

FCC ID: 2AAA9-RA621

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.

2.4G WIFI:

Operation Frequency: WIFI 802.11b/g/n20/ax20: 2412-2462MHz,

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

Antenna Type: Internal PIFA Antenna

Antenna 1: 3.46dBi

Antenna 2: 3.4dBi

R=20cm

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

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	2412	802.11ax20	15.85	16±1	17	50.119	3.46	2.22	0.0221	1
Ant 1	2437		16.47	16±1	17	50.119	3.46	2.22	0.0221	1
Ant 1	2462		16.3	16±1	17	50.119	3.46	2.22	0.0221	1
Ant 2	2412	802.11ax20	16.52	16±1	17	50.119	3.40	2.19	0.0218	1
Ant 2	2437		16.3	16±1	17	50.119	3.40	2.19	0.0218	1
Ant 2	2462		16.52	16±1	17	50.119	3.40	2.19	0.0218	1
Ant 1	2422	802.11ax40	16.42	16±1	17	50.119	3.46	2.22	0.0221	1
Ant 1	2437		16.38	16±1	17	50.119	3.46	2.22	0.0221	1
Ant 1	2452		16.82	16±1	17	50.119	3.46	2.22	0.0221	1
Ant 2	2422	802.11ax40	16.89	16±1	17	50.119	3.40	2.19	0.0218	1
Ant 2	2437		16.43	16±1	17	50.119	3.40	2.19	0.0218	1
Ant 2	2452		16.53	16±1	17	50.119	3.40	2.19	0.0218	1
Ant 1	2412	802.11b	18.41	18±1	19	79.433	3.46	2.22	0.0351	1
Ant 1	2437		18.11	18±1	19	79.433	3.46	2.22	0.0351	1
Ant 1	2462		17.89	18±1	19	79.433	3.46	2.22	0.0351	1
Ant 2	2412	802.11b	18.34	18±1	19	79.433	3.40	2.19	0.0346	1
Ant 2	2437		18.02	18±1	19	79.433	3.40	2.19	0.0346	1
Ant 2	2462		18.27	18±1	19	79.433	3.40	2.19	0.0346	1
Ant 1	2412	802.11g	16.55	17±1	18	63.096	3.46	2.22	0.0278	1
Ant 1	2437		17.25	17±1	18	63.096	3.46	2.22	0.0278	1
Ant 1	2456		16.9	17±1	18	63.096	3.46	2.22	0.0278	1
Ant 2	2412	802.11g	17.22	17±1	18	63.096	3.40	2.19	0.0275	1
Ant 2	2437		17.12	17±1	18	63.096	3.40	2.19	0.0275	1
Ant 2	2456		17.24	17±1	18	63.096	3.40	2.19	0.0275	1
Ant 1	2412	802.11n H20	16.24	16±1	17	50.119	3.46	2.22	0.0221	1
Ant 1	2437		16.83	16±1	17	50.119	3.46	2.22	0.0221	1
Ant 1	2462		16.68	16±1	17	50.119	3.46	2.22	0.0221	1
Ant 2	2412	802.11n H20	16.92	16±1	17	50.119	3.40	2.19	0.0218	1
Ant 2	2437		16.61	16±1	17	50.119	3.40	2.19	0.0218	1
Ant 2	2462		16.95	16±1	17	50.119	3.40	2.19	0.0218	1
Ant 1	2422	802.11n40	16.54	16±1	17	50.119	3.46	2.22	0.0221	1
Ant 1	2437		16.52	16±1	17	50.119	3.46	2.22	0.0221	1
Ant 1	2452		16.92	16±1	17	50.119	3.46	2.22	0.0221	1
Ant 2	2422	802.11n40	16.93	16±1	17	50.119	3.40	2.19	0.0218	1
Ant 2	2437		16.48	16±1	17	50.119	3.40	2.19	0.0218	1
Ant 2	2452		16.58	16±1	17	50.119	3.40	2.19	0.0218	1

5G WIFI:

Power density limited: 1mW/cm

Antenna Type: Internal PIFA antenna

Antenna 1: 4.85dBi

Antenna 2: 4.52dBi

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	802.11a	18.45	19±1	20	100.000	4.85	3.05	0.0608	1
Ant 1	5200		18.77	19±1	20	100.000	4.85	3.05	0.0608	1
Ant 1	5240		19.93	19±1	20	100.000	4.85	3.05	0.0608	1
Ant 2	5180	802.11a	19.3	19±1	20	100.000	4.52	2.83	0.0563	1
Ant 2	5200		19.48	19±1	20	100.000	4.52	2.83	0.0563	1
Ant 2	5240		20.82	20±1	21	125.893	4.52	2.83	0.0709	1
Ant 1	5180	802.11ac20	18.17	18±1	19	79.433	4.85	3.05	0.0483	1
Ant 1	5200		18.43	18±1	19	79.433	4.85	3.05	0.0483	1
Ant 1	5240		18.44	18±1	19	79.433	4.85	3.05	0.0483	1
Ant 2	5180	802.11ac20	18.93	18±1	19	79.433	4.52	2.83	0.0447	1
Ant 2	5200		18.28	18±1	19	79.433	4.52	2.83	0.0447	1
Ant 2	5240		18.63	18±1	19	79.433	4.52	2.83	0.0447	1
Ant 1	5190	802.11ac40	17.39	18±1	19	79.433	4.85	3.05	0.0483	1
Ant 1	5230		18.8	18±1	19	79.433	4.85	3.05	0.0483	1
Ant 2	5190	802.11ac40	18.02	18±1	19	79.433	4.52	2.83	0.0447	1
Ant 2	5230		19.55	19±1	20	100.000	4.52	2.83	0.0563	1
Ant 1	5210	802.11ac80	16.76	17±1	18	63.096	4.85	3.05	0.0383	1
Ant 2	5210	802.11ac80	17.67	17±1	18	63.096	4.52	2.83	0.0355	1
Ant 1	5180	802.11ax20	17.94	18±1	19	79.433	4.85	3.05	0.0483	1
Ant 1	5200		18.08	18±1	19	79.433	4.85	3.05	0.0483	1
Ant 1	5240		18.08	18±1	19	79.433	4.85	3.05	0.0483	1
Ant 2	5180	802.11ax20	18.57	18±1	19	79.433	4.52	2.83	0.0447	1
Ant 2	5200		17.86	18±1	19	79.433	4.52	2.83	0.0447	1
Ant 2	5240		18.21	18±1	19	79.433	4.52	2.83	0.0447	1
Ant 1	5190	802.11ax40	16.49	17±1	18	63.096	4.85	3.05	0.0383	1
Ant 1	5230		17.89	17±1	18	63.096	4.85	3.05	0.0383	1
Ant 2	5190	802.11ax40	17.2	17±1	18	63.096	4.52	2.83	0.0355	1
Ant 2	5230		18.53	18±1	19	79.433	4.52	2.83	0.0447	1
Ant 1	5210	802.11ax80	16	17±1	18	63.096	4.85	3.05	0.0383	1
Ant 2	5210	802.11ax80	16.93	17±1	18	63.096	4.52	2.83	0.0355	1
Ant 1	5180	802.11n H20	17.64	18±1	19	79.433	4.85	3.05	0.0483	1
Ant 1	5200		18.01	18±1	19	79.433	4.85	3.05	0.0483	1
Ant 1	5240		18.51	18±1	19	79.433	4.85	3.05	0.0483	1
Ant 2	5180	802.11n H20	17.76	18±1	19	79.433	4.52	2.83	0.0447	1
Ant 2	5200		18.13	18±1	19	79.433	4.52	2.83	0.0447	1
Ant 2	5240		18.54	18±1	19	79.433	4.52	2.83	0.0447	1
Ant 1	5190	802.11n H40	17.39	18±1	19	79.433	4.85	3.05	0.0483	1
Ant 1	5230		18.75	18±1	19	79.433	4.85	3.05	0.0483	1
Ant 2	5190	802.11n H40	18.14	18±1	19	79.433	4.52	2.83	0.0447	1
Ant 2	5230		19.49	19±1	20	100.000	4.52	2.83	0.0563	1

