

FCC RF EXPOSURE EVALUATION REPORT

FCC ID: KA2IR1210A1

Project No. : 1712C148

Equipment : AC1200 WiFi Router

Model : DIR-1210,DIR-822

Applicant : D-LINK Corporation

Address : 17595 Mt. Herrmann, Fountain Valley, California,
United States 92708

Exposure category : General population/uncontrolled environment

EUT Type: : Production Unit (Engineer Sample)

Device Type : Mobile Device

1. Evaluation Method

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0 . The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

2. Limits for General Population/Uncontrolled Exposure

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

3. Refer Evaluation Method

[ANSI C95.1-1999](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

[FCC KDB publication 447498 D01 General RF Exposure Guidance v06](#): Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

[FCC CFR 47 part1 1.1310](#): Radiofrequency radiation exposure limits.

[FCC CFR 47 part2 2.1093](#): Radiofrequency radiation exposure evaluation: portable devices

4. Calculation Method

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG / 4\pi R^2$$

Where:

S=power density

P=power input to antenna

G=power gain of the antenna in the direction of interest relative to an isotropic radiator

R=distance to the center of radiation of the antenna

5. Conducted Power Results

5.1 Test Setup



5.2 Test Equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Power Meter	ANRITSU	ML2495A	1128009	Mar.26, 2018
2	Pulse Power Sensor	ANRITSU	MA2411B	1027500	Mar.26, 2018

Remark: all calibration period of equipment list is one year.

5.3 Test Procedure

- The EUT was directly connected to the power meter and antenna output port as show in the block diagram Test Setup.
- Setup EUT work at duty cycle more than 98%;
- Read power sensor values in Peak detector;

5.4 Test Results and Manufacturing Tolerance

Mode	Frequency Band	Maximum Peak power declared by Manufacturer	
		Antenna 0	Antenna 1
IEEE 802.11b	2.4G	≤ 22.00	≤ 21.50
IEEE 802.11g	2.4G	≤ 18.00	≤ 19.00
IEEE 802.11n HT20	2.4G	≤ 18.50	≤ 19.00
IEEE 802.11n HT40	2.4G	≤ 19.00	≤ 19.50

Mode	Frequency Band	Maximum Peak power declared by Manufacturer	
		Antenna 2	Antenna 3
IEEE 802.11a	5G Band 1	≤ 24.50	≤ 24.50
	5G Band 3	≤ 24.00	≤ 23.00
IEEE 802.11n HT20	5G Band 1	≤ 25.00	≤ 24.50
	5G Band 3	≤ 25.50	≤ 25.00
IEEE 802.11n HT40	5G Band 1	≤ 27.00	≤ 26.50
	5G Band 3	≤ 27.00	≤ 26.90
IEEE 802.11ac VHT20	5G Band 1	≤ 25.00	≤ 25.00
	5G Band 3	≤ 24.50	≤ 23.00
IEEE 802.11ac VHT40	5G Band 1	≤ 27.00	≤ 26.90
	5G Band 3	≤ 25.00	≤ 24.00
IEEE 802.11ac VHT80	5G Band 1	≤ 24.50	≤ 23.00
	5G Band 3	≤ 27.00	≤ 26.90

Remark:

1. 5G WLAN only record non-beamforming mode as maximum EIRP higher than beamforming mode;

6. Antenna Information

Antenna	Manufacturer	Model Name	Antenna Type	Connector	Maximum Peak Gain (dBi)
Antenna 0	N/A	N/A	Dipole	N/A	5.00
Antenna 1	N/A	N/A	Dipole	N/A	5.00
Antenna 2	N/A	N/A	Dipole	N/A	5.00
Antenna 3	N/A	N/A	Dipole	N/A	5.00

7. Evaluation Results

7.1 Standalone

Antenna 0

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	(dBm)	(mW)					
IEEE 802.11b	22.00	158.4893	5.00	3.1623	100%	0.0998	1.0000
IEEE 802.11g	19.00	79.4328	5.00	3.1623	100%	0.0500	1.0000
IEEE 802.11n HT20	18.50	70.7946	5.00	3.1623	100%	0.0446	1.0000
IEEE 802.11n HT40	19.00	79.4328	5.00	3.1623	100%	0.0500	1.0000

