



# RF EXPOSURE REPORT

**REPORT NO.:** SA970819L02

**MODEL NO.:** EMP-7601, NMP-7601

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

**APPLICANT:** Senao Networks Inc.

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**ISSUED BY:** Advance Data Technology Corporation

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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<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

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 fixed inside the host equipment. 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 are 3dBi or 1.995(numeric) (for 2.4GHz); 4dBi or 2.512(numeric) (for 5.0GHz).

### 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	100.693	20.03	0.040	1.000
6	2437	101.859	20.08	0.040	1.000
11	2462	101.158	20.05	0.040	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	79.983	19.03	0.032	1.000
6	2437	80.353	19.05	0.032	1.000
11	2462	81.096	19.09	0.032	1.000

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

CHAN.	CHAN. FREQ. (MHz)	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 2				
1	2412	19.05	18.56	18.53	223.417	23.49	0.089	1.000
6	2437	18.54	18.59	18.56	215.506	23.33	0.086	1.000
11	2462	19.09	19.10	19.58	253.161	24.03	0.100	1.000

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

CHAN.	CHAN. FREQ. (MHz)	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 2				
1	2422	19.11	19.08	18.61	234.991	23.71	0.093	1.000
4	2437	19.06	19.04	19.07	241.429	23.83	0.096	1.000
7	2452	19.08	19.02	19.11	242.179	23.84	0.096	1.000

**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> )
36	5180	40.365	16.06	0.020	1.000
40	5200	39.902	16.01	0.020	1.000
48	5240	40.644	16.09	0.020	1.000
149	5745	81.283	19.10	0.041	1.000
157	5785	81.096	19.09	0.041	1.000
165	5825	80.724	19.07	0.040	1.000

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

CHAN.	CHAN. FREQ. (MHz)	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 2				
36	5180	10.07	10.61	10.55	33.021	15.19	0.017	1.000
40	5200	10.09	10.54	10.58	32.962	15.18	0.016	1.000
48	5240	10.08	10.52	10.53	32.756	15.15	0.016	1.000
149	5745	19.07	18.55	19.60	243.539	23.87	0.122	1.000
157	5785	19.04	18.04	20.06	245.238	23.90	0.123	1.000
165	5825	19.07	17.61	21.10	267.225	24.27	0.134	1.000

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

CHAN.	CHAN. FREQ. (MHz)	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 2				
38	5190	11.15	12.01	11.51	43.075	16.34	0.022	1.000
46	5230	11.04	12.04	12.13	45.032	16.54	0.023	1.000
151	5755	19.05	18.09	19.60	235.971	23.73	0.118	1.000
159	5795	18.57	18.10	19.61	227.922	23.58	0.114	1.000