



# FCC Test Report

**Test report  
On Behalf of  
Shenzhen Cireck Robot Technology Co., Ltd  
For  
robot vacuum cleaner  
Model No.: SL200**

**FCC ID: 2A8IN-SL200A1**

**Prepared For : Shenzhen Cireck Robot Technology Co., Ltd  
C1701 3 Building, Cloud Park Area One, Bantian, Longgang, Shenzhen, China**

**Prepared By : Shenzhen HUAK Testing Technology Co., Ltd.  
1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping,  
Fuhai Street, Bao'an District, Shenzhen, Guangdong, China**

**Date of Test: May. 06, 2023 ~ May. 18, 2023**

**Date of Report: May. 18, 2023**

**Report Number: HK2305061760-E**

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## Test Result Certification

**Applicant's name** ..... Shenzhen Cireck Robot Technology Co., Ltd

Address ..... C1701 3 Building, Cloud Park Area One, Bantian, Longgang, Shenzhen, China

**Manufacture's Name** ..... Shenzhen Cireck Robot Technology Co., Ltd

Address ..... C1701 3 Building, Cloud Park Area One, Bantian, Longgang, Shenzhen, China

### Product description

Trade Mark: 

Product name ..... robot vacuum cleaner

Model and/or type reference : SL200

**Standards** ..... FCC Rules and Regulations Part 15 Subpart C Section 15.247  
ANSI C63.10: 2013

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**Date of Test** .....

Date (s) of performance of tests ..... **May. 06, 2023 ~ May. 18, 2023**

Date of Issue ..... **May. 18, 2023**

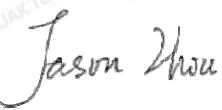
Test Result ..... **Pass**

Testing Engineer : 

(Gary Qian)

Technical Manager : 

(Eden Hu)

Authorized Signatory : 

(Jason Zhou)



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**\*\* Modified History \*\***

Revision	Description	Issued Data	Remark
Revision 1.0	Initial Test Report Release	May. 18, 2023	Jason Zhou

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## 1. Test Result Summary

### 1.1. Test Procedures and Results

Requirement	CFR 47 Section	Result
Antenna requirement	§15.203/§15.247(b)(4)	PASS
AC Power Line Conducted Emission	§15.207	PASS
Conducted Peak Output Power	§15.247(b)(3)	PASS
6dB Emission Bandwidth	§15.247(a)(2)	PASS
Power Spectral Density	§15.247(e)	PASS
Band Edge	§15.247(d)	PASS
Spurious Emission	§15.205/§15.209	PASS

**Note:**

1. PASS: Test item meets the requirement.
2. Fail: Test item does not meet the requirement.
3. N/A: Test case does not apply to the test object.
4. The test result judgment is decided by the limit of test standard.

### 1.2. Information of the Test Laboratory

Shenzhen HUAK Testing Technology Co., Ltd.

Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Testing Laboratory Authorization :

A2LA Accreditation Code is 4781.01.

FCC Designation Number is CN1229.

Canada IC CAB identifier is CN0045.

CNAS Registration Number is L9589.



### 1.3. Measurement Uncertainty

The reported uncertainty of measurement  $y \pm U$ , where expended uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	$\pm 2.71\text{dB}$
2	RF power, conducted	$\pm 0.37\text{dB}$
3	Spurious emissions, conducted	$\pm 0.11\text{dB}$
4	All emissions, radiated(<1G)	$\pm 3.90\text{dB}$
5	All emissions, radiated(>1G)	$\pm 4.28\text{dB}$
6	Temperature	$\pm 0.1^\circ\text{C}$
7	Humidity	$\pm 1.0\%$



## 2. EUT Description

### 2.1. General Description of EUT

Equipment:	robot vacuum cleaner
Model Name:	SL200
Series Model:	N/A
Model Difference:	N/A
FCC ID:	2A8IN-SL200A1
Antenna Type:	Internal Antenna
Antenna Gain:	-0.66dBi
Operation frequency:	802.11b/g/n 20:2412~2462 MHz 802.11n 40: 2422~2452MHz
Number of Channels:	802.11b/g/n20: 11CH 802.11n 40: 7CH
Modulation Type:	CCK/OFDM/DBPSK/DAPSK
Power Source:	DC 20V from adapter or DC 14.4V from battery
Power Rating:	DC 20V from adapter or DC 14.4V from battery

