



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)	☒ GPRS Class 10: 824MHz ~ 849MHz ☒ GPRS Class 10: 1850MHz ~ 1910MHz ☒ EDGE Class 10 & 11 & 12: 824MHz ~ 849MHz ☒ EDGE Class 10 & 11 & 12: 1850MHz ~ 1910MHz ☒ CDMA EvDo: 824MHz ~ 849MHz ☒ CDMA EvDo: 1850MHz ~ 1910MHz ☒ CDMA EvDo: 816.0MHz ~ 823.975MHz ☒ UMTS: 824MHz ~ 849MHz ☒ UMTS: 1710MHz ~ 1755MHz ☒ UMTS: 1850MHz ~ 1910MHz ☒ LTE Band XVII: 704MHz ~ 716MHz ☒ LTE Band XIII: 777MHz ~ 787MHz ☒ LTE Band V: 824MHz ~ 849MHz ☒ LTE Band IV: 1710MHz ~ 1755MHz ☒ LTE Band II: 1850MHz ~ 1910MHz ☒ LTE Band XXV: 1850MHz ~ 1915MHz ☒ WLAN: 2400MHz ~ 2483.5MHz ☒ WLAN: 5725MHz ~ 5850MHz ☒ Bluetooth: 2400MHz ~ 2483.5MHz ☐ Others		
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation) ☐ Others		
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm ²) ☒ General Population/Uncontrolled exposure (S=1mW/cm ²)		
Evaluation applied	☒ MPE Evaluation* ☐ SAR Evaluation ☐ 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.

**For EM7355 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 N6235 Module:

Mode	Transmitter Range (MHz)	Maximum Conducted Power		Max Antenna Gain (dBi)
		(dBm)	(W)	
WLAN	2400 -2483.5	16.9	0.049	1.86
WLAN	5725 -5850	23.9	0.246	1.82
BT	2400 -2483.5	6.8	0.0048	2.6



	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
N6235 Module (Collocated)	WLAN	2400 -2483.5	16.9	0.049	1.86	18.76	75.162	0.015	1.000
	WLAN	5725 -5850	23.9	0.246	1.82	25.72	373.250	0.074	1.000
	BT	2400 -2483.5	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
01	2014/05/06	Revised	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:

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

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

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

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 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				
5.725 - 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								
5.725 - 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								
5.725 - 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								
5.725 - 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								
5.725 - 5.85								