

FCC ID: 2A9FT-Z500-H

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: 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	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density
		(dBm)		tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric	(mW/cm2)	(mW/cm2)
2402	DH5	8.12	8±1	9	7.943	3.58	2.28	0.0036	1
2441		7.79	7±1	8	6.310	3.58	2.28	0.0029	1
2480		8.89	8±1	9	7.943	3.58	2.28	0.0036	1
2402	2DH5	7.86	8±1	9	7.943	3.58	2.28	0.0036	1
2441		7.26	8±1	8	6.310	3.58	2.28	0.0029	1
2480		8.31	8±1	9	7.943	3.58	2.28	0.0036	1
2402	3DH5	7.91	8±1	9	7.943	3.58	2.28	0.0036	1
2441		7.27	8±1	8	6.310	3.58	2.28	0.0029	1
2480		8.31	8±1	9	7.943	3.58	2.28	0.0036	1

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		
2402	GFSK(1M)	-3.83	-3±1	-2	0.631	3.58	2.28	0.0003	1
2440		-3.88	-3±1	-2	0.631	3.58	2.28	0.0003	1
2480		-3.81	-3±1	-2	0.631	3.58	2.28	0.0003	1
2402	GFSK(2M)	-3.78	-3±1	-2	0.631	3.58	2.28	0.0003	1
2440		-3.87	-3±1	-2	0.631	3.58	2.28	0.0003	1
2480		-3.81	-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: $1\text{mW}/\text{cm}^2$

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	Tune-up power (dBm)	Max		Antenna		Evaluation result	Pow er density Limits
		(dBm)		tune-up pow er		Gain			
				(dBm)	(mW)	(dBi)	Numeric	(mW/cm2)	(mW/cm2)
2412	802.11b	18.67	18±1	19	79.433	3.58	2.28	0.0360	1
2437		18.29	18±1	19	79.433	3.58	2.28	0.0360	1
2462		18.99	18±1	19	79.433	3.58	2.28	0.0360	1
2412	802.11g	15.47	15±1	16	39.811	3.58	2.28	0.0181	1
2437		15.51	15±1	16	39.811	3.58	2.28	0.0181	1
2462		15.54	15±1	16	39.811	3.58	2.28	0.0181	1
2412	802.11n H20	13.44	13±1	14	25.119	3.58	2.28	0.0114	1
2437		13.42	13±1	14	25.119	3.58	2.28	0.0114	1
2462		13.45	13±1	14	25.119	3.58	2.28	0.0114	1
2422	802.11n(HT 40)	13.77	13±1	14	25.119	3.58	2.28	0.0114	1
2437		12.47	13±1	14	25.119	3.58	2.28	0.0114	1
2452		12.51	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 pow er (dBm)	Max		Antenna		Evaluation result	Pow er density Limits
		(dBm)		tune-up pow er		Gain			
				(dBm)	(mW)	(dBi)	Numeric	(mW/cm2)	(mW/cm2)
5180	a	11.46	11±1	12	15.849	5.29	3.38	0.0107	1
5200	a	11.95	11±1	12	15.849	5.29	3.38	0.0107	1
5240	a	11.59	11±1	12	15.849	5.29	3.38	0.0107	1
5180	n20	10.78	11±1	12	15.849	5.29	3.38	0.0107	1
5200	n20	11.3	11±1	12	15.849	5.29	3.38	0.0107	1
5240	n20	10.97	11±1	12	15.849	5.29	3.38	0.0107	1
5190	n40	9.32	10±1	11	12.589	5.29	3.38	0.0085	1
5230	n40	10.93	10±1	11	12.589	5.29	3.38	0.0085	1
5180	ac20	11.34	11±1	12	15.849	5.29	3.38	0.0107	1
5200	ac20	11.83	11±1	12	15.849	5.29	3.38	0.0107	1
5240	ac20	11.3	11±1	12	15.849	5.29	3.38	0.0107	1
5190	ac40	11.18	11±1	12	15.849	5.29	3.38	0.0107	1
5230	ac40	10.93	11±1	12	15.849	5.29	3.38	0.0107	1
5210	ac80	10.59	11±1	12	15.849	5.29	3.38	0.0107	1

