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/cm2)	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/f2)	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/f2)	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*r2)

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, 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

Mode	Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
BLE	1.31	1.35	0.0009	1.0	PASS

Mode	Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
BR+EDR	1.29	1.35	0.0009	1.0	PASS

Mode	Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
2.4G Wi-Fi	12.82	19.14	0.0091	1.0	PASS

Mode	Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
5.2G Wi-Fi	10.78	11.97	0.0067	1.0	PASS

Mode	Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
5.3G Wi-Fi	11.51	14.16	0.0080	1.0	PASS

Mode	Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
5.6G Wi-Fi	10.31	10.74	0.0060	1.0	PASS

Mode	Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
5.8G Wi-Fi	10.56	11.38	0.0064	1.0	PASS

Remark: BT antenna gain: 5.47dBi, Wi-Fi antenna gain: 2.4GHz=3.80dBi, 5GHz=4.52dBi.

The device cannot transmit with 2.4GHz Wi-Fi and 5.2GHz, 5.3GHz, 5.6GHz, 5.8GHz Wi-Fi simultaneously, can transmit with 2.4G Wi-Fi, 5.2GHz, 5.3GHz, 5.6GHz, 5.8GHz Wi-Fi and BT simultaneously.

Calculations for simultaneously transmit

Mode	Ratios	Result	Limit	Result
BR+EDR	0.0009			
BLE	0.0009	0.0109	1	PASS
2.4G Wi-Fi	0.0091			

Mode	Ratios	Result	Limit	Result
BR+EDR	0.0009			
BLE	0.0009	0.0085	1	PASS
5.2G Wi-Fi	0.0067			

Mode	Ratios	Result	Limit	Result
BR+EDR	0.0009			
BLE	0.0009	0.0098	1	PASS
5.3G Wi-Fi	0.0080			

Mode	Ratios	Result	Limit	Result
BR+EDR	0.0009			
BLE	0.0009	0.0078	1	PASS
5.6G Wi-Fi	0.0060			

Mode	Ratios	Result	Limit	Result
BR+EDR	0.0009			
BLE	0.0009	0.0082	1	PASS
5.8G Wi-Fi	0.0064			

Ratios = Power Density / Power density Limit

So a SAR test is not required