

# TEST REPORT

**FCC ID: 2ANJ8-IGM1**

**Product: Igloohome Smart Mortise**

**Model No.: IGM1**

**Additional Model: IGM2, IGM3, EL8500-TCB**

**Trade Mark:N/A**

**Report No.: TCT180116E006**

**Issued Date: Jan. 17, 2018**

Issued for:

**igloohome Pte Ltd**

**75 Ayer Rajah Crescent #03-11 Singapore 139953**

Issued By:

**Shenzhen Tongce Testing Lab.**

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## 1. Test Certification

<b>Product:</b>	Igloohome Smart Mortise
<b>Model No.:</b>	IGM1
<b>Additional Model:</b>	IGM2, IGM3, EL8500-TCB
<b>Trade Mark:</b>	N/A
<b>Applicant:</b>	Igloohome Pte Ltd
<b>Address:</b>	75 Ayer Rajah Crescent #03-11 Singapore 139953
<b>Manufacturer:</b>	Accutone Electronics(Shenzhen) Limited
<b>Address:</b>	4 East-5/F, No.5 Plant, Xiliang Industrial Park, Bayueer Street, Xiliang Jumin Xiaozu, Shuijing Resident, Buji Street, Longgang District, Shenzhen City, Guangdong Province, P.R. China
<b>Date of Test:</b>	Jan. 09, 2018- Jan. 17, 2018
<b>Applicable Standards:</b>	FCC Rules and Regulations Part 15 Subpart C Section 15.225 ANSI C63.10: 2013

The above equipment has been tested by Shenzhen Tongce Testing Lab. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

**Tested By:**

*Brews Xu*

**Date:**

Jan. 15, 2018

**Brews Xu**

**Reviewed By:**

*Joe Zhou*

**Date:**

Jan. 16, 2018

**Joe Zhou**

**Approved By:**

*Tomsin*

**Date:**

Jan. 17, 2018

**Tomsin**



## 2. Test Result Summary

Requirement	CFR 47 Section	Result
Antenna requirement	§15.203	PASS
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
Frequency stability	§15.225 §2.1055	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.

### 3. EUT Description

<b>Product Name:</b>	Igloohome Smart Mortise
<b>Model :</b>	IGM1
<b>Additional Model:</b>	IGM2, IGM3, EL8500-TCB
<b>Trade Mark:</b>	N/A
<b>Operation Frequency:</b>	13.56MHz
<b>Modulation Technology:</b>	ASK
<b>Antenna Type:</b>	PCB antenna
<b>Antenna Gain:</b>	0dBi
<b>Power Supply:</b>	DC6V by Battery
<b>Remark:</b>	All above models are identical in the same PCB layout, interior structure and electrical circuits. The differences are color and model name for commercial purpose.

## 4. Genera Information

### 4.1. 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
<p>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 &amp; 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.</p>	

#### 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)

### 4.2. 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.

## 5. Facilities and Accreditations

### 5.1. Facilities

The test facility is recognized, certified, or accredited by the following organizations:

- FCC - Registration No.: 645098

Shenzhen Tongce Testing Lab

The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

- IC - Registration No.: 10668A-1

The 3m Semi-anechoic chamber of Shenzhen TCT Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

### 5.2. Location

Shenzhen Tongce Testing Lab

Address: 1B/F., Building 1, Yibaolai Industrial Park, Qiaotou, Fuyong, Baoan District, Shenzhen, Guangdong, China

