



RF EXPOSURE REPORT

REPORT NO.: RF921111R06

MODEL NO.: WMIA-105AG

ACCORDING: FCC Guidelines for Human Exposure
IEEE C95.1

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0528
ILAC MRA



Lab Code: 200102-0



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 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	6
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/cm²

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

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

This modular is specified to be installed in access point or router which is connected with host through wire. So it is easy to be re-located in the place where at least 20cm far 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 are 3dBi or 1.995 (numeric) for 2.4GHz and 5GHz.

6.2 Output Power Into Antenna & RF Exposure Distance :



For Part 802.11b (CCK technique):

Mode 1 (0.15dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	34.674	0.007	1
6	2437	35.481	0.007	1
11	2462	34.674	0.007	1

Mode 2 (0.87dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	34.674	0.008	1
6	2437	35.481	0.009	1
11	2462	34.674	0.008	1

Mode 4 (1dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	34.674	0.009	1
6	2437	35.481	0.009	1
11	2462	34.674	0.009	1

Mode 5 (1.63dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	34.674	0.010	1
6	2437	35.481	0.010	1
11	2462	34.674	0.010	1

Mode 6 (1.5dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	34.674	0.010	1
6	2437	35.481	0.010	1
11	2462	34.674	0.010	1



For Part 802.11g (OFDM technique):

Mode 1 (0.15dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	26.915	0.006	1
6	2437	28.184	0.006	1
11	2462	27.542	0.006	1
6(Turbo)	2437	26.915	0.006	1

Mode 2 (0.87dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	26.915	0.007	1
6	2437	28.184	0.007	1
11	2462	27.542	0.007	1
6(Turbo)	2437	26.915	0.007	1

Mode 4 (1dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	26.915	0.007	1
6	2437	28.184	0.007	1
11	2462	27.542	0.007	1
6(Turbo)	2437	26.915	0.007	1

Mode 5 (1.63dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	26.915	0.008	1
6	2437	28.184	0.008	1
11	2462	27.542	0.008	1
6(Turbo)	2437	26.915	0.008	1

Mode 6 (1.5dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	26.915	0.008	1
6	2437	28.184	0.008	1
11	2462	27.542	0.008	1
6(Turbo)	2437	26.915	0.008	1



For 802.11a (Normal mode):

Mode 1 (1.47dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5180	43.351	0.012	1
4	5240	39.174	0.011	1
5	5260	36.475	0.010	1
8	5320	45.290	0.013	1
9	5745	31.623	0.009	1
11	5785	31.623	0.009	1
13	5825	31.623	0.009	1

Mode 2 (1.32dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5180	43.351	0.012	1
4	5240	39.174	0.011	1
5	5260	36.475	0.010	1
8	5320	45.290	0.012	1
9	5745	31.623	0.009	1
11	5785	31.623	0.009	1
13	5825	31.623	0.009	1

Mode 3 (2.75dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5180	43.351	0.016	1
4	5240	39.174	0.015	1
5	5260	36.475	0.014	1
8	5320	45.290	0.017	1
9	5745	31.623	0.012	1
11	5785	31.623	0.012	1
13	5825	31.623	0.012	1



Mode 4 (3dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5180	43.351	0.017	1
4	5240	39.174	0.016	1
5	5260	36.475	0.014	1
8	5320	45.290	0.018	1
9	5745	31.623	0.013	1
11	5785	31.623	0.013	1
13	5825	31.623	0.013	11

Mode 6 (0dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5180	43.351	0.009	1
4	5240	39.174	0.008	1
5	5260	36.475	0.007	1
8	5320	45.290	0.009	1
9	5745	31.623	0.006	1
11	5785	31.623	0.006	1
13	5825	31.623	0.006	1



For 802.11a (Turbo mode):

Mode 1 (1.47dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5210	46.026	0.013	1
2	5250	45.920	0.013	1
3	5290	57.677	0.013	1
4	5760	31.623	0.009	1
5	5800	31.623	0.009	1

Mode 2 (1.32dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5210	46.026	0.012	1
2	5250	45.920	0.012	1
3	5290	57.677	0.012	1
4	5760	31.623	0.009	1
5	5800	31.623	0.009	1

Mode 3 (2.75dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5210	46.026	0.017	1
2	5250	45.920	0.017	1
3	5290	57.677	0.017	1
4	5760	31.623	0.012	1
5	5800	31.623	0.012	1

Mode 4 (3dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5210	46.026	0.018	1
2	5250	45.920	0.018	1
3	5290	57.677	0.018	1
4	5760	31.623	0.013	1
5	5800	31.623	0.013	1



Mode 6 (0dBi gain)

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5210	46.026	0.009	1
2	5250	45.920	0.009	1
3	5290	57.677	0.011	1
4	5760	31.623	0.006	1
5	5800	31.623	0.006	1