



# RF EXPOSURE REPORT

**REPORT NO.:** SA960418L24

**MODEL NO.:** WM821-M

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

**APPLICANT:** CyberTAN Technology, Inc.

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**ISSUED BY:** Advance Data Technology Corporation

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**TEST LOCATION:** No. 19, Hwa Ya 2<sup>nd</sup> Rd, Wen Hwa Tsuen, Kwei  
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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 <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	30
1500-100,000	...	...	1.0	30

F = Frequency in MHz



### 3. FRIIS FORMULA

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

where

$P_d$  = power density in  $mW/cm^2$

$P_{out}$  = 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

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 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 -3.5dBi or 0.44668(numeric) (2.4GHz band) and -4.5dBi or 0.35481(numeric) (5.0GHz band)

### 6.2 OUTPUT POWER INTO ANTENNA & RF EXPOSURE VALUE AT DISTANCE 20cm:

For 2.400 ~ 2.4385GHz band:

#### 802.11b DSSS MODULATION:

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	POWER DENSITY (mW/CM <sup>2</sup> )	LIMIT OF POWER DENSITY (mW/CM <sup>2</sup> )
1	2412	71.121	18.52	0.006	1.000
6	2437	71.121	18.52	0.006	1.000
11	2462	71.779	18.56	0.006	1.000

#### 802.11g OFDM MODULATION:

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	POWER DENSITY (mW/CM <sup>2</sup> )	LIMIT OF POWER DENSITY (mW/CM <sup>2</sup> )
1	2412	63.826	18.05	0.006	1.000
6	2437	89.125	19.50	0.008	1.000
11	2462	64.565	18.10	0.006	1.000

**DRAFT 802.11n (20MHz) OFDM MODULATION:**

CHAN.	CHAN. FREQ. (MHz)	PEAK POWER OUTPUT (mW)		PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/CM <sup>2</sup> )	LIMIT OF POWER DENSITY (mW/CM <sup>2</sup> )
		CHAIN 0	CHAIN 1	CHAIN 0	CHAIN 1				
1	2412	51.050	51.168	17.08	17.09	102.218	20.10	0.009	1.000
6	2437	63.973	64.121	18.06	18.07	128.094	21.08	0.011	1.000
11	2462	45.499	44.978	16.58	16.53	90.477	19.57	0.008	1.000

**DRAFT 802.11n (40MHz) OFDM MODULATION:**

CHAN.	CHAN. FREQ. (MHz)	PEAK POWER OUTPUT (mW)		PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/CM <sup>2</sup> )	LIMIT OF POWER DENSITY (mW/CM <sup>2</sup> )
		CHAIN 0	CHAIN 1	CHAIN 0	CHAIN 1				
1	2422	44.875	44.875	16.52	16.52	89.750	19.53	0.008	1.000
4	2437	45.082	44.771	16.54	16.51	89.853	19.54	0.008	1.000
7	2452	22.542	22.491	13.53	13.52	45.033	16.54	0.004	1.000

**For 5.150 ~ 5.350, 5.470 ~ 5.725GHz band:****802.11a OFDM MODULATION:**

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	POWER DENSITY (mW/CM <sup>2</sup> )	LIMIT OF POWER DENSITY (mW/CM <sup>2</sup> )
1	5180	40.179	16.04	0.003	1.000
4	5240	39.994	16.02	0.003	1.000
5	5260	40.551	16.08	0.003	1.000
8	5320	39.902	16.01	0.003	1.000
9	5500	40.272	16.05	0.003	1.000
14	5600	39.994	16.02	0.003	1.000
19	5700	39.811	16.00	0.003	1.000



For 5.150 ~ 5.25GHz band:

DRAFT 802.11n (20MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	PEAK POWER OUTPUT (mW)		PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/CM <sup>2</sup> )	LIMIT OF POWER DENSITY (mW/CM <sup>2</sup> )
		CHAIN 0	CHAIN 1	CHAIN 0	CHAIN 1				
1	5180	22.542	22.803	13.53	13.58	45.345	16.57	0.003	1.000
2	5200	22.751	22.542	13.57	13.53	45.293	16.56	0.003	1.000
4	5240	22.491	22.646	13.52	13.55	45.137	16.55	0.003	1.000

DRAFT 802.11n (40MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	PEAK POWER OUTPUT (mW)		PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/CM <sup>2</sup> )	LIMIT OF POWER DENSITY (mW/CM <sup>2</sup> )
		CHAIN 0	CHAIN 1	CHAIN 0	CHAIN 1				
1	5190	14.256	14.289	11.54	11.55	28.545	14.56	0.002	1.000
2	5230	22.751	22.387	13.57	13.50	45.138	16.55	0.003	1.000

For 5.725 ~ 5.850GHz band:

802.11a OFDM MODULATION:

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	POWER DENSITY (mW/CM <sup>2</sup> )	LIMIT OF POWER DENSITY (mW/CM <sup>2</sup> )
1	5745	40.551	16.08	0.003	1.000
3	5785	40.458	16.07	0.003	1.000
5	5825	39.994	16.02	0.003	1.000

**DRAFT 802.11n (20MHz) OFDM MODULATION:**

CHAN.	CHAN. FREQ. (MHz)	PEAK POWER OUTPUT (mW)		PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/CM <sup>2</sup> )	LIMIT OF POWER DENSITY (mW/CM <sup>2</sup> )
		CHAIN 0	CHAIN 1	CHAIN 0	CHAIN 1				
1	5745	44.668	44.978	16.50	16.53	89.646	19.53	0.006	1.000
3	5785	44.978	45.604	16.53	16.59	90.582	19.57	0.006	1.000
5	5825	45.186	44.668	16.55	16.50	89.854	19.54	0.006	1.000

**DRAFT 802.11n (40MHz) OFDM MODULATION:**

CHAN.	CHAN. FREQ. (MHz)	PEAK POWER OUTPUT (mW)		PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/CM <sup>2</sup> )	LIMIT OF POWER DENSITY (mW/CM <sup>2</sup> )
		CHAIN 0	CHAIN 1	CHAIN 0	CHAIN 1				
1	5755	45.290	44.875	16.56	16.52	90.165	19.55	0.006	1.000
2	5795	45.082	45.394	16.54	16.57	90.476	19.57	0.006	1.000