

12 Maximum Permissible Exposure (MPE)

12.1 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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12.2 Maximum Permissible Exposure (MPE) Evaluation

802.11b Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	16.96	0.00	16.96	0.04966	1
2437.00	16.88	0.00	16.88	0.04875	1
2462.00	16.80	0.00	16.80	0.04786	1

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 peak output power at antenna input terminal:	16.96	(dBm)
Maximum peak output power at antenna input terminal:	49.65923215	(mW)
Duty cycle:	100	(%)
Maximum Pav :	49.65923215	(mW)
Antenna gain (typical):	5.05	(dBi)
Maximum antenna gain:	3.19889511	(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)	0.0316192	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0316 mW/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 2412MHz.

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802.11g Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	15.02	0.00	15.02	0.03177	1
2437.00	14.83	0.00	14.83	0.03041	1
2462.00	15.08	0.00	15.08	0.03221	1

MPE Prediction (802.11g)

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 peak output power at antenna input terminal:	15.08	(dBm)
Maximum peak output power at antenna input terminal:	32.21068791	(mW)
Duty cycle:	100	(%)
Maximum Pav :	32.21068791	(mW)
Antenna gain (typical):	5.05	(dBi)
Maximum antenna gain:	3.19889511	(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)	0.0205093	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0205 mW/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 2462.

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802.11n_20M Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	13.89	0.00	13.89	0.02449	1
2437.00	13.87	0.00	13.87	0.02438	1
2462.00	13.74	0.00	13.74	0.02366	1

MPE Prediction (802.11n_20M)

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 peak output power at antenna input terminal:	13.89	(dBm)
Maximum peak output power at antenna input terminal:	24.49063242	(mW)
Duty cycle:	100	(%)
Maximum Pav :	24.49063242	(mW)
Antenna gain (typical):	5.05	(dBi)
Maximum antenna gain:	3.19889511	(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)	0.0155937	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0156 mW/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 2462.

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802.11n_40M Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2422.00	13.92	0.00	13.92	0.02466	1
2437.00	13.93	0.00	13.93	0.02472	1
2452.00	14.03	0.00	14.03	0.02529	1

MPE Prediction (802.11n_40M)

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 peak output power at antenna input terminal:	14.03	(dBm)
Maximum peak output power at antenna input terminal:	25.29297996	(mW)
Duty cycle:	100	(%)
Maximum Pav :	25.29297996	(mW)
Antenna gain (typical):	5.05	(dBi)
Maximum antenna gain:	3.19889511	(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)	0.0161046	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.0161 mW/cm². This is below the uncontrolled exposure limit of 1 mW/cm² at 2437.

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