

FCC ID: 2APQQ-6252M-PUB

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, and highest channel individually.

Test Result of RF Exposure Evaluation

BT (Worst case)

Antenna gain=1.86dBi

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	4.826	4±1	3.162	1.53	1	0.001	Pass
2441	20	3.361	4±1	3.162	1.53	1	0.001	Pass
2480	20	4.698	4±1	3.162	1.53	1	0.001	Pass

BLE (Worst case)

Antenna gain=1.86dBi

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	1.491	2±1	1.995	1.53	1	0.0006	Pass
2440	20	1.882	2±1	1.995	1.53	1	0.0006	Pass
2480	20	2.751	3±1	2.512	1.53	1	0.0008	Pass

WIFI 2.4GHz (Antenna-A Worst case)

Antenna gain=1.86dBi, Directional gain=4.87dBi

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
2412	20.00	15.6	16±1	50.12	1.53	1	0.0153	Pass
2422	20.00	15.791	16±1	50.12	1.53	1	0.0153	Pass
2437	20.00	15.589	16±1	50.12	1.53	1	0.0153	Pass
2452	20.00	16.569	17±1	63.1	1.53	1	0.0193	Pass
2462	20.00	16.135	17±1	63.1	1.53	1	0.0193	Pass

WIFI 2.4GHz (Antenna-B Worst case)

Antenna gain=1.86dBi, Directional gain=4.87dBi

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
2412	20.00	14.696	15±1	39.81	1.53	1	0.0122	Pass
2422	20.00	14.482	15±1	39.81	1.53	1	0.0122	Pass
2437	20.00	14.602	15±1	39.81	1.53	1	0.0122	Pass
2452	20.00	14.529	15±1	39.81	1.53	1	0.0122	Pass
2462	20.00	14.914	15±1	39.81	1.53	1	0.0122	Pass

WIFI 5GHz (Antenna-A Worst case)

Frequency Range: 5180-5240 MHz

Antenna gain=1.67dBi, Directional gain=4.68dBi

Frequency Range: 5745-5825 MHz

Antenna gain=2.55dBi, Directional gain=5.56dBi

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
5180	20	14.594	15±1	39.81	1.47	1	0.0116	Pass
5190	20	14.331	15±1	39.81	1.47	1	0.0116	Pass
5200	20	15.523	16±1	50.12	1.47	1	0.0146	Pass
5210	20	14.361	15±1	39.81	1.47	1	0.0116	Pass
5230	20	15.281	16±1	50.12	1.47	1	0.0146	Pass
5240	20	15.038	16±1	50.12	1.47	1	0.0146	Pass
5745	20	15.611	16±1	50.12	1.80	1	0.0179	Pass
5755	20	14.928	15±1	39.81	1.80	1	0.0142	Pass
5775	20	16.064	17±1	63.1	1.80	1	0.0226	Pass
5785	20	16.086	17±1	63.1	1.80	1	0.0226	Pass
5795	20	15.826	16±1	50.12	1.80	1	0.0179	Pass
5825	20	14.592	15±1	39.81	1.80	1	0.0142	Pass

WIFI 5GHz (Antenna-B Worst case)

Frequency Range: 5180-5240 MHz

Antenna gain=1.67dBi, Directional gain=4.68dBi

Frequency Range: 5745-5825 MHz

Antenna gain=2.55dBi, Directional gain=5.56dBi

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
5180	20	14.298	15±1	39.81	1.47	1	0.0116	Pass
5190	20	14.838	15±1	39.81	1.47	1	0.0116	Pass
5200	20	16.426	17±1	63.1	1.47	1	0.0184	Pass
5210	20	15.269	16±1	50.12	1.47	1	0.0146	Pass
5230	20	15.931	16±1	50.12	1.47	1	0.0146	Pass
5240	20	15.741	16±1	50.12	1.47	1	0.0146	Pass
5745	20	14.879	15±1	39.81	1.80	1	0.0142	Pass
5755	20	14.496	15±1	39.81	1.80	1	0.0142	Pass
5775	20	12.638	13±1	25.12	1.80	1	0.009	Pass
5785	20	14.728	15±1	39.81	1.80	1	0.0142	Pass
5795	20	13.964	14±1	31.62	1.80	1	0.0113	Pass
5825	20	14.298	15±1	39.81	1.80	1	0.0142	Pass

For the max simultaneous transmission MPE (Worst case):

Power Density (mW/cm ²) ANT A	Power Density (mW/cm ²) ANT B	Total	Power Density Limit (mW/cm ²)	Test Results
5GHz	5GHz	0.041	1.000	Pass
0.0226	0.0184			

Note: 1. The Bluetooth function can transmit at the same time with the Wi-Fi function.

2. When the ANT 1 and ANT 2 transmit simultaneously (MIMO Mode), the formula of calculated the exposure is:

$$(MPE1 / Limit) + (MPE2 / Limit) + \dots \text{etc.} \leq 1$$

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