

FCC ID:2ALS5-8210US

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.

The distance between the WPT coil position and the position of the human arm when the prototype is used is greater than 15CM, As shown below:



BT:
Measurement Result
Operation Frequency: 2402MHz~2480MHz
Power density limited: 1mW/ cm²
Antenna Type:PCB antenna
Antenna gain:2.31dBi;
R=20cm
 $mW=10^{(dBm/10)}$
antenna gain Numeric= $10^{(dBi/10)}= 10^{(2.31/10)}=1.7$

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		
2402	DH5	-0.61	0±1	1	1.259	2.31	1.70	0.0004	1
2441		0.49	0±1	1	1.259	2.31	1.70	0.0004	1
2480		1.06	1±1	2	1.585	2.31	1.70	0.0005	1
2402	2DH5	0.71	1±1	2	1.585	2.31	1.70	0.0005	1
2441		1.58	1±1	2	1.585	2.31	1.70	0.0005	1
2480		1.74	1±1	2	1.585	2.31	1.70	0.0005	1

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		
2402	GFSK(1M)	-0.51	0±1	1	1.259	2.31	1.70	0.0004	1
2440		0.4	0±1	1	1.259	2.31	1.70	0.0004	1
2480		1.01	1±1	2	1.585	2.31	1.70	0.0005	1

WPT:

half-load:

Table 1. H-Field MPE Data-Top

EUT Side	E (A/m)	Limits (A/m)
Max load	0.358	1.63

Table 2. H-Field MPE Data- Surrounding

EUT Side	B(A/m)	A(A/m)	C (A/m)	D(above) (A/m)	Limits (A/m)
Max load	0.359	0.358	0.357	0.356	1.63

Table 3. E-Field MPE

E-Field Measurement (15cm)						
EUT Side	B(V/m)	A(V/m)	E(V/m)	C (V/m)	D(above) (V/m)	Limits (V/m)
Max load	2.125	2.124	2.153	2.161	2.176	614

empty load:

Table 1. H-Field MPE Data-Top

EUT Side	E(A/m)	Limits (A/m)
Max load	0.335	1.63

Table 2. H-Field MPE Data- Surrounding

EUT Side	B(A/m)	A(A/m)	C (A/m)	D(above) (A/m)	Limits (A/m)
Max load	0.336	0.337	0.334	0.331	1.63

Table 3. E-Field MPE

E-Field Measurement (15cm)						
EUT Side	B(V/m)	A(V/m)	E(V/m)	C (V/m)	D(above) (V/m)	Limits (V/m)
Max	2.222	2.216	2.225	2.226	2.228	614

load						
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Fully loaded:

Table 1. H-Field MPE Data-Top

EUT Side	E(A/m)	Limits (A/m)
Max load	0.377	1.63

Table 2. H-Field MPE Data- Surrounding

EUT Side	B(A/m)	A(A/m)	C (A/m)	D(above) (A/m)	Limits (A/m)
Max load	0.375	0.379	0.374	0.376	1.63

Table 3. E-Field MPE

E-Field Measurement (15cm)						
EUT Side	B(V/m)	A(V/m)	E(V/m)	C (V/m)	D(above) (V/m)	Limits (V/m)
Max load	2.223	2.228	2.227	2.229	2.226	614

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 BT + WPT

Mode	Channel Freq. (MHz)	Evaluation result	Limits	Calculation result
BT	2480	0.0005 (mW/cm ²)	1 (mW/cm ²)	0.233015
WPT	0.116	0.379 (A/m)	1.63 (A/m)	

Conclusion:

For the max result : $0.233015 \leq 1.0$ for Max Power Density, compliance RF exposure..



Signature:

Date: 2023-10-18

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