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Gobi2000™ Module Installation and Collocation Guidelines for HP Notebook Host Devices

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Gobi2000™ Module Installation and Collocation Guidelines for HP Notebook Host Devices

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Gobi2000^{TM} Module Installation and Collocation Guidelines for HP Notebook Host Devices

1   Introduction

This document provides module and antenna installation guidelines for notebook computers to be authorized for use with the Gobi2000^{TM} module through a FCC Class I Permissive Change process in accordance with the Supplement Note of FCC KDB 616217. The following installation host configurations are addressed in this document.

1) The Gobi2000 module can be installed as a standalone transmitter in notebooks meeting the following conditions:
   a. Mobile notebooks where >20cm separation distance is provided between the WWAN antenna and the end user.
   b. Portable notebooks that meet the technical parameters defined in Section 2. These parameters define the conservative notebook configuration used as the baseline host to evaluate SAR.
2) Allow collocated transmission with the Gobi2000 module host devices approved under FCC ID J9CGOBI2000-H through a Class I permissive change process. The collocated transmitters must meet the technical requirements defined in Section 2.
3) Allow end-user installation provided module/notebook Two-Way Authentication has been addressed so that modules can only be activated in approved notebooks.

Other configurations not specifically described in this document may be authorized in a Class I permissive changes through coordination with QUALCOMM Incorporated to verify that all technical requirements defined in Supplement Note of FCC KDB 616217 or other relevant FCC specifications are adequately addressed.

The installation guidelines are applicable <u>only</u> for notebook computers where WWAN and collocated antennas are located in the display portion of a notebook computer where SAR evaluation is completed with the display open at a ninety degree angle as defined in KDB 616217 and Section 4 of KDB 447498.

These installation guidelines are not applicable non-notebook host devices or tablet PCs. Any collocated transmitter or antenna that does not meet the technical requirements defined in this document requires a Class II permissive change to authorize simultaneous transmission.

2   Module Installation Guidelines

This section defines host installation limitations for mobile and portable hosts. Supporting RF exposure information is located in Section 3.

2.1   Host Installation Guidelines

2.1.1   Label Requirements

The FCC and Industry Canada IDs must be permanently affixed on the exterior of the notebook or readily accessible under a panel or battery pack of the host device that cannot be separated from the host device itself.

2.1.2   Mobile Hosts (WWAN to user separation distance ≥20cm)

The Gobi2000 module can be installed for use in any authenticated mobile host device. The maximum WWAN conducted power and antenna gain is listed in Table 1.

Table 1

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

2.1.3   Portable Hosts (WWAN to user separation distance <20cm)

The Gobi2000 module can be installed for use in a portable host device with the WWAN antenna limitations defined in Table 2.

2.1.4   End User Installation

Two-way authentication documentation has been submitted as part of a Class II permissive change allowing end-user installation into HP notebooks that utilize the method of authentication.

2.2   Collocated Installation Guidelines

Collocated transmitters can be operated simultaneously with the Gobi2000 module, provided the technical parameters listed in Table 2 are maintained and the information specified in Section 3 is on file as part of a Class I permissive change. A Class II permissive change is required if the host device does not meet the requirements specified in Table 2 and in section 5.

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Table 2 Host Device Limitations

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Parameter	Requirement	RF Exposure Justification
Device type	Notebook	
Display size	Any	
WWAN Antenna locations	Display	
Exterior Display Material	(Non metal)	
WWAN module location	Anywhere	
Minimum WWAN to User Distance	7.0 cm	Section 4
Maximum WWAN SAR	0.371 mW/g	Section 4
Maximum RF coaxial cable loss	3dB	Section 4
Portable Collocated Transmitter Condition	SAR < 1.4mW/g (1gram)	Section 5.2 or Section 5.4
Mobile Collocated Transmitter Condition	0.875 mW/cm^2	Section 5.3 or Section 5.4
Mobile Collocated antenna gain (mobile WWAN)	TBD based on conducted power and maximum MPE	Section 5.3
Mobile Collocated antenna gain (Portable WWAN)	5 dBi	Section 5.1
Distance to external card slots	>5cm	N/A

Other devices may be approved as collocated transmitters, provided the technical requirements of KDB 616217 are satisfied.