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## 2.2. Carrier Frequency of Channels

Channel List For 802.11b/802.11g/802.11n (HT20)							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2412	04	2427	07	2442	10	2457
02	2417	05	2432	08	2447	11	2462
03	2422	06	2437	09	2452	--	--

Channel List For 802.11n (HT40)							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
--	--	04	2427	07	2442	--	--
--	--	05	2432	08	2447	--	--
03	2422	06	2437	09	2452	--	--

**Note:**

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

## 2.3. Operation of EUT During Testing

**Operating Mode****The mode is used: Transmitting mode for 802.11b/802.11g/802.11n (HT20)**

Low Channel: 2412MHz  
Middle Channel: 2437MHz  
High Channel: 2462MHz

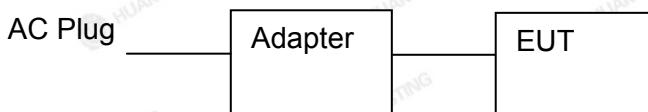
**The mode is used: Transmitting mode for 802.11n (HT40)**

Low Channel: 2422MHz  
Middle Channel: 2437MHz  
High Channel: 2452MHz



## 2.4. Description of Test Setup

Operation of EUT during conducted testing:



Operation of EUT during radiation testing:



### Adapter information

Model: NLD120200W1A4

Input: 100-240V, 50-60Hz, 0.6A

Output: 20V, 1.2A

The sample was placed (0.1m below 1GHz, 0.1m above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. The worst case is Z position.



### 3. General Information

#### 3.1. Test Environment and Mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	56 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Engineering mode:	Keep the EUT in continuous transmitting by select channel and modulations (The value of duty cycle is 98.46%)
The sample was placed (0.1m below 1GHz, 0.1m above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. For the full battery state and The output power to the maximum state.	



We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:

**Per-scan all kind of data rate in lowest channel, and found the follow list which it was worst case.**

Mode	Data rate
802.11b	1Mbps
802.11g	6Mbps
802.11n(H20)	6.5Mbps
802.11n(H40)	13.5Mbps

**Final Test Mode:**

Operation mode:	Keep the EUT in continuous transmitting with modulation
-----------------	---

1. For WIFI function, the engineering test program was provided and enabled to make EUT continuous transmit/receive.

2. According to ANSI C63.10 standards, the test results are both the "worst case" and "worst setup" 1Mbps for 802.11b, 6Mbps for 802.11g, 6.5Mbps for 802.11n(H20), 13.5Mbps for 802.11n(H40). Duty cycle setting during the transmission is 98.5% with maximum power setting for all modulations.



### 3.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	/	/	/	/

**Note:**

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.
3. For conducted measurements (Output Power, 6dB Emission Bandwidth, Power Spectral Density, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.

#### 4. Test Results and Measurement Data

## 4.1. Conducted Emission

## Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.207														
<b>Test Method:</b>	ANSI C63.10:2013														
<b>Frequency Range:</b>	150 kHz to 30 MHz														
<b>Receiver setup:</b>	RBW=9 kHz, VBW=30 kHz, Sweep time=auto														
<b>Limits:</b>	<table border="1"> <thead> <tr> <th rowspan="2">Frequency range (MHz)</th> <th colspan="2">Limit (dBuV)</th> </tr> <tr> <th>Quasi-peak</th> <th>Average</th> </tr> </thead> <tbody> <tr> <td>0.15-0.5</td> <td>66 to 56*</td> <td>56 to 46*</td> </tr> <tr> <td>0.5-5</td> <td>56</td> <td>46</td> </tr> <tr> <td>5-30</td> <td>60</td> <td>50</td> </tr> </tbody> </table>	Frequency range (MHz)	Limit (dBuV)		Quasi-peak	Average	0.15-0.5	66 to 56*	56 to 46*	0.5-5	56	46	5-30	60	50
Frequency range (MHz)	Limit (dBuV)														
	Quasi-peak	Average													
0.15-0.5	66 to 56*	56 to 46*													
0.5-5	56	46													
5-30	60	50													
<b>Test Setup:</b>	<p>Reference Plane</p> <p>40cm</p> <p>E.U.T    AC power    LISN    AC power</p> <p>Test table/Insulation plane</p> <p>80cm</p> <p>Filter</p> <p>EMI Receiver</p> <p>Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.1m</p>														
<b>Test Mode:</b>	transmitting with modulation														
<b>Test Procedure:</b>	<ol style="list-style-type: none"> <li>1. The E.U.T is connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.</li> <li>2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).</li> <li>3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.</li> </ol>														
<b>Test Result:</b>	PASS														

