

**Maximum Permissible Exposure Report****1. Product Information**

EUT	:	Wi-Fi 11n Module
Test Model	:	DLM200
Additional Model No.	:	DLM200-11n, DLM200R1, DLM200-11nR1
Model Declaration	:	PCB board, structure and internal of these model(s) are the same, So no additional models were tested
Ratings	:	Input: DC 3.3V, 2000mA Test Board Supply: DC 12V, 3A Input Supply Rating
Hardware Version	:	/
Software Version	:	/
WIFI(2.4G Band)		
Frequency Range	:	2412MHz~2462MHz
Channel Number	:	11 Channels for 20MHz bandwidth(2412~2462MHz) 7 Channels for 40MHz bandwidth(2422~2452MHz)
Channel Spacing	:	5MHz
Modulation Type	:	IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Description	:	Ant0: External Antenna, 2.1dBi(Max.) Ant1: External Antenna, 2.1dBi(Max.)
WIFI(5.2G Band)		
Frequency Range	:	5180MHz~5240MHz
Channel Number	:	4 channels for 20MHz bandwidth(5180MHz~5240MHz) 2 channels for 40MHz bandwidth(5190MHz~5230MHz)
Modulation Type	:	IEEE 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Description	:	Ant0: External Antenna, 2.6dBi(Max.) Ant1: External Antenna, 2.6dBi(Max.)
WIFI(5.8G Band)		
Frequency Range	:	5745MHz~5825MHz
Channel Number	:	5 channels for 20MHz bandwidth(5745MHz~5825MHz) 2 channels for 40MHz bandwidth(5755MHz~5795MHz)
Modulation Type	:	IEEE 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Description	:	Ant0: External Antenna, 3.4dBi(Max.) Ant1: External Antenna, 3.4dBi(Max.)
Exposure category	:	General population/uncontrolled environment
EUT Type	:	Production Unit
Device Type	:	Mobile Device





2. 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 modelled 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.

3. Limit

3. 1 Refer Evaluation Method

[ANSI C95.1–2019](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz

[FCC KDB publication 447498 D01 General 1 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 2.1091](#): Radiofrequency radiation exposure evaluation: mobile devices.



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3.2 Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	6
3.0 – 30	1842/f	4.89/f	(900/f ²)*	6
30 – 300	61.4	0.163	1.0	6
300 – 1500	/	/	f/300	6
1500 – 100,000	/	/	5	6

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for Occupational/Uncontrolled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 30	824/f	2.19/f	(180/f ²)*	30
30 – 300	27.5	0.073	0.2	30
300 – 1500	/	/	f/1500	30
1500 – 100,000	/	/	1.0	30

F=frequency in MHz

*=Plane-wave equivalent power density

4. MPE 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. Antenna Information

EUT can only use antennas certificated as follows provided by manufacturer;

Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Notes
External Antenna	2412MHz~2462MHz	2412MHz~2462MHz: 2.1dBi(Max.)	WIFI Antenna 0
	5180MHz~5240MHz	5180MHz~5240MHz: 2.6dBi(Max.)	
	5745MHz~5825MHz	5745MHz~5825MHz: 3.4dBi(Max.)	
External Antenna	2412MHz~2462MHz	2412MHz~2462MHz: 2.1dBi(Max.)	WIFI Antenna 1
	5180MHz~5240MHz	5180MHz~5240MHz: 2.6dBi(Max.)	
	5745MHz~5825MHz	5745MHz~5825MHz: 3.4dBi(Max.)	



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**6. Conducted Power****[2.4G WIFI]**

Mode	Channel	Frequency (MHz)	Ant0 Max Conducted Power(dBm)	Ant1 Max Conducted Power(dBm)
11B	1	2412	18.27	18.3
	6	2437	18.78	18.07
	11	2462	18.24	18.76
11G	1	2412	17.55	17.61
	6	2437	17.46	17.56
	11	2462	17.32	17.48
11N20 SISO	1	2412	17.73	17.79
	6	2437	17.64	17.76
	11	2462	17.53	17.51
11N40 SISO	3	2422	17.72	17.82
	6	2437	17.45	17.56
	9	2452	17.71	17.83

[5.2G WIFI]

Mode	Channel	Frequency (MHz)	Ant0 Max Conducted Power(dBm)	Ant1 Max Conducted Power(dBm)
11A	36	5180	16.63	16.54
	40	5200	16.41	16.27
	48	5240	15.96	16.25
11N20 SISO	36	5180	16.73	16.46
	40	5200	16.62	16.61
	48	5240	16.19	16.24
11N40 SISO	38	5190	16.56	16.53
	46	5230	16.36	16.67

[5.8G WIFI]

Mode	Channel	Frequency (MHz)	Ant0 Max Conducted Power(dBm)	Ant1 Max Conducted Power(dBm)
11A	149	5745	16.09	16.55
	157	5785	16.45	16.07
	165	5825	15.99	16.47
11N20 SISO	149	5745	16.14	16.83
	157	5785	16.22	16.07
	165	5825	16.25	16.51
11N40 SISO	151	5755	16.43	17.02
	159	5795	16.37	16.71





