

FCC ID: 2ABC5-E0109

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

$$E \text{ (V/m)} = \frac{\sqrt{30 * P * G}}{d}$$

$$\text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

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: FPC antenna

Antenna gain:2.49dBi;

R=20cm

mW=10^{^(dBi/10)}

antenna gain Numeric=10^{^(dBi/10)}= 10^{^(2.49/10)}=1.77

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density Limits
		(dBm)		tune-up power		Gain		(mW/cm2)	(mW/cm2)
				(dBm)	(mW)	(dBi)	Numeric		
2402	DH5	3.24	2.5±1	3.5	2.239	2.49	1.77	0.0008	1
2441		2.6	2.5±1	3.5	2.239	2.49	1.77	0.0008	1
2480		1.96	2.5±1	3.5	2.239	2.49	1.77	0.0008	1
2402	2DH5	2.85	2±1	3	1.995	2.49	1.77	0.0007	1
2441		2.15	2±1	3	1.995	2.49	1.77	0.0007	1
2480		1.45	2±1	3	1.995	2.49	1.77	0.0007	1
2402	3DH5	2.78	2±1	3	1.995	2.49	1.77	0.0007	1
2441		2.17	2±1	3	1.995	2.49	1.77	0.0007	1
2480		1.53	2±1	3	1.995	2.49	1.77	0.0007	1

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density Limits
		(dBm)		tune-up power		Gain			
				(dBm)	(dBm)	(mW)	(dBi)	Numeric	(mW/cm2)
2402	GFSK(1M)	3.46	3±1	4	2.512	2.49	1.77	0.0009	1
2440		2.79	3±1	4	2.512	2.49	1.77	0.0009	1
2480		2.1	3±1	4	2.512	2.49	1.77	0.0009	1

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density Limits
		(dBm)		tune-up power		Gain			
				(dBm)	(dBm)	(mW)	(dBi)	Numeric	(mW/cm2)
2402	GFSK(2M)	3.39	3±1	4	2.512	2.49	1.77	0.0009	1
2440		2.73	3±1	4	2.512	2.49	1.77	0.0009	1
2480		2.03	3±1	4	2.512	2.49	1.77	0.0009	1

2.4G WIFI:

Operation Frequency: WIFI 802.11b/g/n/ax20: 2412-2462MHz,
WIFI 802.11n/ax40:2422-2452MHz
Power density limited: 1mW/ cm²

Antenna Type: FPC antenna

Antenna gain1: 2.49dBi

R=20cm

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

antenna gain Numeric= $10^{(dBi/10)}=10^{(2.49/10)}=1.77$

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density Limits
		(dBm)		tune-up power		Gain		(mW/cm2)	(mW/cm2)
				(dBm)	(mW)	(dBi)	Numeric		
2412	802.11b	16.02	16±1	17	50.119	2.49	1.77	0.0177	1
2437		16.12	16±1	17	50.119	2.49	1.77	0.0177	1
2462		15.82	16±1	17	50.119	2.49	1.77	0.0177	1
2412	802.11g	13.29	13±1	14	25.119	2.49	1.77	0.0089	1
2437		13.48	13±1	14	25.119	2.49	1.77	0.0089	1
2462		13.54	13±1	14	25.119	2.49	1.77	0.0089	1
2412	802.11n H20	12.13	12±1	13	19.953	2.49	1.77	0.0070	1
2437		12.53	12±1	13	19.953	2.49	1.77	0.0070	1
2462		12.85	12±1	13	19.953	2.49	1.77	0.0070	1
2422	802.11n(H T40)	12.33	12±1	13	19.953	2.49	1.77	0.0070	1
2437		12.83	12±1	13	19.953	2.49	1.77	0.0070	1
2452		12.35	12±1	13	19.953	2.49	1.77	0.0070	1
2412	802.11ax20	11.34	11±1	12	15.849	2.49	1.77	0.0056	1
2437		11.68	11±1	12	15.849	2.49	1.77	0.0056	1
2462		11.81	11±1	12	15.849	2.49	1.77	0.0056	1
2422	802.11ax40	11.21	11±1	12	15.849	2.49	1.77	0.0056	1
2437		11.96	11±1	12	15.849	2.49	1.77	0.0056	1
2452		11.62	11±1	12	15.849	2.49	1.77	0.0056	1

5G WIFI:

Operation Frequency: WIFI 802.11a/ac/n/ax20: 5180-5240MHz; 5745-5825MHz;

WIFI 802.11ac/n/ax40: 5190-5230MHz; 5755-5795MHz;

Power density limited: 1mW/cm

Antenna Type: FPC antenna

Antenna gain:5.2G:3.42dBi;5.8G:4.96dBi;