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## Test Instruments

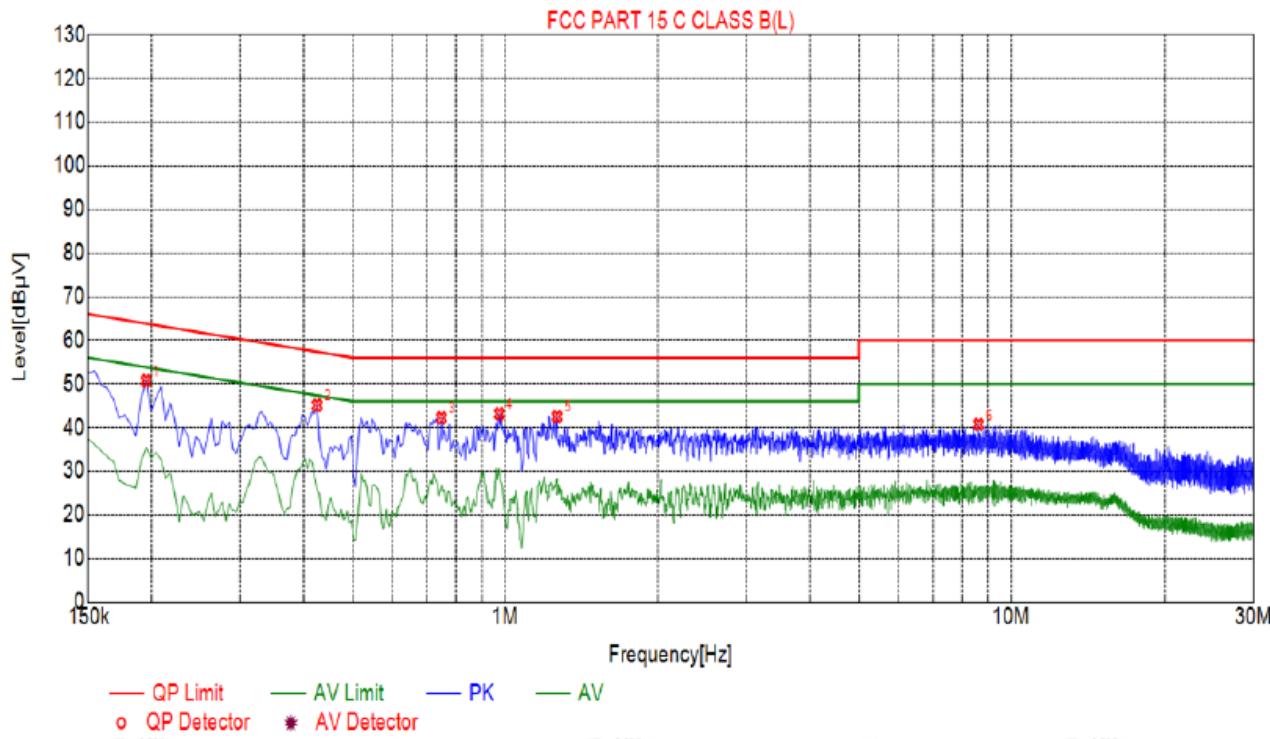
Conducted Emission Shielding Room Test Site (843)					
Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Receiver	R&S	ESR-7	HKE-005	Feb. 17, 2023	Feb. 16, 2024
LISN	R&S	ENV216	HKE-002	Feb. 17, 2023	Feb. 16, 2024
Coax cable (9KHz-30MHz)	Times	381806-002	N/A	Feb. 17, 2023	Feb. 16, 2024
Conducted test software	Tonscend	TS+ Rev 2.5.0.0	HKE-081	N/A	N/A

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).



