

1 Maximum Permissible Exposure (MPE)

1.1 Standard Applicable

According to § 1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Mobile device, the MPE is required.

According to § 1.1310 and § 2.1093 RF exposure is calculated.

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 (minute)
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
300-1500	/	/	F/1500	30
1500-15000	/	/	1.0	30

F = frequency in MHz

* = Plane-wave equipment power density

1.2 Maximum Permissible Exposure (MPE) Evaluation

The worst case of Average power: refer to section 6.5 for detail measurement date.

802.11b

Cable loss = 0		Output Power		Limit (dBm)
CH	Frequency (MHz)	Detector		
		PK (dBm)	AV (dBm)	
1	2412	17.74	13.48	30
7	2442	17.60	13.35	
11	2462	17.42	13.22	

MPE Prediction (802.11b)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG / 4 \pi R^2$$

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

Maximum average output power at antenna input	13.48	(dBm)
Maximum Average output power at antenna input	22.28435149	(mW)
Duty cycle:	100	(%)
Maximum Pav :	22.28435149	(mW)
Antenna gain (typical):	4.95	(dBi)
Maximum antenna gain:	3.126079367	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2412	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0138660	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0138660 mW/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 2412MHz.

The worst case of Average power: refer to section 6.5 for detail measurement date.

Average Measurement

2*2 MIMO

Channel		Frequency (MHz)	Output Chain (dBm)		Combine Output Power (dBm)	Limit(dBm)	Result
			Chain A	chain B			
AN HT20	1	2412	9.29	9.23	12.27	30	Pass
	7	2442	9.09	9.15	12.13	30	Pass
	11	2462	8.59	8.63	11.62	30	Pass
AN HT40	3	2422	8.48	8.44	11.47	30	Pass
	7	2442	8.20	8.26	11.24	30	Pass
	9	2452	7.93	7.98	10.97	30	Pass

MPE Prediction (802.11n HT20)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG / 4 \pi R^2$$

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

MIMO Chain A

Maximum average output power at antenna input	9.29	(dBm)
Maximum Average output power at antenna input	8.49180475	(mW)
Duty cycle:	100	(%)
Maximum Pav :	8.49180475	(mW)
Antenna gain (typical):	4.95	(dBi)
Maximum antenna gain:	3.126079367	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2412	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0052838	(mW/cm^2)

MIMO Chain B

Maximum average output power at antenna input	9.23	(dBm)
Maximum Average output power at antenna input	8.375292821	(mW)
Duty cycle:	100	(%)
Maximum Pav :	8.375292821	(mW)
Antenna gain (typical):	4.95	(dBi)
Maximum antenna gain:	3.126079367	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2412	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0052114	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0052838 mW/cm², 0.0052114 mW/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 2412MHz.

Remark: The worst case of which power is higher between hT20, and hT40 is deduced, and shown on the test report

The worst case of Average power: refer to section 6.5 for detail measurement date.

Zigbee

Cable loss = 0		Output Power		Limit (dBm)
CH	Frequency (MHz)	Detector		
		PK (dBm)	AV (dBm)	
11	2405	4.6	4.52	30
18	2440	4.9	5.02	
26	2480	5.43	5.35	

MPE Prediction (Zigbee)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG / 4 \pi R^2$$

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

Maximum average output power at antenna input	5.35	(dBm)
Maximum Average output power at antenna input	3.427677865	(mW)
Duty cycle:	100	(%)
Maximum Pav :	3.427677865	(mW)
Antenna gain (typical):	2.72	(dBi)
Maximum antenna gain:	1.87068214	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2480	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0012763	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0012763 mW/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 2480MHz.