



FCC TEST REPORT

Test report
On Behalf of
Nanjing Co-Lander Network Technology Co.,Ltd
For
High end smart hotel locks
Model No.: LK-201-L, LK-201

FCC ID: 2AR6K-LK201

Prepared for : Nanjing Co-Lander Network Technology Co.,Ltd
No.9,Yuhua East Road, Yuhuatai District, Nanjing City, Jiangsu Province, China

Prepared By : Shenzhen HUAKE Testing Technology Co., Ltd.
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Bao'an District, Shenzhen City, China

Date of Test: Nov. 13, 2018 ~ Dec. 20, 2018

Date of Report: Dec. 20, 2018

Report Number: HK1811151679-2E



TEST RESULT CERTIFICATION

Applicant's name: Nanjing Co-Lander Network Technology Co.,Ltd
Address: No.9,Yuhua East Road, Yuhuatai District, Nanjing City, Jiangsu Province, China
Manufacture's Name.....: Nanjing Co-Lander Network Technology Co.,Ltd
Address: No.9,Yuhua East Road, Yuhuatai District, Nanjing City, Jiangsu Province, China

Product description

Trade Mark:



Product name.....: High end smart hotel locks
Model and/or type reference : LK-201-L, LK-201
Standards: FCC Rules and Regulations Part 15 Subpart C Section 15.225
ANSI C63.10: 2013

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Date of Test

Date (s) of performance of tests: Nov. 13, 2018 ~ Dec. 20, 2018

Date of Issue.....: Dec. 20, 2018

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

Testing Engineer :

(Gary Qian)

Technical Manager :

(Eden Hu)

Authorized Signatory :

(Jason Zhou)



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1. Test Result Summary

Requirement	CFR 47 Section	Result
Conduction Emission, 0.15MHz to 30MHz	§15.207	N/A
Radiation Emission	§15.225, §15.205, §15.209, §15.35	PASS
Occupied Bandwidth	§ 15.215	PASS
Antenna requirement	§ 15.203	PASS
Frequency stability	§ 15.225	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.

1.1. TEST FACILITY

Test Firm : Shenzhen HUAKE Testing Technology Co., Ltd.

Address 1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China

1.2. MEASUREMENT UNCERTAINTY

Measurement Uncertainty

Conducted Emission Expanded Uncertainty	= 2.23dB, k=2
Radiated emission expanded uncertainty(9kHz-30MHz)	= 3.08dB, k=2
Radiated emission expanded uncertainty(30MHz-1000MHz)	= 4.42dB, k=2
Radiated emission expanded uncertainty(Above 1GHz)	= 4.06dB, k=2



2. EUT Description

Equipment	High end smart hotel locks
Model Name	LK-201-L
Serial No	LK-201
Model Difference	All model's the function, software and electric circuit are the same, only with a product color and model named different. Test sample model: LK-201-L.
FCC ID	2AR6K-LK201
Antenna Type	PCB Antenna
Antenna Gain	0 dBi
BT Operation frequency	13.56MHz
Modulation Type	ASK
Power Source	DC 6V From battery
Power Rating	DC 6V From battery



3. General Information

3.1. Test Environment and Mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	54 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Operation mode:	Keep the EUT in continuous transmitting with modulation
The sample was placed (0.8m below 1GHz, 1.5m 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.	

Per-test mode.			
We have verified the construction and function in typical operation, The EUT was placed on three different polar directions; i.e. X axis, Y axis, Z axis. which was shown in this test report and defined as follows:			
Axis	X	Y	Z
Field Strength(dBuV/m)	62.47	65.62	62.59
Final Test Mode:			
According to ANSI C63.10 standards, the test results are both the “worst case” and “worst setup”: Y axis (see the test setup photo)			

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.

