RF Exposure Evaluation Report

APPLICANT	:	Nokia Shanghai Bell Co., Ltd.
EQUIPMENT	:	NOKIA ONT
BRAND NAME	:	NOKIA
MODEL NAME	:	XS-2437X-B
FCC ID	:	2ADZRXS2437XB
STANDARD	:	47 CFR Part 2.1091 FCC KDB 447498 D01 v06

The product evaluation date was started from Nov. 01, 2024 and completed on Dec. 06, 2024. We, Sporton International Inc. (Kunshan), would like to declare that the device has been evaluated in accordance with 47 CFR Part 2.1091 and FCC KDB 447498 D01 v06, and pass the limit. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

Si Zhang

Approved by: Si Zhang

ACCREDITED Cert #5145.02

Sporton International Inc. (Kunshan)
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People's Republic of China

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA462802	Rev. 01	Initial issue of report.	Dec. 11, 2024

1. Administration Data

1.1. Testing Laboratory

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Testing Laboratory			
Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	SAR01-KS	CN1257	314309

Applicant	
Company Name	Nokia Shanghai Bell Co., Ltd.
Address	No.388, Ningqiao Rd, Pilot Free Trade Zone, Shanghai, 201206 P.R. China

Manufacturer	
Company Name	Nokia of America Corporation
Address	2301 Sugar Bush Rd. Raleigh, NC 27612

2. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	NOKIA ONT
Brand Name	NOKIA
Model Name	XS-2437X-B
Part Number	3TN00958xxxx, 3TN00961xxxx, (x can be A-Z or blank)
FCC ID	2ADZRXS2437XB
Wireless Technology and Frequency Range	WLAN 2.4GHz Band: 2412 MHz - 2462 MHz WLAN 5.2GHz Band: 5180 MHz - 5240 MHz WLAN 5.3GHz Band: 5260 MHz - 5320 MHz WLAN 5.5GHz Band: 5500 MHz - 5720 MHz WLAN 5.8GHz Band: 5745 MHz - 5825 MHz WLAN 6GHz U-NII-5: 5925 MHz - 6425 MHz WLAN 6GHz U-NII-6: 6425 MHz - 6525 MHz WLAN 6GHz U-NII-7: 6525 MHz - 6875 MHz WLAN 6GHz U-NII-8: 6875 MHz - 7125 MHz
Mode	WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 2.4GHz 802.11ax HE20/HE40 WLAN 2.4GHz 802.11be EHT20/EHT40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac/ax VHT20/VHT40/VHT80/VHT160/HE20/HE40/HE80/HE160 WLAN 5GHz 802.11be EHT20/EHT40/EHT80/EHT160 WLAN 6GHz 802.11ax HE20/HE40/HE80/HE160 WLAN 6GHz 802.11be EHT20/EHT40/EHT80/EHT160/EHT320
Antenna Type	WLAN: Dipole Antenna
EUT Stage	Production Unit

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. This device support beamforming for WLAN 2.4GHz 802.11 ax/be HE20/HE40/EHT20/EHT40 and WLAN 5GHz 802.11 ac/ax/be VHT20/VHT40/VHT80/VHT160/HE20/HE40/HE80/HE160/EHT20/EHT40/EHT80/EHT160, and WLAN 6GHz 802.11 ax/be HE20/HE40/HE80/HE160/EHT20/EHT40/EHT80/EHT160/EHT320.
3. The device supports 1S4T(CDD&TXBF) mode for WLAN 2.4GHz/5GHz, and 1S4T(CDD&TXBF) and 4S4T(SDM) mode for WLAN 6GHz; 1S4T: NSS=1, MIMO 4Tx; 4S4T: NSS=4, MIMO 4Tx.
4. WLAN2.4GHz/WLAN5GHz/WLAN6GHz all support SISO and MIMO mode, MIMO tune up power was chosen to perform MPE calculation conservatively.
5. For WLAN CDD&Beamforming mode, the MPE calculation performed separately.
6. There are two Antennas for optional: Inpaq antenna and AOT antenna, the detail gain value please refers to following gain table. Please refer to the antenna report for the maximum Single antenna gain and CDD (Cyclic Delay Diversity) directional gain and TXBF (Tx Beamforming) directional gain.
7. For WLAN2.4GHz/WLAN5GHz Antennas 1, 2, 3, and 4 in this report correspond to antennas 6, 7, 8, and 9 in the antenna report respectively.
8. Part Number are for marketing purpose only, 3TN00958xxxx are identical to 3TN00961xxxx except a power adapter is added to the unit.

Comments and Explanations:
1. The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.
2. The maximum RF output tune up power, antenna gain also the safe distance used for evaluate RF exposure were declared by manufacturer.

