

MPE Evaluation for Fujitsu Notebook Computers

13th March 2012

1. Introduction

Fujitsu seeks approval for use of the Sierra Wireless module listed under **FCC ID: N7NMC8355** for use in a co-located mobile configuration. This Maximum Permissible Exposure (“MPE”) report demonstrates compliance for the Sierra Wireless module with 47 CFR §1.1310 and 2.1091 for standalone and collocated simultaneous transmission in mobile exposure conditions. This MPE analysis is valid for the transmitters operating within the **Product Declaration** parameters defined below.

Any collocated transmitter must have a valid FCC ID documenting equivalent or degraded RF characteristics with the collocated parameters defined in this MPE analysis.

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

The WWAN MPE calculations in the filing are based on conservative conducted transmit power exceeding those listed in the FCC ID: N7NMC8355 filing and the maximum allowable antenna gains per relevant grant notes. The higher transmit power levels are used to present a worst case assessment. Portable user conditions or additional collocated modules are not permitted based on this RF exposure analysis, and will require a Class II permissive change including updated MPE or SAR report.

2. Product Declarations

Table 1 summarizes typical transmitter parameters associated with this FCC ID. Antenna gain is original design specification.

Table 1 WWAN Transmitter Declarations

Mode	Equipment Category	Max Transmitter Duty Cycle	Band Name	Available in U.S.	Transmitter Range (MHz)	Maximum Conducted Power		Max Antenna Gain (dBi)
						(dBm)	(W)	
GPRS/EDGE	GPRS/EDGE Cat 10 (Max 2 UL TX Slots)	25%	850 MHz - US Cellular	Yes	824-849	33.00	2.01	4.00
			900 MHz - EGSM	No	880-915	33.00	2.01	4.00
			1800 MHz - DCS	No	1710-1785	30.00	1.00	3.50
			1900 MHz - US PCS	Yes	1850-1910	30.00	1.00	3.50
WCDMA/HSPA	R7 HSDPA Cat 10 R6 HSUPA Cat 6	100%	Band 1 2.1 GHz	No	1920-1980	25.00	0.316	3.50
			Band 2 1900 MHz	Yes	1850-1910	25.00	0.316	3.50
			Band 4 1700 MHz – AWS	Yes	1710-1755	25.00	0.316	3.50
			Band 5 850 MHz	Yes	824-849	25.00	0.316	4.00
			Band 6 800 MHz (Japan)	No	830-840	25.00	0.316	4.00
			Band 8 900 MHz	No	880-915	25.00	0.316	4.00
CDMA2000	1x EVDO Release 0 EVDO Revision A	100%	BC0 850 MHz	Yes	824-849	25.00	0.316	4.00
			BC1 1900 MHz	Yes	1850-1910	25.00	0.316	3.50
			BC6 2100 MHz – IMT	No	1920-1980	25.00	0.316	3.50
			BC15 1700 – AWS	Yes	1710.1755	25.00	0.316	3.50

This MPE analysis is applicable to the co-located transmitters listed in Table 2. Specific FCC IDs for devices other than those listed are not included with this analysis. A 100% duty cycle is used for calculations to present a worst-case analysis.

Table 2 Co-located WLAN transmitters

Frequency Band	Intel PD92200BNH	Intel PD962205ANH
2400~2483.5 MHz	0.1 W	0.117 W
5150~5250 MHz		0.032 W
5250~5350 MHz		0.029 W
5470~5725 MHz		0.033 W
5725~5850 MHz		0.120 W

The co-located Bluetooth module, FCC ID: QDS-BRCM1043, has output power below the low threshold of 60/f and is, therefore, excluded from the calculations as its contribution to the MPE at 20cm form the device would be negligible.

3. Transmitter Summary

The WWAN modes of operation listed reflect N7NMC8355 parameters associated with this module. Integration of a WLAN module that exceeds the parameters requires a new FCC authorization or permissive change application.

FCC ID:	Original Grant Date	Maximum Conducted RF Power		Maximum Declared Antenna Gain across Fujitsu Notebooks	
		850 MHz	1900 MHz	850 MHz	1700/1900 MHz
N7NMC8355	8-24-2010	2.01 W	1.199 W	1.19 dBi	+2.73 dBi

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).

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

Classic 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

The **power density calculations** for standalone transmitters at an exposure separation distance of 20 cm are shown below.

Module	WLAN	WLAN PD962205ANH			
Mode	PD92200BNH				
Frequency (MHz)	2412	2400 MHz	5150-5350 MHz	5470-5725 MHz	5725-5850 MHz
Output power (dBm)	20	20.7	15.1	15.2	20.8
Gain (dBi)	2.18	2.18	3.31	3.31	3.31
Duty Cycle	1	1	1	1	1
EIRP (mW) (RF exposure)	165	193	69	71	257
Distance (cm)	20	20	20	20	20
Power density (mW/cm ²)	0.03	0.04	0.01	0.01	0.05
Limit	1.00	1.00	1.00	1.00	1.00
% of limit	3.3%	3.8%	1.4%	1.4%	5.1%

Antenna gains listed are the highest gains across all platforms covered by this C2PC.

Module	WWAN N7NMC8355 Module				
Mode	GPRS/EDGE	CDMA/WCDMA	WCDMA	GPRS/EDGE	CDMA/WCDMA
Frequency (MHz)	836	836	1732	1880	1880
Output power (dBm)	33	25	25	30	25
Gain (dBi)	1.19	1.19	2.73	2.73	2.73
Duty Cycle	0.25	1	1	0.25	1
EIRP (mW) (RF exposure)	656	416	593	469	593
Distance (cm)	20	20	20	20	20
Power density (mW/cm ²)	0.13	0.08	0.12	0.09	0.12
Limit	0.56	0.56	1.00	1.00	1.00
% of limit	23.4%	14.8%	11.8%	9.3%	11.8%

Maximum 'worst case' co-located power density levels at 20cm expressed as a percentage of the limits for rf exposure are 5.1% for the WLAN modules and 23.4% for the WWAN module. The combined value for power density represents 28.5% of the limit.