

FCC ID: 2A332-T12

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.

BT:

Measurement Result

Operation Frequency: 2402MHz~2480MHz

Power density limited: 1mW/cm^2

Antenna Type: FPCB antenna

Antenna gain: 2.1dBi;

R=20cm

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

antenna gain Numeric= $10^{(\text{dBi}/10)}=10^{(2.1/10)}=1.62$

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density
		(dBm)		tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric		
2402	DH5	5.822	6±1	7	5.012	2.10	1.62	0.0016	1
2441		4.504	4±1	5	3.162	2.10	1.62	0.0010	1
2480		4.495	5±1	6	3.981	2.10	1.62	0.0013	1
2402	2DH5	5.572	6±1	7	5.012	2.10	1.62	0.0016	1
2441		4.458	4±1	5	3.162	2.10	1.62	0.0010	1
2480		4.735	5±1	6	3.981	2.10	1.62	0.0013	1
2402	3DH5	6.105	6±1	7	5.012	2.10	1.62	0.0016	1
2441		4.89	4±1	5	3.162	2.10	1.62	0.0010	1
2480		5.127	5±1	6	3.981	2.10	1.62	0.0013	1

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density
		(dBm)		tune-up power		Gain		(mW/cm2)	(mW/cm2)
				(dBm)	(mW)	(dBi)	Numeric		
2402	GFSK	1.39	1±1	2	1.585	2.10	1.62	0.0005	1
2440		1.097	1±1	2	1.585	2.10	1.62	0.0005	1
2480		0.697	1±1	2	1.585	2.10	1.62	0.0005	1

2.4G WIFI:

Operation Frequency: WIFI 802.11b/g/n HT20: 2412-2462MHz,
WIFI 802.11n HT40:2422-2452MHz
Power density limited: $1\text{mW}/\text{cm}^2$

Antenna Type: FPCB antenna

Antenna gain: 2.1dBi;

R=20cm

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

antenna gain Numeric= $10^{(\text{dBi}/10)}=10^{(2.1/10)}=1.62$

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density
		(dBm)		tune-up power		Gain		(mW/cm2)	(mW/cm2)
				(dBm)	(mW)	(dBi)	Numeric		
2412	802.11b	13.57	14±1	15	31.623	2.10	1.62	0.0102	1
2437		14.39	14±1	15	31.623	2.10	1.62	0.0102	1
2462		14	14±1	15	31.623	2.10	1.62	0.0102	1
2412	802.11g	12.1	12±1	13	19.953	2.10	1.62	0.0064	1
2437		12.54	12±1	13	19.953	2.10	1.62	0.0064	1
2462		12.25	12±1	13	19.953	2.10	1.62	0.0064	1
2412	802.11n H20	12.21	12±1	13	19.953	2.10	1.62	0.0064	1
2437		12.52	12±1	13	19.953	2.10	1.62	0.0064	1
2462		12.18	12±1	13	19.953	2.10	1.62	0.0064	1
2422	802.11n(H T40)	11.36	11±1	12	15.849	2.10	1.62	0.0051	1
2437		11.18	11±1	12	15.849	2.10	1.62	0.0051	1
2452		11.33	11±1	12	15.849	2.10	1.62	0.0051	1

5G WIFI:

Operation Frequency: WIFI 802.11a/ac/n(HT20): 5180-5240MHz;5260-5320MHz,5500-5700MHz,5745-5825MHz;WIFI 802.11ac/n(HT40): 5190-5230MHz;5270-5310MHz,5510-5670MHz5755-5795MHz; WIFI 802.11ac80:5210-5210MHz;5290-5290MHz;5530-5610MHz;5775-5775MHz

Power density limited: 1mW/cm

Antenna Type: FPCB antenna

Antenna gain:2.1dBi;