## 4.2. Test Result

Test Specification: Line



### Suspected List

NO.	Freq. [MHz]	Level [dBμV]	Factor [dB]	Limit [dBμV]	Margin [dB]	Reading [dBμV]	Detector	Type
1	0.1950	50.72	20.03	63.82	13.10	30.69	PK	L
2	0.4245	45.13	20.04	57.36	12.23	25.09	PK	L
3	0.7485	42.22	20.06	56.00	13.78	22.16	PK	L
4	0.9735	43.14	20.06	56.00	12.86	23.08	PK	L
5	1.2660	42.51	20.09	56.00	13.49	22.42	PK	L
6	8.6235	40.69	20.12	60.00	19.31	20.57	PK	L

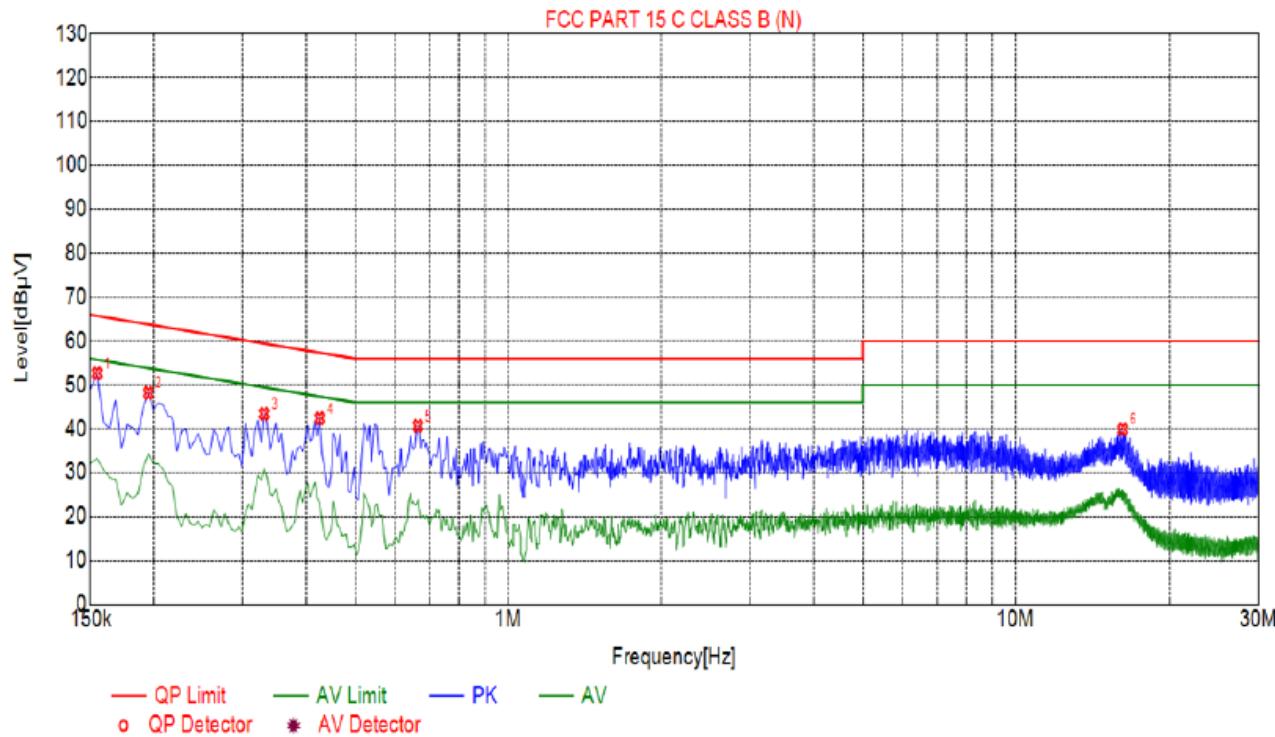
Remark: Margin = Limit – Level

Correction factor = Cable loss + LISN insertion loss

Level=Test receiver reading + correction factor



Test Specification: Neutral



## Suspected List

NO.	Freq. [MHz]	Level [dB $\mu$ V]	Factor [dB]	Limit [dB $\mu$ V]	Margin [dB]	Reading [dB $\mu$ V]	Detector	Type
1	0.1545	52.68	20.03	65.75	13.07	32.65	PK	N
2	0.1950	48.17	20.03	63.82	15.65	28.14	PK	N
3	0.3300	43.41	20.04	59.45	16.04	23.37	PK	N
4	0.4245	42.40	20.04	57.36	14.96	22.36	PK	N
5	0.6630	40.65	20.05	56.00	15.35	20.60	PK	N
6	16.1790	39.88	19.98	60.00	20.12	19.90	PK	N

