

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

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

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	Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2412MHz)	ANT1	17.220	17±1	18	63.096
Middle(2437MHz)	ANT1	16.476	16±1	17	50.119
Highest(2462MHz)	ANT1	16.428	16±1	17	50.119
802.11g mode					
Test channel	Antenna	Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2412MHz)	ANT1	14.629	15±1	16	39.811
Middle(2437MHz)	ANT1	13.862	14±1	15	31.623
Highest(2462MHz)	ANT1	13.958	14±1	15	31.623
802.11n(HT20) mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2412MHz)	ANT1	11.187	12±1	13	19.953
Middle(2437MHz)	ANT1	11.689	11±1	12	15.849
Highest(2462MHz)	ANT1	11.763	11±1	12	15.849
802.11n(HT40) mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2422MHz)	ANT1	10.054	10±1	11	12.589
Middle(2437MHz)	ANT1	9.755	9±1	10	10.000
Highest(2452MHz)	ANT1	9.502	9±1	10	10.000

Test worst case

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
63.096	1.585	0.0199	1.0	PASS

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

2) $P_d = (P_{out} * G) / (4 * \pi * R^2) = (63.096 * 1.585) / (4 * 3.1416 * 20^2) = 0.0199$

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