QUALCOMM
CDMA Technologies

Gobi2000™ Module Lenovo Collocated Mobile Generic MPE Report

80-VP949-3 Rev. C

October 1, 2009

Submit technical questions to:
regulatory.support@qualcomm.com

QUALCOMM Incorporated
5775 Morehouse Drive
San Diego, CA 92121-1714
U.S.A.

October 1, 2009

Gobi2000™ Module Lenovo Collocated Mobile Generic MPE Report

80-VP949-3 Rev. C

Revision history

Revision	Date	Description
A	September 2009	Initial release
B	September 2009	Revised collocated devices and host devices; removal of material not relevant to current device hosts
C	September 2009	Add Industry Canada IDs

1 Introduction

This Maximum Permissive Exposure report demonstrates compliance with FCC CFR 47 §1.1310 and 2.1091 for any collocated transmitters used in simultaneous conditions with the Gobi2000™ WWAN mPCIe module installed into any Lenovo® host platform categorized as "mobile" where the collocated transmitter has a valid FCC ID documenting equivalent or degraded RF characteristics with the collocated parameters defined in this MPE report.

The mobile classification applies when 20 cm or more separation distance is maintained both WWAN and WLAN transmission antennas and the end-user.

The WWAN module is Gobi2000 module authorized under FCC ID J9CGOBI2000-L.

The WWAN MPE calculations in the filing are based on the conducted transmit power levels listed in FCC ID J9CGOBI2000-L filings and the maximum allowable antenna gains per relevant grant notes.

The Collocated MPE calculations are based on worst-case conducted transmit powers and antenna gain parameters. The WLAN FCC IDs referenced in section 1.1 have equal or lower conducted power and antenna gain than that used in the calculations of this report.

Additional future collocated modules to be added to the host notebooks subsequent to this filing may be excluded from further submission, subject to the conditions of KDB 447498, section 7.

1.1 Available Collocated Transmitters

Table 1 lists available WLAN FCC IDs that may be installed in Lenovo notebook computers listed in Table 2. This MPE report is also applicable to future modules with equal or less transmit power than that defined in this MPE report even though the FCC IDs are not identified in this report.

Table 1 Lenovo Collocated FC ID

FCC ID IC ID	Original Grant date	WLAN				WiMAX
		Part 15C 2.4GHz band	Part 15E 5.18 – 5.32GHz	Part 15E 5.50 – 5.70GHz	Part 15C 5.745 – 5.825GHz	Part 27 2.496 – 2.690GHz
TX2-RTL8191SE-L 6317A-RTL8191SE	2/25/2009	0.0667W	N/A	N/A	N/A	N/A
PD9112BNHU 1000M-112BNHU	6/04/2009	0.048 W	N/A	N/A	N/A	N/A
PD9633ANHU 1000M-633ANHU	8/19/2009	0.438 W	0.045 W	0.045 W	0.441 W	N/A
PD9622ANHU 1000M-622ANHU	9/22/2009	0.048 W	0.049 W	0.050 W	0.050 W	N/A

Bluetooth modular transmitter (FCC ID: QDS-BRCM1046) can also be installed in the subject host laptop PCs. The transmission power is 3.06 mW or less and the separation distance between the WWAN and Bluetooth antennas is 20 cm or longer. Therefore the Bluetooth is not considered a collocated transmitter and any collocation evaluation is not required pursuant to the FCC KDB 616217.

2 Host Products

Table 2 lists known mobile host devices at the time of the Class II permissive change submission.

Additional host notebooks may be added in the future without permissive change filings per the rules defined in Section 7 of KDB447498.

Table 2 Lenovo Mobile Platforms

Available Host Models	
ThinkPad T400s/T410s/T410si	X200/X200s/X200si/X201/X201s/X201si
ThinkPad T410/T410i	T510/T510i/W510

3 Transmitter Summary

Table 3 summarizes transmitter parameters associated with this permissive change application.

The WWAN modes of operation reflect the Gobi2000 module parameters associated with this FCC ID J9CGOBI2000-L.

The WLAN and WIMAX transmit power and antenna gain parameters represent the highest transmit power for a given frequency band from all of the WLAN/WPAN FCC IDs identified in Section 1.1 .

Integration of a WLAN module that exceeds the parameters requires a new FCC authorization or permissive change application. A worst-case antenna gain of 5 dBi has been assumed for all WLAN/WIMAX antennas.

Table 3 WWAN and WLAN Declared Transmitter Parameters

Technology	Frequency (MHz)	Maximum Conducted Power (dBm)	Conducted Power (W)	Maximum Antenna Gain (dBi)	Duty Cycle
GPRS 2 UL	824	32.80	1.919	4.00	0.25
CDMA2000	824	24.6	0.29	4.00	1.00
UMTS	824	24.2	0.262	4.00	1.00
GPRS 2 UL	1850	29.4	0.875	3.50	0.25
CDMA2000	1850	24.61	0.289	3.50	1.00
UMTS	1850	24.56	0.286	3.50	1.00
WLAN	2400	29.00	0.794	5.00	1.00
WIMAX	2600	29.00	0.794	5.00	1.00
WLAN	5150	29.00	0.794	5.00	1.00
WLAN	5250	29.00	0.794	5.00	1.00
WLAN	5500	29.00	0.794	5.00	1.00
WLAN	5725	29.00	0.794	5.00	1.00

4 RF Exposure Limits and Equations

According to FCC CFR 47 §1.1310, the criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b).

