



RF EXPOSURE REPORT

REPORT NO.: SA960905L09

MODEL NO.: DGL-4500

ACCORDING: FCC Guidelines for Human Exposure
IEEE C95.1

APPLICANT: D-Link Corporation

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

where

P_d = power density in mW/cm²

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

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 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

The maximum Gain measured in Fully Anechoic Chamber is 2dBi or 1.585(numeric).

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

For 2.400 ~ 2.4385GHz band:

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	56.754	17.54	0.018	1.000
6	2437	56.364	17.51	0.018	1.000
11	2462	56.364	17.51	0.018	1.000

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	65.013	18.13	0.020	1.000
6	2437	63.973	18.06	0.020	1.000
11	2462	65.163	18.14	0.021	1.000



DRAFT 802.11n (20MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (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)
		CHAIN0	CHAIN1	CHAIN2	CHAIN0	CHAIN1	CHAIN2				
1	2412	32.509	22.751	22.491	15.12	13.57	13.52	77.751	18.91	0.025	1.000
6	2437	31.696	22.439	22.594	15.01	13.51	13.54	76.729	18.85	0.024	1.000
11	2462	32.509	22.387	22.491	15.12	13.50	13.52	77.387	18.89	0.024	1.000

DRAFT 802.11n (40MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (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)
		CHAIN0	CHAIN1	CHAIN2	CHAIN0	CHAIN1	CHAIN2				
1	2422	16.255	11.402	12.972	12.11	10.57	11.13	40.629	16.09	0.013	1.000
4	2437	16.181	11.272	12.823	12.09	10.52	11.08	40.276	16.05	0.013	1.000
7	2452	16.032	11.246	12.912	12.05	10.51	11.11	40.190	16.04	0.013	1.000

For 5.150 ~ 5.250GHz 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)
1	5180	41.020	16.13	0.013	1.000
2	5200	39.994	16.02	0.013	1.000
4	5240	39.994	16.02	0.013	1.000



DRAFT 802.11n (20MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (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)
		CHAIN0	CHAIN1	CHAIN2	CHAIN0	CHAIN1	CHAIN2				
1	5180	11.429	16.069	16.144	10.58	12.06	12.08	43.642	16.40	0.014	1.000
2	5200	11.429	16.406	16.069	10.58	12.15	12.06	43.904	16.43	0.014	1.000
4	5240	11.298	16.181	16.144	10.53	12.09	12.08	43.623	16.40	0.014	1.000

DRAFT 802.11n (40MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (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)
		CHAIN0	CHAIN1	CHAIN2	CHAIN0	CHAIN1	CHAIN2				
1	5190	10.139	15.959	15.959	10.06	12.03	12.03	42.057	16.24	0.013	1.000
2	5230	10.257	16.032	16.069	10.11	12.05	12.06	42.358	16.27	0.013	1.000

For 5.725 ~ 5.850GHz 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)
1	5745	91.622	19.62	0.029	1.000
3	5785	101.859	20.08	0.032	1.000
5	5825	102.094	20.09	0.032	1.000


DRAFT 802.11n (20MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (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)
		CHAIN0	CHAIN1	CHAIN2	CHAIN0	CHAIN1	CHAIN2				
1	5745	35.727	56.494	56.494	15.53	17.52	17.52	148.715	21.72	0.047	1.000
3	5785	36.475	56.494	57.280	15.62	17.52	17.58	150.249	21.77	0.047	1.000
5	5825	35.563	56.364	57.677	15.51	17.51	17.61	149.604	21.75	0.047	1.000

DRAFT 802.11n (40MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (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)
		CHAIN0	CHAIN1	CHAIN2	CHAIN0	CHAIN1	CHAIN2				
1	5755	18.365	29.040	28.510	12.64	14.63	14.55	75.915	18.80	0.024	1.000
2	5795	18.323	28.642	28.249	12.63	14.57	14.51	75.214	18.76	0.024	1.000