R=20cm

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

antenna gain Numeric= $10^{(dBi/10)}=10^{(3.42/10)}=2.2$

antenna gain Numeric= $10^{(dBi/10)}=10^{(4.96/10)}=3.13$

5.2G

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density Limits
		(dBm)		tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric	(mW/cm2)	(mW/cm2)
5180	802.11a	12.12	12±1	13	19.953	3.42	2.20	0.0087	1
5200		11.97	12±1	13	19.953	3.42	2.20	0.0087	1
5240		11.98	12±1	13	19.953	3.42	2.20	0.0087	1
5180	802.11n20	11.76	11±1	12	15.849	3.42	2.20	0.0069	1
5200		11.91	11±1	12	15.849	3.42	2.20	0.0069	1
5240		11.78	11±1	12	15.849	3.42	2.20	0.0069	1
5190	802.11n40	11.74	11±1	12	15.849	3.42	2.20	0.0069	1
5230		11.85	11±1	12	15.849	3.42	2.20	0.0069	1
5180	802.11ac20	11.89	11±1	12	15.849	3.42	2.20	0.0069	1
5200		11.88	11±1	12	15.849	3.42	2.20	0.0069	1
5240		11.99	11±1	12	15.849	3.42	2.20	0.0069	1
5190	802.11ac40	11.81	11±1	12	15.849	3.42	2.20	0.0069	1
5230		11.55	11±1	12	15.849	3.42	2.20	0.0069	1
5180	802.11ax20	10.77	11±1	12	15.849	3.42	2.20	0.0069	1
5200		11.76	11±1	12	15.849	3.42	2.20	0.0069	1
5240		11.9	11±1	12	15.849	3.42	2.20	0.0069	1
5190	802.11ax40	11.94	11±1	12	15.849	3.42	2.20	0.0069	1
5230		11.84	11±1	12	15.849	3.42	2.20	0.0069	1

5.8G

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density limits
		(dBm)		tune-up power		Gain		(mW/cm2)	(mW/cm2)
				(dBm)	(mW)	(dBi)	Numeric		
5745	802.11a	13.09	12.5±1	13.5	22.387	4.96	3.13	0.0140	1
5785		12.43	12.5±1	13.5	22.387	4.96	3.13	0.0140	1
5825		11.74	12.5±1	13.5	22.387	4.96	3.13	0.0140	1
5745	802.11n20	12.82	12±1	13	19.953	4.96	3.13	0.0124	1
5785		12.43	12±1	13	19.953	4.96	3.13	0.0124	1
5825		11.68	12±1	13	19.953	4.96	3.13	0.0124	1
5755	802.11n40	12.68	12±1	13	19.953	4.96	3.13	0.0124	1
5795		12.28	12±1	13	19.953	4.96	3.13	0.0124	1
5745	802.11ac20	13.01	12.5±1	13.5	22.387	4.96	3.13	0.0140	1
5785		12.34	12.5±1	13.5	22.387	4.96	3.13	0.0140	1
5825		11.52	12.5±1	13.5	22.387	4.96	3.13	0.0140	1
5755	802.11ac40	12.6	12±1	13	19.953	4.96	3.13	0.0124	1
5795		12.12	12±1	13	19.953	4.96	3.13	0.0124	1
5745	802.11ax20	12.51	12±1	13	19.953	4.96	3.13	0.0124	1
5785		12.37	12±1	13	19.953	4.96	3.13	0.0124	1
5825		11.68	12±1	13	19.953	4.96	3.13	0.0124	1
5755	802.11ax40	10.94	10±1	11	12.589	4.96	3.13	0.0078	1
5795		12.7	12±1	13	19.953	4.96	3.13	0.0124	1

NFC

Operation Frequency: 13.56MHz

Power density limited: 1mW/ cm²

Antenna Type: Induction coil

R=20cm

Transmit power

NFC

Frequency (MHz)	Max Output power (dBuV/m)	EIRP power (dBm)
13.56	63.12	-32.14

$$\text{EIRP} = \text{E} - 104.8 + 20 \log(D)$$

Mode	Channel Freq. (MHz)	EIRP power (dBm)	EIRP power (mW)	Tune-up power (dBm)	Max tune-up power (dBm)	Evaluation result (mW/cm2)	Power density Limits (mW/cm2)
NFC	13.56	-32.14	0.0006	-32±1	-31	0.0000002	0.0090

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 E², H² (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 for NFC + WIFI2.4G

Mode	Channel Freq. (MHz)	Evaluation result (mW/cm2)	Limits (mW/cm2)	Calculation result
NFC	13.56	0.0000002	0.009	0.017722
WIFI2.4G	2412	0.0177	1	

Conclusion:

For the max result : $0.017722 \leq 1.0$ for Max Power Density, compliance RF exposure.

Signature:

Date: 2025-12-16



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