

FCC ID:2A98H-WH01

Maximum Permissible Exposure (MPE)

According to FCC 1.1310: 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 Exposure				
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
300-1,500			f/300	6
1,500-100,000			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
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 * P * G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = Average RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 * P * G}{377 * D^2}$$

From the EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained.

Measurement Result

2.4G WIFI:

Operation Frequency: WIFI 802.11b/g/n HT20: 2412-2462MHz, HT40: 2422-2452MHz

Power density limited: $1\text{mW}/\text{cm}^2$

Antenna Type: PCB antenna

WIFI antenna gain1/2: 4.2dBi/4.2dBi

R=20cm

$\text{mW}=10^{(\text{dBm}/10)}$

antenna gain Numeric= $10^{(\text{dBi}/10)}=10^{(4.2/10)}=2.63$

SISO ANT1

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm^2)	(mW/cm2)
				(dBm)	(mW)	Numeric		
2412	802.11b	15.92	15±1	16	39.81072	2.63	0.02083	1
2437		15.79	15±1	16	39.81072	2.63	0.02083	1
2462		15.65	15±1	16	39.81072	2.63	0.02083	1
2412	802.11g	13.04	13±1	14	25.11886	2.63	0.01314	1
2437		12.97	13±1	14	25.11886	2.63	0.01314	1
2462		12.87	13±1	14	25.11886	2.63	0.01314	1
2412	802.11n H20	11.01	11±1	12	15.84893	2.63	0.00829	1
2437		11.19	11±1	12	15.84893	2.63	0.00829	1
2462		11.2	11±1	12	15.84893	2.63	0.00829	1
2422	802.11n H40	10.21	10±1	11	12.58925	2.63	0.00659	1
2437		10.28	10±1	11	12.58925	2.63	0.00659	1
2452		10.04	10±1	11	12.58925	2.63	0.00659	1

SISO ANT2

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm^2)	(mW/cm2)
				(dBm)	(mW)	Numeric		
2412	802.11b	15.63	16±1	17	50.11872	2.63	0.02622	1
2437		16.16	16±1	17	50.11872	2.63	0.02622	1
2462		15.23	16±1	17	50.11872	2.63	0.02622	1
2412	802.11g	12.98	13±1	14	25.11886	2.63	0.01314	1
2437		12.94	13±1	14	25.11886	2.63	0.01314	1
2462		13.05	13±1	14	25.11886	2.63	0.01314	1
2412	802.11n H20	11.22	11±1	12	15.84893	2.63	0.00829	1
2437		10.92	11±1	12	15.84893	2.63	0.00829	1
2462		11.14	11±1	12	15.84893	2.63	0.00829	1
2422	802.11n H40	9.69	10±1	11	12.58925	2.63	0.00659	1
2437		10.5	10±1	11	12.58925	2.63	0.00659	1
2452		10.18	10±1	11	12.58925	2.63	0.00659	1

5G WIFI:

Operation Frequency: WIFI 802.11a/ac/n(HT20): 5180-5240MHz; 5745-5825MHz; WIFI 802.11ac/n(HT40): 5190-5230MHz; 5755-5795MHz; WIFI 802.11ac80: 5210-5210MHz; 5775-5775MHz

Power density limited: $1\text{mW}/\text{cm}$

Antenna Type: PCB antenna

WIFI antenna1/2 gain: 5.27/5.27dBi;

R=20cm

$\text{mW}=10^{(\text{dBm}/10)}$

antenna gain Numeric= $10^{(\text{dBi}/10)}=10^{(5.27/10)}=3.37$

5.2G
SISO ANT1

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm2)	(mW/cm2)
				(dBm)	(mW)	Numeric		
5180	802.11a	10.36	10±1	11	12.59	3.37	0.00844	1
5200		10.01	10±1	11	12.59	3.37	0.00844	1
5240		10.44	10±1	11	12.59	3.37	0.00844	1
5180	802.11n 20	10.01	10±1	11	12.59	3.37	0.00844	1
5200		9.84	10±1	11	12.59	3.37	0.00844	1
5240		10.28	10±1	11	12.59	3.37	0.00844	1
5190	802.11n 40	11.28	11±1	12	15.85	3.37	0.01063	1
5230		10.24	11±1	12	15.85	3.37	0.01063	1
5180	802.11ac 20	10.08	10±1	11	12.59	3.37	0.00844	1
5200		9.9	10±1	11	12.59	3.37	0.00844	1
5240		10.24	10±1	11	12.59	3.37	0.00844	1
5190	802.11ac 40	10.11	10±1	11	12.59	3.37	0.00844	1
5230		10.11	10±1	11	12.59	3.37	0.00844	1
5210	802.11ac 80	9.86	9±1	10	10	3.37	0.00670	1

