

FCC ID: 2BC4J-VX0001

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

Antenna Type: Ceramic Antenna

antenna gain: 2.66 dBi;

R=20cm

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

antenna gain Numeric= $10^{(\text{dBi}/10)}=10^{(2.66/10)}=1.85$

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	1DH5	6.21	6±1	7	5.012	2.66	1.85	0.0018	1
2441		6.76	6±1	7	5.012	2.66	1.85	0.0018	1
2480		6.66	6±1	7	5.012	2.66	1.85	0.0018	1
2402	2DH5	5.56	6±1	7	5.012	2.66	1.85	0.0018	1
2441		6.12	6±1	7	5.012	2.66	1.85	0.0018	1
2480		6.15	6±1	7	5.012	2.66	1.85	0.0018	1
2402	3DH5	5.85	6±1	7	5.012	2.66	1.85	0.0018	1
2441		6.37	6±1	7	5.012	2.66	1.85	0.0018	1
2480		6.39	6±1	7	5.012	2.66	1.85	0.0018	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)	5.94	6±1	7	5.012	2.66	1.85	0.0018	1
2440		6.38	6±1	7	5.012	2.66	1.85	0.0018	1
2480		6.39	6±1	7	5.012	2.66	1.85	0.0018	1
2402	GFSK(2M)	5.8	6±1	7	5.012	2.66	1.85	0.0018	1
2440		6.31	6±1	7	5.012	2.66	1.85	0.0018	1
2480		6.34	6±1	7	5.012	2.66	1.85	0.0018	1

2.4G WIFI:

Operation Frequency: WIFI 802.11b/g/n20/n40: 2412-2462MHz,
2422-2452MHz

Power density limited: 1mW/ cm²

Antenna Type: External Antenna

Ant1 Gain: 3.44 dBi, Ant2 Gain: 3.72 dBi;

R=20cm

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

Antenna	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		
Ant1	2412	b	12.3	12±1	13	19.953	3.44	2.21	0.0088	1
Ant1	2437	b	11.22	12±1	13	19.953	3.44	2.21	0.0088	1
Ant1	2462	b	12.42	12±1	13	19.953	3.44	2.21	0.0088	1
Ant2	2412	b	12.12	12±1	13	19.953	3.72	2.36	0.0093	1
Ant2	2437	b	12.06	12±1	13	19.953	3.72	2.36	0.0093	1
Ant2	2462	b	12.3	12±1	13	19.953	3.72	2.36	0.0093	1
Ant1	2412	g	12.8	13±1	14	25.119	3.44	2.21	0.0110	1
Ant1	2437	g	13.73	14±1	15	31.623	3.44	2.21	0.0139	1
Ant1	2462	g	13.09	13±1	14	25.119	3.44	2.21	0.0110	1
Ant2	2412	g	12.75	13±1	14	25.119	3.72	2.36	0.0118	1
Ant2	2437	g	14.21	14±1	15	31.623	3.72	2.36	0.0148	1
Ant2	2462	g	13.14	13±1	14	25.119	3.72	2.36	0.0118	1
Ant1	2412	n20	12.4	12±1	13	19.953	3.44	2.21	0.0088	1
Ant1	2437	n20	12.42	12±1	13	19.953	3.44	2.21	0.0088	1
Ant1	2462	n20	12.56	12±1	13	19.953	3.44	2.21	0.0088	1
Ant2	2412	n20	12.11	12±1	13	19.953	3.72	2.36	0.0093	1
Ant2	2437	n20	12.33	12±1	13	19.953	3.72	2.36	0.0093	1
Ant2	2462	n20	12.59	12±1	13	19.953	3.72	2.36	0.0093	1
Ant1	2422	n40	12.41	12±1	13	19.953	3.44	2.21	0.0088	1
Ant1	2437	n40	11.56	12±1	13	19.953	3.44	2.21	0.0088	1
Ant1	2452	n40	12.53	12±1	13	19.953	3.44	2.21	0.0088	1
Ant2	2422	n40	12.32	12±1	13	19.953	3.72	2.36	0.0093	1
Ant2	2437	n40	12.14	12±1	13	19.953	3.72	2.36	0.0093	1
Ant2	2452	n40	12.64	12±1	13	19.953	3.72	2.36	0.0093	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: PCB Antenna

