

RF EXPOSURE REPORT

REPORT NO.: SA980630H04

MODEL NO.: AR5B97

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 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	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

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d is the limit of MPE, $1 mW/cm^2$. 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**

6. Test Results

6.1 Antenna Gain

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

Set 1					
Transmitter Circuit	Brand	Model	Antenna Type	Antenna Gain (dBi)	Antenna Connector
Chain(0)	Inpaq	DAMA1BM3000402	Dipole	3.2	RPSMA
Chain(1)	Inpaq	DAMA1BM3000402	Dipole	3.2	RPSMA
Set 2					
Transmitter Circuit	Brand	Model	Antenna Type	Antenna Gain (dBi)	Antenna Connector
Chain(0)	Wistron	81.EBJ15.005	PIFA	3.6	IPEX
Chain(1)	Wistron	81.EBJ15.005	PIFA	3.6	IPEX

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

For Dipole antenna :

For Part 802.11b:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	156.571	0.065	1.0
6	2437	159.809	0.066	1.0
11	2462	133.677	0.056	1.0

For Part 802.11g:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	373.698	0.155	1.0
6	2437	509.854	0.212	1.0
11	2462	247.154	0.103	1.0

DRAFT 802.11n (20MHz) OFDM

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	346.784	0.144	1.0
6	2437	504.509	0.210	1.0
11	2462	231.398	0.096	1.0

DRAFT 802.11n (40MHz) OFDM

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2422	359.761	0.150	1.0
4	2437	466.057	0.194	1.0
7	2452	256.192	0.106	1.0

**For PIFA antenna :****For Part 802.11b:**

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	156.571	0.071	1.0
6	2437	159.809	0.073	1.0
11	2462	133.677	0.061	1.0

For Part 802.11g:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	373.698	0.170	1.0
6	2437	509.854	0.232	1.0
11	2462	247.154	0.113	1.0

DRAFT 802.11n (20MHz) OFDM

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	346.784	0.158	1.0
6	2437	504.509	0.230	1.0
11	2462	231.398	0.105	1.0

DRAFT 802.11n (40MHz) OFDM

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2422	359.761	0.164	1.0
4	2437	466.057	0.212	1.0
7	2452	256.192	0.117	1.0