Remark: Margin = Limit – Level

Correction factor = Cable loss + LISN insertion loss

Level=Test receiver reading + correction factor

### 4.3. Maximum Conducted Output Power

## Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.247 (b)(3)
<b>Test Method:</b>	KDB 558074 D01 15.247 Meas Guidance v05r02
<b>Limit:</b>	30dBm
<b>Test Setup:</b>	 <p>The diagram illustrates the test setup. On the left is a green rectangular box labeled 'RF automatic control unit'. A grey line with a small circle at the connection point extends from its right side. This line passes through a small white rectangular box labeled 'attenuator'. From the right side of the attenuator, another grey line with a small circle extends to a yellow rectangular box labeled 'EUT' (Equipment Under Test).</p>
<b>Test Mode:</b>	Transmitting mode with modulation
<b>Test Procedure:</b>	<ol style="list-style-type: none"><li>1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 15.247 Meas Guidance v05r02.</li><li>2. The RF output of EUT was connected to the RF automatic control unit by RF cable and attenuator. The path loss was compensated to the results for each measurement.</li><li>3. Set to the maximum power setting and enable the EUT transmit continuously.</li><li>4. Measure the Peak output power and record the results in the test report.</li></ol>
<b>Test Result:</b>	PASS

## Test Instruments

RF Test Room					
Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum analyzer	Agilent	N9020A	HKE-048	Feb. 17, 2023	Feb. 16, 2024
Power meter	Agilent	E4419B	HKE-085	Feb. 17, 2023	Feb. 16, 2024
Power Sensor	Agilent	E9300A	HKE-086	Feb. 17, 2023	Feb. 16, 2024
RF cable	Times	1-40G	HKE-034	Feb. 17, 2023	Feb. 16, 2024
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Feb. 17, 2023	Feb. 16, 2024

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

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**Test Data**

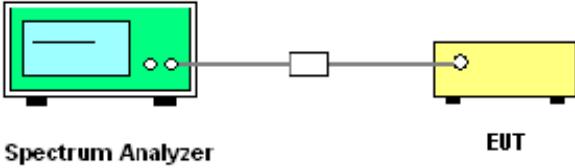
<b>TX 802.11b Mode</b>					
Test Channel	Frequency	Reading Conducted Output Power	Cable loss	Maximum Peak Conducted Output Power	LIMIT
	(MHz)	(dBm)		(dBm)	dBm
CH01	2412	16.33	0.8	17.13	30
CH06	2437	15.67	0.8	16.47	30
CH11	2462	16.99	0.8	17.79	30
<b>TX 802.11g Mode</b>					
CH01	2412	16.12	0.8	16.92	30
CH06	2437	16.43	0.8	17.23	30
CH11	2462	16.31	0.8	17.11	30
<b>TX 802.11n20 Mode</b>					
CH01	2412	16.77	0.8	17.57	30
CH06	2437	16.36	0.8	17.16	30
CH11	2462	16.21	0.8	17.01	30
<b>TX 802.11n40 Mode</b>					
CH03	2422	16.84	0.8	17.64	30
CH06	2437	16.64	0.8	17.44	30
CH09	2452	16.32	0.8	17.12	30

Note: Maximum Peak Conducted Output Power(dBm)= Reading Conducted Output Power(dBm)+ Cable loss



## 4.4. Emission Bandwidth

### Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.247 (a)(2)
<b>Test Method:</b>	KDB 558074 D01 15.247 Meas Guidance v05r02
<b>Limit:</b>	>500kHz
<b>Test Setup:</b>	 <p><b>Spectrum Analyzer</b>      <b>EUT</b></p>
<b>Test Mode:</b>	Transmitting mode with modulation
<b>Test Procedure:</b>	<ol style="list-style-type: none"> <li>1. The testing follows FCC KDB Publication 558074 D01 15.247 Meas Guidance v05r02.</li> <li>2. Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz.</li> <li>4. Measure and record the results in the test report.</li> </ol>
<b>Test Result:</b>	PASS

