FCC TEST REPORT

Test report

On Behalf of

Guangzhou Lightsource Electronics Technology Limited

For

smart lock

Model No.: G20

Serial Model：N10, N20, N30, H01, H11, H21, H31, H61, M11, M21, G11, G21, F11, E13, S06, S31, S21, A10, A11, A12

FCC ID: 2ASLK-G20

Prepared for:	**Guangzhou Lightsource Electronics Technology Limited** **Room 1201, #609 Tianhe North Road, Tianhe District, Guangzhou, China**
Prepared By:	**Shenzhen HUAK Testing Technology Co., Ltd.** **1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China**
Date of Test:	**Dec. 17, 2018 ~ Dec. 25, 2018**
Date of Report:	**Dec. 25, 2018**
Report Number:	**HK1812141883-E**

TEST RESULT CERTIFICATION

Applicant's name ..... : Guangzhou Lightsource Electronics Technology Limited

Address ..... : Room 1201, #609 Tianhe North Road, Tianhe District, Guangzhou, China

Manufacture's Name ..... : Guangzhou Lightsource Electronics Technology Limited

Address ..... : Room 1201, #609 Tianhe North Road, Tianhe District, Guangzhou, China

Product description

Trade Mark: N/A

Product name ..... : smart lock

Model and/or type reference : N10, N20, N30, H01, H11, H21, H31, H61, M11, M21, G11, G21, F11, E13, S06, S31, S21, A10, A11, A12, G20

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 ..... : Dec. 17, 2018 ~ Dec. 25, 2018

Date of Issue ..... : Dec. 25, 2018

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

Testing Engineer : Gary Qian

(Gary Qian)

Technical Manager : Eden Hu

(Eden Hu)

Authorized Signatory : Jason Zhou

(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 HUAK 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	smart lock
Model Name	G20
Serial No	N10, N20, N30, H01, H11, H21, H31, H61, M11, M21, G11, G21, F11, E13, S06, S31, S21, A10, A11, A12
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: G20.
FCC ID	**2ASLK-G20**
Antenna Type	PCB Antenna
Antenna Gain	0 dBi
Operation frequency	13.56MHz
Modulation Type	ASK
Power Source	DC 6V (4×AA Batteries)
Power Rating	DC 6V (4×AA Batteries)

3. Genera 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
/	/	/	/	/

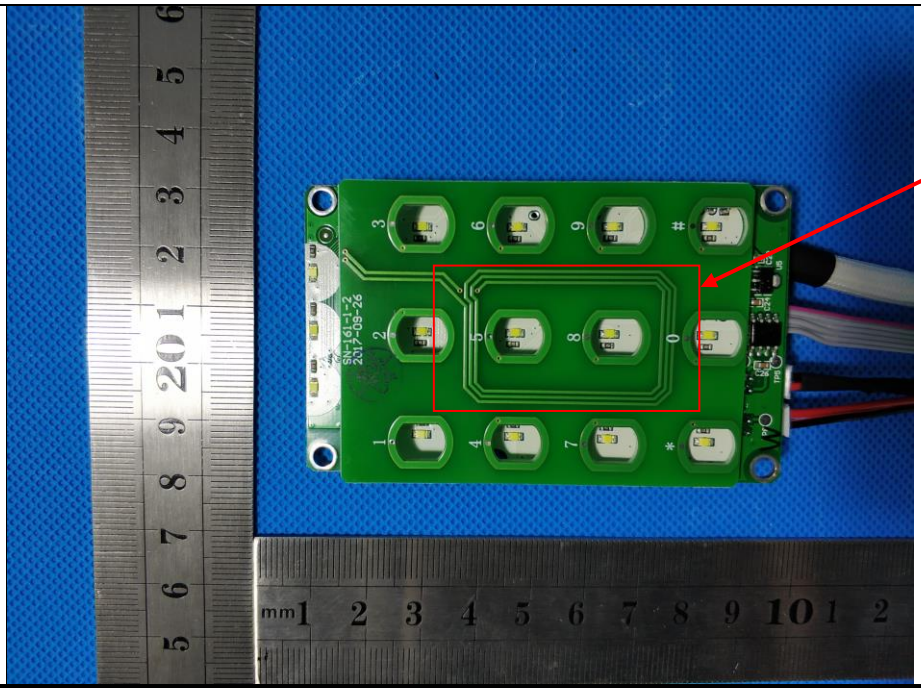
Note:

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

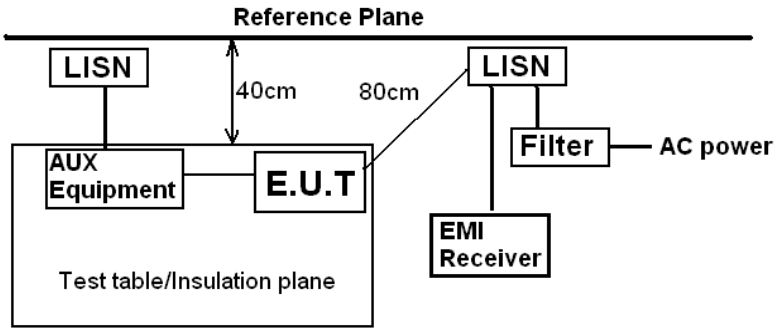
4.1. Antenna Requirement

Standard requirement:	FCC Part15 C Section 15.203
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.	
E.U.T Antenna:	PCB Antenna
The antenna is PCB antenna which permanently attached, and the best case gain of the antenna is 0dBi.	



4.2. Conducted Emission

4.2.1. Test Specification

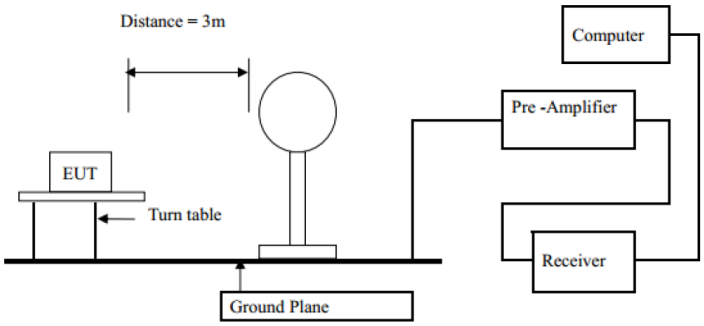
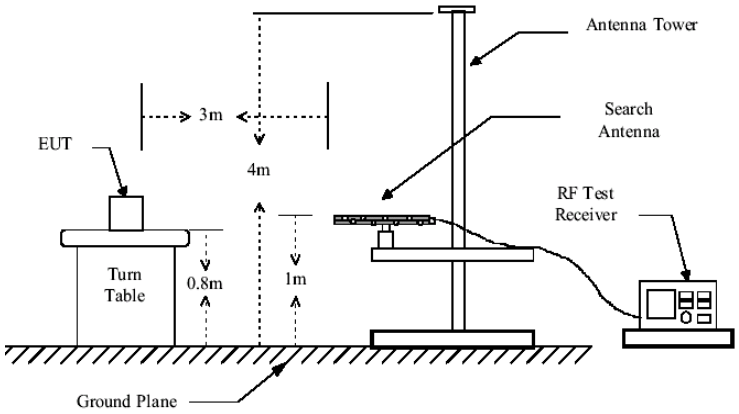
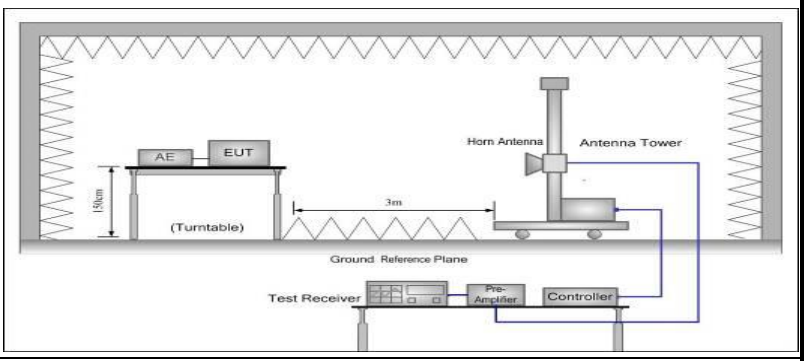
<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.207</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.4:2014</td></tr>
<tr><td>Frequency Range:</td><td>150 kHz to 30 MHz</td></tr>
<tr><td>Receiver setup:</td><td>RBW=9 kHz, VBW=30 kHz, Sweep time=auto</td></tr>
<tr><td>Limits:</td><td>
<table>
<tr><td rowspan="2">Frequency range (MHz)</td><td colspan="2">Limit (dBuV)</td></tr>
<tr><td>Quasi-peak</td><td>Average</td></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>
</td></tr>
<tr><td>Test Setup:</td><td>


Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m
</td></tr>
<tr><td>Test Mode:</td><td>Transmitting Mode</td></tr>
<tr><td>Test Procedure:</td><td>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.
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).
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.</td></tr>
<tr><td>Test Result:</td><td>N/A; The EUT powered by battery, so this test item is not applicable</td></tr>
<tr><td>Test Result:</td><td>N/A</td></tr>
</table>

4.3. Radiated Emission Measurement

4.3.1. Test Specification

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.225(a) and 15.209</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Frequency Range:</td><td>9 kHz to 5 GHz</td></tr>
<tr><td>Measurement Distance:</td><td>3 m</td></tr>
<tr><td>Antenna Polarization:</td><td>Horizontal & Vertical</td></tr>
<tr><td>Receiver Setup:</td><td>
<table>
<tr><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</td></tr>
<tr><td>9kHz- 150kHz</td><td>Quasi-peak</td><td>200Hz</td><td>1kHz</td><td>Quasi-peak Value</td></tr>
<tr><td>150kHz-30MHz</td><td>Quasi-peak</td><td>9kHz</td><td>30kHz</td><td>Quasi-peak Value</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>100KHz</td><td>300KHz</td><td>Quasi-peak Value</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average Value</td></tr>
</table>
</td></tr>
<tr><td></td><td>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.
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.
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.
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.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
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.</td></tr>
</table>

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 emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

Frequencies in restricted band are complied to limit on Paragraph 15.209

Frequency Range (MHz)	Distance (m)	Field strength (dB μV/m)
0.009-0.490	3	20log 2400/F (kHz) + 80
0.490-1.705	3	20log 24000/F (kHz) + 40
1.705-30	3	20log 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
13.28	46.40	15.82	62.22	80.51	-18.29	H	QP
13.28	46.06	15.82	61.88	80.51	-18.63	V	QP
13.87	45.97	15.82	61.79	80.51	-18.72	H	QP
13.87	48.33	15.82	64.15	80.51	-16.36	V	QP
13.56	88.16	12.33	100.49	124.00	-23.51	H	Peak
13.56	84.86	12.33	97.19	124.00	-26.81	V	Peak
13.46	53.77	15.82	69.59	90.47	-20.88	H	QP
13.46	52.15	15.82	67.97	90.47	-22.50	V	QP
13.65	50.33	15.82	66.15	90.47	-24.32	H	QP
13.65	49.34	15.82	65.16	90.47	-25.31	V	QP

Harmonics and Spurious Emissions

Frequency Range (9 kHz-30MHz)

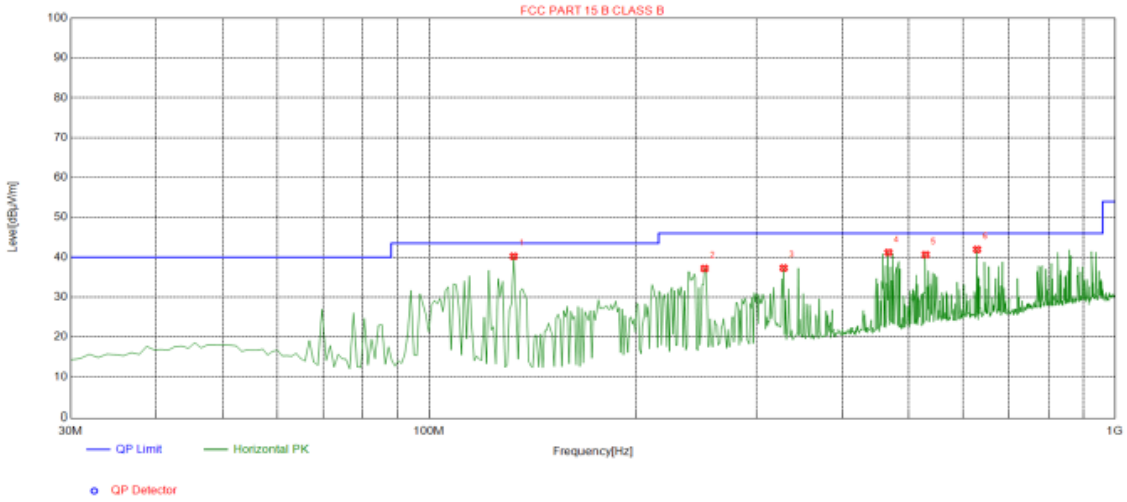
Frequency (MHz)	Level@3m (dBµV/m)	Limit@3m (dBµV/m)
--	--	--
--	--	--
--	--	--
--	--	--

