

RF Exposure Evaluation

According to KDB447498D01 General RF Exposure Guidance v06 4.3.1. Standalone SAR test exclusion considerations 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 Exclusion Threshold condition, listed below, is satisfied.

Limits

According to FCC Part1.1310: 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 part1.1307(b)

TABLE 1—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 Formula

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

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d is the limit of MPE. 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 Result of RF Exposure Evaluation

Antenna Gain: 2.4Gwifi-ant: 2dBi;5Gwifi-ant:2.3dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.0 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Measurement Data

The Max Conducted Peak Output Power data refer to report Report No.: ZKT-211220L7050-01 & ZKT-211220L7050-03

2.4GWIFI:

Worst mode-802.11b mode					
Test channel	Antenna	Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2412MHz)	ANT1	15.694	16±1	17	50.119
Middle(2437MHz)	ANT1	16.308	16±1	17	50.119
Highest(2462MHz)	ANT1	15.258	16±1	17	50.119

Test worst case

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
50.119	2	0.0158	1.0	PASS

Note: 1) Refer to report No. : ZKT-210803L3916 for EUT test Max Conducted Output Power value.

2) $P_d = (P_{out} * G) / (4 * \pi * R^2) = (63.096 * 1.585) / (4 * 3.1416 * 20^2) = 0.0158$

3) EUT wifi2.4G module is more than 20cm away from the human body

5GWIFI:

Mode	Test channel	Antenna Output Power (dBm)	Tune up tolerance(dBm)	Max Tune up (dBm)
802.11a	36	-1.249	-1±1	0
	40	-1.293	-1±1	0
	48	-0.004	-1±1	0
	149	1.425	2±1	3
	157	2.087	2±1	3
	165	1.958	2±1	3
802.11n20	36	-2.628	-2±1	-1
	40	-2.099	-2±1	-1
	48	-1.93	-2±1	-1
	149	0.495	1±1	2
	157	1.521	1±1	2
	165	1.989	1±1	2
802.11n40	38	-3.68	-3±1	-2
	46	-2.396	-3±1	-2
	151	1.094	1±1	2
	159	1.087	1±1	2
802.11ac20	36	-2.998	-2±1	-1
	40	-2.324	-2±1	-1
	48	-1.00	-2±1	-1
	149	1.454	2±1	3
	157	1.458	2±1	3
	165	1.056	2±1	3
802.11ac40	38	-3.639	-3±1	-2
	46	-3.967	-3±1	-2

802.11ac80	151	-0.293	-1±1	0
	159	-0.321	-1±1	0
	42	-5.03	-5±1	-4
	155	0.944	0±1	1

Test worst case

Maximum tune-up Power (dbm)	Maximum tune-up Power (mW)	Calculated value (mW/cm2)	Limit (mW/cm2)
3	1.995	0.000674	1.0

Remark:

1)The Max Conducted Peak Output Power data refer to report Report No.: ZKT-211012L5389-04

2) $P_d = (P_{out} * G) / (4 * \pi * R^2) = (1.995 * 1.698) / (4 * 3.1415 * 20 * 20) = 0.000674$, $G = 10^{gain/10} = 1.698$

Combine Bluetooth +2.4G WIFI + 5G WIFI:

Simultaneous transmission mode	The sum of the ratios	SUM	Limit
2.4GWIFI + 5G WIFI	0.000674+0.0158	0.0165	1.0
Conclusion: 0.0165<1.0, So there is no sar requirement			

EUT wifi-5G module & wifi-2.4G module is more than 20cm away from the human body.

2.The sum of the ratios(2.4GWIFI + 5G WIFI) is less than the limit value of 1.0, so there is no sar requirement.