RF Exposure Evaluation

Limit

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 1.1310 & 2.1091

Table 1-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

Note: f = frequency in MHz

Evaluation Method

Transmission formula: $P_d = (Pout*G)/(4*pi*R^2)$

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

Conducted Power Results & Manufacturing tolerance

Specification	Operating Mode	Conducted Peak Output Power (dBm)	Target (dBm)	Tolerance ±(dB)
2.4GWIFI	802.11b	16.65	16	1
	802.11g	15.26	14.5	1
	802.11n(HT20)	14.86	14	1
	802.11n(HT40)	15.30	14.5	1
BLE	GFSK	10.11	9.5	1
BT+EDR	GFKS	10.63	10	1
	π/4DQPSK	12.65	12	1
	8DPSK	13.21	12.5	1

Evaluation Results

Spec.	Operating Mode	Antenna Distance (cm)	Conducted Output Power		Gain of antenna in linear scale	Power Density (mW /cm^2)	Limit (mW /cm^2)	Result
			dBm	mW				
2.4GWIFI	802.11b	20	17	50.12	1.41	0.014	1	PASS
	802.11g	20	15.5	35.48	1.41	0.010	1	PASS
	802.11n(HT20)	20	15	31.62	1.41	0.009	1	PASS
	802.11n(HT40)	20	15.5	35.48	1.41	0.010	1	PASS
BLE	GFSK	20	10.5	11.22	1.41	0.003	1	PASS
BT+EDR	GFKS	20	11	12.59	1.41	0.004	1	PASS
	π/4DQPSK	20	13	19.95	1.41	0.006	1	PASS
	8DPSK	20	13.5	22.39	1.41	0.006	1	PASS

Remark:

1. Output power including tune up tolerance;

2. The maximum 2.4G antenna gain is 1.5dBi

3. The exposure safety distance is 20cm.

Simulation Transmission

EUT can only work in 2.4GWIFI+BT mode

The formula of calculated the Simulation Transmission MPE is:

CPD1/LPD1+CPD2/LPD2+……etc.＜1

CPD=Calculation Maximum Power Denisty

Mode	Calculate	Limit	Result
2.4GWIFI+BT mode	0.020	1	Pass

Conclusion

The measurement results comply with the FCC Limit per 47 CFR 1.1310 & 2.1091 for the uncontrolled RF Exposure and MPE complicance per KDB 447498 v06.