R=20cm

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

antenna gain Numeric= $10^{(dBi/10)}=10^{(2.1/10)}=1.62$

5.2G

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density
		(dBm)		tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric	(mW/cm2)	(mW/cm2)
5180	802.11a	11.11	11±1	12	15.849	2.10	1.62	0.0051	1
5200		10.01	11±1	12	15.849	2.10	1.62	0.0051	1
5240		10.1	11±1	12	15.849	2.10	1.62	0.0051	1
5180	802.11ac20	10.07	10±1	11	12.589	2.10	1.62	0.0041	1
5200		9.08	10±1	11	12.589	2.10	1.62	0.0041	1
5240		9.12	10±1	11	12.589	2.10	1.62	0.0041	1
5190	802.11ac40	7.86	7±1	8	6.310	2.10	1.62	0.0020	1
5230		7.75	7±1	8	6.310	2.10	1.62	0.0020	1
5210	802.11ac80	7.71	7±1	8	6.310	2.10	1.62	0.0020	1
5180	802.11n H20	9.03	9±1	10	10.000	2.10	1.62	0.0032	1
5200		9.04	9±1	10	10.000	2.10	1.62	0.0032	1
5240		9.1	9±1	10	10.000	2.10	1.62	0.0032	1
5190	802.11n H40	7.86	8±1	9	7.943	2.10	1.62	0.0026	1
5230		8.06	8±1	9	7.943	2.10	1.62	0.0026	1

5.3G

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm2)	Power density (mW/cm2)
		(dBm)		tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric		
5260	802.11a	9.82	9±1	10	10.000	2.10	1.62	0.0032	1
5280		8.98	9±1	10	10.000	2.10	1.62	0.0032	1
5320		9.62	9±1	10	10.000	2.10	1.62	0.0032	1
5260	802.11ac20	8.83	8±1	9	7.943	2.10	1.62	0.0026	1
5280		7.92	8±1	9	7.943	2.10	1.62	0.0026	1
5320		7.51	8±1	9	7.943	2.10	1.62	0.0026	1
5270	802.11ac40	8.62	8±1	9	7.943	2.10	1.62	0.0026	1
5310		7.42	8±1	9	7.943	2.10	1.62	0.0026	1
5290	802.11ac80	7.73	8±1	9	7.943	2.10	1.62	0.0026	1
5260	802.11n H20	8.96	8±1	9	7.943	2.10	1.62	0.0026	1
5280		7.91	8±1	9	7.943	2.10	1.62	0.0026	1
5320		8.56	8±1	9	7.943	2.10	1.62	0.0026	1
5270	802.11n H40	8.56	8±1	9	7.943	2.10	1.62	0.0026	1
5310		7.42	8±1	9	7.943	2.10	1.62	0.0026	1

5.6G

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density
		(dBm)		tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric	(mW/cm2)	(mW/cm2)
5500	802.11a	9.82	9±1	10	10.000	2.10	1.62	0.0032	1
5600		8.98	9±1	10	10.000	2.10	1.62	0.0032	1
5700		9.62	9±1	10	10.000	2.10	1.62	0.0032	1
5500	802.11ac20	8.83	8±1	9	7.943	2.10	1.62	0.0026	1
5600		7.92	8±1	9	7.943	2.10	1.62	0.0026	1
5700		7.51	8±1	9	7.943	2.10	1.62	0.0026	1
5510	802.11ac40	8.62	8±1	9	7.943	2.10	1.62	0.0026	1
5590		7.42	8±1	9	7.943	2.10	1.62	0.0026	1
5670		7.73	8±1	9	7.943	2.10	1.62	0.0026	1
5530	802.11ac80	8.96	8±1	9	7.943	2.10	1.62	0.0026	1
5610		7.91	8±1	9	7.943	2.10	1.62	0.0026	1
5500	802.11n(HT20)	8.56	8±1	9	7.943	2.10	1.62	0.0026	1
5600		8.56	8±1	9	7.943	2.10	1.62	0.0026	1
5700		7.42	8±1	9	7.943	2.10	1.62	0.0026	1

