



A D T

# RF EXPOSURE REPORT

**REPORT NO.:** SA980615H07

**MODEL NO.:** AR5BHB92, AR5BHB92-H

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

**APPLICANT:** Atheros Communications, Inc.

**ADDRESS:** 5480 Great America Parkway, Santa Clara, CA  
95054

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

**LAB LOCATION:** No. 81-1, Lu Liao Keng, 9th Ling, Wu Lung Tsuen,  
Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan



# RF Exposure Measurement

## 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 our lab, 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



A D T

### 3. Friis Formula

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

where

$P_d$  = power density in  $\text{mW/cm}^2$

$P_{out}$  = output power to antenna in  $\text{mW}$

$G$  = gain of antenna in linear scale

$\pi = 3.1416$

$R$  = distance between observation point and center of the radiator in  $\text{cm}$

$P_d$  is the limit of MPE,  $1 \text{ mW/cm}^2$ . 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 20cm.

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**



A D T

## 6. Test Results

### 6.1 Antenna Gain

There are two antennas provided to this EUT, please refer to the following table:

No.	Manufacture	Model No.	Antenna Type	Antenna Connector	Antenna Gain (dBi)	Frequency range (MHz)	Remark
1	Tyco	1513327-1	Dipole	RPSMA	3 (2.4GHz) 4 (5GHz)	2400~2483.5 5150~5850	with Diversity
2	Tyco	1513327-1	Dipole	RPSMA	3 (2.4GHz) 4 (5GHz)	2400~2483.5 5150~5850	with Diversity



A D T

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

For 15.247(2.4GHz) :

For Part 802.11b:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	2412	346.505	0.138	1.0
6	2437	321.820	0.128	1.0
11	2462	334.630	0.133	1.0

For Part 802.11g:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	2412	298.516	0.118	1.0
6	2437	838.557	0.333	1.0
11	2462	286.906	0.114	1.0

## DRAFT 802.11n (20MHz) OFDM

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	2412	187.096	0.074	1.0
6	2437	765.895	0.304	1.0
11	2462	127.371	0.051	1.0

## DRAFT 802.11n (40MHz) OFDM

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	2422	79.035	0.031	1.0
4	2437	317.344	0.126	1.0
7	2452	120.816	0.048	1.0



A D T

**For 15.247(5GHz) :**

**For Part 802.11a:**

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
149	5745	683.818	0.342	1.0
157	5785	455.053	0.227	1.0
165	5825	527.317	0.264	1.0

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

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
149	5745	589.615	0.295	1.0
157	5785	464.582	0.232	1.0
165	5825	649.168	0.324	1.0

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

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
151	5755	771.010	0.385	1.0
159	5795	614.515	0.307	1.0



A D T

**For 15.407(5GHz) :**

**For Part 802.11a:**

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
36	5180	33.307	0.017	1.0
40	5200	32.216	0.016	1.0
48	5240	28.663	0.014	1.0
52	5260	111.154	0.056	1.0
60	5300	95.309	0.048	1.0
64	5320	89.844	0.045	1.0
100	5500	84.812	0.042	1.0
120	5600	127.797	0.064	1.0
140	5700	96.396	0.048	1.0

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

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
36	5180	49.494	0.025	1.0
40	5200	47.158	0.024	1.0
48	5240	41.893	0.021	1.0
52	5260	114.237	0.057	1.0
60	5300	144.723	0.072	1.0
64	5320	73.125	0.037	1.0
100	5500	94.604	0.047	1.0
120	5600	157.129	0.079	1.0
140	5700	138.222	0.069	1.0

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

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
38	5190	39.604	0.020	1.0
46	5230	39.723	0.020	1.0
54	5270	140.423	0.070	1.0
62	5310	41.585	0.021	1.0
102	5510	49.339	0.025	1.0
118	5590	236.958	0.118	1.0
134	5670	143.843	0.072	1.0