



RF EXPOSURE REPORT

REPORT NO.: SA990315H02

MODEL NO.: DIR-815

ACCORDING: FCC Guidelines for Human Exposure
IEEE C95.1

APPLICANT: D-Link Corporation

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ISSUED BY: Bureau Veritas Consumer Products Services
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TEST LOCATION (2): No. 49, Ln. 206, Wende Rd., Shangshan Tsuen,
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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 our lab, 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 : $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot r^2)$

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

The antenna of this product, under normal use condition, is at least 20cm away from the body of the user. So, this device is classified as Mobile Device.



6. TEST RESULTS

6.1 Antenna Gain

There are two antennas provided to this EUT, please refer to the following table:

Chain	Manufacture	Model name	Antenna Gain		Antenna Cable Length	Antenna Type	Connector
			For 2.4GHz Gain (dBi)	For 5GHz Gain (dBi)			
Chain (0) Antenna (1)	Master Wave Technology Co., Ltd.	98144PIPF000	2.90686	5G Band1: 3.82562 5G Band4: 3.33016	48mm	Dipole	IPEX
Chain (1) Antenna (2)	Master Wave Technology Co., Ltd.	98144PIPF001	2.29251	5G Band1:3.25853 5G Band4: 2.82877	245mm	Dipole	IPEX

ANTENNA COMBINATION MODE:

COMBINATION MODE	OPERATION MODE	TX CHAIN(0)	TX CHAIN(1)
A	802.11 a	√	
B	802.11 b	√	
C	802.11 g	√	
D	802.11n(20MHz) for MCS0~7	√	√
E	802.11n(20MHz) for MCS8~15	√	√
F	802.11n(40MHz) for MCS0~7	√	√
G	802.11n(40MHz) for MCS8~15	√	√

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

For 15.247(2.4GHz):

802.11b:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	131.8	0.051	1.0
6	2437	81.3	0.032	1.0
11	2462	74.1	0.029	1.0

802.11g:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	457.1	0.178	1.0
6	2437	346.7	0.135	1.0
11	2462	398.1	0.155	1.0

802.11n (20MHz):

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2412	480.9	0.187	1.0
6	2437	317.0	0.123	1.0
11	2462	469.0	0.182	1.0

802.11n (40MHz):

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1	2422	394.5	0.153	1.0
4	2437	564.3	0.219	1.0
7	2452	385.5	0.150	1.0

For 15.247(5GHz):

802.11a:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
149	5745	218.8	0.094	1.0
157	5785	199.5	0.085	1.0
165	5825	177.8	0.076	1.0

802.11n (20MHz):

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
149	5745	570.2	0.244	1.0
157	5785	544.6	0.233	1.0
165	5825	502.4	0.215	1.0

802.11n (40MHz):

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
151	5755	413.1	0.177	1.0
159	5795	403.9	0.173	1.0



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For 15.407(5GHz):

802.11a:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
36	5180	24.5	0.012	1.0
40	5200	29.5	0.014	1.0
48	5240	27.5	0.013	1.0

802.11n (20MHz):

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
36	5180	27.0	0.013	1.0
40	5200	27.0	0.013	1.0
48	5240	28.3	0.014	1.0

802.11n (40MHz):

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
38	5190	30.6	0.015	1.0
46	5230	46.9	0.023	1.0