

FCC ID: 2A9FT-Z400-H3

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

Antenna Type: External antenna

Antenna gain:3.58dBi;

R=20cm

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

antenna gain Numeric= $10^{(\text{dBi}/10)}=10^{(3.58/10)}=2.28$

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		
2402	DH5	9.467	9±1	10	10.000	3.58	2.28	0.0045	1
2441		9.315	9±1	10	10.000	3.58	2.28	0.0045	1
2480		9.269	9±1	10	10.000	3.58	2.28	0.0045	1
2402	2DH5	8.827	9±1	10	10.000	3.58	2.28	0.0045	1
2441		9.625	9±1	10	10.000	3.58	2.28	0.0045	1
2480		8.397	9±1	10	10.000	3.58	2.28	0.0045	1
2402	3DH5	8.837	9±1	10	10.000	3.58	2.28	0.0045	1
2441		9.556	9±1	10	10.000	3.58	2.28	0.0045	1
2480		9.986	9±1	10	10.000	3.58	2.28	0.0045	1

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		
2402	GFSK(1M)	-3.492	-3±1	-2	0.631	3.58	2.28	0.0003	1
2440		-2.154	-3±1	-2	0.631	3.58	2.28	0.0003	1
2480		-3.753	-3±1	-2	0.631	3.58	2.28	0.0003	1

2.4G WIFI:

Operation Frequency: WIFI 802.11b/g/n HT20: 2412-2462MHz,
 WIFI 802.11n HT40:2422-2452MHz
 Power density limited: 1mW/ cm²

Antenna Type: External antenna

Antenna gain: 3.58dBi;

R=20cm

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

antenna gain Numeric= $10^{(dBi/10)}=10^{(3.58/10)}=2.28$

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		
2412	802.11b	18.7	18±1	19	79.433	3.58	2.28	0.0360	1
2437		18.51	18±1	19	79.433	3.58	2.28	0.0360	1
2462		18.9	18±1	19	79.433	3.58	2.28	0.0360	1
2412	802.11g	15.35	15±1	16	39.811	3.58	2.28	0.0181	1
2437		15.31	15±1	16	39.811	3.58	2.28	0.0181	1
2462		15.65	15±1	16	39.811	3.58	2.28	0.0181	1
2412	802.11n H20	14.3	14±1	15	31.623	3.58	2.28	0.0143	1
2437		14.31	14±1	15	31.623	3.58	2.28	0.0143	1
2462		14.64	14±1	15	31.623	3.58	2.28	0.0143	1
2422	802.11n(H T40)	13.12	13±1	14	25.119	3.58	2.28	0.0114	1
2437		13.33	13±1	14	25.119	3.58	2.28	0.0114	1
2452		13.15	13±1	14	25.119	3.58	2.28	0.0114	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: External antenna

Antenna gain:5.29dBi;

R=20cm

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

antenna gain Numeric= $10^{(dBi/10)}=10^{(5.29/10)}=3.38$

5.2G

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		
5180	802.11a	13.11	13±1	14	25.119	5.29	3.38	0.0169	1
5200		13.65	13±1	14	25.119	5.29	3.38	0.0169	1
5240		13.44	13±1	14	25.119	5.29	3.38	0.0169	1
5180	802.11ac20	13.06	13±1	14	25.119	5.29	3.38	0.0169	1
5200		13.37	13±1	14	25.119	5.29	3.38	0.0169	1
5240		13.42	13±1	14	25.119	5.29	3.38	0.0169	1
5190	802.11ac40	10.86	11±1	12	15.849	5.29	3.38	0.0107	1
5230		11.1	11±1	12	15.849	5.29	3.38	0.0107	1
5210	802.11ac80	9.97	10±1	11	12.589	5.29	3.38	0.0085	1
5180	802.11n H20	13.07	13±1	14	25.119	5.29	3.38	0.0169	1
5200		13.38	13±1	14	25.119	5.29	3.38	0.0169	1
5240		13.35	13±1	14	25.119	5.29	3.38	0.0169	1
5190	802.11n H40	10.4	11±1	12	15.849	5.29	3.38	0.0107	1
5230		11.47	11±1	12	15.849	5.29	3.38	0.0107	1

5.3G

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		
5260	802.11a	13.15	13±1	14	25.119	5.29	3.38	0.0169	1
5280		13.13	13±1	14	25.119	5.29	3.38	0.0169	1
5320		11.4	12±1	13	19.953	5.29	3.38	0.0134	1
5260	802.11ac20	13.03	13±1	14	25.119	5.29	3.38	0.0169	1
5280		13.04	13±1	14	25.119	5.29	3.38	0.0169	1
5320		11.13	12±1	13	19.953	5.29	3.38	0.0134	1
5270	802.11ac40	12	12±1	13	19.953	5.29	3.38	0.0134	1
5310		10.14	10±1	11	12.589	5.29	3.38	0.0085	1
5290	802.11ac80	11.02	11±1	12	15.849	5.29	3.38	0.0107	1
5260	802.11n H20	13	13±1	14	25.119	5.29	3.38	0.0169	1
5280		13.1	13±1	14	25.119	5.29	3.38	0.0169	1
5320		11.18	12±1	13	19.953	5.29	3.38	0.0134	1
5270	802.11n H40	11.55	12±1	13	19.953	5.29	3.38	0.0134	1
5310		9.87	10±1	11	12.589	5.29	3.38	0.0085	1

