

RF Exposure Measurement (Mobile Device–Mini PCI Card)

1. Introduction

The maximum Gain measured in Fully Anechoic Chamber is 4.33dBi or 2.710 (numeric).

2.4GHz frequency band is regarded specially as a dangerous band for its heating harmfulness to the human body. That's why microwave oven is operating in this frequency band. The manufacturer whose product is working in this frequency band is obligatory to prove the harmfulness of his product.

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed.

The Gain of the antenna used in this product is measured in a Fully Anechoic Chamber (FAC), and the maximum total power input to the antenna is measured. Through the Friis transmission formula

2. Classification

MODE: CCK & OFDM

The antenna of the product, under normal use condition, is at least 20cm away from the body of the user. Warning statement for keeping 20cm separation distance and the prohibition of operating next to a person has been printed on the user's manual. So, this product is classified as the Mobile Device.

3. RF Exposure Limit

According to FCC 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).

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE) – Class A

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Average Time (minutes)
30 – 300	61.4	0.163	1.0	6
300 – 1500			F/300	6
1500 – 100,000			5	6

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE) – Class B

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Average Time (minutes)
30 – 300	27.5	0.073	0.2	30
300 – 1500			F/1500	30
1500 – 100,000			1.0	30

F = Frequency in MHz

4. Friis Formula

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

The maximum Gain measured in Fully Anechoic Chamber is 4.33dBi or 2.710 (numeric).

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

$\pi = 3.1416$

MODE: CCK & OFDM

P_d is the limit of MPE, $1\text{mW}/\text{cm}^2$. If we know the maximum Gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

The software provided by Manufacturer enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

6. Test Results

6.1 Antenna Gain

The maximum Gain measured in Fully Anechoic Chamber is 4.33dBi or 2.710 (numeric).

6.2 Output Power into Antenna & RF Exposure value at distance 20cm:

MODE: CCK (802.11b)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	75.858	0.04090	1.0
6	2437	79.433	0.04283	1.0
11	2462	74.131	0.03997	1.0

MODE: OFDM(802.11g)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	77.625	0.04185	1.0
6	2437	75.858	0.04090	1.0
11	2462	72.444	0.03906	1.0

MODE: OFDM(802.11a)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5180	46.132	0.02487	1.0
8	5320	47.098	0.02539	1.0
12	5805	45.394	0.02447	1.0

The minimum allowable distance is very close to the enclosure of the antenna and is very far away from the human being under normal use condition.