

## 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 <sup>2</sup> )	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 <sup>2</sup> )	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

1M BR mode Bluetooth FHSS worst case.

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 tolerance:	0.68	(dBm)
Max. output power including tune-up tolerance:	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 <sup>2</sup> )
Power density at predication frequency at 20 cm (cm)	0.000495	(mW/cm <sup>2</sup> )

### Measurement Result

The predicted power density level at 20 cm is 0.000495 mW/cm<sup>2</sup>.

This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2441MHz.

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**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 <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.000272	(mW/cm <sup>2</sup> )

**Measurement Result**

The predicted power density level at 20 cm is 0.000272 mW/cm<sup>2</sup>.  
This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2442MHz.

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**802.11b Main (2.4GHz WLAN Worst case)**

CH	Frequency (MHz)	Data Rate	Avg. Output Power (dBm)	Avg. Output Power (mW)	Limit	RESULT
1	2412	1	<b>20.56</b>	17.94	1 Watt = 30.00 dBm	PASS
6	2437	1	<b>20.56</b>	<b>17.98</b>	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 tolerance:	<b>17.98</b>	(dBm)
Max. output power including tune-up tolerance:	62.805836	(mW)
Duty cycle:	<b>99.25</b>	(%)
Maximum Pav :	62.334792	(mW)
Peak Antenna gain (Maximum):	<b>3.25</b>	(dBi)
Peak Antenna gain (linear):	2.113489	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	<b>2437</b>	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.026223	(mW/cm <sup>2</sup> )

**Measurement Result**  
The predicted power density level at 20 cm is 0.026223 mW/cm<sup>2</sup>.  
This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2437MHz.

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## 802.11n\_HT20 (5 GHz WLAN Worst case)

### 802.11n\_HT20\_Main

CH	Frequency (MHz)	Data Rate	TOTAL POWER (dBm)	REQUIRED LIMIT (dBm)		RESULT
36	5180	MCS0	<b>10.90</b>	30		PASS
44	5220	MCS0	10.81	30		PASS
48	5240	MCS0	10.71	30		PASS
52	5260	MCS0	<b>10.96</b>	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	<b>10.96</b>	23.98 or $11+10\log(B) =$	24.02	PASS
100	5500	MCS0	<b>10.94</b>	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	<b>10.87</b>	30		PASS
157	5785	MCS0	<b>10.87</b>	30		PASS
165	5825	MCS0	10.71	30		PASS

## MPE Prediction (802.11n\_HT20) (Worst case)

Max. output power including tune-up tolerance:	<b>10.96</b>	(dBm)
Max. output power including tune-up tolerance:	12.473835	(mW)
Duty cycle:	<b>95.74</b>	(%)
Maximum Pav :	11.94245	(mW)
Peak Antenna gain (Maximum):	<b>5</b>	(dBi)
Peak Antenna gain (linear):	3.1622777	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	<b>5260</b>	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm <sup>2</sup> )
Power density at predication frequency at 20 (cm)	0.008	(mW/cm <sup>2</sup> )

**Measurement Result**  
The predicted power density level at 20 cm is 0.008 mW/cm<sup>2</sup>.  
This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 5260MHz.

~ End of Report ~

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