5.8G

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density
		(dBm)		tune-up power		Gain			
				(dBm)	(dBm)	(mW)	(dBi)	Numeric	(mW/cm2)
5745	802.11a	8.37	9±1	10	10.000	2.10	1.62	0.0032	1
5785		9.31	9±1	10	10.000	2.10	1.62	0.0032	1
5825		8.35	9±1	10	10.000	2.10	1.62	0.0032	1
5745	802.11ac20	7.87	7±1	8	6.310	2.10	1.62	0.0020	1
5785		7.73	7±1	8	6.310	2.10	1.62	0.0020	1
5825		7.07	7±1	8	6.310	2.10	1.62	0.0020	1
5755	802.11ac40	6.65	7±1	8	6.310	2.10	1.62	0.0020	1
5795		7.55	7±1	8	6.310	2.10	1.62	0.0020	1
5775	802.11ac80	6.18	6±1	7	5.012	2.10	1.62	0.0016	1
5745	802.11n H20	7.12	8±1	9	7.943	2.10	1.62	0.0026	1
5785		8.33	8±1	9	7.943	2.10	1.62	0.0026	1
5825		8.44	8±1	9	7.943	2.10	1.62	0.0026	1
5755	802.11n H40	7.59	7±1	8	6.310	2.10	1.62	0.0020	1
5795		7.36	7±1	8	6.310	2.10	1.62	0.0020	1

GSM/WCDMA/LTE

Antenna Type: FPCB antenna

GSM850: 0.3dBi;UMTS FDD Band V: 0.3dBi;PCS1900: 1dBi; UMTS FDD Band II: 1dBi; UMTS-FDD Band IV: 0.8dBi;

LTE FDD Band 2 1.0dBi;LTE FDD Band 4 0.8dBi;LTE FDD Band 5 0.3dBi;LTE-FDD Band 7 1.8dBi;LTE FDD Band 12 0.2dBi;LTE FDD Band 13 0.2dBi;LTE FDD Band 17 0.2dBi;LTE FDD Band 25 0.3dBi;LTE FDD Band 41 1.5dBi;

modulation	Max		Antenna		Evaluation result	Power density
	tune-up power		Gain		(mW/cm ²)	(mW/cm ²)
	(dBm)	(mW)	(dBi)	Numeric		
GSM850	33	1995.262	0.3	1.07	0.4253	1
PCS1900	30	1000.000	1	1.26	0.2504	1
WCDMA Band	22.5	177.828	1	1.26	0.0445	1
WCDMA Band	22.5	177.828	0.8	1.20	0.0425	1
WCDMA Band	23.5	223.872	0.3	1.07	0.0477	1
LTE Band 2	22.5	177.828	1	1.26	0.0445	1
LTE Band 4	23.5	223.872	0.8	1.20	0.0535	1
LTE Band 5	24	251.189	0.3	1.07	0.0535	1
LTE Band 7	24.5	281.838	1.8	1.51	0.0849	1
LTE Band 12	23.5	223.872	0.2	1.05	0.0466	1
LTE Band 13	24	251.189	0.2	1.05	0.0523	1
LTE Band 17	23.5	223.872	0.2	1.05	0.0466	1
LTE Band 25	23	199.526	0.3	1.07	0.0425	1
LTE Band 41	24	251.189	1.5	1.41	0.0706	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	SISO					Total Ratio		Verdict
	Max EIRP	Antenna	Separation distance (cm)	Evaluation result	Power density	Evaluation result	Power density Limits	
	(dBm)	Gain		(mW/cm2)	(mW/cm2)			
		(dBi)						
Wi-Fi 2.4G + GSM 850	14.39	2.1	20	0.005467	1	0.780192	1	PASS
	33.3	0.3	20	0.425324	0.549			

Signature:

Date: 2021-12-27



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