For Antenna Gain:

Antenna	Frequency Bands	Maximum Single Antenna gain (dBi)	CDD Gain (dBi)	SDM Gain (dBi)	Beamforming Gain (dBi)
Inpaq antenna	WLAN 2.4GMHz	2.03	0.04	/	5.90
	WLAN 5.2GMHz	3.84	0.33	/	5.85
	WLAN 5.3GMHz	3.84	0.33	/	5.85
	WLAN 5.5GMHz	3.98	0.41	/	5.90
	WLAN 5.8GMHz	3.81	0.08	/	5.50
	WLAN 6GMHz	3.02	0.16	0.16	4.93
AOT antenna	WLAN 2.4GMHz	2.70	-0.05	/	5.88
	WLAN 5.2GMHz	3.36	0.18	/	5.83
	WLAN 5.3GMHz	3.36	0.18	/	5.83
	WLAN 5.5GMHz	3.68	0.49	/	5.95
	WLAN 5.8GMHz	2.58	0.17	/	5.91
	WLAN 6GMHz	3.21	0.23	0.23	4.98

3. Maximum RF average output tune up power among production units

<For CDD/MIMO Mode>

<2.4GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2+3+4
2.4GHz	802.11b	30.0
	802.11g	30.0
	802.11n-HT20	30.0
	802.11n-HT40	28.5
	802.11ax-HE20	30.0
	802.11ax-HE40	28.5
	802.11be-EHT20	30.0
	802.11be-EHT40	28.5

<5GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2+3+4
5.2GHz	802.11a	28.5
	802.11n-HT20	28.0
	802.11n-HT40	27.0
	802.11ac-VHT20	28.0
	802.11ac-VHT40	27.0
	802.11ac-VHT80	20.0
	802.11ax-HE20	30.0
	802.11ax-HE40	29.0
	802.11ax-HE80	20.5
	802.11be-EHT20	30.0
	802.11be-EHT40	29.0
	802.11be-EHT80	20.5
5.3GHz	802.11a	23.0
	802.11n-HT20	23.0
	802.11n-HT40	23.5
	802.11ac-VHT20	23.0
	802.11ac-VHT40	23.5
	802.11ac-VHT80	19.5
	802.11ac-VHT160	19.5
	802.11ax-HE20	23.5
	802.11ax-HE40	23.98
	802.11ax-HE80	20.0
	802.11ax-HE160	20.0
	802.11be-EHT20	23.5
	802.11be-EHT40	23.98
	802.11be-EHT80	20.0
	802.11be-EHT160	20.0
5.5GHz	802.11a	23.0
	802.11n-HT20	23.0
	802.11n-HT40	23.98
	802.11ac-VHT20	23.0
	802.11ac-VHT40	23.98
	802.11ac-VHT80	23.98
	802.11ac-VHT160	23.0
	802.11ax-HE20	23.5
	802.11ax-HE40	23.98
	802.11ax-HE80	23.98
	802.11ax-HE160	23.0
	802.11be-EHT20	23.5
	802.11be-EHT40	23.98
	802.11be-EHT80	23.98
	802.11be-EHT160	23.0
5.8GHz	802.11a	30.0
	802.11n-HT20	30.0
	802.11n-HT40	30.0

	802.11ac-VHT20	30.0
	802.11ac-VHT40	30.0
	802.11ac-VHT80	27.0
	802.11ax-HE20	30.0
	802.11ax-HE40	30.0
	802.11ax-HE80	28.0
	802.11be-EHT20	30.0
	802.11be-EHT40	30.0
	802.11be-EHT80	28.0

<6GHz WLAN>

Mode		Maximum Average Power (dBm)	
		Ant.1+2+3+4	
		1S4T	4S4T
6GHz	802.11ax-HE20	13.0	17.5
	802.11ax-HE40	16.0	20.0
	802.11ax-HE80	19.0	23.0
	802.11ax-HE160	21.5	26.0
	802.11be-EHT20	13.0	17.5
	802.11be-EHT40	16.0	20.5
	802.11be-EHT80	19.0	23.5
	802.11be-EHT160	21.5	26.0
	802.11be-EHT320	24.5	29.0

Note: WLAN2.4GHz/WLAN5GHz/WLAN6GHz all support SISO/MIMO mode, MIMO tune up power was chosen to perform MPE calculation conservatively.

<For Beamforming Mode>

<2.4GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2+3+4
2.4GHz	802.11ax-HE20	29.0
	802.11ax-HE40	25.5
	802.11be-EHT20	29.0
	802.11be-EHT40	25.5

<5GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2+3+4
5.2GHz	802.11ac-VHT20	26.5
	802.11ac-VHT40	26.5
	802.11ac-VHT80	19.5
	802.11ax-HE20	27.5
	802.11ax-HE40	27.5
	802.11ax-HE80	20.0
	802.11be-EHT20	27.5
	802.11be-EHT40	27.5
	802.11be-EHT80	20.0
5.3GHz	802.11ac-VHT20	22.5
	802.11ac-VHT40	23.0
	802.11ac-VHT80	18.5
	802.11ac-VHT160	18.5
	802.11ax-HE20	23.0
	802.11ax-HE40	23.98
	802.11ax-HE80	19.0
	802.11ax-HE160	19.0
	802.11be-EHT20	23.0
	802.11be-EHT40	23.98
	802.11be-EHT80	19.0
	802.11be-EHT160	19.0
5.5GHz	802.11ac-VHT20	22.5
	802.11ac-VHT40	23.98
	802.11ac-VHT80	23.0
	802.11ac-VHT160	22.0
	802.11ax-HE20	23.0
	802.11ax-HE40	23.98
	802.11ax-HE80	23.98
	802.11ax-HE160	22.5
	802.11be-EHT20	23.0
	802.11be-EHT40	23.98
	802.11be-EHT80	23.98
	802.11be-EHT160	22.5
5.8GHz	802.11ac-VHT20	29.0