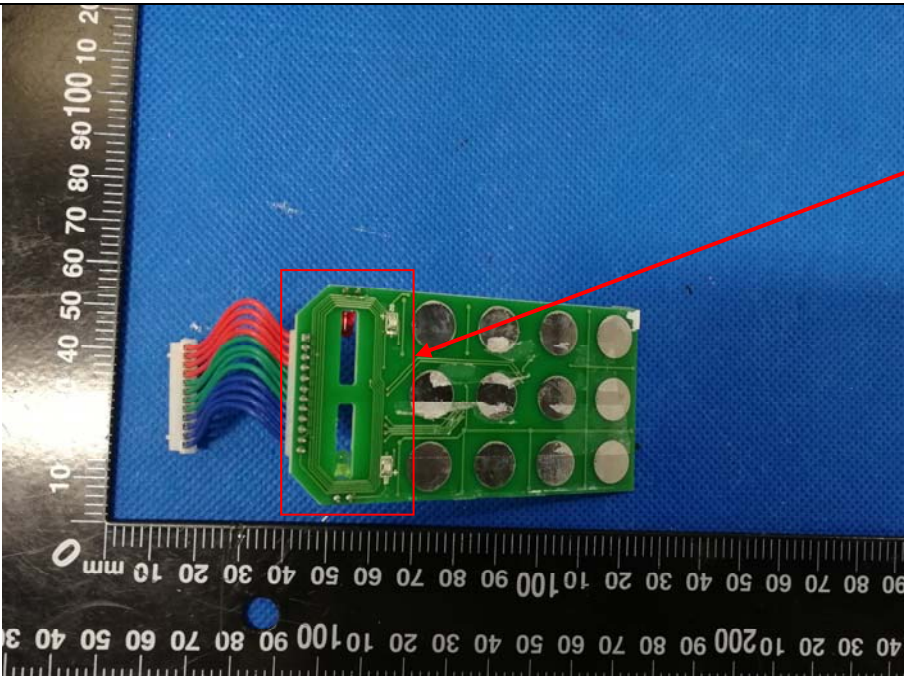
Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	/	/	/	/

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.

4. Test Results and Measurement Data

4.1. Antenna Requirement

Standard requirement:	FCC Part15 C Section 15.203
<p>15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p>	
E.U.T Antenna:	PCB Antenna
<p>The antenna is PCB antenna which permanently attached, and the best case gain of the antenna is 0dBi.</p>	
	



4.2. Conducted Emission

4.2.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.207														
Test Method:	ANSI C63.4:2014														
Frequency Range:	150 kHz to 30 MHz														
Receiver setup:	RBW=9 kHz, VBW=30 kHz, Sweep time=auto														
Limits:	<table><tr><th rowspan="2">Frequency range (MHz)</th><th colspan="2">Limit (dBuV)</th></tr><tr><th>Quasi-peak</th><th>Average</th></tr><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></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													
Test Setup:	<div><p>Reference Plane</p><p>Remark E.U.T.: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p></div>														
Test Mode:	Transmitting Mode														
Test Procedure:	<div><div>1. The E.U.T and simulators are 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.</div><div>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).</div><div>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 C63.4: 2014 on conducted measurement.</div></div>														
Test Result:	N/A; The EUT powered by battery, so this test item is not applicable														
Test Result:	N/A														