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.

Antenna polarity: H

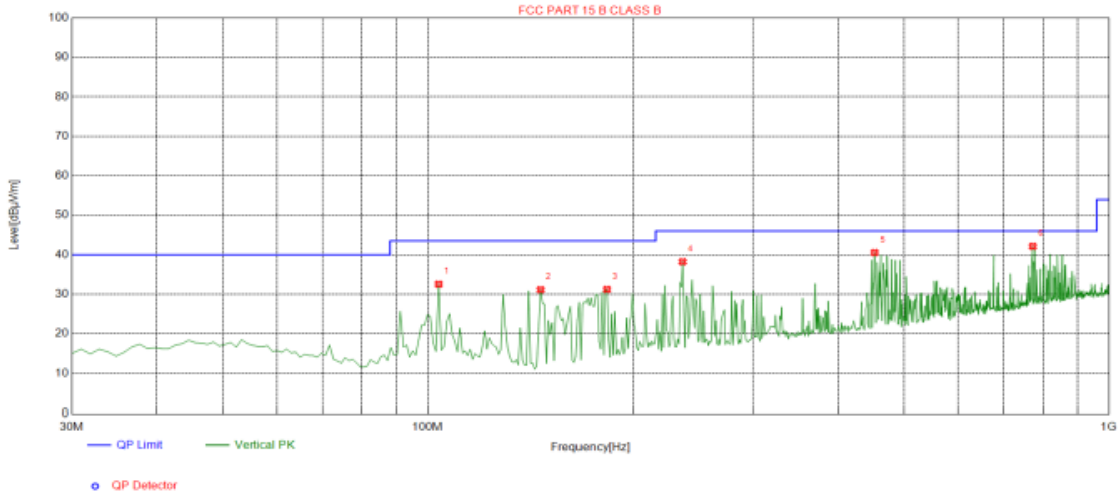


Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	132.820	40.24	-18.74	43.50	3.26	100	360	Horizontal
2	252.130	37.18	-13.42	46.00	8.82	100	360	Horizontal
3	328.760	37.30	-11.65	46.00	8.70	100	276	Horizontal
4	467.470	41.20	-8.42	46.00	4.80	100	276	Horizontal
5	529.550	40.64	-7.46	46.00	5.36	100	276	Horizontal
6	629.460	41.95	-5.48	46.00	4.05	100	123	Horizontal

Remark: Transd = Cableloss + Antenna factor - Pre-amplifier; Margin = Limit – Level

Antenna polarity: V



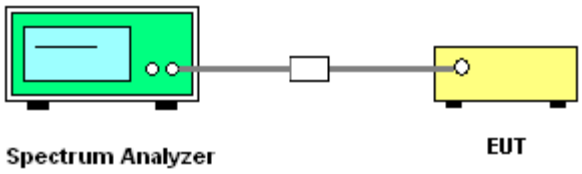
Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	103.720	32.54	-15.41	43.50	10.96	100	284	Vertical
2	146.400	31.14	-19.03	43.50	12.36	100	284	Vertical
3	183.260	31.21	-16.58	43.50	12.29	100	191	Vertical
4	236.610	38.23	-14.01	46.00	7.77	100	284	Vertical
5	452.920	40.55	-8.90	46.00	5.45	100	98	Vertical
6	773.020	42.13	-3.25	46.00	3.87	100	284	Vertical

Remark: Transd = Cableloss + Antenna factor - Pre-amplifier; Margin = Limit – Level