Ant1 Gain:3.5dBi, Ant1 Gain:2.68dBi;

R=20cm

mW=10^(dBm/10)

5.2G

Antenna	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)
Ant1	5180	a	10.92	10±1	11	12.589	3.50	2.24	0.0056	1
Ant1	5200	a	10.301	10±1	11	12.589	3.50	2.24	0.0056	1
Ant1	5240	a	9.499	10±1	11	12.589	3.50	2.24	0.0056	1
Ant2	5180	a	10.25	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5200	a	10.158	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5240	a	9.922	10±1	11	12.589	2.68	1.85	0.0046	1
Ant1	5180	ac20	9.713	9±1	10	10.000	3.50	2.24	0.0045	1
Ant1	5200	ac20	8.797	9±1	10	10.000	3.50	2.24	0.0045	1
Ant1	5240	ac20	9.965	9±1	10	10.000	3.50	2.24	0.0045	1
Ant2	5180	ac20	10.236	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5200	ac20	10.042	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5240	ac20	9.835	10±1	11	12.589	2.68	1.85	0.0046	1
Ant1	5190	ac40	9.161	9±1	10	10.000	3.50	2.24	0.0045	1
Ant1	5230	ac40	9.364	9±1	10	10.000	3.50	2.24	0.0045	1
Ant2	5190	ac40	10.268	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5230	ac40	10.019	10±1	11	12.589	2.68	1.85	0.0046	1
Ant1	5210	ac80	10.785	10±1	11	12.589	3.50	2.24	0.0056	1
Ant2	5210	ac80	10.061	10±1	11	12.589	2.68	1.85	0.0046	1
Ant1	5180	n20	9.831	10±1	11	12.589	3.50	2.24	0.0056	1
Ant1	5200	n20	11.046	11±1	12	15.849	3.50	2.24	0.0071	1
Ant1	5240	n20	10.824	10±1	11	12.589	3.50	2.24	0.0056	1
Ant2	5180	n20	10.259	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5200	n20	10.097	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5240	n20	9.82	10±1	11	12.589	2.68	1.85	0.0046	1
Ant1	5190	n40	8.875	9±1	10	10.000	3.50	2.24	0.0045	1
Ant1	5230	n40	9.91	9±1	10	10.000	3.50	2.24	0.0045	1
Ant2	5190	n40	10.253	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5230	n40	10.03	10±1	11	12.589	2.68	1.85	0.0046	1

5.3G

Antenna	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		
Ant1	5260	a	10.338	11±1	12	15.849	3.50	2.24	0.0071	1
Ant1	5280	a	10.456	11±1	12	15.849	3.50	2.24	0.0071	1
Ant1	5320	a	10.903	11±1	12	15.849	3.50	2.24	0.0071	1
Ant2	5260	a	10.083	11±1	12	15.849	2.68	1.85	0.0058	1
Ant2	5280	a	10.367	11±1	12	15.849	2.68	1.85	0.0058	1
Ant2	5320	a	11.327	11±1	12	15.849	2.68	1.85	0.0058	1
Ant1	5260	ac20	10.969	10±1	11	12.589	3.50	2.24	0.0056	1
Ant1	5280	ac20	9.492	10±1	11	12.589	3.50	2.24	0.0056	1
Ant1	5320	ac20	9.979	10±1	11	12.589	3.50	2.24	0.0056	1
Ant2	5260	ac20	9.804	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5280	ac20	9.779	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5320	ac20	9.755	10±1	11	12.589	2.68	1.85	0.0046	1
Ant1	5270	ac40	9.78	10±1	11	12.589	3.50	2.24	0.0056	1
Ant1	5310	ac40	10.096	10±1	11	12.589	3.50	2.24	0.0056	1
Ant2	5270	ac40	10.426	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5310	ac40	11.295	10±1	11	12.589	2.68	1.85	0.0046	1
Ant1	5290	ac80	9.87	10±1	11	12.589	3.50	2.24	0.0056	1
Ant2	5290	ac80	10.818	10±1	11	12.589	2.68	1.85	0.0046	1
Ant1	5260	n20	9.715	10±1	11	12.589	3.50	2.24	0.0056	1
Ant1	5280	n20	9.61	10±1	11	12.589	3.50	2.24	0.0056	1
Ant1	5320	n20	10.063	10±1	11	12.589	3.50	2.24	0.0056	1
Ant2	5260	n20	10.125	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5280	n20	10.472	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5320	n20	11.28	11±1	12	15.849	2.68	1.85	0.0058	1
Ant1	5270	n40	11.203	11±1	12	15.849	3.50	2.24	0.0071	1
Ant1	5310	n40	11.434	11±1	12	15.849	3.50	2.24	0.0071	1
Ant2	5270	n40	10.44	11±1	12	15.849	2.68	1.85	0.0058	1
Ant2	5310	n40	11.237	11±1	12	15.849	2.68	1.85	0.0058	1

