



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

EUT	Laptop		
Model	R13IXXXXXX (X=0~9,A~Z or blank) ; R8300XXXXXX (X=0~9,A~Z or blank) ; PWS98XXXXXX (X=0~9,A~Z)		
RF Module	1. Intel 2. SIERRA	Model:	1. N6235 2. EM7355
Frequency band (Operating)	<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 type="checkbox"/> Others		
Device category	<input type="checkbox"/> Portable (<20cm separation) <input checked="" type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others		
Exposure classification	<input type="checkbox"/> Occupational/Controlled exposure (S = 5mW/cm ²) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure (S=1mW/cm ²)		
Evaluation applied	<input checked="" type="checkbox"/> MPE Evaluation* <input type="checkbox"/> SAR Evaluation <input type="checkbox"/> N/A		

Remark : 1. For more details, please refer to the User's manual of the EUT.

2. The model R13I was considered the main model for testing.



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



	Technology	Frequency	Maximum Conducted Power		Maximum Antenna Gain	Average EIRP		Power Density @ 20cm	FCC MPE Limit
		MHz	dBm	W	dBi	dBm	mW	mW/cm ²	mW/cm ²
EM7355 Module (Collocated)	GPRS 2 UL	824-849	33.0	2.00	3.0	29.98	995.268	0.198	0.549
	EDGE 2 UL	824-849	28.0	0.63	3.0	24.98	314.731	0.063	0.549
	EDGE 3 UL	824-849	26.2	0.42	3.0	24.94	311.911	0.062	0.549
	EDGE 4UL	824-849	25.0	0.32	3.0	24.99	315.479	0.063	0.549
	GPRS 2 UL	1850-1910	30.0	1.00	3.0	26.98	498.816	0.099	1.000
	EDGE 2 UL	1850-1910	27.0	0.50	3.0	23.98	250.000	0.050	1.000
	EDGE 3 UL	1850-1910	25.2	0.33	3.0	23.94	247.760	0.049	1.000
	EDGE 4UL	1850-1910	24.0	0.25	3.0	23.99	250.594	0.050	1.000
	CDMA BC0	824-849	25.0	0.3	3.0	28.00	630.957	0.126	0.549
	CDMA BC1	1850-1910	25.0	0.3	3.0	28.00	630.957	0.126	1.000
	CDMA BC10	816.0-823.975	25.0	0.3	3.0	28.00	630.957	0.126	0.544
	UMTS	824 -849	24.0	0.251	3.0	27.00	501.187	0.100	0.549
	UMTS	1710-1755	24.0	0.251	6.0	30.00	1000.000	0.199	1.000
	UMTS	1850 -1910	24.0	0.251	3.0	27.00	501.187	0.100	1.000
	LTE	704 -716	24.0	0.3	6.0	30.00	1000.000	0.199	0.469
	LTE	777 -787	24.0	0.3	6.0	30.00	1000.000	0.199	0.518
	LTE	824 -849	24.0	0.3	3.0	27.00	501.187	0.100	0.549
LTE	1710 -1755	24.0	0.3	6.0	30.00	1000.000	0.199	1.000	
LTE	1850 -1910	24.0	0.3	3.0	27.00	501.187	0.100	1.000	
LTE	1850 -1915	24.0	0.3	3.0	27.00	501.187	0.100	1.000	
Other Collocated Transmitters	WLAN	2400 -2500	16.9	0.049	1.86	18.76	75.162	0.015	1.000
	WLAN	5150 -5850	23.9	0.246	1.82	25.72	373.250	0.074	1.000
	BT	2400 -2500	6.8	0.0048	2.6	9.40	8.709	0.002	1.000



Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	2014/04/18	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 / cm²



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 / cm²

Test Result

Table 1: WLAN + BT Collocated MPE Calculation

WLAN/WiMAX Band (GHz)	WLAN Pd (mW/cm ²)	BT Pd (mW/cm ²)	WLAN + BT Pd (mW/cm ²)	Limit
2.3 - 2.4	0.074	0.002	0.076	1.000
2.4 - 2.5				
2.5 - 2.7				
3.3 - 3.8				
5.15 - 5.85				

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

WLAN Band (GHz)	WLAN + BT Pd (mW/cm ²)	FCC MPE Limit (mW/cm ²)	(WLAN + BT Pd) / (MPE Limit)	850 MHz WWAN Pd (mW/cm ²)	FCC MPE Limit (mW/cm ²)	(WWAN 850 MHz) / MPE Limit	(850 MHz WWAN + WLAN + BT fraction)	Limit
2.3 - 2.4	0.076	1.000	0.076	0.198	0.549	0.360	0.436	1.000
2.4 - 2.5								
2.5 - 2.7								
3.3 - 3.8								
5.15 - 5.85								



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

WLAN Band (GHz)	WLAN + BT Pd (mW/cm ²)	FCC MPE Limit (mW/cm ²)	(WLAN + BT Pd) / (MPE Limit)	1900 MHz WWAN Pd (mW/cm ²)	FCC MPE Limit (mW/cm ²)	(WWAN 1900 MHz) / MPE Limit	(1900 MHz WWAN + WLAN + BT fraction)	Limit
2.3 - 2.4	0.076	1.000	0.076	0.126	1.000	0.126	0.202	1.000
2.4 - 2.5								
2.5 - 2.7								
3.3 - 3.8								
5.15 - 5.85								

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

WLAN Band (GHz)	WLAN + BT Pd (mW/cm ²)	FCC MPE Limit (mW/cm ²)	(WLAN + BT Pd) / (MPE Limit)	700 MHz WWAN Pd (mW/cm ²)	FCC MPE Limit (mW/cm ²)	(WWAN 700 MHz) / MPE Limit	(700 MHz WWAN + WLAN + BT fraction)	Limit
2.3 - 2.4	0.076	1.000	0.076	0.199	0.469	0.424	0.500	1.000
2.4 - 2.5								
2.5 - 2.7								
3.3 - 3.8								
5.15 - 5.85								



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

WLAN Band (GHz)	WLAN + BT Pd (mW/cm ²)	FCC MPE Limit (mW/cm ²)	(WLAN + BT Pd) / (MPE Limit)	1700 MHz WWAN Pd (mW/cm ²)	FCC MPE Limit (mW/cm ²)	(WWAN 1700 MHz) / MPE Limit	(1700 MHz WWAN + WLAN + BT fraction)	Limit
2.3 - 2.4	0.076	1.000	0.076	0.199	1.000	0.199	0.275	1.000
2.4 - 2.5								
2.5 - 2.7								
3.3 - 3.8								
5.15 - 5.85								