Antenna 1

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	(dBm)	(mW)					
IEEE 802.11b	21.50	141.2538	5.00	3.1623	100%	0.0889	1.0000
IEEE 802.11g	19.00	79.4328	5.00	3.1623	100%	0.0500	1.0000
IEEE 802.11n HT20	19.00	79.4328	5.00	3.1623	100%	0.0500	1.0000
IEEE 802.11n HT40	19.50	89.1251	5.00	3.1623	100%	0.0561	1.0000

Antenna 2

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	(dBm)	(mW)					
IEEE 802.11a	24.50	281.8383	5.00	3.1623	100%	0.1774	1.0000
IEEE 802.11n HT20	25.50	354.8134	5.00	3.1623	100%	0.2233	1.0000
IEEE 802.11n HT40	27.00	501.1872	5.00	3.1623	100%	0.3155	1.0000
IEEE 802.11ac VHT20	25.00	316.2278	5.00	3.1623	100%	0.1990	1.0000
IEEE 802.11ac VHT40	27.00	501.1872	5.00	3.1623	100%	0.3155	1.0000
IEEE 802.11ac VHT80	27.00	501.1872	5.00	3.1623	100%	0.3155	1.0000

Antenna 3

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	(dBm)	(mW)					
IEEE 802.11a	24.50	281.8383	5.00	3.1623	100%	0.1774	1.0000
IEEE 802.11n HT20	25.00	316.2278	5.00	3.1623	100%	0.1990	1.0000
IEEE 802.11n HT40	26.90	489.7788	5.00	3.1623	100%	0.3083	1.0000
IEEE 802.11ac VHT20	25.00	316.2278	5.00	3.1623	100%	0.1990	1.0000
IEEE 802.11ac VHT40	26.90	489.7788	5.00	3.1623	100%	0.3083	1.0000
IEEE 802.11ac VHT80	26.90	489.7788	5.00	3.1623	100%	0.3083	1.0000

Remark:

1. Maximum power including tune-up tolerance;
2. EIRP including tune-up tolerance;
3. MPE use distance is 20cm from manufacturer declaration of user manual.

7.2 Simultaneous Transmission for SAR Exclusion

The sample support two WLAN modular, 2T2R MIMO antennas for 2.4GHz and 2T2R MIMO for 5GHz, 2.4GHz and 5GHz share difference antennas, need consider simultaneous transmission;

Antenna 0 and Antenna 1 for 2.4GWLAN

Band	Mode	MPE Ratio Antenna 0	MPE Ratio Antenna 1	Σ MPE ratios	Limit	Results
2.4GHz	IEEE 802.11b	0.0998	0.0889	< 0.2	1.0	PASS
	IEEE 802.11g	0.0500	0.0500	< 0.2	1.0	PASS
	IEEE 802.11n HT20	0.0446	0.0500	< 0.1	1.0	PASS
	IEEE 802.11n HT40	0.0500	0.0561	< 0.2	1.0	PASS

Band	Mode	MPE Ratio Antenna 2	MPE Ratio Antenna 3	Σ MPE ratios	Limit	Results
5G	IEEE 802.11a	0.1774	0.1774	< 0.4	1.0	PASS
	IEEE 802.11n HT20	0.2233	0.1990	< 0.5	1.0	PASS
	IEEE 802.11n HT40	0.3155	0.3083	< 0.7	1.0	PASS
	IEEE 802.11ac VHT20	0.1990	0.1990	< 0.4	1.0	PASS
	IEEE 802.11ac VHT40	0.3155	0.3083	< 0.7	1.0	PASS
	IEEE 802.11ac VHT80	0.3155	0.3083	< 0.7	1.0	PASS

Maximum MPE Ratios for dual-mode WLAN simultaneous transmission

Maximum MPE Ratio 2.4GWLAN	Maximum MPE Ratio 5GWLAN	Σ MPE ratios	Limit	Results
< 0.2	< 0.7	< 0.9	1.0	PASS

Remark:

1. Maximum power including tune-up tolerance;
2. EIRP including tune-up tolerance;
3. MPE use distance is 20cm from manufacturer declaration of user manual.

8. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1093 for the uncontrolled RF Exposure and SAR Exclusion Threshold per KDB 447498 v06.