Tel: 86-755-27673339

### 5.3. Measurement Uncertainty

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

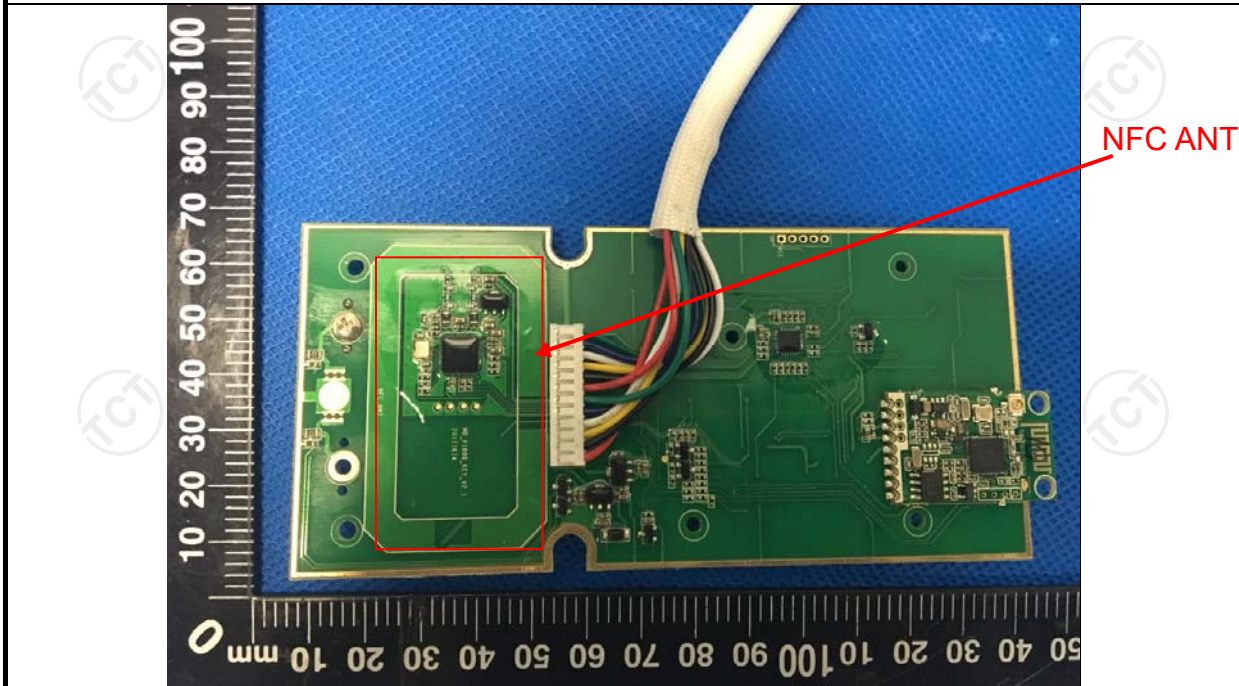
No.	Item	MU
1	Conducted Emission	$\pm 2.56\text{dB}$
2	RF power, conducted	$\pm 0.12\text{dB}$
3	Spurious emissions, conducted	$\pm 0.11\text{dB}$
4	All emissions, radiated(<1G)	$\pm 3.92\text{dB}$
5	All emissions, radiated(>1G)	$\pm 4.28\text{dB}$
6	Temperature	$\pm 0.1^\circ\text{C}$
7	Humidity	$\pm 1.0\%$



## 6. Test Results and Measurement Data

### 6.1. Antenna Requirement

<b>Standard requirement:</b>	FCC Part15 C Section 15.203 /247(c)
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.	
15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.	
<b>E.U.T Antenna:</b>	PCB Antenna
The antenna is PCB antenna which permanently attached, and the best case gain of the antenna is 0dBi.	





## 6.2. Conducted Emission

### 6.2.1. 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><i>Remark</i> E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p>														
<b>Test Mode:</b>	Transmitting Mode														
<b>Test Procedure:</b>	<ol style="list-style-type: none"> <li>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.</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>	N/A; The EUT powered by battery, so this test item is not applicable														

Test Result:

