

RF Exposure Evaluation

According to KDB 447498 D01 General RF Exposure Guidance v06 and part 2.1091, Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition(s), listed below, is (are) satisfied.

Limits

The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

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/f ²)	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/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

Friis transmission formula: $Pd = (P_{out} * G) / (4 * \pi * r^2)$

Where

Pd = power density in mW/cm², **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

Pd is the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

Test Result of RF Exposure Evaluation

2.4GHz WIFI:

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm ²)	(mW/cm ²)
				(dBm)	(mW)	Numeric		
2412	802.11b	15.65	15±1	16	39.81	1.53	0.0121	1
2437		15.92	15±1	16	39.81	1.53	0.0121	1
2462		14.98	15±1	16	39.81	1.53	0.0121	1
2412	802.11g	13.85	14±1	15	31.62	1.53	0.0096	1
2437		14.82	14±1	15	31.62	1.53	0.0096	1
2462		13.61	14±1	15	31.62	1.53	0.0096	1
2412	802.11n H20	12.61	13±1	14	25.12	1.53	0.0076	1
2437		13.25	13±1	14	25.12	1.53	0.0076	1
2462		12.54	13±1	14	25.12	1.53	0.0076	1
2422	802.11n H40	12.18	12±1	13	19.95	1.53	0.0061	1
2437		12.81	12±1	13	19.95	1.53	0.0061	1
2452		11.65	12±1	13	19.95	1.53	0.0061	1

BLE:

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm ²)	(mW/cm ²)
				(dBm)	(mW)	Numeric		
2402	GFSK	11.220	11±1	12	19.95	1.59	0.0050	1
2440		11.297	11±1	12	19.95	1.59	0.0050	1
2480		11.413	11±1	12	19.95	1.59	0.0050	1

Frequency (MHz)	Modulation mode	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm ²)	(mW/cm ²)
				(dBm)	(mW)	Numeric		
		Ant A	Ant A	Ant A	Ant A	Ant A	Ant A	

5180	11a	14.97	14±1	15	31.62	1.73	0.0109	1
5200	11a	14.73	14±1	15	31.62	1.73	0.0109	1
5240	11a	14.45	14±1	15	31.62	1.73	0.0109	1
5180	11n (HT20)	14.85	14±1	15	31.62	1.73	0.0109	1
5200	11n (HT20)	14.65	14±1	15	31.62	1.73	0.0109	1
5240	11n (HT20)	14.43	14±1	15	31.62	1.73	0.0109	1
5190	11n (HT40)	14.55	14±1	15	31.62	1.73	0.0109	1
5230	11n (HT40)	14.32	14±1	15	31.62	1.73	0.0109	1
5180	11ac (HT20)	14.13	14±1	15	31.62	1.73	0.0109	1
5200	11ac (HT20)	14.33	14±1	15	31.62	1.73	0.0109	1
5240	11ac (HT20)	13.65	14±1	15	31.62	1.73	0.0109	1
5190	11ac (HT40)	14.15	14±1	15	31.62	1.73	0.0109	1
5230	11ac (HT40)	13.57	13±1	14	25.12	1.73	0.0086	1
5210	11ac (HT80)	13.58	13±1	14	25.12	1.73	0.0086	1

Remark:

1. WiFi2.4g, WiFi5g donot transmit at the same time

BT and wifi can transmit at the same time

2. In the case of simultaneous launches for wifi and BLE:

The Max Calc. Thresholds : BLE: 0.0050, WiFi:0.0121

BLE and Wifi : $0.0050+0.0121 = 0.0171 \leq 1$

So a SAR test is not required