | 0.00147 | 1 |

**For WWAN**

**WCDMA SC MODE**

(Model: FWFE, FWFI & FWFF – with internal antenna)

| Frequency Band (MHz) | Max Power (dBm) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density (mW/cm$^2$) | Limit (mW/cm$^2$) |
|---|---|---|---|---|---|---|
| 1932.4-1987.6 | 23.41 | 219.28 | 5.94 | 20 | 0.17129 | 1 |

(Model: FWFG – with external antenna)

| Frequency Band (MHz) | Max Power (dBm) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density (mW/cm$^2$) | Limit (mW/cm$^2$) |
|---|---|---|---|---|---|---|
| 1932.4-1987.6 | 23.18 | 207.97 | 5 | 20 | 0.131 | 1 |

**WCDMA MC MODE**

(Model: FWFE, FWFI & FWFF – with internal antenna)

| Frequency Band (MHz) | Max Power (dBm) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density (mW/cm$^2$) | Limit (mW/cm$^2$) |
|---|---|---|---|---|---|---|
| 1932.4-1987.6 | 24.79 | 301.46 | 5.94 | 20 | 0.23548 | 1 |

(Model: FWFG – with external antenna)

| Frequency Band (MHz) | Max Power (dBm) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density (mW/cm$^2$) | Limit (mW/cm$^2$) |
|---|---|---|---|---|---|---|
| 1932.4-1987.6 | 24.73 | 297.080 | 5 | 20 | 0.187 | 1 |

**Conclusion:**

The formula of calculated the MPE is:

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

CPD = Calculation power density

LPD = Limit of power density

| Model | Scenario | The formula of calculated the MPE | Calcualtion Power Density | Limit | Results |
|---|---|---|---|---|---|
| FWFE & FWFI | WLAN 2.4GHz + WLAN 5GHz + BT + WWAN (WCDMA SC MODE) | 0.27979 + 0.24244 + 0.00148 + 0.17129 | 0.695 | 1 | Pass |
| | WLAN 2.4GHz + WLAN 5GHz + BT + WWAN (WCDMA MC MODE) | 0.27979 + 0.24244 + 0.00148 + 0.23548 | 0.75919 | 1 | Pass |
| FWFG | BT + WWAN (WCDMA SC MODE) | 0.00147 + 0.131 | 0.13247 | 1 | Pass |
| | BT + WWAN (WCDMA MC MODE) | 0.00147 + 0.187 | 0.18847 | 1 | Pass |
| FWFF | BT + WWAN (WCDMA SC MODE) | 0.00147 + 0.17129 | 0.17276 | 1 | Pass |
| | BT + WWAN (WCDMA MC MODE) | 0.00147 + 0.23548 | 0.23695 | 1 | Pass |

## 5   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 |
| WWAN FDD Band 2+ Bluetooth + 2.4GHz WiFi + 5GHz WiFi | 0.2 | 0.2 |

**--- END ---**