RF EXPOSURE REPORT

REPORT NO.: SA950206H07
MODEL NO.: WA8011A-A
FCC ID: MAD-WA8011-A

ACCORDING: FCC Guidelines for Human Exposure
IEEE C95.1

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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 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 : $Pd = (Pout*G) / (4*pi*r^2)$

where
Pd = power density in mW/cm^2
Pout = output power to antenna in mW
G = gain of antenna in linear scale
Pi = 3.1416
R = distance between observation point and center of the radiator in cm

Pd 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

Product is professional installed in a place where at least 45cm far away from the body of the user. Warning statement to the user for keeping at least 45cm or more separation distance from the antenna has been included in users manual. So, this device is classified as **Mobile Device**.

6 Test Results

6.1 Antenna Gain

For 2.4GHz

The maximum Gain of the antenna is 13dBi or 19.95262(numeric).

For 5GHz

Antenna A: The maximum Gain of the antenna is 8dBi or 6.30957(numeric).
Antenna B: The maximum Gain of the antenna is 6dBi or 3.98107(numeric).
Antenna C: The maximum Gain of the antenna is 16dBi or 39.8107(numeric).

For 2.4GHz + 5GHz(Antenna C)

The maximum antenna Gain is 19.4554dBi or 88.2146(numeric).

For 2.4GHz						
No.	Model No.	Gain (dBi)	Cable Loss (dB)	Net Gain (dB)	Antenna Type	Antenna Connector
1-4	B8-R2-75mm	14.0	1.0	13.0	(H-Plane)Sectoredand	N-Female
For 5GHz						
No.	Model No.	Gain (dBi)	Cable Loss (dB)	Net Gain (dB)	Antenna Type	Antenna Connector
A	HG5310U	10.0	2.0	8.0	OMNI Dipole	N-Female
B	HG5808U	8.0	2.0	6.0	OMNI Dipole	N-Female
C	SA-A04-090250	18.0	2.0	16.0	Panel Directional	N-Jack

Note:

1. All of the above antennas are outdoor Antenna.
2. From above antennas, the different type of antennas was chosen for final test and its data were recorded in this report.
3. For 2.4GHz antennas, antenna 1, 2, 3 and 4 are the same type of antenna ((H-Plane)Sectoredand), we choose the worst antenna (decided by pretest) for final test. Antenna 1, the worst antenna, was selected as representative antenna for the test.
4. For 5GHz antenna, all of the antennas are different type or frequency band, was selected as all antenna for the test.
5. Antenna Model No. SA-A04-090250 can be used in point-to-point applications.

6.2 Output Power Into Antenna & RF Exposure value:

For 2.4GHz

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	51.286	0.040	1.0
6	2437	114.815	0.090	1.0
11	2462	67.608	0.053	1.0

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	14.125	0.011	1.0
6	2437	138.038	0.108	1.0
11	2462	27.542	0.022	1.0

For 5GHz

Operated in 5250MHz ~ 5350MHz band: (15.407)

Antenna A

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	5260	96.383	0.0239	1.0
4	5320	50.933	0.0127	1.0

Antenna C

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	5260	15.382	0.0241	1.0
4	5320	14.622	0.0229	1.0

Operated in 5725 ~ 5850MHz band: (15.247)

Antenna B

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	5745	66.069	0.0103	1.0
3	5785	77.625	0.0121	1.0
5	5825	63.096	0.0099	1.0

Antenna C

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	5745	50.119	0.0784	1.0
3	5785	60.256	0.0943	1.0
5	5825	133.968	0.2096	1.0

CONCULSION:

Both of the 11g and 11a can transmit simultaneously, the formula of calculated the MPE is:

$CPD_1 / LPD_1 + CPD_2 / LPD_2 + \ldots\ldots$etc. < 1

CPD = Calculation power density

LPD = Limit of power density

Therefore, the calculation of this situation is 0.108 / 1 + 0.2096 / 1 = 0.3176, which is less than the “1” limit.