RF Exposure Evaluation

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: **$Pd = (Pout*G)/(4*pi*r^2)$**

Where

Pd = power density in mW/cm^2, **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, 1 mW/cm^2. 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

1) For BT

Antenna Gain: 2dBi

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

GFSK mode				
Test Channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2402MHz)	5.176	5±1	6	3.981
Middle(2441MHz)	6.529	6±1	7	5.011
Highest(2480MHz)	5.143	5±1	6	3.981

Test worst case

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm2)	Limit	Result
5.011	2	0.00158	1.0	PASS

Note: 1) Refer to report No. : ZKT-210618L2728-02 for EUT test Max Conducted average Output Power value.

2) Pd = (Pout*G)/(4* Pi * R2)=(5.011 *1.585)/(4*3.1416*20^2)= 0.00158

3) EUT Bluetooth module is more than 20cm away from the human body

2)For WIFI:

Antenna Gain: 2dBi

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

802.11b mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2412MHz)	ANT1	10.693	10±1	11.0	12.589
Middle(2437MHz)	ANT1	10.566	10±1	11.0	12.589
Highest(2462MHz)	ANT1	10.202	10±1	11.0	12.589
802.11g mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2412MHz)	ANT1	9.835	9±1	10.0	10.00
Middle(2437MHz)	ANT1	9.428	9±1	10.0	10.00
Highest(2462MHz)	ANT1	8.606	8±1	9.0	7.943

802.11n(HT20) mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2412MHz)	ANT1	9.435	9±1	10.0	10.00
Middle(2437MHz)	ANT1	8.967	8±1	9.0	7.943
Highest(2462MHz)	ANT1	8.123	8±1	9.0	7.943
802.11n(HT40) mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2422MHz)	ANT1	9.591	9±1	10.0	10.00
Middle(2437MHz)	ANT1	9.174	9±1	10.0	10.00
Highest(2452MHz)	ANT1	8.702	8±1	9.0	7.943

Test worst case

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm2)	Limit	Result
12.589	2	0.004	1.0	PASS

Note: 1) Refer to report No. : ZKT-210618L2728-01 for EUT test Max Conducted average Output Power value.

2) Pd = (Pout*G)/(4* Pi * R2)=(12.589 *1.585)/(4*3.1416*20^2)= 0.004

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