FCC ID: RRJQ5S

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 (V/m) = $\frac{\sqrt{30 * P * G}}{d}$ Power Density: *Pd* (W/m²) = $\frac{E^2}{377}$

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: Rod Antenna

Antenna gain: 3dBi;

R=20cm

mW=10^(dBm/10)

antenna gain Numeric=10^(dBi/10)= 10^(3/10)=2

Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max tune-up power (dBm)	Max tune-up power (mW)	Antenna Gain (dBi)	Antenna Gain Numeric	Evaluation result (mW/cm2)	Power density (mW/cm2)
2402	GFSK	7.538	7±1	8	6.310	3.00	2.00	0.0025	1
2440		7.713	7±1	8	6.310	3.00	2.00	0.0025	1
2480		7.506	7±1	8	6.310	3.00	2.00	0.0025	1

SISO 2.4G WIFI:

Operation Frequency: WIFI 802.11b/g/n HT20: 2412-2462MHz,
WIFI 802.11n HT40:2422-2452MHz
Power density limited: 1mW/ cm^2
Antenna Type: Rod Antenna
Antenna1 gain: 3dBi;
Antenna2 gain: 3dBi;
R=20cm
mW=10^(dBm/10)
antenna gain Numeric=10^(dBi/10)= 10^(3/10)=2

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		
Ant 1	2412	802.11b	13.07	14±1	15	31.623	3.00	2.00	0.0126	1
Ant 1	2437		13.95	14±1	15	31.623	3.00	2.00	0.0126	1
Ant 1	2462		14.43	14±1	15	31.623	3.00	2.00	0.0126	1
Ant 2	2412	802.11b	13.7	13±1	14	25.119	3.00	2.00	0.0100	1
Ant 2	2437		13.04	13±1	14	25.119	3.00	2.00	0.0100	1
Ant 2	2462		12.97	13±1	14	25.119	3.00	2.00	0.0100	1
Ant 1	2412	802.11g	11.65	12±1	13	19.953	3.00	2.00	0.0079	1
Ant 1	2437		12.51	12±1	13	19.953	3.00	2.00	0.0079	1
Ant 1	2456		12.71	12±1	13	19.953	3.00	2.00	0.0079	1
Ant 2	2412	802.11g	11.65	11±1	12	15.849	3.00	2.00	0.0063	1
Ant 2	2437		11.3	11±1	12	15.849	3.00	2.00	0.0063	1
Ant 2	2456		10.98	11±1	12	15.849	3.00	2.00	0.0063	1
Ant 1	2412	802.11n H20	11.56	12±1	13	19.953	3.00	2.00	0.0079	1
Ant 1	2437		12.43	12±1	13	19.953	3.00	2.00	0.0079	1
Ant 1	2462		12.63	12±1	13	19.953	3.00	2.00	0.0079	1
Ant 2	2412	802.11n H20	11.59	11±1	12	15.849	3.00	2.00	0.0063	1
Ant 2	2437		11.11	11±1	12	15.849	3.00	2.00	0.0063	1
Ant 2	2462		10.85	11±1	12	15.849	3.00	2.00	0.0063	1
Ant 1	2422	802.11n(HT40)	10.92	11±1	12	15.849	3.00	2.00	0.0063	1
Ant 1	2437		11.8	11±1	12	15.849	3.00	2.00	0.0063	1
Ant 1	2452		11.95	11±1	12	15.849	3.00	2.00	0.0063	1
Ant 2	2422	802.11n(HT40)	11.84	11±1	12	15.849	3.00	2.00	0.0063	1
Ant 2	2437		11.59	11±1	12	15.849	3.00	2.00	0.0063	1
Ant 2	2452		11.29	11±1	12	15.849	3.00	2.00	0.0063	1

SISO 5G WIFI:

Operation Frequency: WIFI 802.11a/ac/n(HT20): 5180-5240MHz,5745-5825MHz;
WIFI 802.11ac/n(HT40): 5190-5230MHz, 5755-5795MHz;
WIFI 802.11ac80:5210-5210MHz,5775-5775MHz
Power density limited: 1mW/cm
Antenna Type: Rod Antenna
Antenna1 gain: 3dBi;
Antenna2 gain: 3dBi;
R=20cm
mW=10^(dBm/10)
antenna gain Numeric=10^(dBi/10)= 10^(3/10)=2

