

FCC ID: 2A9YN-MWTERM311

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

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

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.

BT:

Measurement Result

Operation Frequency: 2402MHz~2480MHz

Power density limited: 1mW/ cm²

Antenna Type: Internal Antenna

antenna gain: 3.11 dBi;

R=20cm

mW=10^(dBm/10)

Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm2)	Power density (mW/cm2)
				tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric		
2402	DH5	0.52	1±1	2	1.585	3.11	2.05	0.0006	1
2441		1.69	1±1	2	1.585	3.11	2.05	0.0006	1
2480		1.48	1±1	2	1.585	3.11	2.05	0.0006	1
2402	2DH5	2.25	3±1	4	2.512	3.11	2.05	0.0010	1
2441		3.39	3±1	4	2.512	3.11	2.05	0.0010	1
2480		3.18	3±1	4	2.512	3.11	2.05	0.0010	1
2402	3DH5	2.7	3±1	4	2.512	3.11	2.05	0.0010	1
2441		3.8	3±1	4	2.512	3.11	2.05	0.0010	1
2480		3.54	3±1	4	2.512	3.11	2.05	0.0010	1

Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm2)	Power density (mW/cm2)
				tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric		
2402	GFSK(1M)	-1.96	-1±1	0	1.000	3.11	2.05	0.0004	1
2440		-1.45	-1±1	0	1.000	3.11	2.05	0.0004	1
2480		-1.08	-1±1	0	1.000	3.11	2.05	0.0004	1
2402	GFSK(2M)	-2.08	-2±1	-1	0.794	3.11	2.05	0.0003	1
2440		-1.58	-2±1	-1	0.794	3.11	2.05	0.0003	1
2480		-1.2	-2±1	-1	0.794	3.11	2.05	0.0003	1

2.4G WIFI:

Operation Frequency: WIFI 802.11b/g/n20/n40: 2412-2462MHz, 2422-2452MHz

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

Antenna Type: Internal Antenna

antenna gain: 3.09 dBi;

R=20cm

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

Antenna	Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm ²)	Power density (mW/cm ²)
			(dBm)		tune-up power		Gain			
					(dBm)	(mW)	(dBi)	Numeric		
Ant 1	2412	b	16.78	16±1	17	50.119	3.09	2.04	0.0203	1
Ant 2	2412	b	15.43	16±1	17	50.119	3.09	2.04	0.0203	1
Ant 1	2437	b	16.1	16±1	17	50.119	3.09	2.04	0.0203	1
Ant 2	2437	b	14.98	15±1	16	39.811	3.09	2.04	0.0161	1
Ant 1	2462	b	15.94	15±1	16	39.811	3.09	2.04	0.0161	1
Ant 2	2462	b	14.66	15±1	16	39.811	3.09	2.04	0.0161	1
Ant 1	2412	g	14.52	14±1	15	31.623	3.09	2.04	0.0128	1
Ant 2	2412	g	13.51	14±1	15	31.623	3.09	2.04	0.0128	1
Ant 1	2437	g	12.63	13±1	14	25.119	3.09	2.04	0.0102	1
Ant 2	2437	g	14.1	14±1	15	31.623	3.09	2.04	0.0128	1
Ant 1	2462	g	12.79	13±1	14	25.119	3.09	2.04	0.0102	1
Ant 2	2462	g	13.03	13±1	14	25.119	3.09	2.04	0.0102	1
Ant 1	2412	n20	12.78	13±1	14	25.119	3.09	2.04	0.0102	1
Ant 2	2412	n20	13.33	13±1	14	25.119	3.09	2.04	0.0102	1
Ant 1	2437	n20	11.94	12±1	13	19.953	3.09	2.04	0.0081	1
Ant 2	2437	n20	12.67	12±1	13	19.953	3.09	2.04	0.0081	1
Ant 1	2462	n20	12.21	12±1	13	19.953	3.09	2.04	0.0081	1
Ant 2	2462	n20	11.92	12±1	13	19.953	3.09	2.04	0.0081	1
Ant 1	2422	n40	13.1	13±1	14	25.119	3.09	2.04	0.0102	1
Ant 2	2422	n40	13.68	13±1	14	25.119	3.09	2.04	0.0102	1
Ant 1	2437	n40	11.95	12±1	13	19.953	3.09	2.04	0.0081	1
Ant 2	2437	n40	12.51	12±1	13	19.953	3.09	2.04	0.0081	1
Ant 1	2452	n40	12.11	12±1	13	19.953	3.09	2.04	0.0081	1
Ant 2	2452	n40	12.41	12±1	13	19.953	3.09	2.04	0.0081	1

5G WIFI:

Operation Frequency: WIFI 802.11a/ac/n(HT20): 5180-5240MHz;5260-5320MHz, 5745-5825MHz;
 WIFI 802.11ac/n(HT40): 5190-5230MHz;5270-5310MHz, 5755-5795MHz;
 WIFI 802.11ac80:5210-5210MHz;5290-5290MHz; 5775-5775MHz

Power density limited: 1mW/cm

Antenna Type: Internal Antenna

antenna gain:3.5dBi;