3   Class I Permissive Change Documentation Requirements

The following documentation must be kept on file to allow simultaneous transmission as part of a Class I permissive change. A Class II permissive change is required if the technical requirements of KDB 616217 cannot be met.

- List of all collocated transmitters with FCC and IC IDs
- Verification that all WWAN and WLAN antennas are >5cm from external USB, PCMCIA or other notebook I/O ports that support an external plug-in transmitter.
- Drawings showing antenna locations and separation distances
- Antenna types with respective dimensions and far field antenna gains
- Specific module to antenna RF coaxial cable losses
- RF exposure analyses demonstrating compliance with Section 4 of KDB 616217 as shown below

For each simultaneous transmission configuration identified in (1) above, if the conditions in (a) or (b) below are satisfied and fully documented in the SAR report or Class I permissive change documentation, simultaneous transmission SAR evaluation is not required for that configuration[11]

a.   when the $[(\sum$ of the highest measured 1-g SAR for each portable transmitter/antenna included in the simultaneous transmission configuration $) / 1.6$ W/kg$] + \sum$ of $[($the highest MPE for each mobile transmitter/antenna included in the simultaneous transmission configuration$) / ($the corresponding MPE limit$)] < 1$; or

b.   for antennas included in the simultaneous transmitting configuration that require SAR evaluation, when the separation distance between each antenna pair is

  i.   greater than $5 \cdot [(SAR_1 + SAR_2) / 1.6]^{1.5}$ cm, rounded to the nearest cm, and

  ii.   the $\sum$ of $[($the highest MPE for each mobile transmitter/antenna included in the simultaneous transmission configuration$) / ($the corresponding MPE limit$)] < 1$

where: $\sum$ in a. above excludes antennas that do not require SAR evaluation, and

  MPE does not apply to displays < 10" diagonal for both a. and b. above

4 Individual WWAN SAR Evaluation

Portable RF exposure evaluation has been completed based on SAR measurements on a notebook computer that provided 7.0 cm of separation distance between the edge of the WWAN antenna and the end user is maintained with the display orientated at 90 degrees as illustrated in Figure 1. The measured 1-g SAR for the WWAN configuration was 0.371 mW/g (1g) as reported in the Class II Permissive Change filed in November of 2009.

To provide a conservative analysis and flexibility in the cable loss of host products, the individual SAR results have been scaled up by 3dB to include margin for a host device that may have less cable loss resulting in a higher conducted transmitter power delivered to the antenna. The 3dB factory is very conservative as the cable loss between the antenna and module is much less than 3dB.   For this reason, the measured WWAN SAR is scaled up 3dB to a value of 0.742 mW/g (1g) to be the declared maximum SAR for the conservative host and for use in the collocated analysis calculations.

Figure 1-1 Antenna Locations
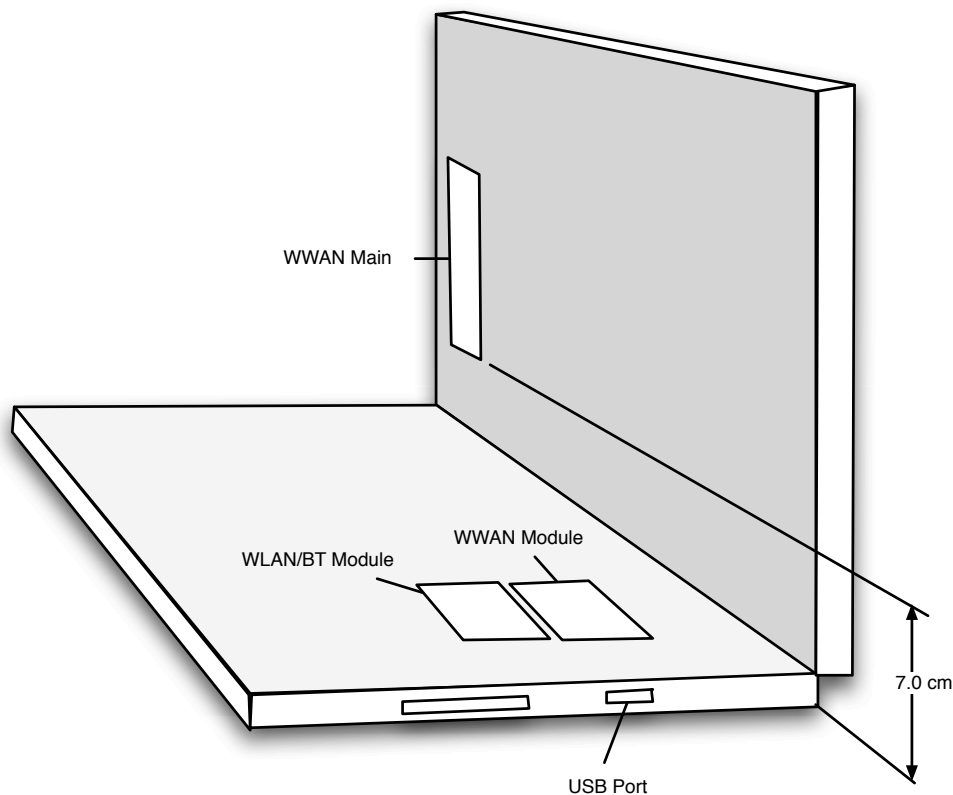
5   Simultaneous RF Exposure Evaluation Guidelines For Collocated Transmitters Allowable through a Class I Permissive change

