



# APPENDIX I RADIO FREQUENCY EXPOSURE

## LIMIT

According to §15.247(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this chapter.

## EUT Specification

<b>EUT</b>	Notebook PC		
<b>Model</b>	SA14XXXXXX ( X=0~9, a~z, A~Z, or blank)		
<b>RF Module</b>	1. Intel 2. SIERRA	Model:	1. N 6235 2. MC7355
<b>Frequency band (Operating)</b>	<input checked="" type="checkbox"/> GPRS Class 10: 824MHz ~ 849MHz <input checked="" type="checkbox"/> GPRS Class 10: 1850MHz ~ 1910MHz <input checked="" type="checkbox"/> EDGE Class 10 & 11 & 12: 824MHz ~ 849MHz <input checked="" type="checkbox"/> EDGE Class 10 & 11 & 12: 1850MHz ~ 1910MHz <input checked="" type="checkbox"/> CDMA EvDo: 824MHz ~ 849MHz <input checked="" type="checkbox"/> CDMA EvDo: 1850MHz ~ 1910MHz <input checked="" type="checkbox"/> CDMA EvDo: 816.0MHz ~ 823.975MHz <input checked="" type="checkbox"/> UMTS: 824MHz ~ 849MHz <input checked="" type="checkbox"/> UMTS: 1710MHz ~ 1755MHz <input checked="" type="checkbox"/> UMTS: 1850MHz ~ 1910MHz <input checked="" type="checkbox"/> LTE Band XVII: 704MHz ~ 716MHz <input checked="" type="checkbox"/> LTE Band XIII: 777MHz ~ 787MHz <input checked="" type="checkbox"/> LTE Band V: 824MHz ~ 849MHz <input checked="" type="checkbox"/> LTE Band IV: 1710MHz ~ 1755MHz <input checked="" type="checkbox"/> LTE Band II: 1850MHz ~ 1910MHz <input checked="" type="checkbox"/> LTE Band XXV: 1850MHz ~ 1915MHz <input checked="" type="checkbox"/> WLAN: 2400MHz ~ 2483.5MHz <input checked="" type="checkbox"/> WLAN: 5725MHz ~ 5850MHz <input checked="" type="checkbox"/> Bluetooth: 2400MHz ~ 2483.5MHz <input type="checkbox"/> Others		
<b>Device category</b>	<input type="checkbox"/> Portable (<20cm separation) <input checked="" type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others		
<b>Exposure classification</b>	<input type="checkbox"/> Occupational/Controlled exposure (S = 5mW/cm <sup>2</sup> ) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure (S=1mW/cm <sup>2</sup> )		
<b>Evaluation applied</b>	<input checked="" type="checkbox"/> MPE Evaluation* <input type="checkbox"/> SAR Evaluation <input type="checkbox"/> N/A		



**For MC7355 Module:**

Mode	Equipment Category	Max Transmitter Duty Cycle	Transmitter Range (MHz)	Maximum Conducted Power		Max Antenna Gain (dBi)	
				(dBm)	(W)	Standalone	Collocated
GPRS	Class 10	25%	824-849	33.0	2.00	6.5	3.0
			1850-1910	30.0	1.00	3.0	3.0
EDGE	Class 10	25%	824-849	28.0	0.63	6.5	3.0
			1850-1910	27.0	0.50	3.0	3.0
	Class 11	37.50%	824-849	26.2	0.42	6.5	3.0
			1850-1910	25.2	0.33	3.0	3.0
	Class 12	50%	824-849	25.0	0.32	6.5	3.0
			1850-1910	24.0	0.25	3.0	3.0
CDMA	EvDo	100%	824-849	25.0	0.32	6.5	3.0
			1850-1910	25.0	0.32	3.0	3.0
			816.0 – 823.975	25.0	0.32	6.5	3.0
UMTS	HSDPA HSUPA	100%	824 -849	24.0	0.25	6.5	3.0
			1710-1755	24.0	0.25	6.0	6.0
			1850 -1910	24.0	0.25	3.0	3.0
LTE	Band 17	100%	704 -716	24.0	0.25	9.0	6.0
	Band 13		777 -787	24.0	0.25	9.0	6.0
	Band 5		824 -849	24.0	0.25	6.5	3.0
	Band 4		1710 -1755	24.0	0.25	6.0	6.0
	Band 2		1850 -1910	24.0	0.25	3.0	3.0
	Band 25		1850 -1915	24.0	0.25	3.0	3.0