Table 4 Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (Minutes)
(A) Limits For Occupational / Control Exposures (f = frequency)				
30-300	61.4	0.163	1.0	6
300-1500	…	…	f/300	6
1500-100,000	…	…	5.0	6
(B) Limits For General Population / Uncontrolled Exposure (f = frequency)				
30-300	27.5	0.073	0.2	30
300-1500	…	…	f/1500	30
1500-100,000	…	…	1.0	30

Friis transmission formula:

$$P_d = \frac{P_{out} \times G}{4\pi R^2}$$

Where,

P_d = power density (mW/cm2)

P_{out} = output power to antenna (mW)

G = gain of antenna in linear scale

R = distance between observation point and center of the radiator (cm)

5 MPE Calculations

5.1 Stand Alone Transmitter Calculations

The power density calculations for standalone transmitters at an exposure separation distance of 20 cm are shown in Table 5 per the transmit power and antenna gain values declared in Table 3.

For frequency dependent limits, the lowest transmitter frequency was used to represent the lowest MPE limit (e.g. 824MHz = 0.549 mW/cm^2).

The WLAN power levels listed represent the worst-case values for the corresponding frequency ranges associated.

Table 5 WWAN and WLAN Standalone MPE Calculations

Technology	Frequency (MHz)	Maximum Conducted Power (dBm)	Conducted Power (W)	Maximum Antenna Gain (dBi)	Duty Cycle	Average EIRP (dBm)	Average EIRP (W)	Power Density @ 20cm (mW/cm^2)	FCC MPE Limit (mW/cm^2)
GPRS 2 UL	824	32.8	1.919	4.00	0.25	30.81	1.21	**0.240**	0.549
CDMA2000	824	24.6	0.29	4.00	1.00	28.62	0.73	0.145	0.549
UMTS	824	24.2	0.262	4.00	1.00	28.18	0.66	0.131	0.549
GPRS 2 UL	1850	29.4	0.875	3.50	0.25	26.90	0.49	0.097	1.000
CDMA2000	1850	24.61	0.289	3.50	1.00	28.11	0.65	**0.129**	1.000
UMTS	1850	24.56	0.286	3.50	1.00	28.06	0.64	0.127	1.000
WLAN	2400	29.00	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WLAN	5150	29.00	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WLAN	5250	29.00	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WLAN	5500	29.00	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WLAN	5800	29.00	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WIMAX	2600	29.00	0.794	5.00	1.00	34.00	2.51	0.500	1.000

5.2 Collocated MPE Calculations

Per OET 65, when RF sources have difference frequencies, the fraction of the FCC power density limit shall be determined and the sum of all fractional components shall be less than 1.

Table 6 WWAN 850 MHz Collocation Power Density

WLAN Band	WLAN Pd (mW/cm^2)	FCC MPE Limit (mW/cm^2)	(WLAN Pd) / (MPE Limit)	850 MHz WWAN Pd (mW/cm^2)	FCC MPE Limit (mW/cm^2)	(WWAN 850 MHz) / MPE Limit)	(850 MHz WWAN fraction) + (WLAN fraction)	Limit	Pass/Fail
2.4 GHz	0.500	1.000	0.500	0.240	0.549	0.436	0.936	1	Pass
5.1 GHz	0.500	1.000	0.500	0.240	0.549	0.436	0.936	1	Pass
5.2 GHz	0.500	1.000	0.500	0.240	0.549	0.436	0.936	1	Pass
5.5 GHz	0.500	1.000	0.500	0.240	0.549	0.436	0.936	1	Pass
5.8 GHz	0.500	1.000	0.500	0.240	0.549	0.436	0.936	1	Pass
2.6 GHz	0.500	1.000	0.500	0.240	0.549	0.436	0.936	1	Pass

Table 7 WWAN 1900 MHz Collocation Power Density

Band	WLAN Pd (mW/cm^2)	FCC MPE Limit (mW/cm^2)	(WLAN Pd) / (MPE Limit)	1900 MHz Pd (mW/cm^2)	FCC MPE Limit (mW/cm^2)	(WWAN 1900 MHz) / MPE Limit)	(1900 MHz WWAN fraction) + (WLAN fraction)	Limit	Pass/Fail
2.4 GHz	0.500	1.000	0.500	0.129	1.000	0.129	0.628	1	Pass
5.1 GHz	0.500	1.000	0.500	0.129	1.000	0.129	0.628	1	Pass
5.2 GHz	0.500	1.000	0.500	0.129	1.000	0.129	0.628	1	Pass
5.5 GHz	0.500	1.000	0.500	0.129	1.000	0.129	0.628	1	Pass
5.8 GHz	0.500	1.000	0.500	0.129	1.000	0.129	0.628	1	Pass
2.6 GHz	0.500	1.000	0.500	0.129	1.000	0.129	0.628	1	Pass