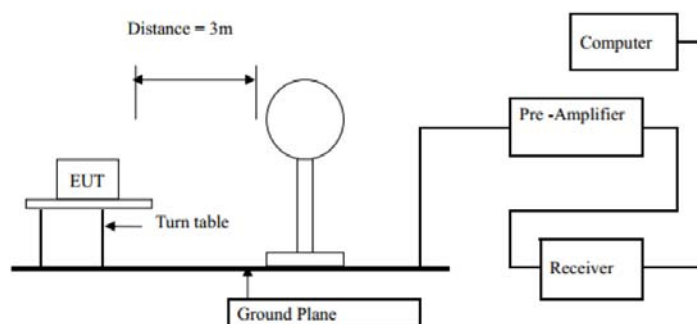
4.3. Radiated Emission Measurement

4.3.1. Test Specification

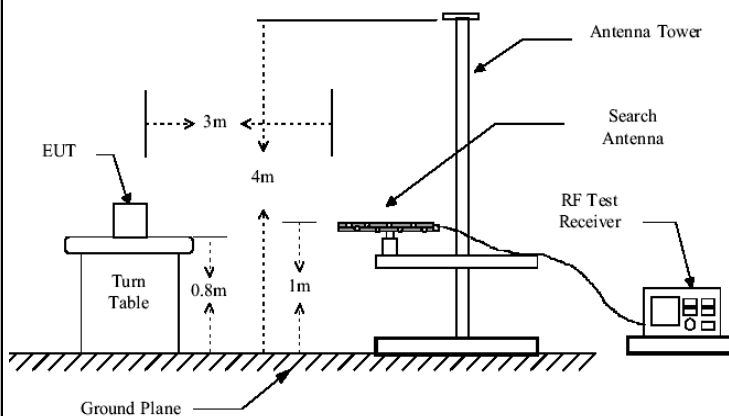
Test Requirement:	FCC Part15 C Section 15.225(a) and 15.209				
Test Method:	ANSI C63.10:2013				
Frequency Range:	9 kHz to 5 GHz				
Measurement Distance:	3 m				
Antenna Polarization:	Horizontal & Vertical				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	9kHz- 150kHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value
	150kHz- 30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value
	30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		Peak	1MHz	10Hz	Average Value
	<div>1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber in below 1GHz, 1.5m above the ground in above 1GHz. The table was rotated 360 degrees to determine the position of the highest radiation.</div> <div>2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</div> <div>3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.</div> <div>4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.</div> <div>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</div> <div>6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</div>				

Test setup:

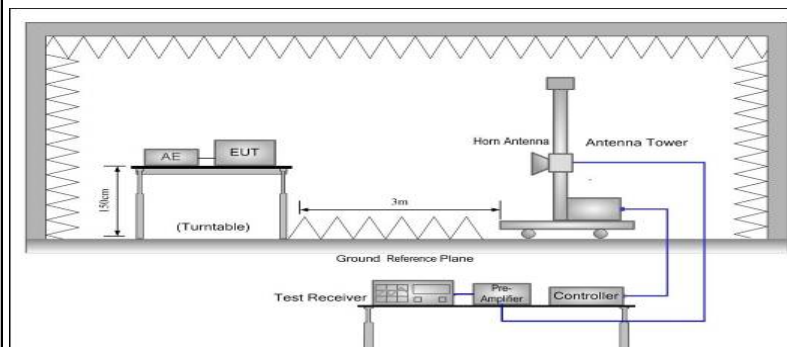
For radiated emissions below 30MHz



30MHz to 1GHz



Above 1GHz



Test Mode:

Transmitting Mode

Test results:

PASS

**4.3.2. Limit**

(a) The field strength of any emission within this band shall not exceed 10,000 microvolts/meter at 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply.

Frequencies in restricted band are complied to limit on Paragraph 15.209

Frequency Range (MHz)	Distance (m)	Field strength (dB μ V/m)
0.009-0.490	3	$20\log 2400/F$ (kHz) + 80
0.490-1.705	3	$20\log 24000/F$ (kHz) + 40
1.705-30	3	$20\log 30$ + 40
30-88	3	40.0
88-216	3	43.5
216-960	3	46.0
Above 960	3	54.0

4.3.3. Test Instruments

Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
ESPI Test Receiver	ROHDE&SCHWARZ	ESVD	100008	Dec. 27, 2018
Spectrum Analyzer	ROHDE&SCHWARZ	FSEM	848597/001	Dec. 27, 2018
Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Dec. 27, 2018
Pre-amplifier	HP	8447D	2727A05017	Dec. 27, 2018
Loop antenna	ZHINAN	ZN30900A	12024	Dec. 27, 2018
Broadband Antenna	Schwarzbeck	VULB9163	340	Dec. 27, 2018
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Dec. 27, 2018
Coax cable	HUAK	N/A	N/A	Dec. 27, 2018
Coax cable	HUAK	N/A	N/A	Dec. 27, 2018
Coax cable	HUAK	N/A	N/A	Dec. 27, 2018
Coax cable	HUAK	N/A	N/A	Dec. 27, 2018
EMI Test Software	Shurple Technology	EZ-EMC	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).



