



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/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

BT Mode						
Mode	Output power to antenna (dBm)	Output power to antenna (mW)	Antenna Gain (dBi)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
GFSK	-1.658	0.68	3.55	0.000306	1.0	PASS
π/4-DQPSK	-1.331	0.74	3.55	0.000332	1.0	PASS
8-DPSK	-1.045	0.79	3.55	0.000356	1.0	PASS

2.4G WI-FI Mode						
Mode	Output power to antenna (dBm)	Output power to antenna (mW)	Antenna Gain (dBi)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
802.11b	15.624	36.51	2.52	0.012976	1.0	PASS
802.11g	14.874	30.72	2.52	0.010918	1.0	PASS
802.11n20	14.067	25.51	2.52	0.009066	1.0	PASS

5.8G WI-FI Mode						
Mode	Output power to antenna (dBm)	Output power to antenna (mW)	Antenna Gain (dBi)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
802.11a	14.792	30.14	2.56	0.010811	1.0	PASS
802.11n20	14.515	28.28	2.56	0.010144	1.0	PASS
802.11ac20	14.153	26.02	2.56	0.009333	1.0	PASS

Note: The device BT and 2.4G Wi-Fi & 5.8G WI-FI can transmit at the same time;

So the worst simultaneous transmission consideration:

The ratio = $MPE_{(BT)} / \text{limit} + MPE_{(2.4G\ WI-FI)} / \text{limit} + MPE_{(5.8G\ WI-FI)} / \text{limit} = 0.000356 / 1.0 + 0.012976 / 1.0 + 0.010811 / 1.0 = 0.024143 < 1.0$.