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

Antenna gain: 4.26dBi

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

Output Power Into Antenna & RF Exposure Evaluation Distance: 20cm

Measurement Data

The Max Conducted Peak Output Power data refer to report Report No.:ZKT-221226L9674-01/ZKT-221226L9674-02/ZKT-221226L9674-03/ZKT-221226L9674-05

1.1 EUT RF EXPOSURE

Operational Mode: EDR （GFSK worst case）						
Channel	Maximum Peak Conducted Output Power (dBm)	Tune up tolerance (dB)	Maximum tune-up Power		Calculated value (mW/cm2)	Limit
			(dBm)	(mW)		
2402 MHZ	4.46	4±1	5	3.162	0.0016	1.0
Conclusion: the calculated value ≤1.0, SAR is exempted.						

1) Pd = (Pout*G)/(4* Pi * R2)=(3.162*2.667)/(4*3.14159*20*20)=0.0016, G=10gain/10 = 2.667

Operational Mode: BLE （GFSK worst case）						
Channel	Maximum Peak Conducted Output Power (dBm)	Tune up tolerance (dB)	Maximum tune-up Power		Calculated value (mW/cm2)	Exclusion threshold (mW/cm2)
			(dBm)	(mW)		
2402 MHZ	1.45	1±1	2	1.585	0.0008	1.0
Conclusion: the calculated value ≤1.0, SAR is exempted.						

1) Pd = (Pout*G)/(4* Pi * R2)=(1.585*2.667)/(4*3.14159*20*20)=0.0008, G=10gain/10 = 2.667

Operational Mode: 802.11g						
Channel	Maximum Peak Conducted Output Power (dBm)	Tune up tolerance (dB)	Maximum tune-up Power		Calculated value (mW/cm2)	Exclusion threshold (mW/cm2)
			(dBm)	(mW)		
2412 MHZ	18.51	18±1	19	79.433	0.0421	1.0
Conclusion: the calculated value ≤3.0, SAR is exempted.						

1) Pd = (Pout*G)/(4* Pi * R2)=(79.433*2.667)/(4*3.14159*20*20)=0.0421, G=10gain/10 = 2.667

Operational Mode: ZigBee						
Channel	Maximum Peak Conducted Output Power (dBm)	Tune up tolerance (dB)	Maximum tune-up Power		Calculated value (mW/cm2)	Exclusion threshold (mW/cm2)
			(dBm)	(mW)		
2480 MHZ	15.29	15±1	16	39.811	0.0211	1.0
Conclusion: the calculated value ≤1.0, SAR is exempted.						

1) Pd = (Pout*G)/(4* Pi * R2)=(39.8111*2.667)/(4*3.14159*20*20)=0.0211, G=10gain/10 = 2.667

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
EDR+BLE+2.4G WIFI+ZigBee	0.0016+0.0008+0.0421+0.0211	0.0656	1.0
conclusion : 0.0656 < 1.0, So there is no sar requirement			