12. Radio Frequency Exposure

12.1 Applicable Standards

☐ §1.1307(b)(3)(i)(A)	The available maximum time-averaged power is no more than 1 mW, regardless of separation distance.
☒ §1.1307(b)(3)(i)(c)	ERP is below a threshold calculated based on the distance , R between the person and the antenna / radiating structure, where R > λ / 2 π. TABLE B.1—THRESHOLDS FOR SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION
☐ § 1.1307(b)(3)(i)(B).	Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= Pth

TABLE B.1—THRESHOLDS FOR SINGLE RF SOURCES
SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION

RF Source Frequency			Minimum Distance			Threshold ERP
f_L MHz		f_H MHz	$\lambda_L / 2\pi$		$\lambda_H / 2\pi$	W
0.3	–	1.34	159 m	–	35.6 m	$1{,}920\ R^2$
1.34	–	30	35.6 m	–	1.6 m	$3{,}450\ R^2/f^2$
30	–	300	1.6 m	–	159 mm	$3.83\ R^2$
300	–	1,500	159 mm	–	31.8 mm	$0.0128\ R^2 f$
1,500	–	100,000	31.8 mm	–	0.5 mm	$19.2 R^2$

Subscripts L and H are low and high; λ is wavelength.
From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns.

$$P_{th}\ (\text{mW}) = \begin{cases} ERP_{20\ cm}(d/20\ \text{cm})^x & d \leq 20\ \text{cm} \\ ERP_{20\ cm} & 20\ \text{cm} < d \leq 40\ \text{cm} \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\ cm}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \leq f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \leq f \leq 6\ \text{GHz} \end{cases}$$

d = the separation distance (cm);

12.1 EUT Specification

Frequency band (Operating)	☐ WLAN: 2412MHz ~ 2462MHz ☐ WLAN: 5150MHz ~ 5250MHz ☐ WLAN: 5250MHz ~ 5350MHz ☐ WLAN: 5470MHz ~ 5725MHz ☐ WLAN: 5725MHz ~ 5850MHz ☒ Bluetooth: 2402MHz ~ 2480MHz
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation)
Antenna diversity	☒ Single antenna ☐ Multiple antennas 　☐ Tx diversity 　☐ Rx diversity 　☐ Tx/Rx diversity
Evaluation applied	☐ Blanket 1 mW Blanket Exemption ☒ MPE-based Exemption ☐ SAR-based Exemption
Remark: The maximum conducted output power is 3.68dBm (2.33mW) at 2402MHz (with 4.9dBi antenna gain.)-For Chip:Nordic The maximum conducted output power is 12.95dBm (19.724mW) at 2402MHz (with 2.7dBi antenna gain.)- For Chip: WCN3680	

12.2 Result

For Chip:Nordic

Channel Frequency (MHz)	Max. Conducted output power (dBm)	Max. Tune up power (dBm)	Antenna Gain(dBi)	Max.Tune up e.r.p. Power (dBm)	Max. Tune up e.r.p power (mW)	Limit (mW)
2402-2480	3.68	4.18	4.9	6.93	4.93	3060

No non-compliance noted.

For Chip: WCN3680

Channel Frequency (MHz)	Max. Conducted output power (dBm)	Max. Tune up power (dBm)	Antenna Gain(dBi)	Max.Tune up e.r.p. Power (dBm)	Max. Tune up e.r.p power (mW)	Limit (mW)
2402-2480	12.95	13.45	2.7	14.00	25.12	3060

No non-compliance noted.

Maximum Permissible Exposure (Co-location)

WCN3680 BLE+ Nordic BLE

Modulation Type	Channel Frequency (MHz)	Max. Conducted output power (dBm)	Max. Tune up power (dBm)	Antenna Gain(dBi)	Distance (cm)	Max.Tune up e.r.p. Power(mW)	Limit (mW)	MPE Ratio
GFSK(1Mbps)	2402-2480	12.95	13.45	2.7	20	25.12	3060.00	0.008
GFSK(1Mbps)	2402-2480	3.68	4.18	4.9	20	4.93	3060.00	0.002
Co-location Total								0.010
ΣMPE ratios Limit								1.000

WCN3680 WIFI 2.4G + Nordic BLE

Modulation Type	Channel Frequency (MHz)	Max. Conducted output power (dBm)	Max. Tune up power (dBm)	Antenna Gain(dBi)	Distance (cm)	Max.Tune up e.r.p. Power(mW)	Limit (mW)	MPE Ratio
11g	2412-2462	23.31	23.81	2.7	20	272.90	3060.00	0.089
GFSK(1Mbps)	2402-2480	3.68	4.18	4.9	20	4.93	3060.00	0.002
Co-location Total								0.091
ΣMPE ratios Limit								1.000

WCN3680 WIFI 5G + Nordic BLE

Modulation Type	Channel Frequency (MHz)	Max. Conducted output power (dBm)	Max. Tune up power (dBm)	Antenna Gain(dBi)	Distance (cm)	Max.Tune up e.r.p. Power(mW)	Limit (mW)	MPE Ratio
11ac VHT20	5260-5320	16.32	16.82	3.8	20	70.31	3060.00	0.023
GFSK(1Mbps)	2402-2480	3.68	4.18	4.9	20	4.93	3060.00	0.002
Co-location Total								0.025
ΣMPE ratios Limit								1.000

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