4.3.4. Test Data

Field Strength of Fundamental

Frequency (MHz)	Reading (dBuV/m)	Correction Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polar (H/V)	Detector
13.21	46.35	15.82	62.17	80.51	-18.34	H	QP
13.21	46.01	15.82	61.83	80.51	-18.68	V	QP
13.85	45.89	15.82	61.71	80.51	-18.8	H	QP
13.85	48.3	15.82	64.12	80.51	-16.39	V	QP
13.56	88.15	12.33	100.48	124	-23.52	H	Peak
13.56	84.79	12.33	97.12	124	-26.88	V	Peak
13.45	53.69	15.82	69.51	90.47	-20.96	H	QP
13.45	52.13	15.82	67.95	90.47	-22.52	V	QP
13.62	50.24	15.82	66.06	90.47	-24.41	H	QP
13.62	49.28	15.82	65.1	90.47	-25.37	V	QP

Harmonics and Spurious Emissions

Frequency Range (9 kHz-30MHz)

Frequency (MHz)	Level@3m (dBμV/m)	Limit@3m (dBμV/m)
--	--	--
--	--	--
--	--	--
--	--	--

Note: 1. Emission Level=Reading+ Cable loss-Antenna factor-Amp factor

2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement

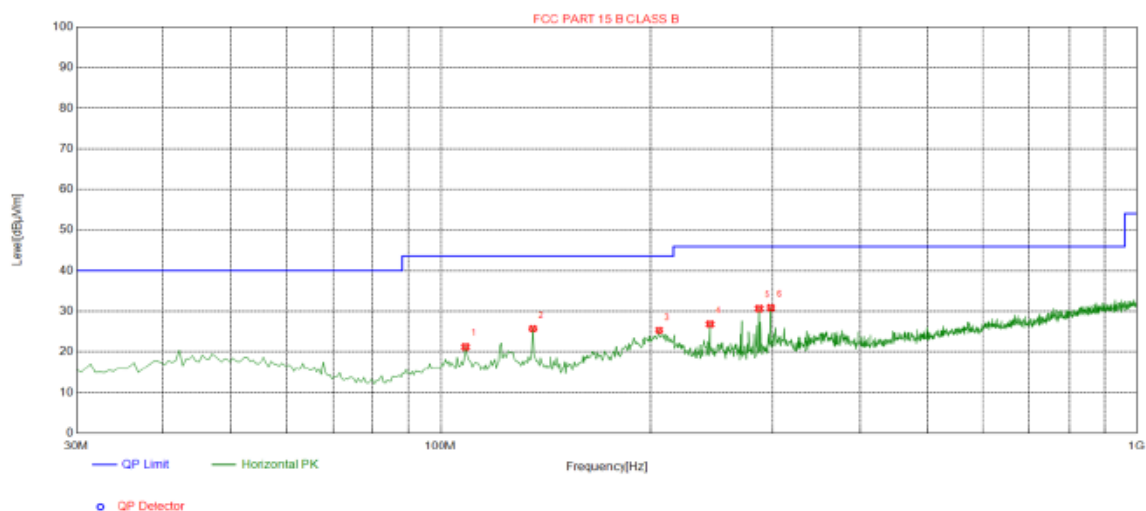


About 30MHz-1GHz

Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

The level of the peak emission are less than the average limit, so the average value is not reflected in the report.