N/A

### 6.3. Radiated Emission Measurement

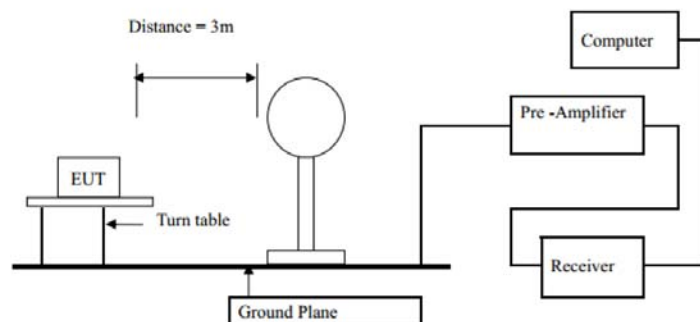
#### 6.3.1. Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.225(a) and 15.209				
<b>Test Method:</b>	ANSI C63.10:2013				
<b>Frequency Range:</b>	9 kHz to 1 GHz				
<b>Measurement Distance:</b>	3 m				
<b>Antenna Polarization:</b>	Horizontal & Vertical				
<b>Receiver Setup:</b>	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
	FCC Part15 C Section 15.225				
	<b>Frequency (MHz)</b>	<b>Limit (uV/m @30m)</b>	<b>Limit (dBuV/m @3m)</b>	<b>Detector</b>	
	13.110-13.410	106	80.5	QP	
	13.410-13.553	334	90.5	QP	
	13.553-13.567	15848	124.0	QP	
	13.567-13.7110	224	90.5	QP	
	13.710-14.010	106	80.5	QP	
	<b>Note:</b> RF Voltage (dBuV) = 20 log RF Voltage (uV) Limit (dBuV/m @3m) = 20log(Limit (uV/m @30m)) + 40				
	FCC Part15 C Section 15.209				
	<b>Frequency Range (MHz)</b>	<b>Distance (m)</b>	<b>Field strength (dB μ V/m)</b>	<b>Detector</b>	
	0.009-0.490	3	20log 2400/F (kHz) + 80	QP	
0.490-1.705	3	20log 24000/F (kHz) + 40	QP		
1.705-30	3	20log 30 + 40	QP		
30-88	3	40.0	40.0		
88-216	3	43.5	43.5		
216-960	3	46.0	46.0		
Above 960	3	54.0	54.0		
<b>Note:</b>					
1. RF Voltage (dBuV) = 20 log RF Voltage (uV)					
2. In the Above Table, the tighter limit applies at the band edges.					
3. Distance refers to the distance in meters between the measuring instrument antenna and the EUT					
4. The radiated emissions should be tested under 3-axes position (Lying, Side, and Stand), After pre-test. It was found that the worse radiated emission was get at the lying position.					
5. If measurement is made at 3m distance, then F.S Limitation at 3m distance is adjusted by using the formula $Ld1 = Ld2 * (d2/d1)$					

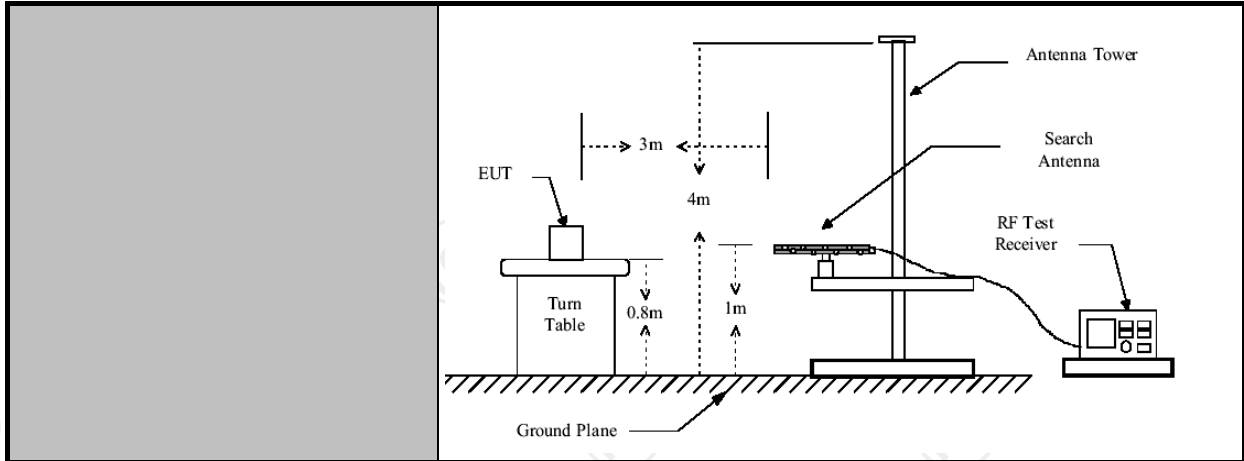
1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber in below 1GHz. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the 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.

