

FCC ID:2A954-JC21A-04

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.

Measurement Result

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

WIFI antenna1/2 gain: 4.5dBi;

R=20cm

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

antenna gain Numeric= $10^{(dBi/10)}=10^{(4.5/10)}=2.82$

ANT1:

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm2)	(mW/cm2)
				(dBm)	(mW)	Numeric		
2412	802.11b	15.72	15±1	16	39.81072	2.82	0.02233	1
2437		15.3	15±1	16	39.81072	2.82	0.02233	1
2462		15.29	15±1	16	39.81072	2.82	0.02233	1
2412	802.11g	13.38	13±1	14	25.11886	2.82	0.01409	1
2437		13.43	13±1	14	25.11886	2.82	0.01409	1
2462		13.06	13±1	14	25.11886	2.82	0.01409	1
2412	802.11n H20	12.51	12±1	13	19.95262	2.82	0.01119	1
2437		12.16	12±1	13	19.95262	2.82	0.01119	1
2462		12.57	12±1	13	19.95262	2.82	0.01119	1
2422	802.11n H40	12.97	12±1	13	19.95262	2.82	0.01119	1
2437		12.67	12±1	13	19.95262	2.82	0.01119	1
2452		12.54	12±1	13	19.95262	2.82	0.01119	1

ANT2:

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm2)	(mW/cm2)
				(dBm)	(mW)	Numeric		
2412	802.11b	15.42	15±1	16	39.81072	2.82	0.02233	1
2437		15.4	15±1	16	39.81072	2.82	0.02233	1
2462		15.39	15±1	16	39.81072	2.82	0.02233	1
2412	802.11g	13.55	13±1	14	25.11886	2.82	0.01409	1
2437		13.66	13±1	14	25.11886	2.82	0.01409	1
2462		13.15	13±1	14	25.11886	2.82	0.01409	1
2412	802.11n H20	12.62	12±1	13	19.95262	2.82	0.01119	1
2437		12.72	12±1	13	19.95262	2.82	0.01119	1
2462		12.65	12±1	13	19.95262	2.82	0.01119	1
2422	802.11n H40	12.54	12±1	13	19.95262	2.82	0.01119	1
2437		12.37	12±1	13	19.95262	2.82	0.01119	1
2452		12.62	12±1	13	19.95262	2.82	0.01119	1

GSM/WCDMA/LTE
Antenna Type: PIFA antenna
Max Antenna gain: 3.51dBi;

Operating Mode	Maximum measured EIRP(ERP) Power	tune-up power	Antenna		Maximum measured EIRP(ERP)	Evaluation result	Power density Limits
	(dBm)	(dBm)	Gain		(mW)	(mW/cm ²)	(mW/cm ²)
			(dBi)	Numeri			
WCDMA Band 2	26.02	26	4.16	2.61	398.107	0.2064	1.00
WCDMA Band 4	24.72	25	4.16	2.61	316.228	0.1640	1.00
WCDMA Band 5	24.92	25	4.16	2.61	316.228	0.1640	0.56
LTE Band 2	22.04	22	4.16	2.61	158.489	0.0822	1.00
LTE Band 4	21.96	22.00	4.16	2.61	158.489	0.0822	1.00
LTE Band 5	22.24	23	4.16	2.61	199.526	0.1034	0.55
LTE Band 7	22.35	23	4.16	2.61	199.526	0.1034	1.00
LTE Band 12	22.80	23.00	4.16	2.61	199.526	0.1034	0.47
LTE Band 13	21.72	22.00	4.16	2.61	158.489	0.0822	0.52
LTE Band 17	21.66	22	4.16	2.61	158.489	0.0822	0.47
LTE Band 38	22.58	23.00	4.16	2.61	199.526	0.1034	1.00
LTE Band 40	22.31	23.00	4.16	2.61	199.526	0.1034	1.00
LTE Band 41	22.31	23.00	4.16	2.61	199.526	0.1034	1.00
LTE Band 66	21.61	22.00	4.16	2.61	158.489	0.0822	1.00

WLAN2.4G MIMO

conducted power (dBm)	Gain (dBi)	tune up(dBm)	tune up(dBm)	EIRP (mW)	R(cm)	S (mW/cm ²)	MPE Limit (mW/m ²)	Calculation result	Conclusion
11.8	4.97	11±1	12	15.849	20	0.015670	1	0.031341	Pass
11.8	4.97	11±1	12	15.849	20	0.015670	1		

Conclusion:

The conclusion should be $0.2064 < 1$ for Max Power Density, Compliance the RF Exposure requirement.

The 2.4Gwifi has the maximum Power Density value 0.0331341 mW/cm² in 2.4G MIMO transmitting mode;

Signature:

Date: 2023-02-23



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