

FCC RF Exposure Evaluation

1 Reference Documents

1.1 Applicable Limit Regulations

ANSI C95.1-1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

1.2 Applicable Measurement Standards

FCC KDB publication 447498 D01 General 1 RF Exposure Guidance v06: RF EXPOSURE PROCEDURES AND EQUIPMENT AUTHORIZATION POLICIES FOR MOBILE AND PORTABLE DEVICES

FCC CFR 47 part1 1.1310: Radiofrequency radiation exposure limits.

FCC CFR 47 part2 2.1091: Radiofrequency radiation exposure evaluation: mobile devices.

2 RF Exposure Limit

Limits for General Population/Uncontrolled Exposure in §1.1310

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f ²)*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30

f = frequency in MHz *Plane-wave equivalent power density

3 Friis Formula

Friis transmission formula : $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot r^2)$ where

Pd = power density in **W/m²**

Pout = output power to antenna in **W**

G = gain of antenna in linear scale

Pi = 3.1416

R = distance between observation point and center of the radiator in **m**

Pd is the limit of MPE. If we know the maximum Gain of the antenna and the total power input to the antenna, through the calculation, we will know the MPE value at distance 20cm.

4 Classification

The antenna of this product, under normal use condition, is at least 20cm away from the body of the user. So, this device is classified as Mobile Device.

5 Test Results

5.1 The maximum antenna gain

The maximum antenna gain for external antenna is GSM

GSM850/WCDMA Band V: 1.1dBi

PCS1900/WCDMA Band II: 0.2dBi

5.2 Output Power Into Antenna & RF Exposure value at distance 20cm

Conducted Output power calculation:

The conducted power calculation results for GSM turn-up

mode	timeslot	Duty cycle	Max.Peak Output Power(dBm)	Average Output Power(dBm)
GSM 850	1 slot	12.5%	35(33+2)	26
GSM 1900	1 slot	12.5%	32(30+2)	23

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

The conducted power measurement results for WCDMA turn-up

Mode	Max.Average Output Power(dBm)
UMTS Band 2	25
UMTS Band 5	25

So the worst cases for each frequency band are:

Frequency band	Average Output Power Including power tolerance (dBm)	Average Output Power Including power tolerance (mW)	Antenna gain (dBi)	Antenna gain (numeric)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)	PASS /FAIL
GSM 850	26	398.11	1.1	1.29	0.10	0.57	PASS
GSM 1900	23	199.53	0.2	1.05	0.04	1.00	PASS
WCDMA 850	25	316.23	1.1	1.29	0.08	0.57	PASS
WCDMA 1900	25	316.23	0.2	1.05	0.07	1.00	PASS