### Test Instruments

RF Test Room					
Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum analyzer	Agilent	N9020A	HKE-048	Feb. 17, 2023	Feb. 16, 2024
RF cable	Times	1-40G	HKE-034	Feb. 17, 2023	Feb. 16, 2024
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Feb. 17, 2023	Feb. 16, 2024

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

**Test data**

Test channel	6dB Emission Bandwidth (MHz)			
	802.11b	802.11g	802.11n(H20)	802.11n(H40)
Lowest	10.04	16.28	17.00	35.44
Middle	10.04	16.32	17.12	35.12
Highest	10.00	16.28	17.52	35.52
Limit:			>500kHz	
Test Result:			PASS	

**Test plots as follows:**



## 802.11b Modulation

## Lowest channel



## Middle channel



## Highest channel



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## 802.11g Modulation

## Lowest channel



## Middle channel



## Highest channel



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## 802.11n (HT20) Modulation

## Lowest channel



## Middle channel



## Highest channel



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## 802.11n (HT40) Modulation

## Lowest channel



## Middle channel



## Highest channel



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## 4.5. Power Spectral Density

### Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.247 (e)
<b>Test Method:</b>	KDB 558074 D01 15.247 Meas Guidance v05r02
<b>Limit:</b>	The average power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.
<b>Test Setup:</b>	
<b>Test Mode:</b>	Transmitting mode with modulation
<b>Test Procedure:</b>	<ol style="list-style-type: none"><li>1. The testing follows Measurement procedure 10.2 method PKPSD of FCC KDB Publication 558074 D01 15.247 Meas Guidance v05r02.</li><li>2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.</li><li>3. Set to the maximum power setting and enable the EUT transmit continuously.</li><li>4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW): <math>3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}</math>. Video bandwidth VBW <math>\geq 3 \times \text{RBW}</math>. Set the span to at least 1.5 times the OBW.</li><li>5. Detector = Peak, Sweep time = auto couple.</li><li>6. Employ trace averaging (Peak) mode over a minimum of 100 traces. Use the peak marker function to determine the maximum power level.</li><li>7. Measure and record the results in the test report.</li></ol>
<b>Test Result:</b>	PASS

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## Test Instruments

RF Test Room					
Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum analyzer	Agilent	N9020A	HKE-048	Feb. 17, 2023	Feb. 16, 2024
RF Cable (9KHz-26.5GHz)	Tonscend	170660	N/A	Feb. 17, 2023	Feb. 16, 2024
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Feb. 17, 2023	Feb. 16, 2024
RF test software	Tonscend	JS1120-B Version 2.6	HKE-083	N/A	N/A

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

**Test data**

EUT Set Mode	Channel	Result (dBm/30kHz)	Offset	Test Result (dBm/30kHz)	Test Result (dBm/3kHz)
802.11b	Lowest	-8.55	9.44	0.89	-9.11
	Middle	-10.06	9.44	-0.62	-10.62
	Highest	-8.61	9.44	0.83	-9.17
802.11g	Lowest	-14.98	9.44	-5.54	-15.54
	Middle	-14.83	9.44	-5.39	-15.39
	Highest	-14.71	9.44	-5.27	-15.27
802.11n(H20)	Lowest	-15.27	9.44	-5.83	-15.83
	Middle	-15.39	9.44	-5.95	-15.95
	Highest	-15.11	9.44	-5.67	-15.67
802.11n(H40)	Lowest	-17.78	9.44	-8.34	-18.34
	Middle	-18.28	9.44	-8.84	-18.84
	Highest	-17.61	9.44	-8.17	-18.17
PSD Test Result (dBm/30kHz)= Result +Offset					
Offset= Instrument attenuation +cable loss=8.64 dB +0.8 dB =9.44dB					
PSD test result (dBm/3kHz)= PSD test result (dBm/30kHz)-10					
Limit: 8dBm/3kHz					
Test Result:	PASS				

