



# ***HP/Gobi2000™ Module Collocated MPE Calculations***

***J9CGOBI2000-H***

***80-VP948-8 Rev. A***

***August 1, 2008***

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80-VP948-8 Rev. A

## Revision history

Revision	Date	Description
A	August 2009	Initial release

# 1 Introduction

This Maximum Permissible Exposure report demonstrates compliance with FCC CFR 47 §1.1310 and 2.1091 for collocated transmitters used in simultaneous conditions with the Gobi2000™ WWAN mPCIe installed in a host platform categorized as “mobile”. The mobile classification applies when 20 cm or more separation distance is maintained between the transmission antennas and the end-user.

The WWAN module is a Gobi2000 module authorized with FCC ID J9CGOBI2000-H.

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 WLAN Transmitters

HP has provided the following list of WLAN FCC IDs that may be installed in HP mobile notebook computers:

- PD9512ANM
- PD9512ANMU
- PD9533ANM
- PD9533ANMU
- QDS-BRCM1036
- QDS-BRCM1028

**Table 1** gives output power levels of each of the WLAN devices as given in their respective FCC grants. The maximum power levels are highlighted in boldface. The transmit powers used in collocated MPE calculations will be worst case conservative values such that all collocated transmitters will have equal or less power. A Class II permissive change may be required to add a collocated transmitter if the new module exceeds values defined in the MPE calculations.

**Table 1 Available Collocated grant power levels**

		FCC ID					
		PD9512ANM	PD9512ANMU	PD9533ANM	PD9533ANMU	QDS-BRCM1036	QDS-BRCM1028
<b>Band</b>	2412-2462	0.091	0.091	0.07	0.07	<b>0.798</b>	0.179
	2422-2452	0.037	0.037	0.13	0.13	<b>0.221</b>	-
	5180-5320	0.028	0.028	<b>0.045</b>	<b>0.045</b>	0.027	-
	5190-5310	0.025	0.025	<b>0.045</b>	<b>0.045</b>	0.033	-
	5260-5320	-	-	<b>0.11</b>	<b>0.11</b>	0.083	-
	5270-5310	-	-	0.087	0.087	<b>0.106</b>	-
	5500-5700	0.054	0.054	<b>0.11</b>	<b>0.11</b>	0.105	-
	5510-5670	0.025	0.025	0.081	0.081	<b>0.154</b>	-
	5745-5825	0.018	0.018	0.063	0.063	<b>0.521</b>	-
5755-5795	0.021	0.021	0.068	0.068	<b>0.521</b>	-	

## 2 Transmitter Summary

Table 2 summarizes transmitter parameters associated with this permissive change application.

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

The collocated 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 collocated 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 collocated antennas.

**Table 2 WWAN and Collocated Transmitter Declared Transmitter Parameters**

Technology	Frequency (MHz)	Maximum Conducted Power (dBm)	Conducted Power (W)	Maximum Antenna Gain (dBi)
GPRS 2 UL	824	32.8	1.919	4.00
CDMA2000	824	24.6	0.29	4.00
UMTS	824	24.2	0.262	4.00
GPRS 2 UL	1850	29.4	0.875	3.50
CDMA2000	1850	24.61	0.289	3.50
UMTS	1850	24.56	0.286	3.50
WLAN	2412-2462	29.0	0.798	5.00
WLAN	2422-2452	23.4	0.221	5.00
WLAN	5180-5320	16.5	0.045	5.00
WLAN	5190-5310	16.5	0.045	5.00
WLAN	5260-5320	20.4	0.11	5.00
WLAN	5270-5310	20.3	0.106	5.00
WLAN	5500-5700	20.4	0.11	5.00
WLAN	5510-5670	21.9	0.154	5.00
WLAN	5745-5825	27.2	0.521	5.00
WLAN	5755-5795	27.2	0.521	5.00

### 3 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 3 Limits for Maximum Permissible Exposure (MPE)**

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	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/cm<sup>2</sup>)

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

$G$  = gain of antenna in linear scale

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

## 4 MPE Calculations

### 4.1 Stand Alone Transmitter Calculations

The MPE calculations for standalone transmitters at a separation distance of 20 cm are shown in Table 4 per the transmit power and antenna gain values declared in Table 2.

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

The WLAN power levels listed represent the worst-case values for the corresponding frequency ranges associated with the grants listed in Section 1.1 *Available Collocated WLAN Transmitters* and given in **Table 1**.

**Table 4 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 <sup>2</sup> )	FCC MPE Limit (mW/cm <sup>2</sup> )
GPRS 2 UL	824	32.8	1.919	4.00	0.25	30.81	1.21	<b>0.240</b>	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	<b>0.129</b>	1.000
UMTS	1850	24.56	0.286	3.50	1.00	28.06	0.64	0.127	1.000
WLAN	2412-2462	29.0	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WLAN	2422-2452	29.0	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WLAN	5180-5320	29.0	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WLAN	5190-5310	29.0	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WLAN	5260-5320	29.0	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WLAN	5270-5310	29.0	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WLAN	5500-5700	29.0	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WLAN	5510-5670	29.0	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WLAN	5745-5825	29.0	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WLAN	5755-5795	29.0	0.794	5.00	1.00	34.00	2.51	0.500	1.000

## 4.2 Collocated MPE Calculations

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

**Table 5 WWAN 850 MHz Collocation**

WLAN Band	(WLAN Pd) / (MPE Limit)	(WWAN 850 MHz) / (MPE Limit)	(850 MHz WWAN fraction) + (WLAN fraction)	Limit	Pass/Fail
2412-2462	0.500	0.436	0.936	1	Pass
2422-2452	0.500	0.436	0.936	1	Pass
5180-5320	0.500	0.436	0.936	1	Pass
5190-5310	0.500	0.436	0.936	1	Pass
5260-5320	0.500	0.436	0.936	1	Pass
5270-5310	0.500	0.436	0.936	1	Pass
5500-5700	0.500	0.436	0.936	1	Pass
5510-5670	0.500	0.436	0.936	1	Pass
5745-5825	0.500	0.436	0.936	1	Pass
5755-5795	0.500	0.436	0.936	1	Pass

**Table 6 WWAN 1900 MHz Collocation**

WLAN Band	(WLAN Pd) / (MPE Limit)	(WWAN 1900 MHz) / (MPE Limit)	(1900 MHz WWAN fraction) + (WLAN fraction)	Limit	Pass/Fail
2412-2462	0.500	0.129	0.628	1	Pass
2422-2452	0.500	0.129	0.628	1	Pass
5180-5320	0.500	0.129	0.628	1	Pass
5190-5310	0.500	0.129	0.628	1	Pass
5260-5320	0.500	0.129	0.628	1	Pass
5270-5310	0.500	0.129	0.628	1	Pass
5500-5700	0.500	0.129	0.628	1	Pass
5510-5670	0.500	0.129	0.628	1	Pass
5745-5825	0.500	0.129	0.628	1	Pass
5755-5795	0.500	0.129	0.628	1	Pass