5.6G

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		
5500	802.11a	12.87	12±1	13	19.953	5.29	3.38	0.0134	1
5600		12.24	12±1	13	19.953	5.29	3.38	0.0134	1
5700		12.61	12±1	13	19.953	5.29	3.38	0.0134	1
5500	802.11ac20	12.86	12±1	13	19.953	5.29	3.38	0.0134	1
5600		12.2	12±1	13	19.953	5.29	3.38	0.0134	1
5700		12.33	12±1	13	19.953	5.29	3.38	0.0134	1
5510	802.11ac40	10.8	11±1	12	15.849	5.29	3.38	0.0107	1
5590		11.64	11±1	12	15.849	5.29	3.38	0.0107	1
5670		12.13	12±1	13	19.953	5.29	3.38	0.0134	1
5530	802.11ac80	10.02	11±1	12	15.849	5.29	3.38	0.0107	1
5610		11.63	11±1	12	15.849	5.29	3.38	0.0107	1
5500	802.11n(HT20)	11.89	12±1	13	19.953	5.29	3.38	0.0134	1
5600		12.02	12±1	13	19.953	5.29	3.38	0.0134	1
5700		12.52	12±1	13	19.953	5.29	3.38	0.0134	1

5.8G

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		
5745	802.11a	14.45	14±1	15	31.623	5.29	3.38	0.0213	1
5785		13.86	14±1	15	31.623	5.29	3.38	0.0213	1
5825		14.1	14±1	15	31.623	5.29	3.38	0.0213	1
5745	802.11ac20	14.24	14±1	15	31.623	5.29	3.38	0.0213	1
5785		13.71	14±1	15	31.623	5.29	3.38	0.0213	1
5825		13.83	14±1	15	31.623	5.29	3.38	0.0213	1
5755	802.11ac40	14.59	14±1	15	31.623	5.29	3.38	0.0213	1
5795		14.77	14±1	15	31.623	5.29	3.38	0.0213	1
5775	802.11ac80	14.47	14±1	15	31.623	5.29	3.38	0.0213	1
5745	802.11n H20	14.31	14±1	15	31.623	5.29	3.38	0.0213	1
5785		13.69	14±1	15	31.623	5.29	3.38	0.0213	1
5825		13.87	14±1	15	31.623	5.29	3.38	0.0213	1
5755	802.11n H40	14.51	14±1	15	31.623	5.29	3.38	0.0213	1
5795		14.67	14±1	15	31.623	5.29	3.38	0.0213	1

GSM/WCDMA/LTE
 Antenna Type: External antenna Gain:2dBi

modulation	Max		Antenna		Evaluation result (mW/cm2)	Power density (mW/cm2)
	tune-up power		Gain			
	(dBm)	(mW)	(dBi)	Numeric		
GSM850	33	1995.262	2	1.58	0.6291	1
PCS1900	31	1258.925	2	1.58	0.3969	1
WCDMA Band 2	25	316.228	2	1.58	0.0997	1
WCDMA Band 5	24	251.189	2	1.58	0.0792	1
LTE Band 2	24.5	281.838	2	1.58	0.0889	1
LTE Band 4	24	251.189	2	1.58	0.0792	1
LTE Band 5	24	251.189	2	1.58	0.0792	1
LTE Band 7	24.5	281.838	2	1.58	0.0889	1
LTE Band 12	23.5	223.872	2	1.58	0.0706	1
LTE Band 13	23.5	223.872	2	1.58	0.0706	1
LTE Band 17	23.5	223.872	2	1.58	0.0706	1
LTE Band 25	22	158.489	2	1.58	0.0500	1
LTE Band 26A	23.5	223.872	2	1.58	0.0706	1
LTE Band 26B	23.5	223.872	2	1.58	0.0706	1
LTE Band 41	25.5	354.813	2	1.58	0.1119	1
LTE Band 66	22.5	177.828	2	1.58	0.0561	1
LTE Band 71	23.5	223.872	2	1.58	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 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 MODE

Band	SISO					MIMO		Verdict
	Max Power	Antenna	Separation distance (cm)	Evaluation result	Power density	Evaluation result	Power density Limits	
	(dBm)	Gain (dBi)		(mW/cm2)	(mW/cm2)			
Wi-Fi 2.4G + GSM 850	18.9	3.58	20	0.015443	1	0.693315	1	PASS
	32.72	2	20	0.372152	0.549			

Signature:
 Date: 2022-11-28



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