**Test plots as follows:**



## 802.11b Modulation

## Lowest channel



## Middle channel



## Highest channel



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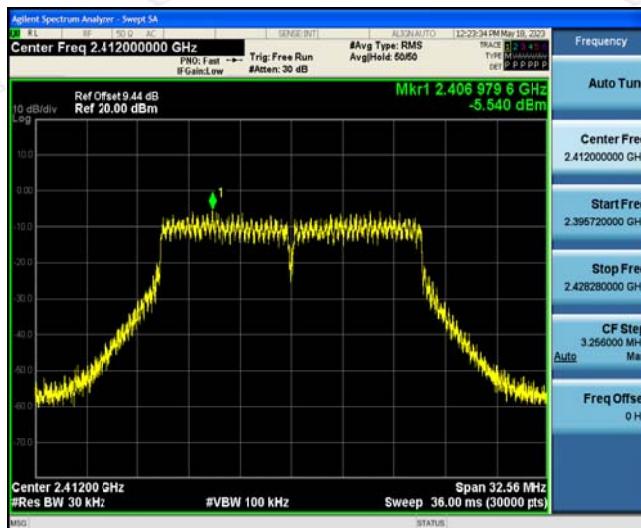
TEL : +86-755 2302 9901 FAX : +86-755 2302 9901 E-mail : [service@cer-mark.com](mailto:service@cer-mark.com)

Add: 1-2F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

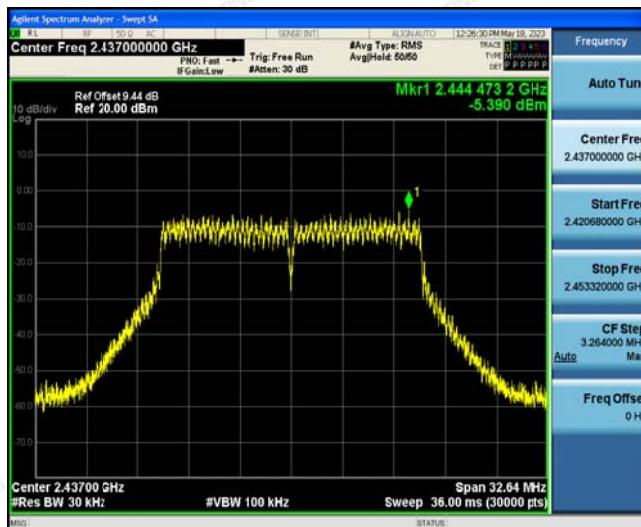


## 802.11g Modulation

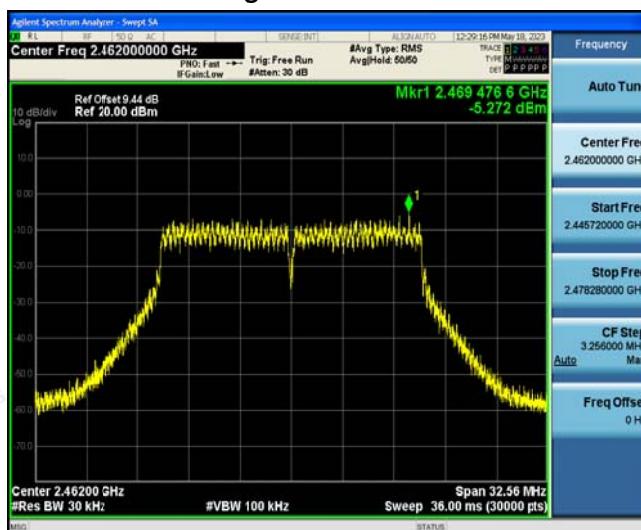
## Lowest channel



## Middle channel



## Highest channel



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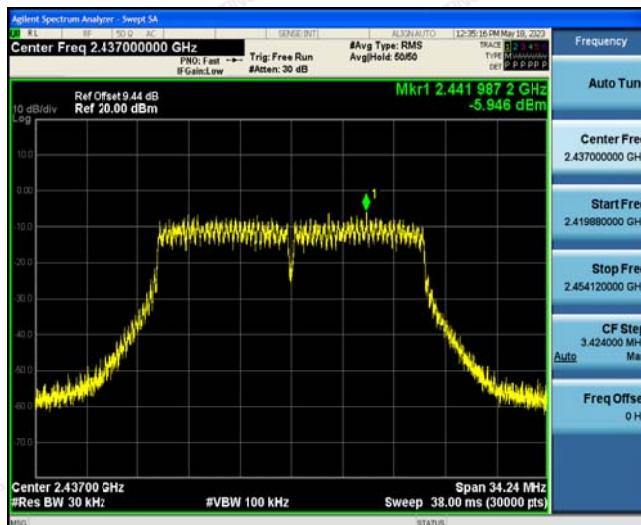