5.6G

Antenna	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		
Ant1	5500	a	11.567	11±1	12	15.849	3.50	2.24	0.0071	1
Ant1	5600	a	11.447	11±1	12	15.849	3.50	2.24	0.0071	1
Ant1	5700	a	10.891	11±1	12	15.849	3.50	2.24	0.0071	1
Ant2	5500	a	10.066	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5600	a	7.805	8±1	9	7.943	2.68	1.85	0.0029	1
Ant2	5700	a	8.467	8±1	9	7.943	2.68	1.85	0.0029	1
Ant1	5500	ac20	10.917	10±1	11	12.589	3.50	2.24	0.0056	1
Ant1	5600	ac20	10.814	10±1	11	12.589	3.50	2.24	0.0056	1
Ant1	5700	ac20	10.264	10±1	11	12.589	3.50	2.24	0.0056	1
Ant2	5500	ac20	10.802	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5600	ac20	10.383	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5700	ac20	10.259	10±1	11	12.589	2.68	1.85	0.0046	1
Ant1	5510	ac40	11.204	11±1	12	15.849	3.50	2.24	0.0071	1
Ant1	5590	ac40	10.996	11±1	12	15.849	3.50	2.24	0.0071	1
Ant1	5670	ac40	10.615	11±1	12	15.849	3.50	2.24	0.0071	1
Ant2	5510	ac40	10.332	11±1	12	15.849	2.68	1.85	0.0058	1
Ant2	5590	ac40	10.127	11±1	12	15.849	2.68	1.85	0.0058	1
Ant2	5670	ac40	10.336	11±1	12	15.849	2.68	1.85	0.0058	1
Ant1	5530	ac80	10.797	10±1	11	12.589	3.50	2.24	0.0056	1
Ant1	5610	ac80	9.475	9±1	10	10.000	3.50	2.24	0.0045	1
Ant2	5530	ac80	10.058	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5610	ac80	8.801	9±1	10	10.000	2.68	1.85	0.0037	1
Ant1	5500	n20	11.051	11±1	12	15.849	3.50	2.24	0.0071	1
Ant1	5600	n20	10.798	11±1	12	15.849	3.50	2.24	0.0071	1
Ant1	5700	n20	10.304	11±1	12	15.849	3.50	2.24	0.0071	1
Ant2	5500	n20	10.046	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5600	n20	7.761	8±1	9	7.943	2.68	1.85	0.0029	1
Ant2	5700	n20	8.46	8±1	9	7.943	2.68	1.85	0.0029	1
Ant1	5510	n40	11.155	11±1	12	15.849	3.50	2.24	0.0071	1
Ant1	5590	n40	11.02	11±1	12	15.849	3.50	2.24	0.0071	1
Ant1	5670	n40	10.575	11±1	12	15.849	3.50	2.24	0.0071	1
Ant2	5510	n40	10.332	11±1	12	15.849	2.68	1.85	0.0058	1
Ant2	5590	n40	10.189	11±1	12	15.849	2.68	1.85	0.0058	1
Ant2	5670	n40	10.479	11±1	12	15.849	2.68	1.85	0.0058	1