5.1   Mobile Hosts

The power density calculations for standalone transmitters at an exposure separation distance of 20 cm are shown Table 3 with the declared transmit power and antenna gain values. The calculations are based on a cable loss of 0 dBi. The collocated transmitter values represent worst-case transmit power and antenna gains allowable for use with the Gobi2000 module.

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.

Per OET 65, when RF sources have different frequencies, the fraction of the FCC power density limit shall be determined and the sum of all fractional components shall be less than 1. The fractional MPE calculation is also addressed in Supplement Note 1 of FCC KDB 616217.

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	32.8	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

Table 4 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 5 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

5.2   Portable Hosts: Sum of Total SAR < SAR Limit

A portable collocated transmitter can be operated simultaneously with the WWAN transmitter provided the individual SAR results for the portable collocated transmitter are less than the value specified below. The maximum individual SAR value is based on an adjusted WWAN 1-g SAR of 0.742 mW/g.

$$\frac{SAR_{WWAN}}{1.6} + \frac{SAR_{collocated}}{1.6} \leq 1$$

$$SAR_{collocated} \leq 1.6 - SAR_{WWAN}$$

$$SAR_{collocated} \leq 0.858 mW/g$$

5.3   Portable Hosts Sum of WWAN SAR + Collocated MPE <1

For mobile collocated transmitters operating greater than 1 GHz, mobile collocated transmitter can be operated simultaneously with the portable WWAN transmitter, provided the individual MPE results for the mobile collocated transmitter are less than the value specified below. The maximum individual SAR value is based on an adjusted WWAN 1-g SAR of 0.742 mW/g.

$$\frac{SAR_{WWAN}}{1.6} + \frac{MPE_{collocated}}{1} \leq 1$$

$$MPE_{collocated} \leq 1 - \frac{SAR_{WWAN}}{1.6}$$

$$MPE_{collocated} \leq 0.536 mW/cm^2$$

5.4   Portable Hosts Max Collocated SAR Vs. Distance

If the summation of SAR exceeds the FCC limit, collocation is permitted through a Class I permissive change provided the minimum allowable separation distance derived from the equation below is satisfied. An alternate equation provides the maximum collocated SAR based on a specified separation distance. In addition, the sum of the highest MPE must be less than the corresponding MPE limit as defined in section 4. B)ii) of the Supplemental note of KDB 616217.

5.4.1   Minimum separation distance for Collocated Transmitters

$$5 * ([\frac{SAR_{WWAN} + SAR_{collocated}}{1.6}]^{1.5}) \leq Ant\_Separation_{WWAN-to-Collocated}$$

5.4.2   Maximum collocated SAR vs distance

$$5 * ([\frac{SAR_{WWAN} + SAR_{collocated}}{1.6}]^{1.5}) \leq Ant\_Separation_{WWAN-to-Collocated}$$

$$SAR_{collocated} = 1.6 * (\frac{Separation_{WWAN-to-Collocated}}{1.5})^{\frac{2}{3}} - SAR_{WWAN}$$

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