SISO ANT2

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm2)	(mW/cm2)
				(dBm)	(mW)	Numeric		
5180	802.11a	10.03	10±1	11	12.59	3.37	0.00844	1
5200		10.02	10±1	11	12.59	3.37	0.00844	1
5240		10.21	10±1	11	12.59	3.37	0.00844	1
5180	802.11n 20	9.88	10±1	11	12.59	3.37	0.00844	1
5200		10	10±1	11	12.59	3.37	0.00844	1
5240		10.15	10±1	11	12.59	3.37	0.00844	1
5190	802.11n 40	10.14	10±1	11	12.59	3.37	0.00844	1
5230		10.54	10±1	11	12.59	3.37	0.00844	1
5180	802.11ac 20	9.81	10±1	11	12.59	3.37	0.00844	1
5200		9.91	10±1	11	12.59	3.37	0.00844	1
5240		10.08	10±1	11	12.59	3.37	0.00844	1
5190	802.11ac 40	9.85	10±1	11	12.59	3.37	0.00844	1
5230		10.22	10±1	11	12.59	3.37	0.00844	1
5210	802.11ac 80	10.21	10±1	11	12.58925	3.37	0.00844	1

5.8G
SISO ANT1

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm2)	(mW/cm2)
				(dBm)	(mW)	Numeric		
5745	802.11a	10.34	10±1	11	12.59	3.37	0.00844	1
5785		10.07	10±1	11	12.59	3.37	0.00844	1
5825		10.12	10±1	11	12.59	3.37	0.00844	1
5745	802.11n20	10.34	10±1	11	12.59	3.37	0.00844	1
5785		10.15	10±1	11	12.59	3.37	0.00844	1
5825		10.37	10±1	11	12.59	3.37	0.00844	1
5755	802.11n40	10.23	10±1	11	12.59	3.37	0.00844	1
5795		10.05	10±1	11	12.59	3.37	0.00844	1
5745	802.11ac 20	10.17	10±1	11	12.59	3.37	0.00844	1
5785		10	10±1	11	12.59	3.37	0.00844	1
5825		10.3	10±1	11	12.59	3.37	0.00844	1
5755	802.11ac 40	10.21	10±1	11	12.59	3.37	0.00844	1
5795		10.3	10±1	11	12.59	3.37	0.00844	1
5775	802.11ac 80	10.11	10±1	11	12.59	3.37	0.00844	1

SISO ANT2

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm2)	(mW/cm2)
				(dBm)	(mW)	Numeric		
5745	802.11a	10.22	10±1	11	12.59	3.37	0.00844	1
5785		10.12	10±1	11	12.59	3.37	0.00844	1
5825		10.23	10±1	11	12.59	3.37	0.00844	1
5745	802.11n20	10.05	10±1	11	12.59	3.37	0.00844	1
5785		10.38	10±1	11	12.59	3.37	0.00844	1
5825		10.28	10±1	11	12.59	3.37	0.00844	1
5755	802.11n40	10.16	10±1	11	12.59	3.37	0.00844	1
5795		10.29	10±1	11	12.59	3.37	0.00844	1
5745	802.11ac 20	9.85	10±1	11	12.59	3.37	0.00844	1
5785		10.17	10±1	11	12.59	3.37	0.00844	1
5825		10.08	10±1	11	12.59	3.37	0.00844	1
5755	802.11ac 40	10.02	10±1	11	12.59	3.37	0.00844	1
5795		10.12	10±1	11	12.59	3.37	0.00844	1
5775	802.11ac 80	9.98	9±1	10	10.00	3.37	0.00670	1

WLAN2.4G MIMO

Antenna	Tune-up limit (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	Calculation result	Conclusion
Ant 1	10.67	4.2	14.9	30.90	20	0.006148	1	0.012751	Pass
Ant 2	11.01	4.2	15.21	33.19	20	0.006603	1		

WLAN5G MIMO

Antenna	Tune-up limit (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	Calculation result	Conclusion
Ant 1	10	5.27	15.27	33.65	20	0.006695	1	0.014762	Pass
Ant 2	10.81	5.27	16.08	40.55	20	0.008067	1		

Conclusion:

The conclusion should be $0.02622 < 1$ for Max Power Density, Compliance the RF Exposure requirement.

The 2.4Gwifi has the maximum Power Density value 0.012751 mW/cm² in 2.4G MIMO transmitting mode;

The 5Gwifi has the maximum Power Density value 0.014762 mW/cm² in 5G MIMO transmitting mode;

Signature:

Date: 2023-03-13



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