

# RF Exposure Exhibit

**EUT Name:** Highpower USB Wifi Module

**Model No.:** MAXR 950

CFR 47 Part 15.247 and 90

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# 1 Test Methodology

In this document, we evaluate the RF Exposure to human body due the intentional transmission from the transmitter (EUT). The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. 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.

## 1.1 RF Exposure Limit

According to FCC 1.1310 table 1: 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	6
1500 - 100,000	...	...	1.0	30

F = Frequency in MHz

## 1.2 EUT Operating Condition

The software provided by Manufacturer enabled the EUT to transmit data at lowest, middle and highest channel individually. Software provided enables to transmit on multi channels simultaneously.

### 1.2.1 Classification

Arada proprietary software is used for mobile installation. EUT is installed inside a mobile host device. The antenna of the product, under normal use condition, is at least 20cm away from the body of the user and accessible to the end user. Warning statement to the user for keeping at least 20cm or more separation distance with the antenna should be included in user's manual.

### 1.3 Test Results

#### 1.3.1 Antenna Gain

Highest gain of the antenna used with device is 2.1dBi

#### 1.3.2 Mobile Configuration

Calculations for this report are based on highest power measured for each band.

Band	Mode	Output Power dBm	Antenna gain (Max)	EIRP/ERP		Channels Available	Channels Used	Total EIRP	
				dBm	W			W	dBm
2400 – 2483.5MHz	802.11b, g & HT20	29.12	2.1	31.22	1.32	11	1		
4940 – 4990MHz		30.94	2.1	33.04	2.01	20	1	2.01	33.04
Totals:								2.01	33.04

Note 1: Stations using 2400 to 2483.5MHz Power limited 1 Watt Max gain of antenna 6dBi;  
 Stations operating 4940 to 4990MHz band maximum output power permitted antenna port is 33dBm.

The highest measured power is +33.04dBm or 2.01W.

Using the Friss transmission formula, the EIRP is  $P_{out} * G$ , and R is 20cm.

$$P_d = EIRP / (1600\pi)$$

$$P_d = (2010) / (1600\pi) = 0.399mW/cm^2, \text{ which is below the limit.}$$

#### Calculating the distance at which Power density equal the limit

Calculation uses the free space transmission formula:

$$S = (PG) / (4\pi d^2)$$

Where: S is power density ( $W/m^2$ ), P is output power (W), G is antenna gain relative to isotropic, d is separation distance from the transmitting antenna (m).

$$d = \sqrt{PG / 4\pi} \quad d \text{ in Cm when } PG \text{ in } mW/cm^2 \quad \text{Limit for Frequency above 1500MHz}$$

permissible power density is  $1.0 mW/cm^2$

$$d = \sqrt{2010 / 4\pi (1)}$$

$$D = 12.65cms$$

### 1.3.3 Sample Calculation

The Friss 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

$\pi \approx 3.1416$

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

Ref. : David K. Cheng, *Field and Wave Electromagnetics*, Second Edition, Page 640, Eq. (11-133).