

**FCC ID: O6M2000I**

**731 confirmation number:**

## **RF Exposure Measurement**

### **1. Introduction**

2.4 GHz 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. 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 total power input to the antenna is measured by power meter. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

### **2. 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)**

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Average Time (minutes)
<b>(A)Limits For Occupational / Control Exposures</b>				
300-1500	...	...	F/300	6
1500-100,000	...	...	5	6
<b>(B)Limits For General Population / Uncontrolled Exposure</b>				
300-1500	...	...	F/1500	6
1500-100,000	...	...	1.0	30

F = Frequency in MHz

### **3. Friis Formula**

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

where

$P_d$  = power density in mW/cm<sup>2</sup>

$P_{out}$  = output power to antenna in mW

$G$  = gain of antenna in linear scale

$\pi = 3.1416$

$R$  = distance between observation point and center of the radiator in cm

The limit of MPE here is 1.0 mW/cm<sup>2</sup> which makes  $P_d=1.0$ . If the Gain of the antenna and the total output power to the antenna  $P_{out}$  is known, then the Allowance Minimum Distance  $r$  can be calculated.

Ref. : David K. Cheng, *Field and Wave Electromagnetics*, Second Edition,  
Page 640, Eq. (11-133).

### **4 EUT Operating condition**

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

### **5 Climate Condition**

The temperature and related humidity: 20 °C and 78% RH

## Test Result

### Output Power Into Antenna:

The maximum Gain measured in Fully Anechoic Chamber is - 4dBi or 0.4 in linear scale.

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (dBm)	PASS/FAIL
1	2412	13.80	30	PASS
6	2437	14.84	30	PASS
11	2462	15.48	30	PASS

### RF Exposure Distance Limits :

CHANNEL	CHANNEL FREQUENCY (MHz)	OUTPUT POWER TO ANTENNA (mW)	MINIMUM ALLOWABLE DISTANCE ( r ) (Centi-Meter)
1	2412	23.9	0.87
6	2437	30.5	0.98
11	2462	35.3	1.13

The distance r (4<sup>th</sup> column) calculated from the Friis transmission formula is far more shorter than 20 cm separation requirement. So, RF exposure limit warning or SAR test are not required.