RF EXPOSURE REPORT

REPORT NO.: SA940418L08
MODEL NO.: P-780

ACCORDING: FCC Guidelines for Human Exposure
IEEE C95.1

APPLICANT: Gemtek Technology Co., Ltd.

ADDRESS: No.1, Jen Ai Road, Hsinchu lndustrial Park, Hukou Hsinchu, Taiwan, R.O.C. 303

ISSUED BY: Advance Data Technology Corporation

LAB ADDRESS: No. 47, 14th Ling, Chia Pau Tsuen, Lin Kou Hsiang 244, Taipei Hsien, Taiwan, R.O.C.

TEST LOCATION: No. 19, Hwa Ya 2nd Rd., Wen Hwa Tsuen, Kwei Shan Hsiang, Taoyuan Hsien 333, 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

This device is not fixed inside the host equipment, it is connected with host through wire. So it is easy to be re-located in the place where at least 20cm far away from the body of the user. Warning statement to the user for keeping at least 20cm or more separation distance with the antenna should be included in users manual. So, this device is classified as **Mobile Device**.

6. Test Results

6.1 Antenna Gain

The maximum Gain measured in Fully Anechoic Chamber is 4.5and 8dBi or 2.818 and 6.3096 (numeric) (for 2.4GHz), 7dBi and 8dBi or 5.012 and 6.3096 (numeric)(for 5GHz).

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

For Antenna gain: 4.5dBi

802.11b DSSS modulation

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	2412	28.314	0.016	1.0
6	2437	28.576	0.016	1.0
11	2462	28.249	0.016	1.0

802.11g OFDM modulation

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	2412	41.687	0.023	1.0
6	2437	42.170	0.024	1.0
11	2462	42.364	0.024	1.0

For Antenna gain: 8dBi

802.11b DSSS modulation

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	2412	28.314	0.036	1.0
6	2437	28.576	0.036	1.0
11	2462	28.249	0.035	1.0

802.11g OFDM modulation

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	2412	41.687	0.052	1.0
6	2437	42.170	0.053	1.0
11	2462	42.364	0.053	1.0

For Antenna gain: 7dBi

802.11a OFDM modulation

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	5180	9.376	0.009	1.0
4	5240	8.913	0.009	1.0
5	5260	11.995	0.012	1.0
8	5320	14.521	0.014	1.0
9	5745	25.235	0.025	1.0
11	5785	25.410	0.025	1.0
13	5820	25.293	0.025	1.0

For Antenna gain: 8dBi

802.11a OFDM modulation

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	5180	9.376	0.012	1.0
4	5240	8.913	0.011	1.0
5	5260	11.995	0.015	1.0
8	5320	14.521	0.018	1.0
9	5745	25.235	0.032	1.0
11	5785	25.410	0.032	1.0
13	5820	25.293	0.032	1.0

Note: Both of the 2.4GHz and 5GHz bands can transmit simultaneously, the maximum power density value is 0.085 mW/cm^2, which is less than the 1mW/cm^2 limit.

Collocated RF exposure consideration:

For worst cast that both transmitter on simultaneously at the highest power, 42.364 mW x2, the maximum achievable power density at 20 cm will be 0.053 mW/cm^2 x 2 = 0.106 mW/cm^2 which is far below the limit of 1 mW/cm^2 .