	802.11ac-VHT40	29.5
	802.11ac-VHT80	27.5
	802.11ax-HE20	30.0
	802.11ax-HE40	30.0
	802.11ax-HE80	28.5
	802.11be-EHT20	30.0
	802.11be-EHT40	30.0
	802.11be-EHT80	28.5

<6GHz WLAN>

Mode		Maximum Average Power (dBm)
		Ant.1+2+3+4
6GHz	802.11ax-HE20	13.0
	802.11ax-HE40	15.5
	802.11ax-HE80	18.5
	802.11ax-HE160	21.5
	802.11be-EHT20	13.0
	802.11be-EHT40	15.5
	802.11be-EHT80	18.5
	802.11be-EHT160	21.5
	802.11be-EHT320	23.5

Note: This device support beamforming for WLAN 2.4GHz 802.11 ax/be HE20/HE40/EHT20/EHT40 and WLAN 5GHz 802.11 ac/ax/be VHT20/VHT40/VHT80/VHT160/HE20/HE40/HE80/HE160/EHT20/EHT40/EHT80/EHT160, and WLAN 6GHz 802.11 ax/be HE20/HE40/HE80/HE160/EHT20/EHT40/EHT80/EHT160/EHT320.

4. RF Exposure Limit Introduction

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f2)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f2)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

The MPE was calculated at 26 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:
S = Power Density
P = Output Power at Antenna Terminals
G = Gain of Transmit Antenna (linear gain)
R = Distance from Transmitting Antenna

5. Radio Frequency Radiation Exposure Evaluation

5.1. Standalone Power Density Calculation

<WLAN MIMO Mode>

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Average EIRP (dBm)	Average EIRP (mW)	Power Density at 26cm (mW/cm^2)	Limit (mW/cm^2)	Power Density / Limit
WLAN2.4GHz	2412	0.04	30.00	30.040	1009.253	0.119	1.000	0.119
WLAN5.2GHz	5180	0.33	30.00	30.330	1078.947	0.127	1.000	0.127
WLAN5.3GHz	5260	0.33	23.98	24.310	269.774	0.032	1.000	0.032
WLAN5.5GHz	5500	0.49	23.98	24.470	279.898	0.033	1.000	0.033
WLAN5.8GHz	5745	0.17	30.00	30.170	1039.920	0.122	1.000	0.122
WLAN6GHz	5925	0.23	29.00	29.230	837.529	0.099	1.000	**0.099**

<WLAN Beamforming Mode>

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Average EIRP (dBm)	Average EIRP (mW)	Power Density at 26cm (mW/cm^2)	Limit (mW/cm^2)	Power Density / Limit
WLAN2.4GHz	2412	5.90	29.00	34.900	3090.295	0.364	1.000	**0.364**
WLAN5.2GHz	5180	5.85	27.50	33.350	2162.719	0.255	1.000	0.255
WLAN5.3GHz	5260	5.85	23.98	29.830	961.612	0.113	1.000	0.113
WLAN5.5GHz	5500	5.95	23.98	29.930	984.011	0.116	1.000	0.116
WLAN5.8GHz	5745	5.91	30.00	35.910	3899.420	0.459	1.000	**0.459**
WLAN6GHz	5925	4.98	23.50	28.480	704.693	0.083	1.000	0.083

Note:

1. For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band.
2. For WLAN 2.4GHz/5GHz, chose the maximum RF output tune up power and the maximum antenna gain of all antennas among same frequency WLAN bands to perform MPE calculation conservatively. For WLAN 6GHz, chose the maximum RF output tune up power and the maximum antenna gain of CDD and SDM mode among same frequency WLAN bands to perform MPE calculation conservatively.

5.2. Collocated Power Density Calculation

<WLAN 2.4GHz + WLAN 5GHz + WLAN 6GHz >:

Maximum WLAN 2.4GHz Power Density / Limit	Maximum WLAN 5GHz Power Density / Limit	Maximum WLAN 6GHz Power Density / Limit	Σ(Power Density / Limit) of WLAN 2.4GHz + WLAN 5GHz + WLAN 6GHz
0.364	0.459	0.099	0.922

Note:

1. For colocation analysis, choose the highest (power density/limit) among WLAN 2.4GHz/5GHz/6GHz MIMO mode and Beamforming mode respectively.
2. ∑(Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for WLAN 2.4GHz + WLAN 5GHz + WLAN 6GHz.
3. Considering all transmitter of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and collocated transmitters is compliant.

Conclusion:

According to 47 CFR §2.1091, the equipment at least 26 cm to show compliance with the power density limit, the RF exposure analysis concludes that the RF Exposure is FCC compliant.

------THE END------