**Test setup:**

For radiated emissions below 30MHz



30MHz to 1GHz



<b>Test Mode:</b>	Transmitting Mode
<b>Test results:</b>	PASS

**6.3.2. Test Instruments**

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

### 6.3.3. Test Data

#### Field Strength of Fundamental

Frequency	Reading	Correction Factor	Result	Limit	Margin	Polar	Detector
MHz	dBuV/m	dB/m	dBuV/m	dBuV/m	dB	H/V	
13.5600	76.12	-6.29	69.83	124	-54.17	H	Peak
13.5600	73.27	-6.29	66.98	124	-57.02	V	Peak

#### Harmonics and Spurious Emissions

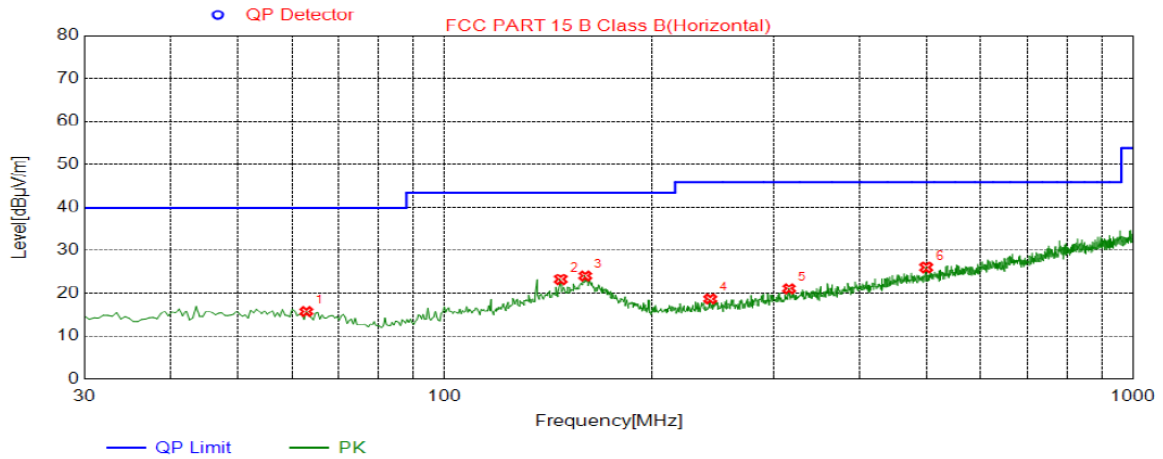
##### Frequency Range (9 kHz-30MHz)

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

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

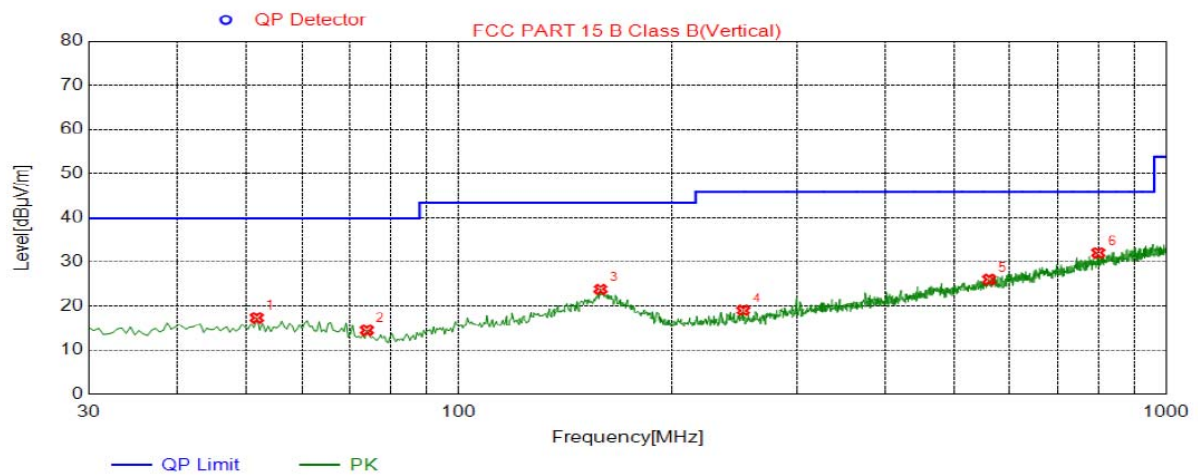
2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement





**Suspected List**

NO.	Freq. [MHz]	Level [dBuV/m]	Factor [dB]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	62.9800	15.83	-16.71	40.00	24.17	100	169	Horizontal
2	147.3700	23.35	-11.42	43.50	20.15	100	348	Horizontal
3	159.9800	24.13	-9.12	43.50	19.37	100	123	Horizontal
4	242.9150	18.77	-14.65	46.00	27.23	100	203	Horizontal
5	316.1500	21.15	-12.66	46.00	24.85	100	33	Horizontal
6	499.9650	26.11	-8.20	46.00	19.89	100	257	Horizontal

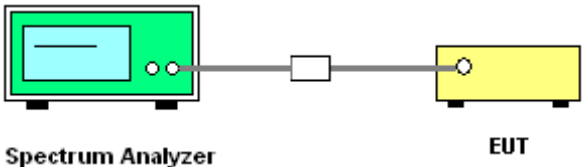


### Suspected List

NO.	Freq. [MHz]	Level [dBuV/m]	Factor [dB]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	51.8250	17.41	-16.58	40.00	22.59	100	310	Vertical
2	74.1350	14.60	-18.39	40.00	25.40	100	12	Vertical
3	158.5250	23.90	-9.40	43.50	19.60	100	329	Vertical
4	252.1300	19.11	-14.39	46.00	26.89	100	323	Vertical
5	561.0750	26.10	-6.61	46.00	19.90	100	94	Vertical
6	800.1800	32.12	-2.22	46.00	13.88	100	333	Vertical

## 6.4. Occupied Bandwidth

### 6.4.1. Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.215(c)
<b>Test Method:</b>	ANSI C63.10: 2013
<b>Limit:</b>	N/A
	<ol style="list-style-type: none"> <li>1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT.</li> <li>2. Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>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; <math>RBW \geq 1\%</math> of the 20 dB bandwidth; <math>VBW \geq RBW</math>; Sweep = auto; Detector function = peak; Trace = max hold.</li> <li>4. Measure and record the results in the test report.</li> </ol>
<b>Test setup:</b>	 <p style="text-align: center;">Spectrum Analyzer                      EUT</p>
<b>Test Mode:</b>	Transmitting Mode
<b>Test results:</b>	PASS

