

IEM6270 FCC MPE Evaluation

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Revision history

Revision	Date	Description
A	July 2011	Initial release

1 Internal Photos

1.1 Introduction

This Maximum Permissive Exposure ("MPE") report demonstrates compliance for the IEM6270 GSM/GPRS/EDGE/UMTS/HSDPA module with FCC CFR 47 §1.1310 and 2.1091 for standalone and collocated simultaneous transmission in mobile exposure conditions. The MPE analysis is valid for transmitters operating within the parameters defined in Table 2 used for analysis.

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 the nominal WWAN conducted transmit power level defined in the FCC/IC filing and declared maximum allowable antenna gains to comply with maximum radiated transmit power levels or collocated transmitter operations.

Portable user conditions or additional collocated modules not allowed based on this RF exposure analysis require a Class II permissive change and updated MPE or SAR report.

1.2 Collocated Transmitters

This MPE analysis is applicable to any collocated transmitters within the frequency and EIRP parameters used in the MPE calculations in sections 3 and 5.2. Specific FCC IDs for those devices are not necessary or identified in this analysis providing they are classified as mobile transmitters.

2 Transmitter Summary

Table summarizes transmitter parameters associated with this application.

The WWAN modes of operation reflect the IEM6270 module parameters while the unlicensed transmit power and antenna gain parameters represent a maximum transmit power for a given frequency band.

Integration of a collocated transmitter that exceeds the parameters in Table 1 requires a new FCC authorization or permissive change application.

Technology	Frequency (MHz)	Maximum Conducted Power (dBm)	Conducted Power (W)	Maximum Antenna Gain (dBi)	Duty Cycle	Peak EIRP (dBm)	Peak EIRP (W)	ERP (W)
GPRS 2 UL	824	33.0	2.00	5.00	0.25	38.00	6.31	3.82
UMTS	824	24.0	0.25	5.00	1.00	29.00	0.79	0.48
GPRS 2 UL	1850	30.0	1.00	3.00	0.25	33.00	2.00	1.21
UMTS	1850	24.00	0.25	3.00	1.00	27.00	0.50	0.30
Any	400-800				1.00	27	0.5	0.3
Any	800-1000				1.00	29	0.79	0.48
Any	>1000				1.00	33.00	2.00	1.21

Table 1 WWAN and WLAN Declared Transmitter Parameters

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).

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Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Power Density Strength (A/m) (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		

	Table 1	Limits	for Maximum	Permissible	Exposure (MPE)
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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)

Table 2 shows duty cycles for typical technologies.

Table 2 Technology Duty	Cycles for MPE Calculations
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Technology	Duty Cycle
WCDMA	100%
GSM	12.5%
GPRS Cat 10 (2 Uplink Transmit Slots)	25.0%

4 MPE Calculations

4.1 Stand Alone Transmitter Calculations

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

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

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

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/c m^2)
GPRS 2 UL	824	33.0	2.00	5.00	0.25	31.98	1.58	0.314	0.549
UMTS	824	24.0	0.25	5.00	1.00	29.00	0.79	0.158	0.549
GPRS 2 UL	1850	30.0	1.00	3.00	0.25	26.98	0.50	0.099	1.000
UMTS	1850	24.00	0.25	3.00	1.00	27.00	0.50	0.100	1.000
Any	400					27.00	0.50	0.100	0.267
Any	800					30.00	0.79	0.158	0.533
Any	>1GHz					33.00	2.00	0.397	1.000

Table 3 WWAN and WLAN Standalone MPE Calculations

4.2 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.

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
400 to 800 MHz	0.100	0.267	0.374	0.314	0.549	0.571	0.945	1	Pass
800 to 1000 MHz	0.158	0.533	0.296	0.314	0.549	0.571	0.868	1	Pass
>1GHz	0.397	1.000	0.397	0.314	0.549	0.571	0.968	1	Pass

Table 4 WWAN 850 MHz Collocation Power Density

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
400 to 800 MHz	0.100	0.267	0.374	0.100	1.000	0.100	0.474	1	Pass
800 to 1000 MHz	0.158	0.533	0.296	0.100	1.000	0.100	0.396	1	Pass
>1GHz	0.397	1.000	0.397	0.100	1.000	0.100	0.497	1	Pass