

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: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot r^2)$

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

BR+EDR mode

Mode	Output power to antenna (dBm)	Tune-up Power(dBm)	Max Tune-up Power(dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
8DPSK	1.4	1(±1)	2	1.58	0.0004	1.0	PASS

For 2.4GHz WiFi

Mode	Output power to antenna (dBm)	Tune-up Power(dBm)	Max Tune-up Power(dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
802.11b	12.65	12(±1)	13	19.95	0.0056	1.0	PASS

For 5.2GHz WiFi

Mode	Output power to antenna (dBm)	Tune-up Power(dBm)	Max Tune-up Power(dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
802.11n20	12.69	12(±1)	13	19.95	0.0056	1.0	PASS

For 5.8GHz WiFi

Mode	Output power to antenna (dBm)	Tune-up Power(dBm)	Max Tune-up Power(dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
802.11ac20	9.39	9(±1)	10	10	0.0028	1.0	PASS

Remark: antenna gain= BR+EDR: 1.46dBi, 2.4GHz WiFi:1.46dBi, 5.2GHz WiFi:1.46dBi, 5.8GHz WiFi:1.46dBi

The device cannot transmit with 2.4G WiFi and 5.2, 5.8G WiFi simultaneously, can transmit with 2.4G WiFi, 5.2, 5.8G WiFi and Bluetooth BR+EDR simultaneously.

Calculations for simultaneously transmit

Mode	Ratios	Result	Limit	Result
BR+EDR	0.0004	0.006	1	PASS
2.4G Wi-Fi	0.0056			

Mode	Ratios	Result	Limit	Result
BR+EDR	0.0004	0.006	1	PASS
5.2G Wi-Fi	0.0056			

Mode	Ratios	Result	Limit	Result
BR+EDR	0.0004	0.0032	1	PASS
5.8G Wi-Fi	0.0028			

Ratios = Power Density / Power density Limit

So a SAR test is not required