RF EXPOSURE REPORT

REPORT NO.: SA960808L14

MODEL NO.: WLI-TX4-AG300N

ACCORDING: FCC Guidelines for Human Exposure
IEEE C95.1

APPLICANT: Buffalo Inc.

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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	30
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

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

The antenna of the 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

The maximum Gain measured in Fully Anechoic Chamber is 4.66dBi or 2.92415 (numeric)(2.4GHz) & 4.32dBi or 2.70396 (numeric)(5.0GHz).

6.2 OUTPUT POWER INTO ANTENNA & RF EXPOSURE VALUE AT DISTANCE 20cm:

802.11b DSSS MODULATION

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	POWER DENSITY (mW/cm^2)	LIMIT OF POWER DENSITY (mW/cm^2)
1	2412	32.211	15.08	0.019	1.0
6	2437	90.782	19.58	0.053	1.0
11	2462	79.799	19.02	0.046	1.0

802.11g OFDM MODULATION

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	POWER DENSITY (mW/cm^2)	LIMIT OF POWER DENSITY (mW/cm^2)
1	2412	51.286	17.10	0.030	1.0
6	2437	70.958	18.51	0.041	1.0
11	2462	56.754	17.54	0.033	1.0

DRAFT 802.11n (20MHz) OFDM MODULATION

CHAN.	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)		PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/cm^2)	LIMIT OF POWER DENSITY (mW/cm^2)
		CHAIN 0	CHAIN 1	CHAIN 0	CHAIN 1				
1	2412	39.994	22.803	16.02	13.58	62.797	17.98	0.037	1.0
6	2437	70.958	50.234	18.51	17.01	121.192	20.83	0.071	1.0
11	2462	50.350	50.933	17.02	17.07	101.283	20.06	0.059	1.0

DRAFT 802.11n (40MHz) OFDM MODULATION

CHAN.	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)		PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/cm^2)	LIMIT OF POWER DENSITY (mW/cm^2)
		CHAIN 0	CHAIN 1	CHAIN 0	CHAIN 1				
1	2422	22.803	20.324	13.58	13.08	43.127	16.35	0.025	1.0
4	2437	63.826	50.933	18.05	17.07	114.759	20.60	0.067	1.0
7	2452	35.810	22.542	15.54	13.53	58.352	17.66	0.034	1.0

For 5.150 ~ 5.350, 5.470 ~ 5.725GHz band:

802.11a OFDM MODULATION:

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	POWER DENSITY (mW/cm^2)	LIMIT OF POWER DENSITY (mW/cm^2)
For 5.150 ~ 5.350GHz band:					
36	5180	28.379	14.53	0.014	1.0
40	5200	28.445	14.54	0.014	1.0
48	5240	28.379	14.53	0.014	1.0
52	5260	28.973	14.62	0.015	1.0
60	5300	16.069	12.06	0.008	1.0
64	5320	16.368	12.14	0.008	1.0
For 5.470 ~ 5.725GHz band:					
100	5500	14.223	11.53	0.008	1.0
120	5600	17.865	12.52	0.010	1.0
140	5700	20.091	13.03	0.011	1.0

DRAFT 802.11n (20MHz) OFDM MODULATION

CHAN.	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)		PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/cm^2)	LIMIT OF POWER DENSITY (mW/cm^2)
		CHAIN 0	CHAIN 1	CHAIN 0	CHAIN 1				
For 5.150 ~ 5.350GHz band:									
36	5180	22.542	22.491	13.53	13.52	45.033	16.54	0.023	1.0
40	5200	22.439	22.542	13.51	13.53	44.981	16.53	0.023	1.0
48	5240	22.491	25.410	13.52	14.05	47.900	16.80	0.024	1.0
52	5260	23.121	40.272	13.64	16.05	63.392	18.02	0.032	1.0
60	5300	18.197	18.030	12.60	12.56	36.227	15.59	0.018	1.0
64	5320	14.488	28.642	11.61	14.57	43.129	16.35	0.022	1.0
For 5.470 ~ 5.725GHz band:									
100	5500	12.735	23.014	11.05	13.62	35.749	15.53	0.019	1.0
120	5600	9.183	17.947	9.63	12.54	27.131	14.33	0.015	1.0
140	5700	10.280	16.368	10.12	12.14	26.648	14.26	0.014	1.0

DRAFT 802.11n (40MHz) OFDM MODULATION

CHAN.	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)		PEAK POWER OUTPUT (dBm)		TOTAL PEAK POWER (mW)	TOTAL PEAK POWER (dBm)	POWER DENSITY (mW/cm^2)	LIMIT OF POWER DENSITY (mW/cm^2)
		CHAIN 0	CHAIN 1	CHAIN 0	CHAIN 1				
For 5.150 ~ 5.350GHz band:									
38	5190	22.491	22.594	13.52	13.54	45.085	16.54	0.023	1.0
46	5230	22.542	22.856	13.53	13.59	45.398	16.57	0.023	1.0
54	5270	22.699	22.594	13.56	13.54	45.293	16.56	0.023	1.0
62	5310	14.355	41.115	11.57	16.14	55.470	17.44	0.028	1.0
For 5.470 ~ 5.725GHz band:									
102	5510	20.324	25.586	13.08	14.08	45.909	16.62	0.025	1.0
118	5590	25.527	25.882	14.07	14.13	51.409	17.11	0.028	1.0
134	5670	20.230	25.410	13.06	14.05	45.640	16.59	0.025	1.0