



RF EXPOSURE REPORT

REPORT NO.: SA940326H02

MODEL NO.: WL-464

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

π = 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 30cm away from the body of the user. Warning statement to the user for keeping at least 30cm 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

Antenna 1: The maximum Gain of the antenna is 6.8dBi.

Antenna 2: The maximum Gain of the antenna is 8.8dBi.

Antenna 3: The maximum Gain of the antenna is 18.8dBi.

Antenna 4: The maximum Gain of the antenna is 2.5dBi.

No.	Model	Antnnna Type	2.4/ 5GHz Antenna Gain	Cable Loss
1	3CWE591 (Z1996)	High gain omni antenna	6/ 8 dBi	1.2dB
2	3CWE598 (Z1997)	Medium gain panel antenna	8/ 10 dBi	1.2dB
3	3CWE596	High gain panel antenna	18/ 20 dBi	1.2dB
4	3CWE502	Small Omni (Rubber Duck)	2.5/ 2.5 dBi	NA

Note: 1. Antenna 2 and 3 can only be used in point-to-point applications.



6.2 Output Power Into Antenna & RF Exposure value at distance 30cm:

Operated in 5150 ~ 5250MHz, 5250MHz ~ 5350MHz band: (15.407)

Normal Mode : Antenna 1

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5180	26.91534804	0.0113906	1.0
4	5240	27.10191632	0.011469556	1.0
5	5260	143.8798578	0.060890089	1.0
8	5320	80.53784412	0.03408369	1.0

Turbo Mode : Antenna 1

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5210	28.18382931	0.011927423	1.0
2	5250	29.37649652	0.012432161	1.0
3	5290	94.62371614	0.040044844	1.0

Normal Mode : Antenna 2

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5180	16.21810097	0.010877939	1.0
4	5240	16.55769963	0.011105717	1.0
5	5260	81.28305162	0.054518841	1.0
8	5320	71.12135137	0.047703101	1.0

Turbo Mode : Antenna 2

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5210	16.71090614	0.011208477	1.0
2	5250	18.45015419	0.01237504	1.0
3	5290	75.8577575	0.050879942	1.0



Normal Mode : Antenna 3

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5180	2.187761624	0.033016355	1.0
4	5240	2.070141349	0.031241302	1.0
5	5260	10.66596121	0.160964138	1.0
8	5320	11.69499391	0.176493668	1.0

Turbo Mode : Antenna 3

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5210	2.21309471	0.033398667	1.0
2	5250	2.249054606	0.033941351	1.0
3	5290	11.58777356	0.174875564	1.0

Normal Mode : Antenna 4

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5180	26.91534804	0.004232009	1.0
4	5240	27.10191632	0.004261344	1.0
5	5260	143.8798578	0.022622813	1.0
8	5320	80.53784412	0.012663292	1.0

Turbo Mode : Antenna 4

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5210	28.18382931	0.004431458	1.0
2	5250	29.37649652	0.004618986	1.0
3	5290	94.62371614	0.01487807	1.0



Operated in 5725 ~ 5850MHz band: (15.247)

Normal Mode : Antenna 1

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5745	85.90135215	0.036353532	1.0
5	5825	83.56030182	0.035362797	1.0

Turbo Mode : Antenna 1

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5760	86.69618758	0.036689907	1.0
2	5800	85.50667129	0.036186503	1.0

Normal Mode : Antenna 2

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5745	85.90135215	0.057616465	1.0
5	5825	83.56030182	0.056046257	1.0

Turbo Mode : Antenna 2

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5760	86.69618758	0.058149584	1.0
2	5800	85.50667129	0.057351742	1.0



Normal Mode : Antenna 3

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5745	85.90135215	0.576164653	1.0
5	5825	83.56030182	0.560462566	1.0

Turbo Mode : Antenna 3

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5760	86.69618758	0.581495838	1.0
2	5800	85.50667129	0.573517416	1.0

Normal Mode : Antenna 4

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5745	85.90135215	0.013506618	1.0
5	5825	83.56030182	0.013138525	1.0

Turbo Mode : Antenna 4

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	5760	86.69618758	0.013631593	1.0
2	5800	85.50667129	0.013444561	1.0