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

WIFI 2.4G

Channel	Max output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
2412MHz SISO(ANT 1)	16.57	45.39	0.0453	1.0	PASS
2412MHz MIMO	16.21	41.78	0.0833	1.0	PASS

Antenna gain:

ANT 1: 7dBi

ANT 2: 7dBi

MIMO: 10.01dBi

3G

Mode	Max output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
WCDMA Band II	23.74	236.59	0.0939	1.0	PASS
WCDMA Band IV	24.19	262.42	0.1042	1.0	PASS
WCDMA Band V	21.84	152.76	0.0606	0.55	PASS

Antenna gain:

ANT 1: 3dBi

ANT 2: 2dBi

4G

Mode	Max output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
Band 2	24.3	269.15	0.1068	1.0	PASS
Band 4	22.92	195.88	0.0778	1.0	PASS
Band 5	21.32	135.52	0.0538	0.55	PASS
Band 12	19.1	81.28	0.0323	0.47	PASS
Band 13	21.95	156.68	0.0622	0.52	PASS
Band 14	25.00	316.23	0.1255	0.53	PASS
Band 66	25.00	316.23	0.1255	1.0	PASS
Band 71	21.06	127.64	0.0507	0.45	PASS

Antenna gain:

ANT 1: 3dBi

ANT 2: 2dBi

802.11 b/g/n could work in Synchronous transmitting mode.

The maximum simultaneously power density were as below

WCDMA BAND II+2.4G WIFI: 0.18 <1.

WCDMA BAND IV +2.4G WIFI: 0.19 <1.

WCDMA BAND V +2.4G WIFI: 0.19 <1

LTE BAND 2+2.4G WIFI: 0.19 <1

LTE BAND 4+2.4G WIFI: 0.16<1

LTE BAND 5+2.4G WIFI: 0.18 <1

LTE BAND 12+2.4G WIFI: 0.15 <1

LTE BAND 13+2.4G WIFI: 0.20 <1

LTE BAND 14+2.4G WIFI: 0.32 <1

LTE BAND 66+2.4G WIFI: 0.21 <1

LTE BAND 71+2.4G WIFI: 0.20 <1

Remark:

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