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: Pd = (Pout*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 id 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

BT ANT1: 3.74dBi;

2.4G- ANT1:10.13dBi; ANT2:10.15 dBi;MIMO: 13.16dBi

5G-WIFI ANT1:12.04dBi ; ANT2: 12.29dBi ; ANT3: 8.94dBi; ANT4: 9.14 dBi ; ANT5:9.80 dBi ; ANT6: 9.94 dBi MIMO: 18.24dBi;

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-220920L7016-01 & ZKT-220920L7016-02

2.4GWIFI worst mode and channel:

Test channel	Antenna Output Power (dBm)		Maximum tune-up Power (dbm)		Maximum tune-up Power (dbm)
	ANT1	ANT2	ANT1	ANT2	
802.11n –2412MHz	16.06	16.22	16±1	16±1	20.01
802.11n –2437MHz	15.88	16.32	16±1	16±1	20.01
802.11n –2462MHz	16.15	15.95	16±1	16±1	20.01

Test worst case

Maximum tune-up Power (dbm)	Maximum tune-up Power (mW)	Calculated value (mW/cm2)	Limit (mW/cm2)
20.01	100.24	0.413	1.0

Remark:

1)The Max Conducted Peak Output Power data refer to report Report No.: ZKT-220920L7016-01

2) Pd = (Pout*G)/(4* Pi * R^2)=(100.24*20.07)/(4*3.1415*20*20)= 0.413, $G=10^{gain/10}$ =20.07

5GWIFI- worst mode and channel:

Mode Test channel	Antenna Output Power (dBm)						Tune up tolerance(dBm)						Max Tune up (dBm)
	ANT1	ANT2	ANT3	ANT4	ANT5	ANT6	ANT1	ANT2	ANT3	ANT4	ANT5	ANT6	
802.11ax-5180MHz	3.74	3.74	3.79	3.49	3.78	3.73	4±1	4±1	4±1	4±1	4±1	4±1	12.78
802.11ax-5200MHz	3.70	3.81	3.74	3.63	3.53	3.75	4±1	4±1	4±1	4±1	4±1	4±1	12.78
802.11ax-5240MHz	3.98	4.04	3.97	3.97	4.04	4.08	4±1	4±1	4±1	4±1	4±1	4±1	12.78

Test worst case

Maximum tune-up Power(dbm)	Maximum tune-up Power(mW)	Calculated value (mW/cm2)	Limit (mW/cm2)
12.78	18.967	0.252	1.0

Remark:

1)The Max Conducted Peak Output Power data refer to report Report No.: ZKT-221109L8361-04

2) Pd = (Pout*G)/(4* Pi * R^2)=(18.967 *66.68)/(4*3.1415*20*20)=0.252, $G=10^{gain/10}$ =66.68

EUT RF Exposure Evaluation simultaneous transmission operations

According to 865664D02 2.2 d) 1):

The sum of the ratios of the spatially averaged results to the applicable frequency dependent MPE limits :

Simultaneous transmission mode	The sum of the ratios	SUM	Limit
2.4G WIFI + 5G WIFI	0.413+0.252	0.665	1.0
conclusion : 0.665 < 1.0, So there is no sar requirement			

NOTE:1. 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.