



RF EXPOSURE REPORT

REPORT NO.: RF921112R05B

MODEL NO.: WBR2-G54, WBR2-B11, WLA2-G54S

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

This device is not fixed inside the host equipment, it is connected with host through wire. So it is easy to be re-located in the place where at least 20 cm 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

Antenna 1: The maximum Gain of the antenna is 1.99dBi.

Antenna 2: The maximum Gain of the antenna is 2.15dBi.

Antenna 3: The maximum Gain of the antenna is 2.0dBi.

Antenna 4: The maximum Gain of the antenna is 4.0dBi.

FOR DSSS:

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

Antenna 1

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	39.81072	0.000501	1.0
6	2437	48.97788	0.000616	1.0
11	2462	48.97788	0.000616	1.0

Antenna 2

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	38.01894	0.000496	1.0
6	2437	46.77351	0.000611	1.0
11	2462	47.86301	0.000625	1.0

Antenna 3

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	39.81072	0.012552	1.0
6	2437	40.45759	0.012756	1.0
11	2462	41.68694	0.013144	1.0

Antenna 4

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	30.69022	0.015337	1.0
6	2437	32.35937	0.016171	1.0
11	2462	34.19794	0.017089	1.0

FOR OFDM:

Antenna 1

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	104.71285	0.001318	1.0
6	2437	107.15193	0.001348	1.0
11	2462	114.81536	0.001445	1.0
Turbo 6	2437	53.703180	0.000676	1.0

Antenna 2

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	102.3293	0.0013359	1.0
6	2437	100	0.0013055	1.0
11	2462	109.6478	0.0014315	1.0
Turbo 6	2437	52.48075	0.000685	1.0

Antenna 3

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	100.23052	0.031603	1.0
6	2437	105.68175	0.033322	1.0
11	2462	103.99202	0.032789	1.0
Turbo 6	2437	52.48075	0.016547	1.0

Antenna 4

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	63.09573	0.031530	1.0
6	2437	66.52732	0.033245	1.0
11	2462	69.18310	0.034572	1.0
Turbo 6	2437	34.67369	0.017327	1.0