5.8G

Antenna	Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm ²)	Power density Limits (mW/cm ²)
					tune-up power		Gain			
					(dBm)	(mW)	(dBi)	Numeric		
Ant 1	5745	802.11a	16.73	16±1	17	50.119	4.85	3.05	0.0305	1
Ant 1	5785		16.81	16±1	17	50.119	4.85	3.05	0.0305	1
Ant 1	5825		15.38	16±1	17	50.119	4.85	3.05	0.0305	1
Ant 2	5745	802.11a	15.23	16±1	17	50.119	4.52	2.83	0.0282	1
Ant 2	5785		15.13	16±1	17	50.119	4.52	2.83	0.0282	1
Ant 2	5825		14.34	15±1	16	39.811	4.52	2.83	0.0224	1
Ant 1	5745	802.11ac20	16.54	16±1	17	50.119	4.85	3.05	0.0305	1
Ant 1	5785		16.56	16±1	17	50.119	4.85	3.05	0.0305	1
Ant 1	5825		15.2	16±1	17	50.119	4.85	3.05	0.0305	1
Ant 2	5745	802.11ac20	14.98	15±1	16	39.811	4.52	2.83	0.0224	1
Ant 2	5785		14.86	15±1	16	39.811	4.52	2.83	0.0224	1
Ant 2	5825		14.36	15±1	16	39.811	4.52	2.83	0.0224	1
Ant 1	5755	802.11ac40	17.09	17±1	18	63.096	4.85	3.05	0.0383	1
Ant 1	5795		16.34	17±1	18	63.096	4.85	3.05	0.0383	1
Ant 2	5755		16.47	17±1	18	63.096	4.52	2.83	0.0355	1
Ant 2	5795	802.11ac40	15.42	16±1	17	50.119	4.52	2.83	0.0282	1
Ant 1	5775	802.11ac80	17.22	17±1	18	63.096	4.85	3.05	0.0383	1
Ant 2	5775	802.11ac80	15.56	16±1	17	50.119	4.52	2.83	0.0282	1
Ant 1	5745	802.11ax20	16.28	16±1	17	50.119	4.85	3.05	0.0305	1
Ant 1	5785		16.41	16±1	17	50.119	4.85	3.05	0.0305	1
Ant 1	5825		14.95	15±1	16	39.811	4.85	3.05	0.0242	1
Ant 2	5745	802.11ax20	14.72	15±1	16	39.811	4.52	2.83	0.0224	1
Ant 2	5785		14.63	15±1	16	39.811	4.52	2.83	0.0224	1
Ant 2	5825		14.03	15±1	16	39.811	4.52	2.83	0.0224	1
Ant 1	5755	802.11ax40	16.39	16±1	17	50.119	4.85	3.05	0.0305	1
Ant 1	5795		15.47	16±1	17	50.119	4.85	3.05	0.0305	1
Ant 2	5755		15.64	16±1	17	50.119	4.52	2.83	0.0282	1
Ant 2	5795	802.11ax40	14.75	15±1	16	39.811	4.52	2.83	0.0224	1
Ant 1	5775	802.11ax80	16.79	16±1	17	50.119	4.85	3.05	0.0305	1
Ant 2	5775	802.11ax80	14.93	15±1	16	39.811	4.52	2.83	0.0224	1
Ant 1	5745	802.11n H20	16.58	16±1	17	50.119	4.85	3.05	0.0305	1
Ant 1	5785		16.59	16±1	17	50.119	4.85	3.05	0.0305	1
Ant 1	5825		15.17	15±1	16	39.811	4.85	3.05	0.0242	1
Ant 2	5745	802.11n H20	15.02	15±1	16	39.811	4.52	2.83	0.0224	1
Ant 2	5785		14.86	15±1	16	39.811	4.52	2.83	0.0224	1
Ant 2	5825		14.33	15±1	16	39.811	4.52	2.83	0.0224	1
Ant 1	5755	802.11n H40	17.14	17±1	18	63.096	4.85	3.05	0.0383	1
Ant 1	5795		16.05	17±1	18	63.096	4.85	3.05	0.0383	1
Ant 2	5755		16.73	17±1	18	63.096	4.52	2.83	0.0355	1
Ant 2	5795	802.11n H40	15.8	16±1	17	50.119	4.52	2.83	0.0282	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	Ant1	17	3.46	20	0.022117	1	0.043930	1	PASS
	Ant2	17	3.4	20	0.021813	1			
Wi-Fi 5.2G ac40	Ant1	19	4.85	20	0.048275	1	0.104602	1	PASS
	Ant2	20	4.52	20	0.056327	1			
Wi-Fi 5.8G n40	Ant1	18	4.85	20	0.038346	1	0.073886	1	PASS
	Ant2	18	4.52	20	0.03554	1			

Conclusion:

For the max result : $0.104602 \leq 1 \text{ mW/cm}^2$ for Power density, compliance with RF exposure.

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

Signature:

Date: 2022-003-15



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