5.2G

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		
Ant 1	5180	802.11a	9.55	10±1	11	12.589	3.00	2.00	0.0050	1
Ant 1	5200		9.66	10±1	11	12.589	3.00	2.00	0.0050	1
Ant 1	5240		10.09	10±1	11	12.589	3.00	2.00	0.0050	1
Ant 2	5180	802.11a	9.71	10±1	11	12.589	3.00	2.00	0.0050	1
Ant 2	5200		10.08	10±1	11	12.589	3.00	2.00	0.0050	1
Ant 2	5240		9.92	10±1	11	12.589	3.00	2.00	0.0050	1
Ant 1	5180	802.11ac20	8.86	9±1	10	10.000	3.00	2.00	0.0040	1
Ant 1	5200		8.59	9±1	10	10.000	3.00	2.00	0.0040	1
Ant 1	5240		9.13	9±1	10	10.000	3.00	2.00	0.0040	1
Ant 2	5180	802.11ac20	8.5	8±1	9	7.943	3.00	2.00	0.0032	1
Ant 2	5200		8.74	8±1	9	7.943	3.00	2.00	0.0032	1
Ant 2	5240		7.37	8±1	9	7.943	3.00	2.00	0.0032	1
Ant 1	5190	802.11ac40	6.39	7±1	8	6.310	3.00	2.00	0.0025	1
Ant 1	5230		7.25	7±1	8	6.310	3.00	2.00	0.0025	1
Ant 2	5190	802.11ac40	8.14	8±1	9	7.943	3.00	2.00	0.0032	1
Ant 2	5230		7	8±1	9	7.943	3.00	2.00	0.0032	1
Ant 1	5210	802.11ac80	6.21	6±1	7	5.012	3.00	2.00	0.0020	1
Ant 2	5210	802.11ac80	6.66	6±1	7	5.012	3.00	2.00	0.0020	1
Ant 1	5180	802.11n H20	8.08	8±1	9	7.943	3.00	2.00	0.0032	1
Ant 1	5200		8.37	8±1	9	7.943	3.00	2.00	0.0032	1
Ant 1	5240		8.7	8±1	9	7.943	3.00	2.00	0.0032	1
Ant 2	5180	802.11n H20	8.42	8±1	9	7.943	3.00	2.00	0.0032	1
Ant 2	5200		8.62	8±1	9	7.943	3.00	2.00	0.0032	1
Ant 2	5240		7.36	8±1	9	7.943	3.00	2.00	0.0032	1
Ant 1	5190	802.11n H40	7.68	7±1	8	6.310	3.00	2.00	0.0025	1
Ant 1	5230		7.15	7±1	8	6.310	3.00	2.00	0.0025	1
Ant 2	5190	802.11n H40	7.95	7±1	8	6.310	3.00	2.00	0.0025	1
Ant 2	5230		6.9	7±1	8	6.310	3.00	2.00	0.0025	1

5.8G

Antenna	Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max tune-up power (dBm)	Max tune-up power (mW)	Antenna Gain (dBi)	Antenna Gain Numeric	Evaluation result (mW/cm2)	Power density (mW/cm2)
Ant 1	5745	802.11a	9.03	9±1	10	10.000	3.00	2.00	0.0040	1
Ant 1	5785		9.86	9±1	10	10.000	3.00	2.00	0.0040	1
Ant 1	5825		9.36	9±1	10	10.000	3.00	2.00	0.0040	1
Ant 2	5745	802.11a	9.83	10±1	11	12.589	3.00	2.00	0.0050	1
Ant 2	5785		9.77	10±1	11	12.589	3.00	2.00	0.0050	1
Ant 2	5825		10.3	10±1	11	12.589	3.00	2.00	0.0050	1
Ant 1	5745	802.11ac20	8.68	8±1	9	7.943	3.00	2.00	0.0032	1
Ant 1	5785		8.62	8±1	9	7.943	3.00	2.00	0.0032	1
Ant 1	5825		8.99	8±1	9	7.943	3.00	2.00	0.0032	1
Ant 2	5745	802.11ac20	8.97	9±1	10	10.000	3.00	2.00	0.0040	1
Ant 2	5785		8.78	9±1	10	10.000	3.00	2.00	0.0040	1
Ant 2	5825		9.67	9±1	10	10.000	3.00	2.00	0.0040	1
Ant 1	5755	802.11ac40	7.82	7±1	8	6.310	3.00	2.00	0.0025	1
Ant 1	5795		7.45	7±1	8	6.310	3.00	2.00	0.0025	1
Ant 2	5755	802.11ac40	6.81	7±1	8	6.310	3.00	2.00	0.0025	1
Ant 2	5795		7.61	7±1	8	6.310	3.00	2.00	0.0025	1
Ant 1	5775	802.11ac80	6.61	6±1	7	5.012	3.00	2.00	0.0020	1
Ant 2	5775	802.11ac80	6.63	6±1	7	5.012	3.00	2.00	0.0020	1
Ant 1	5745	802.11n H20	8.47	8±1	9	7.943	3.00	2.00	0.0032	1
Ant 1	5785		8.41	8±1	9	7.943	3.00	2.00	0.0032	1
Ant 1	5825		8.75	8±1	9	7.943	3.00	2.00	0.0032	1
Ant 2	5745	802.11n H20	9.17	9±1	10	10.000	3.00	2.00	0.0040	1
Ant 2	5785		8.93	9±1	10	10.000	3.00	2.00	0.0040	1
Ant 2	5825		9.74	9±1	10	10.000	3.00	2.00	0.0040	1
Ant 1	5755	802.11n H40	8	7±1	8	6.310	3.00	2.00	0.0025	1
Ant 1	5795		6.98	7±1	8	6.310	3.00	2.00	0.0025	1
Ant 2	5755	802.11n H40	6.78	7±1	8	6.310	3.00	2.00	0.0025	1
Ant 2	5795		7.6	7±1	8	6.310	3.00	2.00	0.0025	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 (dBm)	Antenna Gain (dBi)	Separation distance (cm)	Evaluation result (mW/cm2)	Power density (mW/cm2)	Evaluation result	Power density Limits	
Wi-Fi 2.4G N20	Ant1	13	3	20	0.00792	1	0.014211	1	PASS
	Ant2	12	3	20	0.006291	1			
Wi-Fi 5.2G AC20	Ant1	10	3	20	0.003969	1	0.007122	1	PASS
	Ant2	9	3	20	0.003153	1			
Wi-Fi 5.8G AC20	Ant1	9	3	20	0.003153	1	0.007122	1	PASS
	Ant2	10	3	20	0.003969	1			

Note: This product does not support simultaneous transmission of Bluetooth and wifi.

Signature:
Date: 2022-01-06

NAME AND TITLE (Please print or type): alex li/Manager

COMPANY (Please print or type): Shenzhen NTEK Testing Technology Co., Ltd./ 1/F, Building E, Fenda Science Park, Sanwei Community, Xixiang Street Bao'an District, Shenzhen P.R. China.