RF Exposure Evaluation Report

APPLICANT	:	Nokia Shanghai Bell Co., Ltd.
EQUIPMENT	:	NOKIA WiFi Beacon 3.1
BRAND NAME	:	NOKIA
MODEL NAME	:	Beacon 3.1
FCC ID	:	2ADZRBEACON311
STANDARD	:	47 CFR Part 2.1091 FCC KDB 447498 D01 v06

The product evaluation date was started from Dec. 30, 2024 and completed on Dec. 30, 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
FA4N0526	Rev. 01	Initial issue of report.	Jan. 16, 2025

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 WiFi Beacon 3.1
Brand Name	NOKIA
Model Name	Beacon 3.1
FCC ID	2ADZRBEACON311
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
Mode	WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 2.4GHz 802.11ax HE20/HE40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac/ax VHT20/VHT40/VHT80/VHT160/HE20/HE40/HE80/HE160
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 HE20/HE40 and WLAN 5GHz 802.11 ac/ax VHT20/VHT40/VHT80/VHT160/HE20/HE40/HE80/HE160.
3. The device supports 1S2T(CDD&TXBF) mode for WLAN 2.4GHz/5GHz.
4. WLAN2.4GHz/WLAN5GHz 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. WLAN 2.4G has three antennas (Ant.3/4/5). In the MIMO (ant.3+ant.5, or ant.4+ant.5) mode, the ant.3 and ant.4 share the same conducted path and same conducted output power level, and the ant.3/ant.4 will automatically switch when working and will not be used at the same time, always maintain 2*2 MIMO TX/RX with ant5.
7. For WLAN2.4GHz Antennas 1 and 2 in this report correspond to antennas 3 and 5 in the antenna report respectively.

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:

Frequency Bands	Maximum Single Antenna gain (dBi)	Beamforming Gain (dBi)
WLAN 2.4GMHz	2.97	4.18
WLAN 5.2GMHz	3.07	3.75
WLAN 5.3GMHz	3.07	3.75
WLAN 5.5GMHz	2.86	4.44
WLAN 5.8GMHz	2.79	4.5

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
2.4GHz	802.11b	30.0
	802.11g	29.5
	802.11n-HT20	29.5
	802.11n-HT40	26.0
	802.11ax-HE20	29.5
	802.11ax-HE40	26.0

<5GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2
5.2GHz	802.11a	29.0
	802.11n-HT20	29.0
	802.11n-HT40	27.0
	802.11ac-VHT20	29.0
	802.11ac-VHT40	27.5
	802.11ac-VHT80	21.5
	802.11ac-VHT160	20.0
	802.11ax-HE20	30.0
	802.11ax-HE40	28.0
	802.11ax-HE80	22.0
	802.11ax-HE160	20.0
5.3GHz	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	21.5
	802.11ac-VHT160	20.0
	802.11ax-HE20	23.98
	802.11ax-HE40	23.98
	802.11ax-HE80	22.0
	802.11ax-HE160	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	20.0
	802.11ax-HE20	23.5

	802.11ax-HE40	23.98
	802.11ax-HE80	23.98
	802.11ax-HE160	20.0
5.8GHz	802.11a	28.5
	802.11n-HT20	28.5
	802.11n-HT40	29.0
	802.11ac-VHT20	28.5
	802.11ac-VHT40	29.0
	802.11ac-VHT80	25.0
	802.11ax-HE20	28.5
	802.11ax-HE40	29.0
	802.11ax-HE80	26.0

Note: WLAN2.4GHz/WLAN5GHz 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
2.4GHz	802.11ax-HE20	28.0
	802.11ax-HE40	25.0

<5GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2
5.2GHz	802.11ac-VHT20	28.5
	802.11ac-VHT40	26.0
	802.11ac-VHT80	20.0
	802.11ac-VHT160	19.0
	802.11ax-HE20	29.0
	802.11ax-HE40	26.0
	802.11ax-HE80	21.0
	802.11ax-HE160	19.0
5.3GHz	802.11ac-VHT20	22.0
	802.11ac-VHT40	23.5
	802.11ac-VHT80	21.0
	802.11ac-VHT160	19.0
	802.11ax-HE20	23.0
	802.11ax-HE40	23.98
	802.11ax-HE80	21.0
	802.11ax-HE160	19.0
5.5GHz	802.11ac-VHT20	21.0
	802.11ac-VHT40	22.0
	802.11ac-VHT80	22.0
	802.11ac-VHT160	18.0
	802.11ax-HE20	21.5
	802.11ax-HE40	23.0
	802.11ax-HE80	22.0
	802.11ax-HE160	18.0
5.8GHz	802.11ac-VHT20	27.0
	802.11ac-VHT40	27.5
	802.11ac-VHT80	23.5
	802.11ax-HE20	27.0
	802.11ax-HE40	27.5
	802.11ax-HE80	24.0

Note: This device support beamforming for WLAN 2.4GHz 802.11 ax HE20/HE40 and WLAN 5GHz 802.11 ac/ax VHT20/VHT40/VHT80/VHT160/HE20/HE40/HE80/HE160.

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 20 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 20cm (mW/cm^2)	Limit (mW/cm^2)	Power Density / Limit
WLAN2.4GHz	2412	2.97	30.00	32.970	1981.527	0.394	1.000	**0.394**
WLAN5.2GHz	5180	3.07	30.00	33.070	2027.683	0.404	1.000	**0.404**
WLAN5.3GHz	5260	3.07	23.98	27.050	506.991	0.101	1.000	0.101
WLAN5.5GHz	5500	2.86	23.98	26.840	483.059	0.096	1.000	0.096
WLAN5.8GHz	5745	2.79	29.00	31.790	1510.080	0.301	1.000	0.301

<WLAN Beamforming Mode>

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Average EIRP (dBm)	Average EIRP (mW)	Power Density at 20cm (mW/cm^2)	Limit (mW/cm^2)	Power Density / Limit
WLAN2.4GHz	2412	4.18	28.00	32.180	1651.962	0.329	1.000	0.329
WLAN5.2GHz	5180	3.75	29.00	32.750	1883.649	0.375	1.000	0.375
WLAN5.3GHz	5260	3.75	23.98	27.730	592.925	0.118	1.000	0.118
WLAN5.5GHz	5500	4.44	23.00	27.440	554.626	0.110	1.000	0.110
WLAN5.8GHz	5745	4.50	27.50	32.000	1584.893	0.315	1.000	0.315

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.

5.2. Collocated Power Density Calculation

<WLAN 2.4GHz + WLAN 5GHz >:

Maximum WLAN 2.4GHz Power Density / Limit	Maximum WLAN 5GHz Power Density / Limit	Σ(Power Density / Limit) of WLAN 2.4GHz + WLAN 5GHz
0.394	0.404	0.798

Note:

1. For colocation analysis, choose the highest (power density/limit) among WLAN 2.4GHz/5GHz 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.
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 20 cm to show compliance with the power density limit, the RF exposure analysis concludes that the RF Exposure is FCC compliant.

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