## 802.11n (HT20) Modulation

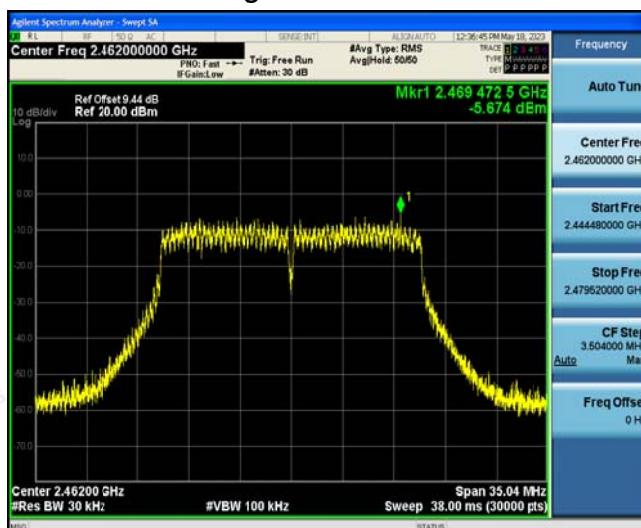
## Lowest channel



## Middle channel



## Highest channel



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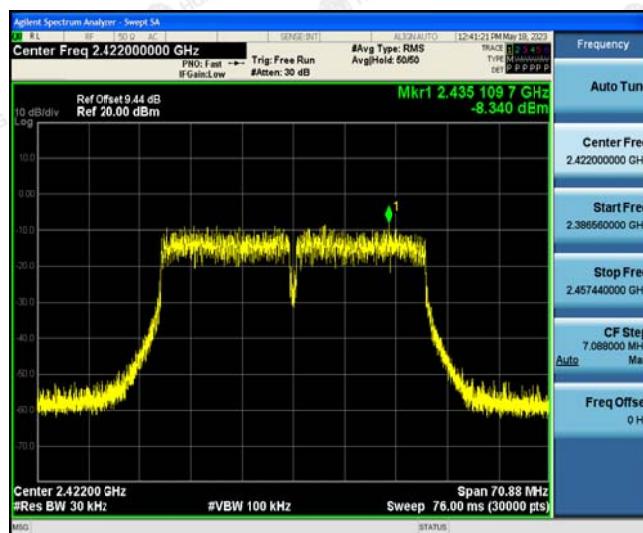
TEL : +86-755 2302 9901 FAX : +86-755 2302 9901 E-mail : [service@cer-mark.com](mailto:service@cer-mark.com)

Add: 1-2F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

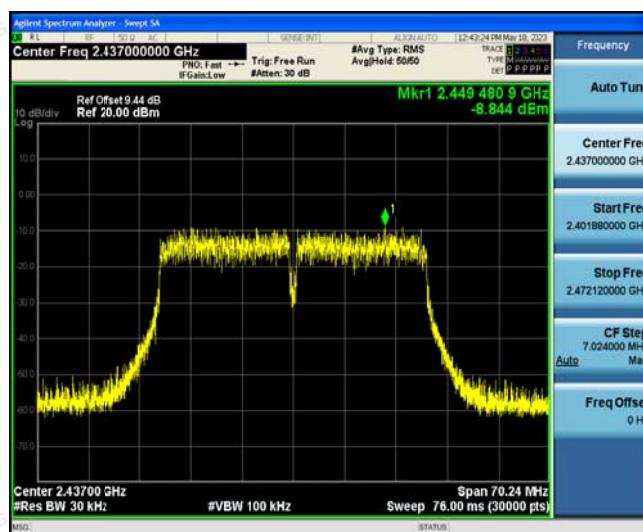


## 802.11n (HT40) Modulation

## Lowest channel



## Middle channel



## Highest channel



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