# RF EXPOSURE REPORT

**REPORT NO. :** SA940120A01
**MODEL NO. :** R15D

**ACCORDING :** FCC Guidelines for Human Exposure
IEEE C95.1

**APPLICANT :** TWINHEAD INTERNATIONAL CORP.

**ADDRESS :** 10F, No. 550, Rueiguang Rd., Neihu Chiu, Taipei, Taiwan 114, R.O.C.

**ISSUED BY :** Advance Data Technology Corporation

**LAB ADDRESS :** No. 47, 14th Ling, Chia Pau Tsuen, Lin Kou Hsiang 224, Taipei Hsien, Taiwan, R.O.C.

# RF Exposure Measurement (Mobile Device)

## 1. Introduction

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) calibrated for antenna measurement in ADT, and also the maximum total power input to the antenna is measured. 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.

Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

## 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 ($mW/cm^2$) | Average Time (minutes) |
|---|---|---|---|---|
| **(A)Limits For Occupational / Control Exposures** | | | | |
| 300-1500 | … | … | F/300 | 6 |
| 1500-100,000 | … | … | 5 | 6 |
| **(B)Limits For General Population / Uncontrolled Exposure** | | | | |
| 300-1500 | … | … | F/1500 | 6 |
| 1500-100,000 | … | … | 1.0 | 30 |

F = Frequency in MHz

## 3. Friis Formula

Friis transmission formula : Pd = (Pout*G) / (4*pi*$r^2$)

where
Pd = power density in mW/$cm^2$
Pout = 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

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 r.

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

## 4. EUT Operating condition

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

## 5. Classification

The antenna of the product, under normal use condition, is at least 20cm away from the body of the user. Warming 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.

## 6. Test Results

### 6.1 Antenna Gain

2.4GHz:
The maximum Gain measured in Fully Anechoic Chamber is 2.27dBi (= 1.69 numeric).

5.150 ~ 5.350GHz:
The maximum Gain measured in Fully Anechoic Chamber is –2.35dBi (= 0.58 numeric).

5.725 ~ 5.850GHz:
The maximum Gain measured in Fully Anechoic Chamber is –1.31dBi (= 0.74 numeric).

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

For 802.11b (2.412 ~ 2.462GHz):

| Channel | Channel Frequency (MHz) | Output Power to Antenna (mW) | Power Density ($mW/cm^2$) | Limit of Power Density ($mW/cm^2$) |
|---|---|---|---|---|
| 1 | 2412 | 40.365 | 0.014 | 1 |
| 6 | 2437 | 39.537 | 0.013 | 1 |
| 11 | 2462 | 39.994 | 0.013 | 1 |

For 802.11g (2.412 ~ 2.462GHz):

| Channel | Channel Frequency (MHz) | Output Power to Antenna (mW) | Power Density ($mW/cm^2$) | Limit of Power Density ($mW/cm^2$) |
|---|---|---|---|---|
| 1 | 2412 | 25.119 | 0.008 | 1 |
| 6 | 2437 | 25.235 | 0.008 | 1 |
| 11 | 2462 | 25.293 | 0.008 | 1 |

For 802.11a (5.150 ~ 5.350GHz):

| Channel | Channel Frequency (MHz) | Output Power to Antenna (mW) | Power Density ($mW/cm^2$) | Limit of Power Density ($mW/cm^2$) |
|---|---|---|---|---|
| 1 | 5180 | 10.116 | 0.001 | 1 |
| 4 | 5240 | 11.041 | 0.001 | 1 |
| 5 | 5260 | 26.062 | 0.003 | 1 |
| 8 | 5320 | 24.491 | 0.003 | 1 |

For 802.11a (5.725 ~ 5.850GHz):

| Channel | Channel Frequency (MHz) | Output Power to Antenna (mW) | Power Density ($mW/cm^2$) | Limit of Power Density ($mW/cm^2$) |
|---|---|---|---|---|
| 1 | 5745 | 25.003 | 0.004 | 1 |
| 3 | 5785 | 24.946 | 0.004 | 1 |
| 5 | 5825 | 24.889 | 0.004 | 1 |