



# RF EXPOSURE REPORT

**REPORT NO.:** SA971117L07

**MODEL NO.:** APL21-069

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

**APPLICANT:** Sonicwall, Inc.

**ADDRESS:** 1143 Borregas Ave. Sunnyvale CA 94089-1306  
USA

**ISSUED BY:** Bureau Veritas Consumer Products Services  
(H.K.) Ltd., Taoyuan Branch

**LAB ADDRESS:** No. 47, 14th Ling, Chia Pau Tsuen, Lin Kou  
Hsiang, Taipei Hsien 244, 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 <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

The antenna of this product, under normal use condition, is at least 20cm 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 3dBi or 1.99526(numeric)(For 2.4GHz) & 4dBi or 2.51189(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 (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	16.62	16.73	16.84	141.323	21.50	0.056	1.0
6	2437	16.81	17.14	16.93	149.051	21.73	0.059	1.0
11	2462	16.92	17.52	16.91	154.788	21.90	0.061	1.0

#### 802.11g OFDM MODULATION

CHANNEL	CHANNEL FREQUENCY (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	22.31	21.53	22.14	476.130	26.78	0.189	1.0
6	2437	22.23	21.72	21.83	468.108	26.70	0.186	1.0
11	2462	22.24	21.61	21.72	460.965	26.64	0.183	1.0

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

CHANNEL	CHANNEL FREQUENCY (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	22.32	22.03	21.14	460.213	26.63	0.183	1.0
6	2437	22.34	21.82	21.74	472.730	26.75	0.188	1.0
11	2462	22.15	21.75	21.63	459.228	26.62	0.182	1.0

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

CHANNEL	CHANNEL FREQUENCY (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	22.05	21.54	21.53	445.118	26.48	0.177	1.0
4	2437	24.03	23.56	24.02	732.264	28.65	0.291	1.0
7	2452	22.02	21.55	22.04	462.066	26.65	0.183	1.0



**For 5.150 ~ 5.250GHz band:  
802.11a OFDM MODULATION:**

CHANNEL	CHANNEL FREQUENCY (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	11.53	12.52	11.54	46.344	16.66	0.023	1.0
40	5200	11.51	12.54	11.56	46.427	16.67	0.023	1.0
48	5240	11.55	12.51	11.52	46.303	16.66	0.023	1.0

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

CHANNEL	CHANNEL FREQUENCY (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	11.02	12.06	11.03	41.393	16.17	0.021	1.0
40	5200	11.04	12.04	11.05	41.436	16.17	0.021	1.0
48	5240	11.53	12.53	11.54	46.385	16.66	0.023	1.0

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

CHANNEL	CHANNEL FREQUENCY (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	10.05	10.51	10.02	31.408	14.97	0.016	1.0
46	5230	10.03	10.04	10.53	31.460	14.98	0.016	1.0



**For 5.725 ~ 5.850GHz band:  
802.11a OFDM MODULATION:**

CHANNEL	CHANNEL FREQUENCY (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				
149	5745	21.52	21.04	20.55	382.464	25.83	0.191	1.0
157	5785	21.02	21.53	20.53	381.686	25.82	0.191	1.0
165	5825	20.54	21.55	20.56	369.892	25.68	0.185	1.0

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

CHANNEL	CHANNEL FREQUENCY (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				
149	5745	21.52	21.05	20.56	383.019	25.83	0.191	1.0
157	5785	21.06	21.53	20.51	382.337	25.82	0.191	1.0
165	5825	20.04	21.56	19.54	334.094	25.24	0.167	1.0

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

CHANNEL	CHANNEL FREQUENCY (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				
151	5755	21.02	21.04	20.05	354.689	25.50	0.177	1.0
159	5795	20.53	21.06	19.54	330.573	25.19	0.165	1.0