



# RF Exposure for FCC (MPE)

**EUT Name:** Wireless RF Sensor Module

**EUT Model:** CAM-PR

**FCC ID:** 2ALBX-CAMPRMR01

FCC Title 47; Part 15C, RSS-247 Issue 2 and ANSI C63.10:2013

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# 1 RF Exposure Measurement (Mobile Device) 15.247(i)

## 1.1 Test Methodology for FCC

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 Semi-Anechoic Chamber, and also the maximum total power input to the antenna is measured. Through the Friis transmission formula (see section 4.9.6) and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

## 1.2 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
<b>1500-100,000</b>	...	...	<b>1.0</b>	<b>30</b>

$f$  = Frequency in MHz

Per The highlighted data, the Power Density Limit at 2.462 GHz would be **1.0 mW/cm<sup>2</sup>**.

### 1.3 EUT Operating condition

The software provided by Manufacturer enabled the EUT to transmit data at lowest, middle and highest channel individually. The Worst-case values are used for the following equations.

Since the EUT has two transmitters, both were turned and measured simultaneously, on using a 100% Duty Cycle for each.

Power Output measurements are found in section 6.1 of TUV Test report #31750771.001

### 1.4 Classification

The antenna of the 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 user's manual. Therefore, this device is classified as a **Mobile Device**.

### 1.5 Test Results

#### 1.5.1 Antenna Gain

The maximum publish Gain of the Antenna is 1.5 dBi or 1.41 (numeric).

#### 1.5.2 Output Power into Antenna & RF Exposure value at distance 20cm:

Calculations for this report are based on highest power measurement and the highest gain of the antenna. Limit for MPE (from FCC part 1.1310 table 1) is **1.0 mW/cm<sup>2</sup>**

Highest Pout is -0.19 dBm = 0.96 mW, highest antenna gain (in linear scale) is 1.41, R is 20cm, and  $f = 2440$  MHz. The Power measurement was made with both transmitters set to a 100% duty cycle.

$Pd = (0.96 * 1.41) / (1600\pi) = \mathbf{0.0003 \text{ mW/cm}^2}$ , which is 0.9997 mW/cm<sup>2</sup> below to the limit.

The Exposure time of 30 Minutes was not included nor required for this calculation.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

### 1.6 Sample Calculation

The Friis transmission formula:  $Pd = (Pout * G) / (4 * \pi * R^2)$

Where;

Pd = power density in mW/cm<sup>2</sup>

Pout = 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).