5.8G

Antenna	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		
Ant1	5745	a	11.383	11±1	12	15.849	3.50	2.24	0.0071	1
Ant1	5785	a	11.314	11±1	12	15.849	3.50	2.24	0.0071	1
Ant1	5825	a	11.057	11±1	12	15.849	3.50	2.24	0.0071	1
Ant2	5745	a	10.964	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5785	a	10.313	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5825	a	10.6	10±1	11	12.589	2.68	1.85	0.0046	1
Ant1	5745	ac20	10.724	10±1	11	12.589	3.50	2.24	0.0056	1
Ant1	5785	ac20	10.71	10±1	11	12.589	3.50	2.24	0.0056	1
Ant1	5825	ac20	10.335	10±1	11	12.589	3.50	2.24	0.0056	1
Ant2	5745	ac20	10.902	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5785	ac20	10.376	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5825	ac20	10.702	10±1	11	12.589	2.68	1.85	0.0046	1
Ant1	5755	ac40	10.97	10±1	11	12.589	3.50	2.24	0.0056	1
Ant1	5795	ac40	10.804	10±1	11	12.589	3.50	2.24	0.0056	1
Ant2	5755	ac40	10.904	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5795	ac40	10.282	10±1	11	12.589	2.68	1.85	0.0046	1
Ant1	5775	ac80	10.694	10±1	11	12.589	3.50	2.24	0.0056	1
Ant2	5775	ac80	9.959	10±1	11	12.589	2.68	1.85	0.0046	1
Ant1	5745	n20	10.872	10±1	11	12.589	3.50	2.24	0.0056	1
Ant1	5785	n20	10.706	10±1	11	12.589	3.50	2.24	0.0056	1
Ant1	5825	n20	10.293	10±1	11	12.589	3.50	2.24	0.0056	1
Ant2	5745	n20	10.891	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5785	n20	10.292	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5825	n20	10.626	10±1	11	12.589	2.68	1.85	0.0046	1
Ant1	5755	n40	11.034	11±1	12	15.849	3.50	2.24	0.0071	1
Ant1	5795	n40	10.728	11±1	12	15.849	3.50	2.24	0.0071	1
Ant2	5755	n40	9.297	10±1	11	12.589	2.68	1.85	0.0046	1
Ant2	5795	n40	10.052	10±1	11	12.589	2.68	1.85	0.0046	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		(mW/cm2)	(mW/cm2)			
			(dBi)						
Wi-Fi 2.4G N20+BT	BT Ant	7	2.66	20	0.00184	1	0.019952	1	PASS
	Ant1	13	3.44	20	0.008764	1			
	Ant2	13	3.72	20	0.009348	1			
Wi-Fi 5.2G n20+BT	BT Ant	7	2.66	20	0.00184	1	0.013541	1	PASS
	Ant1	12	3.5	20	0.007059	1			
	Ant2	11	2.68	20	0.004642	1			
Wi-Fi 5.3G n20+BT	BT Ant	7	2.66	20	0.00184	1	0.014743	1	PASS
	Ant1	12	3.5	20	0.007059	1			
	Ant2	12	2.68	20	0.005844	1			
Wi-Fi 5.6G AC40+BT	BT Ant	7	2.66	20	0.00184	1	0.014743	1	PASS
	Ant1	12	3.5	20	0.007059	1			
	Ant2	12	2.68	20	0.005844	1			
Wi-Fi 5.8G n40+BT	BT Ant	7	2.66	20	0.00184	1	0.011134	1	PASS
	Ant1	11	3.5	20	0.005607	1			
	Ant2	10	2.68	20	0.003687	1			

Conclusion:

For the max result : $0.09952 \leq 1\text{mW/cm}^2$ for Power density, compliance with RF exposure.

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

Signature:

Date: 2023-12-18



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