5.3G

Channel Freq. (MHz)	modulation	conducted power	Tune-up pow er (dBm)	Max		Antenna		Evaluation result (mW/cm2)	Pow er density Limits (mW/cm2)
		(dBm)		tune-up pow er	Gain				
				(dBm)	(mW)	(dBi)	Numeric		
5260	a	16	15±1	16	39.811	5.29	3.38	0.0268	1
5280	a	15.87	15±1	16	39.811	5.29	3.38	0.0268	1
5320	a	14.81	15±1	16	39.811	5.29	3.38	0.0268	1
5260	n20	14.88	14±1	15	31.623	5.29	3.38	0.0213	1
5280	n20	14.5	14±1	15	31.623	5.29	3.38	0.0213	1
5320	n20	13.84	14±1	15	31.623	5.29	3.38	0.0213	1
5270	n40	14	13±1	14	25.119	5.29	3.38	0.0169	1
5310	n40	12.16	13±1	14	25.119	5.29	3.38	0.0169	1
5260	ac20	14.9	14±1	15	31.623	5.29	3.38	0.0213	1
5280	ac20	14.47	14±1	15	31.623	5.29	3.38	0.0213	1
5320	ac20	13.81	14±1	15	31.623	5.29	3.38	0.0213	1
5270	ac40	13.5	13±1	14	25.119	5.29	3.38	0.0169	1
5310	ac40	12.73	13±1	14	25.119	5.29	3.38	0.0169	1
5290	ac80	11.8	11±1	12	15.849	5.29	3.38	0.0107	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	a	13.79	14±1	15	31.623	5.29	3.38	0.0213	1
5600	a	14.67	14±1	15	31.623	5.29	3.38	0.0213	1
5700	a	13.06	14±1	15	31.623	5.29	3.38	0.0213	1
5500	n20	13.52	14±1	15	31.623	5.29	3.38	0.0213	1
5600	n20	14.55	14±1	15	31.623	5.29	3.38	0.0213	1
5700	n20	13	14±1	15	31.623	5.29	3.38	0.0213	1
5510	n40	10.54	11±1	12	15.849	5.29	3.38	0.0107	1
5590	n40	12.1	12±1	13	19.953	5.29	3.38	0.0134	1
5670	n40	12.13	12±1	13	19.953	5.29	3.38	0.0134	1
5500	ac20	13.74	14±1	15	31.623	5.29	3.38	0.0213	1
5600	ac20	14.54	14±1	15	31.623	5.29	3.38	0.0213	1
5700	ac20	12.99	13±1	14	25.119	5.29	3.38	0.0169	1
5510	ac40	11.92	12±1	13	19.953	5.29	3.38	0.0134	1
5590	ac40	13.01	13±1	14	25.119	5.29	3.38	0.0169	1
5670	ac40	12.68	13±1	14	25.119	5.29	3.38	0.0169	1
5530	ac80	11.01	12±1	13	19.953	5.29	3.38	0.0134	1
5610	ac80	12.9	12±1	13	19.953	5.29	3.38	0.0134	1

5.8G

Channel Freq. (MHz)	modulation	conducted power	Tune-up pow er (dBm)	Max		Antenna		Evaluation result	Pow er density Limits
		(dBm)		tune-up pow er		Gain			
				(dBm)	(dBm)	(mW)	(dBi)	Numeric	(mW/cm2)
5745	a	15.21	15±1	16	39.811	5.29	3.38	0.0268	1
5785	a	15.34	15±1	16	39.811	5.29	3.38	0.0268	1
5825	a	15.51	15±1	16	39.811	5.29	3.38	0.0268	1
5745	n20	14.91	15±1	16	39.811	5.29	3.38	0.0268	1
5785	n20	15.23	15±1	16	39.811	5.29	3.38	0.0268	1
5825	n20	15.41	15±1	16	39.811	5.29	3.38	0.0268	1
5755	n40	15.56	15±1	16	39.811	5.29	3.38	0.0268	1
5795	n40	15.21	15±1	16	39.811	5.29	3.38	0.0268	1
5745	ac20	15.12	15±1	16	39.811	5.29	3.38	0.0268	1
5785	ac20	15.22	15±1	16	39.811	5.29	3.38	0.0268	1
5825	ac20	15.38	15±1	16	39.811	5.29	3.38	0.0268	1
5755	ac40	15.68	15±1	16	39.811	5.29	3.38	0.0268	1
5795	ac40	15.16	15±1	16	39.811	5.29	3.38	0.0268	1
5775	ac80	14.63	15±1	16	39.811	5.29	3.38	0.0268	1

GSM/WCDMA/LTE

Antenna Type: External antenna Gain:1dBi

modulation	Max		Antenna		Evaluation result	Power density
	tune-up power		Gain		(mW/cm2)	(mW/cm2)
	(dBm)	(mW)	(dBi)	Numeric		
GSM850	33	1995.262	1	1.26	0.4997	1
PCS1900	30.5	1122.018	1	1.26	0.2810	1
WCDMA Band 2	24	251.189	1	1.26	0.0629	1
WCDMA Band 4	24	251.189	1	1.26	0.0629	1
WCDMA Band 5	24	251.189	1	1.26	0.0629	1
LTE Band 2	24.5	281.838	1	1.26	0.0706	1
LTE Band 4	24	251.189	1	1.26	0.0629	1
LTE Band 5	24	251.189	1	1.26	0.0629	1
LTE Band 7	24	251.189	1	1.26	0.0629	1
LTE Band 12	24	251.189	1	1.26	0.0629	1
LTE Band 13	23.5	223.872	1	1.26	0.0561	1
LTE Band 14	23.5	223.872	1	1.26	0.0561	1
LTE Band 17	24	251.189	1	1.26	0.0629	1
LTE Band 25	24	251.189	1	1.26	0.0629	1
LTE Band 26A	23.5	223.872	1	1.26	0.0561	1
LTE Band 26B	24	251.189	1	1.26	0.0629	1
LTE Band 41	23.5	223.872	1	1.26	0.0561	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					MIMO		Verdict
	Max Power	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	18.99	3.58	20	0.015766	1	0.695201	1	PASS
	32.73	1	20	0.37301	0.549			

Signature:

Date: 2023-04-04



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