



RF EXPOSURE REPORT

REPORT NO.: SA960815L14

MODEL NO.: DIR-855

ACCORDING: FCC Guidelines for Human Exposure
IEEE C95.1

APPLICANT: D-Link Corporation

ADDRESS: 17595 Mt. Herrmann, Fountain Valley, CA 92708,
U.S.A.

ISSUED BY: Advance Data Technology Corporation

LAB ADDRESS: 47 14th Lin, Chiapau Tsun, Linko, Taipei, Taiwan,
R.O.C.

TEST LOCATION: No. 19, Hwa Ya 2nd Rd., Kueishan, Taoyuan,
Taiwan, R.O.C.



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 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 2dBi or 1.5849(numeric).

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	50.350	17.02	0.016	1.0
6	2437	41.020	16.13	0.013	1.0
11	2462	40.458	16.07	0.013	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	50.466	17.03	0.016	1.0
6	2437	65.163	18.14	0.021	1.0
11	2462	50.350	17.02	0.016	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 2	CHAIN 0	CHAIN 1	CHAIN 2				
1	2412	25.293	31.842	20.370	14.03	15.03	13.09	77.505	18.89	0.024	1.0
6	2437	31.989	40.365	25.235	15.05	16.06	14.02	97.588	19.89	0.031	1.0
11	2462	32.509	40.272	25.235	15.12	16.05	14.02	98.015	19.91	0.031	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 2	CHAIN 0	CHAIN 1	CHAIN 2				
1	2422	14.454	14.223	11.272	11.60	11.53	10.52	39.950	16.02	0.013	1.0
4	2437	17.906	22.909	14.289	12.53	13.60	11.55	55.104	17.41	0.017	1.0
7	2452	18.155	22.751	14.555	12.59	13.57	11.63	55.461	17.44	0.017	1.0

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	32.137	15.07	0.010	1.0
2	5200	31.623	15.00	0.010	1.0
4	5240	32.359	15.10	0.010	1.0
9	5745	63.680	18.04	0.020	1.0
11	5785	63.241	18.01	0.020	1.0
13	5825	63.387	18.02	0.020	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 2	CHAIN 0	CHAIN 1	CHAIN 2				
1	5180	14.355	14.289	12.388	11.57	11.55	10.93	41.032	16.13	0.013	1.0
2	5200	14.223	14.223	12.417	11.53	11.53	10.94	40.863	16.11	0.013	1.0
4	5240	14.158	14.125	12.331	11.51	11.50	10.91	40.614	16.09	0.013	1.0
9	5745	56.885	44.875	45.186	17.55	16.52	16.55	146.945	21.67	0.046	1.0
11	5785	57.412	45.709	44.771	17.59	16.60	16.51	147.892	21.70	0.047	1.0
13	5825	50.466	45.604	40.087	17.03	16.59	16.03	136.156	21.34	0.043	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 2	CHAIN 0	CHAIN 1	CHAIN 2				
1	5190	12.503	12.794	16.181	10.97	11.07	12.09	41.477	16.18	0.013	1.0
2	5230	12.677	12.706	16.106	11.03	11.04	12.07	41.489	16.18	0.013	1.0
3	5755	28.576	28.314	28.642	14.56	14.52	14.57	85.532	19.32	0.027	1.0
4	5795	28.379	28.774	28.840	14.53	14.59	14.60	85.993	19.34	0.027	1.0

CONCLUSION: Both of the modules can transmit simultaneously, the formula of

calculated the MPE is: $CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$ CPD = Calculation power density

LPD = Limit of power density

Therefore, the calculation of this situation is $0.047 / 1 + 0.013 / 1 = 0.06$, which is less than the "1" limit.