FCC ID: WA5WS3910

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)

KDB447498 D01 General RF Exposure Guidance v06

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.

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/ cm^2
Antenna Type: PCB antenna
WIFI antenna gain: 3.37dBi;
R=20cm
mW=10^(dBm/10)
antenna gain Numeric=10^(dBi/10)= 10^(3.37/10)=2.17

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	13.61	13±1	14	25.11886	2.17	0.01084	1
2437		13.88	13±1	14	25.11886	2.17	0.01084	1
2462		13.72	13±1	14	25.11886	2.17	0.01084	1
2412	802.11g	13.78	14±1	15	31.62278	2.17	0.01365	1
2437		14.07	14±1	15	31.62278	2.17	0.01365	1
2462		14.02	14±1	15	31.62278	2.17	0.01365	1
2412	802.11n H20	13.82	14±1	15	31.62278	2.17	0.01365	1
2437		14.05	14±1	15	31.62278	2.17	0.01365	1
2462		14.09	14±1	15	31.62278	2.17	0.01365	1
2422	802.11n H40	13.98	14±1	15	31.62278	2.17	0.01365	1
2437		14.06	14±1	15	31.62278	2.17	0.01365	1
2452		14.07	14±1	15	31.62278	2.17	0.01365	1

Operation Frequency: 915MHz
Antenna Type: FPC Antenna
Antenna gain: 0.1dBi,
R=20cm
mW=10^(dBm/10)

Transmit power

Frequency (MHz)	EIRP power (dBuV/m)	EIRP power (dBm)	EIRP power (mW)
915	91.54	-3.72	0.4246

EIRP=E-104.8+20log(D)

Maximum Permissible Exposure:

Channel Freq. (MHz)	modulation	EIRP power (dBm)	EIRP power (mW)	Tune-up power (dBm)	Max tune-up power (dBm)	Evaluation result (mW/cm2)	Power density Limits (mW/cm2)
915	FSK	-3.72	0.4246	-3±1	-2	0.000126	0.61

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 for WIFI2.4G + 915MHz

Mode	Evaluation result (mW/cm2)	Limits (mW/cm2)	Calculation result
WIFI2.4G	0.01365	1	0.013857
915MHz	0.000126	0.61	

Conclusion:
For the simultaneous max result : 0.013857≤ 1 for Max Power Density, compliance RF exposure.

Signature:
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