

14 MAXIMUM PERMISSIBLE EXPOSURE (MPE)

14.1 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 Permissive 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

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14.2 Maximum Permissible Exposure (MPE) Evaluation

Max. Rated Avg. Power + Max. Tolerance ($\pm 0.5\text{dBm}$): 14.72dBm

Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (mW)
2412	14.61	28.91	1000
2437	14.52	28.31	1000
2462	14.72	29.65	1000

MPE Prediction (802.11b 2412~2462)

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	14.72	(dBm)
Maximum average output power at antenna input	29.648314	(mW)
Duty cycle:	100	(%)
Maximum Pav :	29.648314	(mW)
Antenna gain (Maximum):	3.92	(dBi)
Antenna gain (linear):	2.4660393	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2462	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0145529	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0145529mW/cm². This is below the uncontrolled exposure limit of 1mW/cm² at 2462MHz.

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Max. Rated Avg. Power + Max. Tolerance ($\pm 0.5\text{dBm}$): 12.94dBm

Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (mW)
2412	12.86	19.32	1000
2437	12.94	19.68	1000
2462	12.78	18.97	1000

MPE Prediction (802.11g 2412~2462)

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	12.94	(dBm)
Maximum average output power at antenna input	19.678863	(mW)
Duty cycle:	100	(%)
Maximum Pav :	19.678863	(mW)
Antenna gain (Maximum):	3.92	(dBi)
Antenna gain (linear):	2.4660393	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0096594	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0096594mW/cm². This is below the uncontrolled exposure limit of 1mW/cm² at 2437MHz.

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Max. Rated Avg. Power + Max. Tolerance ($\pm 1\text{dBm}$): 11.95dBm

Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (mW)
2412	11.79	15.10	1000
2437	11.95	15.67	1000
2462	11.84	15.28	1000

MPE Prediction (802.11n-HT20 2412~2462)

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	11.95	(dBm)
Maximum average output power at antenna input	15.667511	(mW)
Duty cycle:	100	(%)
Maximum Pav :	15.667511	(mW)
Antenna gain (Maximum):	3.92	(dBi)
Antenna gain (linear):	2.4660393	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0076904	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0076904mW/cm². This is below the uncontrolled exposure limit of 1mW/cm² at 2437MHz.

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Max. Rated Avg. Power + Max. Tolerance ($\pm 1\text{dBm}$): 11.84dBm

Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (mW)
2422	11.79	15.10	1000
2437	11.74	14.93	1000
2452	11.84	15.28	1000

MPE Prediction (802.11n-HT40 2422~2452)

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	11.84	(dBm)
Maximum average output power at antenna input	15.275661	(mW)
Duty cycle:	100	(%)
Maximum Pav :	15.275661	(mW)
Antenna gain (Maximum):	3.92	(dBi)
Antenna gain (linear):	2.4660393	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2452	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.0074981	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0074981mW/cm². This is below the uncontrolled exposure limit of 1mW/cm² at 2452MHz.

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