Horizontal

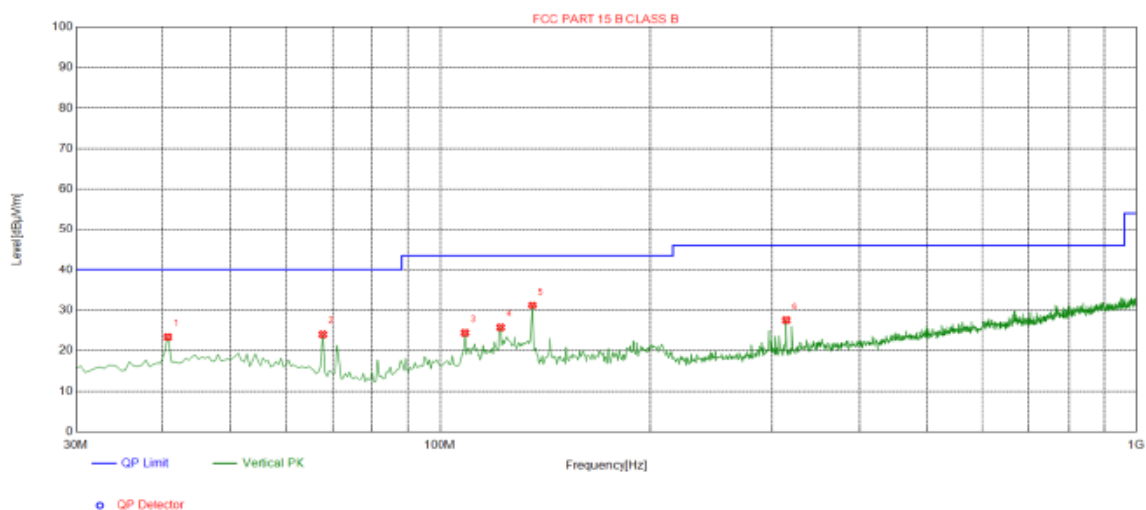


Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	108.570	21.20	-15.43	43.50	22.30	100	62	Horizontal
2	135.730	25.71	-18.92	43.50	17.79	100	181	Horizontal
3	206.055	25.28	-14.90	43.50	18.22	100	140	Horizontal
4	243.885	26.88	-13.67	46.00	19.12	100	106	Horizontal
5	286.565	30.64	-12.98	46.00	15.36	100	115	Horizontal
6	298.205	30.82	-12.75	46.00	15.18	100	286	Horizontal



Vertical




Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	40.6700	23.47	-14.42	40.00	16.53	100	305	Vertical
2	67.8300	24.12	-17.13	40.00	15.88	100	341	Vertical
3	108.570	24.49	-15.43	43.50	19.01	100	262	Vertical
4	122.150	25.81	-17.42	43.50	17.69	100	223	Vertical
5	135.730	31.25	-18.92	43.50	12.25	100	187	Vertical
6	314.210	27.58	-12.40	46.00	18.42	100	44	Vertical



4.4. Occupied Bandwidth

4.4.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.215(c)
Test Method:	ANSI C63.10: 2013
Limit:	N/A
	<ol style="list-style-type: none">1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT.2. Set to the maximum power setting and enable the EUT transmit continuously.3. Use the following spectrum analyzer settings for 20dB Bandwidth measurement. Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel; RBW \geq 1% of the 20 dB bandwidth; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold.4. Measure and record the results in the test report.
Test setup:	 <p>Spectrum Analyzer EUT</p>
Test Mode:	Transmitting Mode
Test results:	PASS

4.4.2. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100060	Dec. 27, 2018

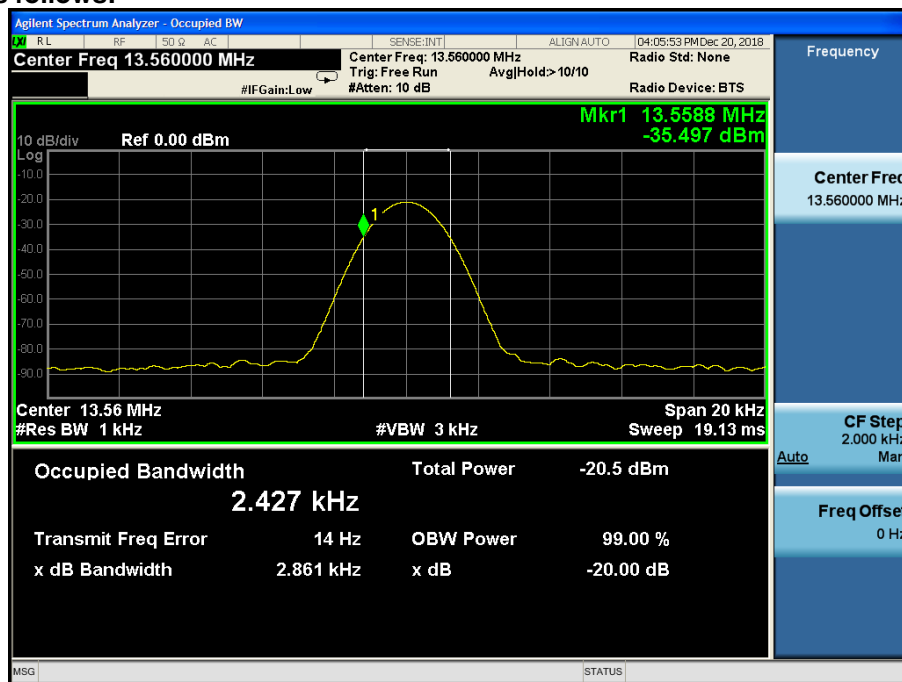
Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).



