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

BLE

Channel	Output power to antenna (dBm)	Max tune-up		Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
		dbm	mW			
2402MHz	-0.12	0	1	0.0005	1.0	PASS

Antenna gain: 3.83dbi

4G-Cat-M1

Band	Frequency(MHz)	Output power to antenna (dBm)	Max tune-up		Power Density at R=20cm(mW/cm^2)	Limit (mW/cm^2)	Result
			dBm	mW			
2	1850.7-1909.3	21.19	22	158.48	0.093	1.0	PASS
4	1710.7-1754.3	21.21	22	158.48	0.085	1.0	PASS
5	824.7-848.3	21.23	22	158.48	0.082	0.55	PASS
12	699.7-715.3	20.54	21	125.89	0.031	0.47	PASS
13	779.5-784.5	20.81	21	125.89	0.035	0.52	PASS
25	1850.7-1914.3	21.17	22	158.48	0.093	1.0	PASS
26	814.7-823.3	21.71	22	158.48	0.084	0.54	PASS
26	824.7-848.3	21.1	22	158.48	0.084	0.55	PASS

Antenna gain:

Band	Gain(dbi)	Band	Gain(dbi)
2	4.715	13	1.427
4	4.31	25	4.72
5	4.149	26	4.244
12	0.885		

For simultaneous transmitting: BLE+Cat-m is 0.125<1

The max power density is less than MPE exempt limit, so it is compliance.