HP UNDP-1 Collocated MPE Calculations

J9CUNDP-1H

80-VH688-11 Rev. C

May 16, 2008

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Revision history

Revision	Date	Description
A	May 2008	Initial release
B	May 2008	Update to WLAN FCC IDs
C	July 2008	Update to WLAN FCC IDs

1 Introduction

This Maximum Permissive Exposure report demonstrates compliance with FCC CFR 47 §1.1310 and 2.1091 for collocated transmitters used in simultaneous conditions with the UNDP-1 WWAN mPCIe installed in a host platform categorized as "mobile". The mobile classification applies when 20cm or more separation distance is maintained between the transmission antennas and the end-user.

The WWAN module is model UNDP-1 authorized with FCC ID J9CUNDP-1H.

1.1 Available Collocated WLAN Transmitters

HP has provided the following list of WLAN FCC ID's that may be installed in HP notebook computers:

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

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2 Transmitter Summary

Table 1 summarizes transmitter parameters associated with this permissive change application.

The WWAN modes of operation reflect the UNDP-1 parameters associated with this FCC ID J9CUND-1H.

The WLAN transmit power and antenna gain parameters represent worst case parameters for a collocated WLAN module in the host platform and are equal to or less then the FCC granted power levels for the WLAN modules listed in Section 1.1. Integration of a WLAN module that exceeds the parameters requires a new FCC authorization or permissive change application.

Table 1 WWAN and WLAN Declared Transmitter Parameters

Technology	Frequency (MHz)	Maximum Conducted Power (dBm)	Conducted Power (W)	Maximum Antenna Gain (dBi)
GPRS 2 UL	824	32.98	1.986	4.00
CDMA2000	824	24.91	0.310	4.00
UMTS	824	24.42	0.277	4.00
GPRS 2 UL	1850	29.47	0.885	3.50
CDMA2000	1850	24.61	0.289	3.50
UMTS	1850	24.56	0.286	3.50
WLAN	2400	29.00	0.794	3.00
WLAN	5150	29.00	0.794	5.00
WLAN	5250	29.00	0.794	5.00
WLAN	5500	29.00	0.794	5.00
WLAN	5725	29.00	0.794	5.00

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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 2 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:

$$Pd = (Pout * G) / (4\pi R2)$$

Where,

Pd = power density (mW/cm2)

Pout = output power to antenna (mW)

G = gain of antenna in linear scale

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

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4 MPE Calculations

4.1 Stand Alone Transmitter Calculations

The MPE calculations for standalone transmitters at a separation distance of 20cm are shown in Table 3 per the transmit power and antenna gain values declared in Table 1.

For frequency dependent limits, the lowest transmitter frequency was used to represent the lowest MPE limit (e.g. 824MHz = 0.549 mW/cm2.

Table 3 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	32.98	1.986	4.00	0.25	30.96	1.25	0.248	0.549
CDMA2000	824	24.91	0.310	4.00	1.00	28.91	0.78	0.155	0.549
UMTS	824	24.42	0.277	4.00	1.00	28.42	0.70	0.138	0.549
GPRS 2 UL	1850	29.47	0.885	3.50	0.25	26.95	0.50	0.099	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	3.00	1.00	32.00	1.58	0.315	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	5725	29.00	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 then 1.

Table 4 WWAN 850 MHz Collocation

WLAN Band	(WLAN Pd) / (MPE Limit)	(WWAN 850 MHz) / MPE Limit)	(850 MHz WWAN fraction) + (WLAN fraction)	Limit	Pass/Fail
2.4 GHz	0.315	0.452	0.767	1	Pass
5.1 GHz	0.500	0.452	0.951	1	Pass
5.2 GHz	0.500	0.452	0.951	1	Pass
5.5 GHz	0.500	0.452	0.951	1	Pass
5.8 GHz	0.500	0.452	0.951	1	Pass

Table 5 WWAN 1900 MHz Collocation Power Density

WLAN Band	(WLAN Pd) / (MPE Limit)	(WWAN 1900 MHz) / MPE Limit)	(1900 MHz WWAN fraction) + (WLAN fraction)	Limit	Pass/Fail
2.4 GHz	0.315	0.129	0.444	1	Pass
5.1 GHz	0.500	0.129	0.628	1	Pass
5.2 GHz	0.500	0.129	0.628	1	Pass
5.5 GHz	0.500	0.129	0.628	1	Pass
5.8 GHz	0.500	0.129	0.628	1	Pass

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