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
	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⩾1% of the 20 dB bandwidth; VBW⩾RBW; Sweep = auto; Detector function = peak; Trace = max hold. 4. Measure and record the results in the test report.
Test setup:	
Test Mode:	Transmitting Mode
Test results:	PASS

4.4.2. Test Instruments

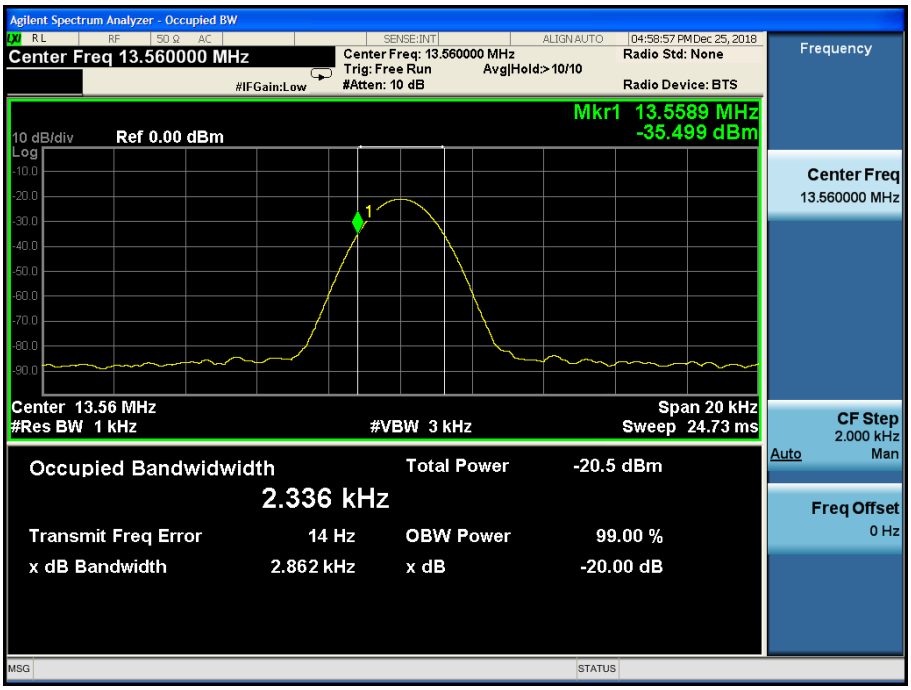
RF Test Room				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	N9020A	MY49100060	Dec. 27, 2018

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

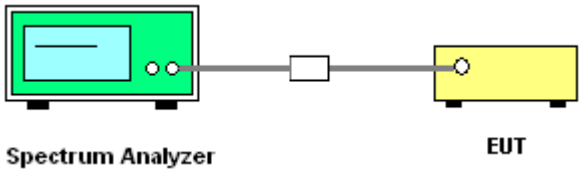
Test Channel (MHz)	20dB Occupy Bandwidth (kHz)	Limit (kHz)	Conclusion
13.56	2.862	N/A	PASS

Test plots as follows:



4.5. Frequency stability

4.5.1. Test Specification

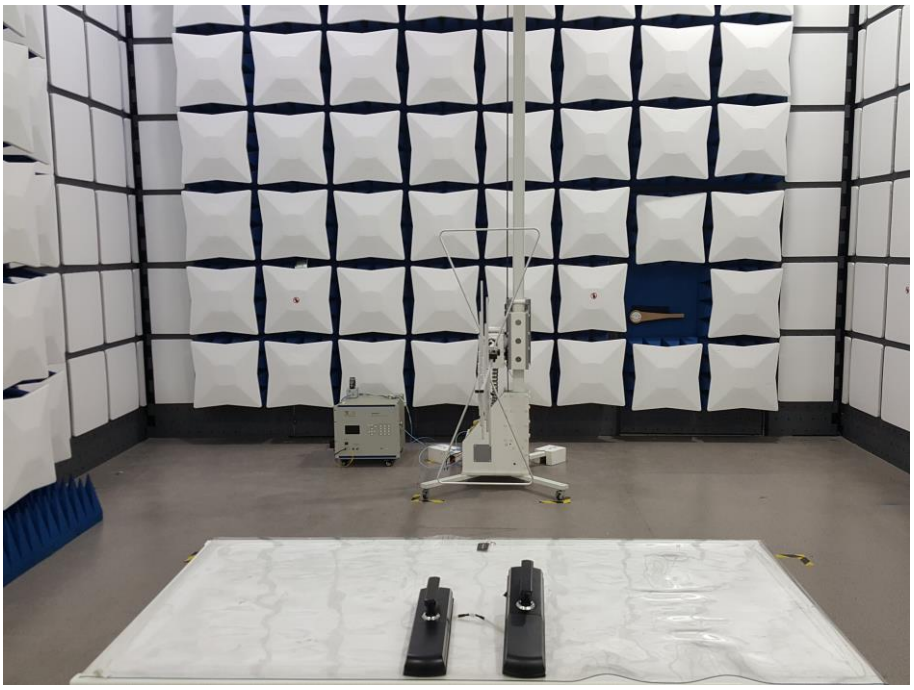
Test Requirement:	FCC Part15 C Section 15.225
Test Method:	ANSI C63.10: 2013
Limit:	+/-0.01%
	1. The equipment under test was connected to an external DC power supply and input rated voltage. 2. RF output was connected to a spectrum analyzer. 3. The EUT was placed inside the temperature chamber. 4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25℃ operating frequency as reference frequency. 5. Turn EUT off and set the chamber temperature to －20℃. After the temperature stabilized for approximately 30 minutes recorded the frequency. 6. Repeat step measure with 10℃ increased per stage until the highest temperature of +50℃ reached.
Test setup:	
Test Mode:	Transmitting Mode
Test results:	PASS

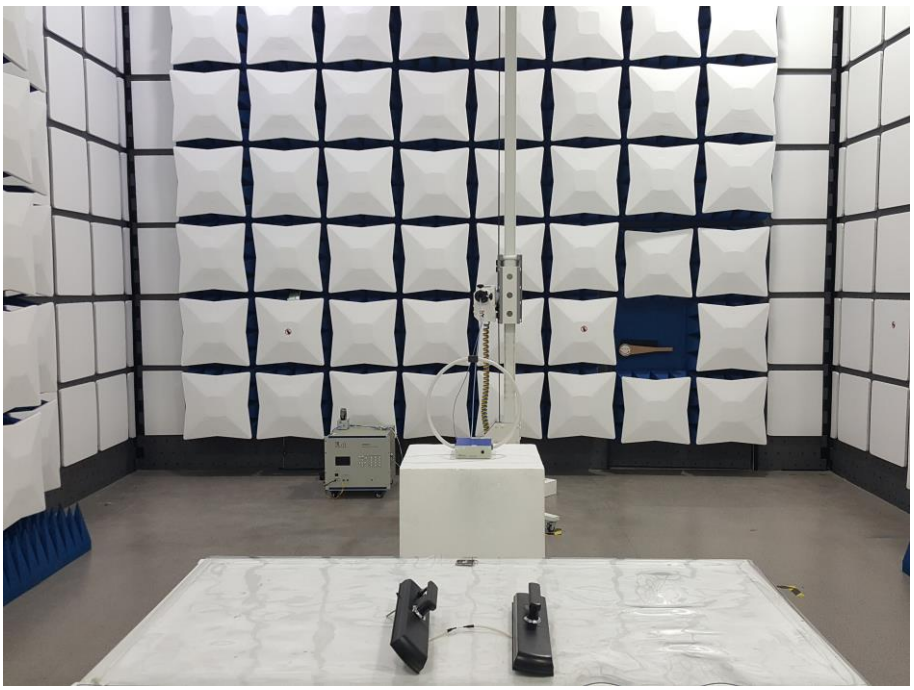
4.5.2. Test Data

Voltage (Vdc)	Temperature (℃)	Frequency (MHz)	Deviation (%)	Limit (%)
6	0	13.560251	0.00185%	+/-0.01%
6	10	13.560325	0.00240%	
6	20	13.560163	0.00120%	
6	30	13.560523	0.00368%	
6	40	13.560223	0.00164%	
6	45	13.560397	0.00292%	
6.4	20	13.560211	0.00156%	
5.7	20	13.560363	0.00268%	

Appendix A: Photographs of Test Setup

Radiated Emission





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