**For N 6235 Module:**

Mode	Transmitter Range (MHz)	Maximum Conducted Power		Max Antenna Gain (dBi)
		(dBm)	(W)	
WLAN	2400 -2483.5	16.9	0.049	0.39
WLAN	5725 -5850	23.9	0.246	2.10
BT	2400 -2483.5	6.8	0.0048	0.39



	Technology	Frequency	Maximum Conducted Power		Maximum Antenna Gain	Average EIRP		Power Density @ 20cm	FCC MPE Limit
		MHz	dBm	W	dBi	dBm	mW	mW/cm <sup>2</sup>	mW/cm <sup>2</sup>
<b>MC7355 Module (Collocated)</b>	<b>GPRS 2 UL</b>	824-849	33.0	2.00	3.0	29.98	995.268	0.198	0.549
	<b>EDGE 2 UL</b>	824-849	28.0	0.63	3.0	24.98	314.731	0.063	0.549
	<b>EDGE 3 UL</b>	824-849	26.2	0.42	3.0	24.94	311.911	0.062	0.549
	<b>EDGE 4UL</b>	824-849	25.0	0.32	3.0	24.99	315.479	0.063	0.549
	<b>GPRS 2 UL</b>	1850-1910	30.0	1.00	3.0	26.98	498.816	0.099	1.000
	<b>EDGE 2 UL</b>	1850-1910	27.0	0.50	3.0	23.98	250.000	0.050	1.000
	<b>EDGE 3 UL</b>	1850-1910	25.2	0.33	3.0	23.94	247.760	0.049	1.000
	<b>EDGE 4UL</b>	1850-1910	24.0	0.25	3.0	23.99	250.594	0.050	1.000
	<b>CDMA BC0</b>	824-849	25.0	0.3	3.0	28.00	630.957	0.126	0.549
	<b>CDMA BC1</b>	1850-1910	25.0	0.3	3.0	28.00	630.957	0.126	1.000
	<b>CDMA BC10</b>	816.0-823.975	25.0	0.3	3.0	28.00	630.957	0.126	0.544
	<b>UMTS</b>	824 -849	24.0	0.251	3.0	27.00	501.187	0.100	0.549
	<b>UMTS</b>	1710-1755	24.0	0.251	6.0	30.00	1000.000	0.199	1.000
	<b>UMTS</b>	1850 -1910	24.0	0.251	3.0	27.00	501.187	0.100	1.000
	<b>LTE</b>	704 -716	24.0	0.3	6.0	30.00	1000.000	0.199	0.469
	<b>LTE</b>	777 -787	24.0	0.3	6.0	30.00	1000.000	0.199	0.518
	<b>LTE</b>	824 -849	24.0	0.3	3.0	27.00	501.187	0.100	0.549
	<b>LTE</b>	1710 -1755	24.0	0.3	6.0	30.00	1000.000	0.199	1.000
<b>LTE</b>	1850 -1910	24.0	0.3	3.0	27.00	501.187	0.100	1.000	
<b>LTE</b>	1850 -1915	24.0	0.3	3.0	27.00	501.187	0.100	1.000	
<b>N 6235 Module (Collocated)</b>	<b>WLAN</b>	2400 -2483.5	16.9	0.049	0.39	17.29	53.580	0.011	1.000
	<b>WLAN</b>	5725 -5850	23.9	0.246	2.10	26.00	398.107	0.079	1.000
	<b>BT</b>	2400 -2483.5	6.8	0.0048	0.39	7.19	5.236	0.001	1.000



### Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	2014/04/28	Initial Issue	ALL	Gloria Chang



## **TEST RESULTS**

**No non-compliance noted.**

### **Calculation**

Given  $E = \frac{\sqrt{30 \times P \times G}}{d}$  &  $S = \frac{E^2}{377}$

Where  $E$  = Field strength in Volts / meter

$P$  = Power in Watts

$G$  = Numeric antenna gain

$d$  = Distance in meters

$S$  = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{377d^2}$$

Changing to units of mW and cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = d \text{ (m)} / 100$$

