

RF EXPOSURE REPORT

REPORT NO.: SA970306H01

MODEL NO.: WMP-ND03

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 : $P_d = (P_{out} * G) / (4 * \pi * r^2)$

where

P_d = power density in mW/cm^2

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

$\pi = 3.1416$

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 antennas provided to this EUT, please refer to the following table:

1.

No	Model No.	Antenna Gain	For 2.4GHz Gain (dBi)	For 5.15~5.25GHz Gain (dBi)	For 5.25~5.35GHz Gain (dBi)	For 5.47~5.725GHz Gain (dBi)	For 5.725~5.850GHz Gain (dBi)	Antenna Type	Connector
1	DAP-2590	Gain (dBi)	4	6.10	6.42	6.21	7.12	Dipole	Reverse SMA
		Cable Loss (dB)	0.3	0.6					
		Net Gain (dB)	3.7	5.5	5.82	5.61	6.52		
2	ALP05-220170	Gain (dBi)	4.83	4.98	5.10	5.25	6.00	Dipole	RP SMA Plug
		Cable Loss (dB)	0.3	0.6					
		Net Gain (dB)	4.53	4.38	4.5	4.65	5.4		

Note: From above antennas, 2.4GHz worst case was antenna 2 and 5GHz worst case was antenna 1.

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

For 15.247(2.4GHz) :

For Part 802.11b(TRANSFER RATE: 1Mbps):

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	136.66	0.077	1.0
6	2437	130.60	0.074	1.0
11	2462	143.74	0.081	1.0

For Part 802.11b(TRANSFER RATE: 11Mbps):

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	284.90	0.161	1.0
6	2437	442.30	0.250	1.0
11	2462	267.04	0.151	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	194.84	0.110	1.0
6	2437	439.19	0.248	1.0
11	2462	181.59	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	179.27	0.101	1.0
6	2437	265.48	0.150	1.0
11	2462	154.76	0.087	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	124.14	0.070	1.0
4	2437	152.91	0.086	1.0
7	2452	96.43	0.054	1.0

For 15.247(5GHz) :

For Part 802.11a:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5745	276.25	0.247	1.0
3	5785	329.59	0.294	1.0
5	5825	323.58	0.289	1.0

For 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	5745	515.46	0.460	1.0
3	5785	472.05	0.421	1.0
5	5825	270.74	0.242	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	5755	313.46	0.280	1.0
3	5795	300.98	0.269	1.0

For 15.407(5GHz) :

For Part 802.11a:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5180	29.06	0.026	1.0
2	5200	25.75	0.023	1.0
4	5240	26.66	0.024	1.0

For 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	5180	28.62	0.026	1.0
2	5200	24.76	0.022	1.0
4	5240	25.69	0.023	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	5190	16.75	0.015	1.0
2	5230	48.63	0.043	1.0