



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

WIFI module 1:

For 2.4G WIFI

Antenna Gain: 3.39dBi

Test Mode	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
802.11b	20.00	12.84	12±1	31.623	2.18	1	0.01346	Pass
802.11g	20.00	14.37	14±1	25.119	2.18	1	0.02133	Pass
802.11n(HT20)	20.00	15.96	15±1	25.119	2.18	1	0.02685	Pass
802.11n(HT40)	20.00	15.85	15±1	19.953	2.18	1	0.02685	Pass

For 5.2G WIFI

Antenna Gain: 4.71dBi

Test Mode	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
802.11a	20.00	13.82	13±1	31.623	2.96	1	0.01694	Pass
802.11n20	20.00	13.83	13±1	25.119	2.96	1	0.01694	Pass
802.11n40	20.00	13.12	13±1	25.119	2.96	1	0.01694	Pass
802.11ac20	20.00	13.96	13±1	19.953	2.96	1	0.01694	Pass
802.11ac40	20.00	12.99	12±1	19.953	2.96	1	0.01346	Pass



WIFI module 2:

ANT1:For 2.4G WIFI

Antenna Gain: 3.30dBi

Test Mode	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
802.11b	20.00	12.37	12±1	31.623	2.14	1	0.01310	Pass
802.11g	20.00	14.89	14±1	25.119	2.14	1	0.02076	Pass
802.11n(HT20)	20.00	13.84	13±1	25.119	2.14	1	0.01649	Pass
802.11n(HT40)	20.00	15.97	15±1	19.953	2.14	1	0.02614	Pass

For 5.2G WIFI

Antenna Gain: 3.37dBi

Test Mode	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
802.11a	20.00	13.47	13±1	31.623	2.17	1	0.01684	Pass
802.11n20	20.00	13.32	13±1	25.119	2.17	1	0.01684	Pass
802.11n40	20.00	12.47	12±1	25.119	2.17	1	0.01338	Pass
802.11ac20	20.00	13.38	13±1	19.953	2.17	1	0.01684	Pass
802.11ac40	20.00	12.47	12±1	19.953	2.17	1	0.01338	Pass



ANT2:For 2.4G WIFI

Antenna Gain: 3.30dBi

Test Mode	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
802.11b	20.00	13.55	13±1	31.623	2.14	1	0.01649	Pass
802.11g	20.00	14.64	14±1	25.119	2.14	1	0.02076	Pass
802.11n(HT20)	20.00	14.64	14±1	25.119	2.14	1	0.02076	Pass
802.11n(HT40)	20.00	15.67	15±1	19.953	2.14	1	0.02614	Pass

For 5.2G WIFI

Antenna Gain: 3.37dBi

Test Mode	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
802.11a	20.00	13.14	13±1	31.623	2.17	1	0.01684	Pass
802.11n20	20.00	13.10	13±1	25.119	2.17	1	0.01684	Pass
802.11n40	20.00	12.35	12±1	25.119	2.17	1	0.01338	Pass
802.11ac20	20.00	13.23	13±1	19.953	2.17	1	0.01684	Pass
802.11ac40	20.00	12.41	12±1	19.953	2.17	1	0.01338	Pass



Simultaneous transmit:

NO,	Configurations	Maximum MPE Value			Limits
		WIFI 2.4GHz	WIFI 5GHz	Transmit simultaneously	
1	2.4GHz+5GHz	0.02614	0.01684	0.04298	1

Note:

1. Two independent WLAN modules are integrated in EUT. Firmware time-division control ensures only one module transmits at any time, simultaneous transmission is forbidden. Each module is evaluated separately, no power superposition.

2. According to KDB 447498 D01 General RF Exposure Guidance v06, At the transmit simultaneously calculation method is as follows:

Transmit simultaneously MPE = $\sum$ of MPE ratios

MPE ratios = Field strengths or power density / MPE limit at the test frequency

Conclusion:

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