4.4.3. Test data

Test Channel (MHz)	20dB Occupy Bandwidth (kHz)	Limit (kHz)	Conclusion
13.56	2.861	N/A	PASS

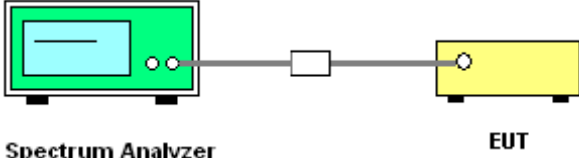
Test plots as follows:





4.5. Frequency stability

4.5.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.225
Test Method:	ANSI C63.10: 2013
Limit:	+/-0.01%
	<ol style="list-style-type: none">1. The equipment under test was connected to an external DC power supply and input rated voltage.2. RF output was connected to a spectrum analyzer.3. The EUT was placed inside the temperature chamber.4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25°C operating frequency as reference frequency.5. Turn EUT off and set the chamber temperature to - 20°C. After the temperature stabilized for approximately 30 minutes recorded the frequency.6. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.
Test setup:	 <p>The diagram illustrates the test setup. On the left is a green rectangular box labeled 'Spectrum Analyzer'. A black cable connects it to a small white rectangular box. This white box is connected to a yellow rectangular box labeled 'EUT' (Equipment Under Test).</p>
Test Mode:	Transmitting Mode
Test results:	PASS

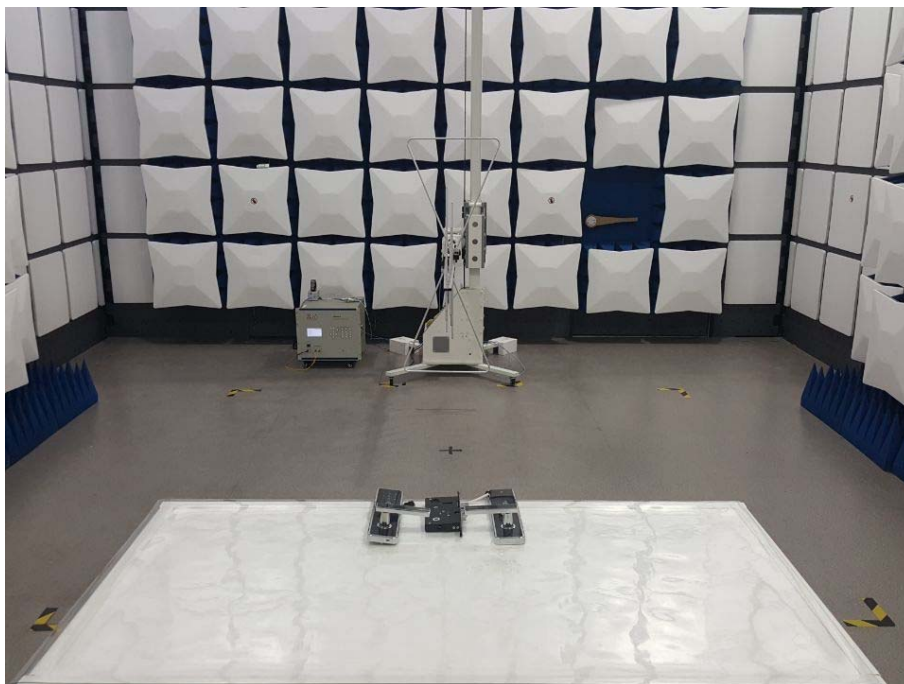
**4.5.2. Test Data**

Voltage (Vdc)	Temperature (°C)	Frequency (MHz)	Deviation (%)	Limit (%)
6	0	13.560250	0.00184	+/-0.01%
6	10	13.560324	0.00239	
6	20	13.560185	0.00136	
6	30	13.560542	0.00400	
6	40	13.560227	0.00167	
6	45	13.560357	0.00263	
6.4	20	13.560211	0.00156	
5.7	20	13.560322	0.00237	



Appendix A: Photographs of Test Setup

Radiated Emission



*******END OF REPORT*******