



RF Exposure Evaluation

FCC KDB publication 447498 D01 General RF Exposure Guidance v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

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: $Pd = (Pout \cdot G) / (4 \cdot \pi \cdot r^2)$

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, and highest channel individually.



Test Result of RF Exposure Evaluation

PCB antenna

Antenna gain=1.44dBi

BLE Mode

Test Frequency (MHz)	Minimum Separation Distance (cm)	Output Power (dBm)	Target power (dBm)	Target power (mW)	Antenna Gain (Numeric)	Power Density Limit (mW/cm ²)	Power Density At 20 cm (mW/cm ²)	Test Results
2402	20.00	18.09	18±1	79.43	1.39	1	0.022	Pass
2440	20.00	16.79	17±1	63.1	1.39	1	0.0175	Pass
2480	20.00	16.73	17±1	63.1	1.39	1	0.0175	Pass

802.15.4 Mode

Test Frequency (MHz)	Minimum Separation Distance (cm)	Output Power (dBm)	Target power (dBm)	Target power (mW)	Antenna Gain (Numeric)	Power Density Limit (mW/cm ²)	Power Density At 20 cm (mW/cm ²)	Test Results
2405	20.00	17.29	17±1	63.1	1.39	1	0.0175	Pass
2440	20.00	16.18	17±1	63.1	1.39	1	0.0175	Pass
2480	20.00	16.19	17±1	63.1	1.39	1	0.0175	Pass

Wire antenna

Antenna gain=0dBi

BLE Mode

Test Frequency (MHz)	Minimum Separation Distance (cm)	Output Power (dBm)	Target power (dBm)	Target power (mW)	Antenna Gain (Numeric)	Power Density Limit (mW/cm ²)	Power Density At 20 cm (mW/cm ²)	Test Results
2402	20.00	18.09	18±1	79.43	1.00	1	0.0158	Pass
2440	20.00	16.48	17±1	63.1	1.00	1	0.0126	Pass
2480	20.00	16.5	17±1	63.1	1.00	1	0.0126	Pass

802.15.4 Mode

Test Frequency (MHz)	Minimum Separation Distance (cm)	Output Power (dBm)	Target power (dBm)	Target power (mW)	Antenna Gain (Numeric)	Power Density Limit (mW/cm ²)	Power Density At 20 cm (mW/cm ²)	Test Results
2405	20.00	17.29	17±1	63.1	1.00	1	0.0126	Pass
2440	20.00	16.18	17±1	63.1	1.00	1	0.0126	Pass
2480	20.00	16.19	17±1	63.1	1.00	1	0.0126	Pass



Dipole Antenna

Antenna gain=8dBi

BLE Mode

Test Frequency (MHz)	Minimum Separation Distance (cm)	Output Power (dBm)	Target power (dBm)	Target power (mW)	Antenna Gain (Numeric)	Power Density Limit (mW/cm ²)	Power Density At 20 cm (mW/cm ²)	Test Results
2402	20.00	18.09	18±1	79.43	6.31	1	0.0997	Pass
2440	20.00	16.48	17±1	63.1	6.31	1	0.0792	Pass
2480	20.00	16.5	17±1	63.1	6.31	1	0.0792	Pass

802.15.4 Mode

Test Frequency (MHz)	Minimum Separation Distance (cm)	Output Power (dBm)	Target power (dBm)	Target power (mW)	Antenna Gain (Numeric)	Power Density Limit (mW/cm ²)	Power Density At 20 cm (mW/cm ²)	Test Results
2405	20.00	17.29	17±1	63.1	6.31	1	0.0792	Pass
2440	20.00	16.18	17±1	63.1	6.31	1	0.0792	Pass
2480	20.00	16.19	17±1	63.1	6.31	1	0.0792	Pass

Note: The BT/BLE does not support simultaneous transmission, And the PCB antenna/ Wire antenna/ Dipole Antenna does not support simultaneous transmission

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure.