

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 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

MPE Prediction

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

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1.2 Maximum Permissible Exposure (MPE) Evaluation

BLE mode:			
CH	Frequency (MHz)	Max. Avg. Output include tune up tolerance Power (dBm)	Required Limit
0	2402	-0.33	1 Watt = 30 dBm
20	2442	-0.04	1 Watt = 30 dBm
39	2480	-0.24	1 Watt = 30 dBm

Max. output power including tune-up tolerance:	-0.04	(dBm)
Max. output power including tune-up tolerance:	0.9908319	(mW)
Duty cycle:	65.22	(%)
Maximum Pav :	0.6462206	(mW)
Peak Antenna gain (Maximum):	3.25	(dBi)
Peak Antenna gain (linear):	2.113489	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2442	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.000272	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.000272 mW/cm².
This is below the uncontrolled exposure limit of 1 mW/cm² at 2442MHz.

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1M BR mode (Average):

CH	Freq. (MHz)	Max. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
0	2402	0.39	1.094	125
39	2441	0.68	1.169	125
78	2480	0.58	1.143	125

Max. output power including tune-up tolerancel:	0.68	(dBm)
Max. output power including tune-up tolerancel:	1.1694994	(mW)
Duty cycle:	100	(%)
Maximum Pav :	1.1694994	(mW)
Peak Antenna gain (Maximum):	3.28	(dBi)
Peak Antenna gain (linear):	2.128139	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2441	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.000495	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.000495 mW/cm².

This is below the uncontrolled exposure limit of 1 mW/cm² at 2441MHz.

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802.11b Main (Worst case)						
CH	Frequency (MHz)	Data Rate	Avg. Output Power (dBm)	Avg. Output Power (mW)	Limit	RESULT
1	2412	1	20.56	17.94	1 Watt = 30.00 dBm	PASS
6	2437	1	20.56	17.98	1 Watt = 30.00 dBm	PASS
11	2462	1	20.54	17.88	1 Watt = 30.00 dBm	PASS

Max. output power including tune-up tolerancel:	17.98	(dBm)
Max. output power including tune-up tolerancel:	62.805836	(mW)
Duty cycle:	99.25	(%)
Maximum Pav :	62.334792	(mW)
Peak Antenna gain (Maximum):	3.25	(dBi)
Peak Antenna gain (linear):	2.113489	(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)	0.026223	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.026223 mW/cm².

This is below the uncontrolled exposure limit of 1 mW/cm² at 2437MHz.

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802.11a Max. output power

802.11n_HT20_Main

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	REQUIRED LIMIT (dBm)		RESULT
36	5180	MCS0	11.00	30		PASS
44	5220	MCS0	10.81	30		PASS
48	5240	MCS0	10.71	30		PASS
52	5260	MCS0	11.00	23.98	or $11+10\log(B) = 23.99$	PASS
60	5300	MCS0	10.94	23.98	or $11+10\log(B) = 23.98$	PASS
64	5320	MCS0	10.96	23.98	or $11+10\log(B) = 24.02$	PASS
100	5500	MCS0	11.00	23.98	or $11+10\log(B) = 24.07$	PASS
116	5580	MCS0	10.67	23.98	or $11+10\log(B) = 23.97$	PASS
140	5700	MCS0	10.83	23.98	or $11+10\log(B) = 24.14$	PASS
149	5745	MCS0	11.00	30		PASS
157	5785	MCS0	11.00	30		PASS
165	5825	MCS0	10.71	30		PASS

MPE Prediction (802.11n_HT20) (Worst case)

Max. output power including tune-up tolerancel:	11.00	(dBm)
Max. output power including tune-up tolerancel:	12.589254	(mW)
Duty cycle:	95.74	(%)
Maximum Pav :	12.052952	(mW)
Peak Antenna gain (Maximum):	5	(dBi)
Peak Antenna gain (linear):	3.1622777	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	5260	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.008	(mW/cm ²)
Measurement Result		
The predicted power density level at 20 cm is 0.008 mW/cm ² .		
This is below the uncontrolled exposure limit of 1 mW/cm ² at 5260MHz.		

~ End of Report ~

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