RF Exposure evaluation

FCC ID: 2A7EH-N4PRO

1. Reference

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

KDB447498 D01: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies

2. Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	6
3.0 – 30	1842/f	4.89/f	($900/f^2$)*	6
30 – 300	61.4	0.163	1.0	6
300 – 1500	/	/	f/300	6
1500 – 100,000	/	/	5	6

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 30	824/f	2.19/f	($180/f^2$)*	30
30 – 300	27.5	0.073	0.2	30
300 – 1500	/	/	f/1500	30
1500 – 100,000	/	/	1.0	30

F=frequency in MHz

*=Plane-wave equivalent power density

3. MPE Calculation Method

Predication of MPE limit at a given distance
Equation from page 18 of OET Bulletin 65, Edition 97-01

$S=PG/4\pi R^2$

Where: S=power density
P=power input to antenna
G=power gain of the antenna in the direction of interest relative to an isotropic radiator
R=distance to the center of radiation of the antenna

4. Antenna Information

N4Pro can only use antennas certificated as follows provided by manufacturer;

Antenna No.	Model No. of antenna:	Type of antenna:	Gain of the antenna (Max.)	Frequency range:
BLE	/	FPC ANT	0.86dBi for 2400-2500MHz	
2.4GWIFI	/	FPC ANT	0.86dBi for 2400-2500MHz	
5GWIFI	/	FPC ANT	0.72dBi for 5150-5250MHz	
			0.52dBi for 5725-5875MHz	

5. Manufacturing Tolerance

BLE(Peak)

BLE			
Channel	Channel 00	Channel 19	Channel 39
Target (dBm)	-3.0	-3.0	-3.0
Tolerance ±(dB)	1.0	1.0	1.0

2.4GHz WIFI(Peak)

Frequency (MHz)	11b		
	2412	2437	2462
Target (dBm)	14.0	14.0	14.0
Tolerance ± (dB)	1.0	1.0	1.0
Frequency (MHz)	11g		
	2412	2437	2462
Target (dBm)	13.0	13.0	13.0
Tolerance ± (dB)	1.0	1.0	1.0
Frequency (MHz)	11n(HT20)		
	2412	2437	2462
Target (dBm)	13.0	13.0	13.0
Tolerance ± (dB)	1.0	1.0	1.0
Frequency	11n(HT40)		

(MHz)	2422	2437	2452
Target (dBm)	13.0	13.0	13.0
Tolerance ± (dB)	1.0	1.0	1.0

5GHz WLAN Band 1

IEEE 802.11a (Average)			
Frequency(MHz)	5180	5200	5240
Target (dBm)	8.0	8.0	8.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Frequency(MHz)	5180	5200	5240
Target (dBm)	8.0	8.0	8.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Average)			
Frequency(MHz)	5190	5230	
Target (dBm)	5.0	5.0	
Tolerance ± (dB)	1.0	1.0	
IEEE 802.11ac VHT20 (Average)			
Frequency(MHz)	5180	5200	5240
Target (dBm)	8.0	8.0	8.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11ac VHT40 (Average)			
Frequency(MHz)	5190	5230	
Target (dBm)	5.0	5.0	
Tolerance ± (dB)	1.0	1.0	
IEEE 802.11ac VHT80 (Average)			
Frequency(MHz)	5210		
Target (dBm)	5.0		
Tolerance ± (dB)	1.0		

5GHz WLAN Band 4

IEEE 802.11a (Average)			
Frequency(MHz)	5745	5785	5825
Target (dBm)	8.0	8.0	8.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Frequency(MHz)	5745	5785	5825
Target (dBm)	8.0	8.0	8.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Average)			
Frequency(MHz)	5755	5795	

Target (dBm)	5.0		5.0
Tolerance ± (dB)	1.0		1.0
IEEE 802.11ac VHT20 (Average)			
Frequency(MHz)	5745	5785	5825
Target (dBm)	8.0	8.0	8.0
Tolerance ± (dB)	1.0	1.0	1.0
IEEE 802.11ac VHT40 (Average)			
Frequency(MHz)	5755		5795
Target (dBm)	5.0		5.0
Tolerance ± (dB)	1.0		1.0
IEEE 802.11ac VHT80 (Average)			
Frequency(MHz)	5775		
Target (dBm)	5.0		
Tolerance ± (dB)	1.0		

6. Standalone MPE Result

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, r=20cm, as well as the gain of the used antenna refer to antenna information,the RF power density can be obtained.

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
BLE	-2.0	0.6310	0.86	1.2190	0.0002	1.0000
2.4GWIFI	15.0	31.6228	0.86	1.2190	0.0077	1.0000
5GWIFI Band 1	9.0	7.9433	0.72	1.1803	0.0019	1.0000
5GWIFI Band 4	9.0	7.9433	0.52	1.1272	0.0018	1.0000

Remark:

1. Output power (Peak) including turn-up tolerance;

2. MPE evaluate distance is 20cm from user manual provide by manufacturer.

7. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

----------THE END OF REPORT----------