7. Manufacturing Tolerance

[2.4G WIFI_Ant0]			
IEEE 802.11b(Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	18.0	18.0	18.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11g(Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	17.0	17.0	17.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n20(Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	17.0	17.0	17.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n40(Peak)			
Channel	Channel 03	Channel 06	Channel 09
Target (dBm)	17.0	17.0	17.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

[2.4G WIFI_Ant1]			
IEEE 802.11b(Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	18.0	18.0	18.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11g(Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	17.0	17.0	17.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n20(Peak)			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	17.0	17.0	17.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n40(Peak)			
Channel	Channel 03	Channel 06	Channel 09
Target (dBm)	17.0	17.0	17.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

[5.2G WIFI_Ant0]			
IEEE 802.11a (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	16.0	16.0	15.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	16.0	16.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Average)			
Channel	Channel 38	Channel 46	
Target (dBm)	16.0	16.0	
Tolerance $\pm$ (dB)	1.0	1.0	





[5.2G WIFI_Ant1]

IEEE 802.11a (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	16.0	16.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	16.0	16.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Average)			
Channel	Channel 38	Channel 46	
Target (dBm)	16.0	16.0	
Tolerance $\pm$ (dB)	1.0	1.0	

[5.8G WIFI_Ant0]

IEEE 802.11a (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	16.0	16.0	15.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	16.0	16.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Average)			
Channel	Channel 151	Channel 159	
Target (dBm)	16.0	16.0	
Tolerance $\pm$ (dB)	1.0	1.0	

[5.8G WIFI_Ant1]

IEEE 802.11a (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	16.0	16.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	16.0	16.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Average)			
Channel	Channel 151	Channel 159	
Target (dBm)	17.0	16.0	
Tolerance $\pm$ (dB)	1.0	1.0	





8. Measurement Results

8.1 Standalone MPE Evaluation

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, $r=20\text{cm}$, as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

[2.4G WIFI_Ant0]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11b	19.0	79.4328	2.1	1.6218	0.0256	1.0000
IEEE 802.11g	18.0	63.0957	2.1	1.6218	0.0204	1.0000
IEEE 802.11n HT20	18.0	63.0957	2.1	1.6218	0.0204	1.0000
IEEE 802.11n HT40	18.0	63.0957	2.1	1.6218	0.0204	1.0000

[2.4G WIFI_Ant1]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11b	19.0	79.4328	2.1	1.6218	0.0256	1.0000
IEEE 802.11g	18.0	63.0957	2.1	1.6218	0.0204	1.0000
IEEE 802.11n HT20	18.0	63.0957	2.1	1.6218	0.0204	1.0000
IEEE 802.11n HT40	18.0	63.0957	2.1	1.6218	0.0204	1.0000

[5.2G WIFI_Ant0]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11a	17.0	50.1187	2.6	1.8197	0.0182	1.0000
IEEE 802.11n HT20	17.0	50.1187	2.6	1.8197	0.0182	1.0000
IEEE 802.11n HT40	17.0	50.1187	2.6	1.8197	0.0182	1.0000

[5.2G WIFI_Ant1]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11a	17.0	50.1187	2.6	1.8197	0.0182	1.0000
IEEE 802.11n HT20	17.0	50.1187	2.6	1.8197	0.0182	1.0000
IEEE 802.11n HT40	17.0	50.1187	2.6	1.8197	0.0182	1.0000

[5.8G WIFI_Ant0]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11a	17.0	50.1187	3.4	2.1878	0.0218	1.0000
IEEE 802.11n HT20	17.0	50.1187	3.4	2.1878	0.0218	1.0000
IEEE 802.11n HT40	18.0	63.0957	3.4	2.1878	0.0275	1.0000

[5.8G WIFI_Ant1]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11a	17.0	50.1187	3.4	2.1878	0.0218	1.0000
IEEE 802.11n HT20	17.0	50.1187	3.4	2.1878	0.0218	1.0000
IEEE 802.11n HT40	17.0	50.1187	3.4	2.1878	0.0218	1.0000

Remark:



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1. Output power including tune-up tolerance;
2. Output power was adjusted to duty cycle at 100% if measured duty cycle less than 98%;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer.

8.2 Simultaneous Transmission MPE Evaluation

The sample support two WIFI Antenna, so need consider simultaneous transmission;

Simultaneous transmission MPE

According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

$\sum$ of MPE ratios ≤ 1.0

WIFI Ant0 MAX ratios	WIFI Ant1 MAX ratios	$\sum$ MPE ratios	Limit	Results
0.0275	0.0256	0.0531	1.0	Pass

Remark:

1. Output power including tune-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer;
3. 2.4G WIFI output power is burst peak power;
4. 5G WIFI output power is burst average power;
5. MPE values = $PG/4\pi R^2$

9. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

-----THE END OF REPORT-----