Yields

$$S = \frac{30 \times (P/1000) \times G}{377 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2} \quad \text{Equation 1}$$

Where  $d$  = Distance in cm

$P$  = Power in mW

$G$  = Numeric antenna gain

$S$  = Power density in mW / cm<sup>2</sup>



**Maximum Permissible Exposure**

Substituting the MPE safe distance using  $d = 20$  cm into Equation 1:

$$S = 0.000199 \times P \times G$$

Where  $P =$  Power in mW

$G =$  Numeric antenna gain

$S =$  Power density in mW / cm<sup>2</sup>

**Test Result**

**Table 1: WLAN + BT Collocated MPE Calculation**

WLAN Band (GHz)	WLAN Pd (mW/cm <sup>2</sup> )	BT Pd (mW/cm <sup>2</sup> )	WLAN + BT Pd (mW/cm <sup>2</sup> )	Limit
2.3 - 2.4	0.079	0.001	0.080	1.000
2.4 - 2.5				
2.5 - 2.7				
3.3 - 3.8				
5.725 - 5.85				

**Table 2: WWAN 850MHz + WLAN + BT Collocated MPE Calculation**

WLAN Band (GHz)	WLAN + BT Pd (mW/cm <sup>2</sup> )	FCC MPE Limit (mW/cm <sup>2</sup> )	(WLAN + BT Pd) / (MPE Limit)	850 MHz WWAN Pd (mW/cm <sup>2</sup> )	FCC MPE Limit (mW/cm <sup>2</sup> )	(WWAN 850 MHz) / MPE Limit	(850 MHz WWAN + WLAN + BT fraction)	Limit
2.3 - 2.4	0.080	1.000	0.080	0.198	0.549	0.360	0.440	1.000
2.4 - 2.5								
2.5 - 2.7								
3.3 - 3.8								
5.725 - 5.85								



**Table 3: WWAN 1900MHz + WLAN + BT Collocated MPE Calculation**

WLAN Band (GHz)	WLAN + BT Pd (mW/cm <sup>2</sup> )	FCC MPE Limit (mW/cm <sup>2</sup> )	(WLAN + BT Pd) / (MPE Limit)	1900 MHz WWAN Pd (mW/cm <sup>2</sup> )	FCC MPE Limit (mW/cm <sup>2</sup> )	(WWAN 1900 MHz) / MPE Limit	(1900 MHz WWAN + WLAN + BT fraction)	Limit
2.3 - 2.4	0.080	1.000	0.080	0.126	1.000	0.126	0.206	1.000
2.4 - 2.5								
2.5 - 2.7								
3.3 - 3.8								
5.725 - 5.85								

**Table 4: WWAN 700MHz + WLAN + BT Collocated MPE Calculation**

WLAN Band (GHz)	WLAN + BT Pd (mW/cm <sup>2</sup> )	FCC MPE Limit (mW/cm <sup>2</sup> )	(WLAN + BT Pd) / (MPE Limit)	700 MHz WWAN Pd (mW/cm <sup>2</sup> )	FCC MPE Limit (mW/cm <sup>2</sup> )	(WWAN 700 MHz) / MPE Limit	(700 MHz WWAN + WLAN + BT fraction)	Limit
2.3 - 2.4	0.080	1.000	0.080	0.199	0.469	0.424	0.504	1.000
2.4 - 2.5								
2.5 - 2.7								
3.3 - 3.8								
5.725 - 5.85								



**Table 5: WWAN 1700MHz + WLAN + BT Collocated MPE Calculation**

WLAN Band (GHz)	WLAN + BT Pd (mW/cm <sup>2</sup> )	FCC MPE Limit (mW/cm <sup>2</sup> )	(WLAN + BT Pd) / (MPE Limit)	1700 MHz WWAN Pd (mW/cm <sup>2</sup> )	FCC MPE Limit (mW/cm <sup>2</sup> )	(WWAN 1700 MHz) / MPE Limit	(1700 MHz WWAN + WLAN + BT fraction)	Limit
2.3 - 2.4	0.080	1.000	0.080	0.199	1.000	0.199	0.279	1.000
2.4 - 2.5								
2.5 - 2.7								
3.3 - 3.8								
5.725 - 5.85								