



RF EXPOSURE REPORT

REPORT NO.: SA971021L03

MODEL NO.: DIR-825

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:

CHAN.	CHAN. FREQ. (MHz)	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				
1	2412	18.59	18.57	144.222	21.59	0.045	1.000
6	2437	18.60	18.56	144.223	21.59	0.045	1.000
11	2462	18.55	18.54	143.064	21.56	0.045	1.000

802.11g OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	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				
1	2412	22.61	22.59	363.941	25.61	0.115	1.000
6	2437	23.58	23.57	455.544	26.59	0.144	1.000
11	2462	22.04	22.05	320.280	25.06	0.101	1.000

DRAFT 802.11n (20MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	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				
1	2412	22.06	22.08	322.130	25.08	0.102	1.000
6	2437	23.54	23.59	454.503	26.58	0.143	1.000
11	2462	22.12	22.14	326.611	25.14	0.103	1.000



DRAFT 802.11n (40MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	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				
1	2422	21.57	21.52	285.455	24.56	0.090	1.000
4	2437	23.52	23.58	452.940	26.56	0.143	1.000
7	2452	21.54	21.56	285.780	24.56	0.090	1.000

For 5.150 ~ 5.250GHz band:

802.11a OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	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				
36	5180	12.05	12.08	32.176	15.08	0.010	1.000
40	5200	12.11	12.06	32.325	15.10	0.010	1.000
48	5240	12.09	12.11	32.436	15.11	0.010	1.000

DRAFT 802.11n (20MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	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				
36	5180	12.07	12.03	32.065	15.06	0.010	1.000
40	5200	12.13	12.09	32.511	15.12	0.010	1.000
48	5240	12.05	12.08	32.176	15.08	0.010	1.000

DRAFT 802.11n (40MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	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				
38	5190	12.08	12.04	32.139	15.07	0.010	1.000
46	5230	12.05	12.07	32.139	15.07	0.010	1.000



For 5.725 ~ 5.850GHz band:

802.11a OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	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				
149	5745	21.06	21.04	254.701	24.06	0.080	1.000
157	5785	21.04	21.06	254.701	24.06	0.080	1.000
165	5825	21.02	21.03	253.239	24.04	0.080	1.000

DRAFT 802.11n (20MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	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				
149	5745	21.09	21.05	255.879	24.08	0.081	1.000
157	5785	21.06	21.04	254.701	24.06	0.080	1.000
165	5825	21.05	21.12	256.770	24.10	0.081	1.000

DRAFT 802.11n (40MHz) OFDM MODULATION:

CHAN.	CHAN. FREQ. (MHz)	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				
151	5755	22.06	22.05	321.019	25.07	0.101	1.000
159	5795	22.04	22.01	318.810	25.04	0.101	1.000