R=20cm

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

5.2G

Antenna	Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm ²)	Power density (mW/cm ²)
			(dBm)		tune-up power		Gain			
					(dBm)	(mW)	(dBi)	Numeric		
Ant 1	5180	a	10.1	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5200	a	11.04	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5240	a	11.27	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5180	a	10.47	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5200	a	11.13	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5240	a	11.18	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5180	ac20	10.34	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5200	ac20	11.06	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5240	ac20	11.21	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5180	ac20	10.41	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5200	ac20	10	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5240	ac20	10.27	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5190	ac40	10.24	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5230	ac40	10.88	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5190	ac40	10.79	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5230	ac40	11.37	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5210	ac80	11.18	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5210	ac80	11.59	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5180	n20	10.22	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5200	n20	11.46	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5240	n20	11.36	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5180	n20	10.73	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5200	n20	11.09	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5240	n20	11.05	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5190	n40	10.81	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5230	n40	10.98	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5190	n40	10.55	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5230	n40	10.69	11±1	12	15.849	3.50	2.24	0.0071	1

5.3G

Antenna	Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm ²)	Power density (mW/cm ²)
					tune-up power		Gain			
					(dBm)	(mW)	(dBi)	Numeric		
Ant 1	5260	a	10.44	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5280	a	10.27	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5320	a	10.95	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5260	a	11	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5280	a	10.55	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5320	a	11.02	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5260	ac20	10.7	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5280	ac20	10.08	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5320	ac20	10.74	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5260	ac20	11.03	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5280	ac20	10.5	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5320	ac20	11.03	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5270	ac40	10.17	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5310	ac40	10.74	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5270	ac40	10.56	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5310	ac40	11.29	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5290	ac80	11.22	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5290	ac80	11.56	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5260	n20	10.18	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 1	5280	n20	9.81	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 1	5320	n20	10.9	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 2	5260	n20	10.92	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 2	5280	n20	10.47	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 2	5320	n20	10.95	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 1	5270	n40	10.05	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 1	5310	n40	10.69	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 2	5270	n40	9.75	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 2	5310	n40	10.57	10±1	11	12.589	3.50	2.24	0.0056	1

5.8G

Antenna	Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density
					tune-up power		Gain			
			(dBm)		(dBm)	(mW)	(dBi)	Numeric	(mW/cm ²)	(mW/cm ²)
Ant 1	5745	a	10.34	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 1	5785	a	10.58	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 1	5825	a	10.57	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 2	5745	a	10.08	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 2	5785	a	10.32	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 2	5825	a	10.26	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 1	5745	ac20	10.69	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 1	5785	ac20	10.59	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 1	5825	ac20	10.82	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 2	5745	ac20	10.2	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 2	5785	ac20	10.39	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 2	5825	ac20	10.28	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 1	5755	ac40	11.01	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5795	ac40	10.58	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5755	ac40	10.8	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5795	ac40	10.17	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5775	ac80	11.35	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5775	ac80	11	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5745	n20	10.01	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 1	5785	n20	10.76	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 1	5825	n20	10.56	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 2	5745	n20	10.05	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 2	5785	n20	10.32	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 2	5825	n20	10.22	10±1	11	12.589	3.50	2.24	0.0056	1
Ant 1	5755	n40	11.25	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 1	5795	n40	10.53	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5755	n40	10.63	11±1	12	15.849	3.50	2.24	0.0071	1
Ant 2	5795	n40	10.07	11±1	12	15.849	3.50	2.24	0.0071	1

SIMULTANEOUS TRANSMISSIONS

When a number of sources at different frequencies, and/or broadband sources, contribute to the total exposure, it becomes necessary to weigh each contribution relative to the MPE. To comply with the MPE, the fraction of the MPE in terms of E^2 , H^2 (or power density) incurred within each frequency interval should be determined and the sum of all such fractions should not exceed unity. In order to ensure compliance with the MPE for a controlled environment, the sum of the ratios of the power density to the corresponding MPE should not exceed unity. That is

$$\sum_{i=1}^n \frac{S_i}{MPE_i} \leq 1$$

Max. SIMULTANEOUS TRANSMISSIONS MODE

Band	Antenna	SISO					MIMO		Verdict
		tune-up power	Antenna	Separation distance (cm)	Evaluation result	Power density	Evaluation result	Power density Limits	
		(dBm)	Gain (dBi)		(mW/cm ²)	(mW/cm ²)			
Wi-Fi 2.4G N20+BT	Ant1	14	3.09	20	0.010179	1	0.021381	1	PASS
	Ant2	14	3.09	20	0.010179	1			
	BT	4	3.11	20	0.001023	1			
Wi-Fi 5.2G n20 +BT	Ant1	12	3.09	20	0.006423	1	0.013869	1	PASS
	Ant2	12	3.09	20	0.006423	1			
	BT	4	3.11	20	0.001023	1			
Wi-Fi 5.3G AC20 +BT	Ant1	12	3.09	20	0.006423	1	0.013869	1	PASS
	Ant2	12	3.09	20	0.006423	1			
	BT	4	3.11	20	0.001023	1			
Wi-Fi 5.8G AC40 +BT	Ant1	12	3.09	20	0.006423	1	0.013869	1	PASS
	Ant2	12	3.09	20	0.006423	1			
	BT	4	3.11	20	0.001023	1			

Conclusion:

For the max result : $0.021381 \leq 1 \text{ mW/cm}^2$ for Power density, compliance with RF exposure.

Note: This product does not support 2.4G band and 5G band simultaneous delivery.

Signature:

Date: 2023-10-12



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