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# Report On

RF Exposure Estimation of the  
Shanghai SAND Information Technology System Co.,Ltd  
GSM/GPRS EFT-POS PS400

COMMERCIAL-IN-CONFIDENCE

FCC ID: XLHPS400

Document 57008081 Report 03 Issue 1

August 2009



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**LI Qun**  
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**DATED**

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18 August 2009



## RF Exposure Measurement

### 1 Introduction

This document was prepared to analyze the expected level of Non-Ionizing Electromagnetic Radiation ("NIER") caused by the radio transmission equipment GSM/GPRS EFT-POS PS400 belonging to Shanghai SAND Information Technology System Co.,Ltd.

### 2 Limits and Guidelines on Maximum Permissible Exposure (MPE)

Based on Section Part 1.1037(b) requirement for environmental impact of human exposure to radio-frequency (RF) radiation, following limits table specified in Part 1.1310 was used to evaluate the MPE for the equipment GSM/GPRS EFT-POS PS400 belonging to Shanghai SAND Information Technology System Co.,Ltd.

**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> )	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1824/f	4.89/f	*(900/ f <sup>2</sup> )	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/Uncontrolled Exposures				
0.3-1.34	614	1.63	*(100)	30
1.34-30	1824/f	4.89/f	*(180/ f <sup>2</sup> )	30
30-300	27.5	0.163	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30

f = frequency in MHz

\*Plane-wave equivalent power density

NOTE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

### 3 Calculation of Output Power threshold for GSM/GPRS EFT-POS PS400

Below method describes a theoretical approach to calculate the power density based on a typical configuration of the Shanghai SAND Information Technology System Co.,Ltd GSM/GPRS EFT-POS PS400.

In accordance with 47CFR FCC Part 2.1091, the product was defined as a mobile device where a distance of 20cm normally can be maintained between the user and product. .

#### 3.1 Typical Configuration of the GSM/GPRS EFT-POS PS400

The GSM/GPRS EFT-POS PS400 supports frequency bands of GSM 824 – 849 MHz and GSM 1850 – 1910 MHz.

#### 3.2 Antennas and Technical Description of GSM/GPRS EFT-POS PS400

Max. output power at antenna connector(dBm)	Operation Mode	CH Bottom (824.2MHz)	CH Middle (836.4MHz)	CH Top (848.8MHz)
	GSM 850	31.89	31.90	31.95
	GPRS 850	31.89	31.90	31.95
Transmitter frequency band	824 – 849 MHz			
Number of antenna ports	1			
External antenna gain	0.57dBi			

Max. output power at antenna connector(dBm)	PCS 1900	CH Bottom (1850.2MHz)	CH Middle (1880.0MHz)	CH Top (1909.8MHz)
	GSM 1900	28.94	28.54	28.32
	GPRS 1900	28.93	28.52	28.29
Transmitter frequency band	1850 – 1910 MHz			
Number of antenna ports	1			
External antenna gain	0.57dBi			

#### 3.3 Estimation of Maximum Permissible Exposure

Assuming the worst case of an isotropic radiator, the power density for given radiated power and distance can be calculated from following formula:

$$S = P \cdot G / (4 \pi r^2)$$

Whereas:

S= Power density in mW/cm<sup>2</sup>

P= input power to the antenna in mW

G=antenna gain relative to an isotropic antenna

r=distance from the antenna to the point of investigation

The antenna of this product, under normal use condition, is at least 20cm away from the body of the user. Warning statement to the user for keeping at least 20cm or more separation distance with the antenna was included in the user manual from manufacturer.

### 3.4 Calculation result:

#### For GSM 850 Mode

Channel Frequency (MHz)	P (dBm)	Power density S (mW/cm <sup>2</sup> )	Limit of Power density S (mW/cm <sup>2</sup> )
824.2	31.89	0.176	0.549
836.4	31.90	0.176	0.558
848.8	31.95	0.178	0.566

#### For GPRS 850 Mode

Channel Frequency (MHz)	P (dBm)	Power density S (mW/cm <sup>2</sup> )	Limit of Power density S (mW/cm <sup>2</sup> )
824.2	31.89	0.176	0.549
836.4	31.90	0.176	0.558
848.8	31.95	0.178	0.566

#### For GPRS 1900 Mode

Channel Frequency (MHz)	P (dBm)	Power density S (mW/cm <sup>2</sup> )	Limit of Power density S (mW/cm <sup>2</sup> )
1850.2	28.94	0.089	1.0
1880.0	28.54	0.081	1.0
1909.8	28.32	0.077	1.0

#### For GPRS 1900 Mode

Channel Frequency (MHz)	P (dBm)	Power density S (mW/cm <sup>2</sup> )	Limit of Power density S (mW/cm <sup>2</sup> )
1850.2	28.93	0.089	1.0
1880.0	28.52	0.081	1.0
1909.8	28.29	0.076	1.0

As shown in above tables, the power density of GSM/GPRS EFT-POS PS400 on operating channel under different modulation type is well below the limits.

### 3.5 Uncertainty of Calculation

Above calculations do not consider possible reflections from the ground, neighbouring buildings or other obstacles. Furthermore above calculations are assuming that the transceiver is operating at full power.