### 6.4.2. Test Instruments

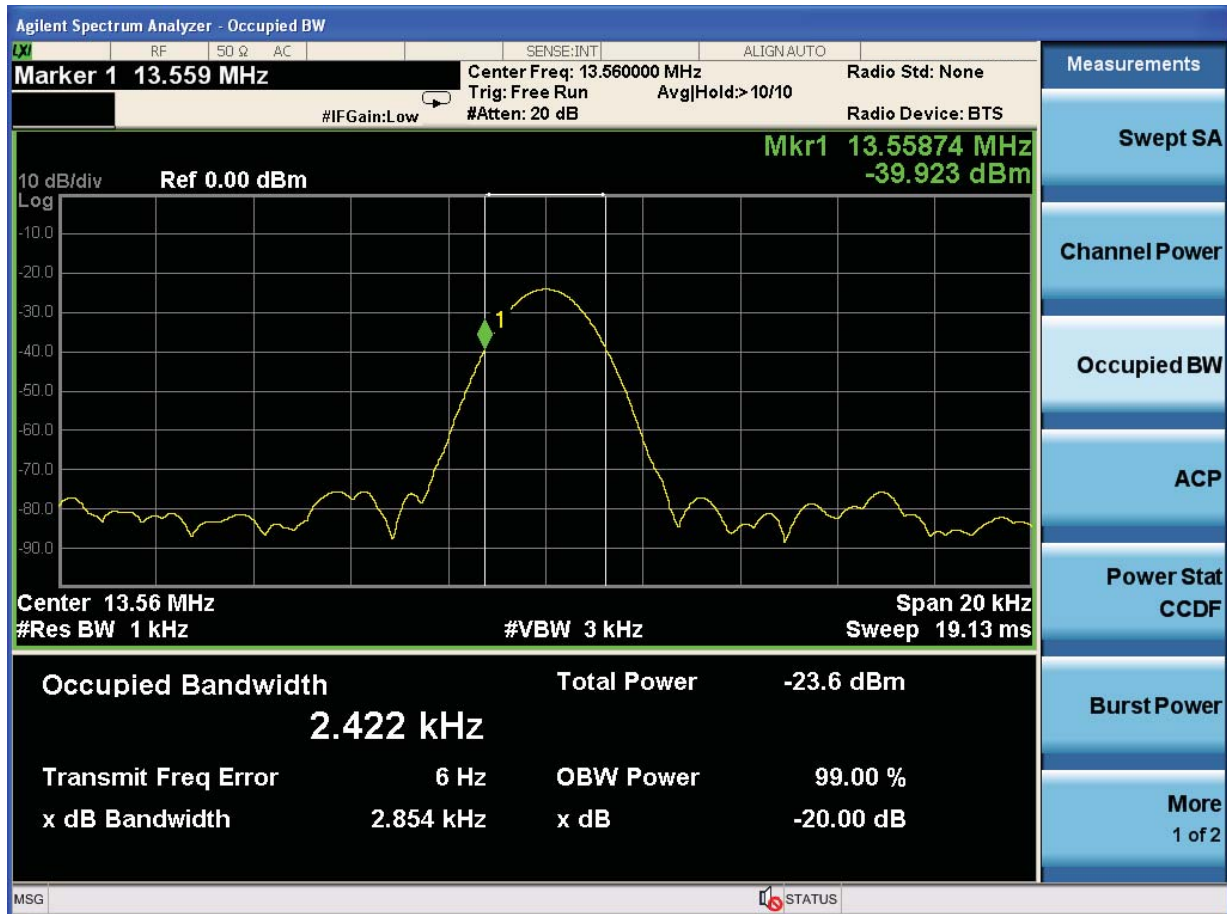
RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 27, 2018

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

6.4.3. Test data


Test Channel (MHz)	20dB Occupy Bandwidth (KHz)	Limit (kHz)	Conclusion
13.56	2.854	N/A	PASS

Test plots as follows:



## 6.5. Frequency stability

### 6.5.1. Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.225
<b>Test Method:</b>	ANSI C63.10: 2013
<b>Limit:</b>	+/-0.01%
	<ol style="list-style-type: none"> <li>1. The equipment under test was connected to an external DC power supply and input rated voltage.</li> <li>2. RF output was connected to a spectrum analyzer.</li> <li>3. The EUT was placed inside the temperature chamber.</li> <li>4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25°C operating frequency as reference frequency.</li> <li>5. Turn EUT off and set the chamber temperature to -20°C. After the temperature stabilized for approximately 30 minutes recorded the frequency.</li> <li>6. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.</li> </ol>
<b>Test setup:</b>	 <p style="text-align: center;">Spectrum Analyzer                      EUT</p>
<b>Test results:</b>	PASS

### 6.5.2. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 27, 2018
DC Power	GW	GPR-6030 D	/	Sep. 27, 2018

6.5.3. Test Data

Voltage (Vdc)	Temperature (°C)	Frequency (MHz)	Deviation (%)	Limit (%)
6	0	13.560141	0.00104	+/-0.01%
6	10	13.560257	0.00189	
6	20	13.560148	0.00109	
6	30	13.560291	0.00215	
6	40	13.560205	0.00150	
6	45	13.560198	0.00151	
6.4	20	13.560173	0.00128	
5.7	20	13.560162	0.00119	

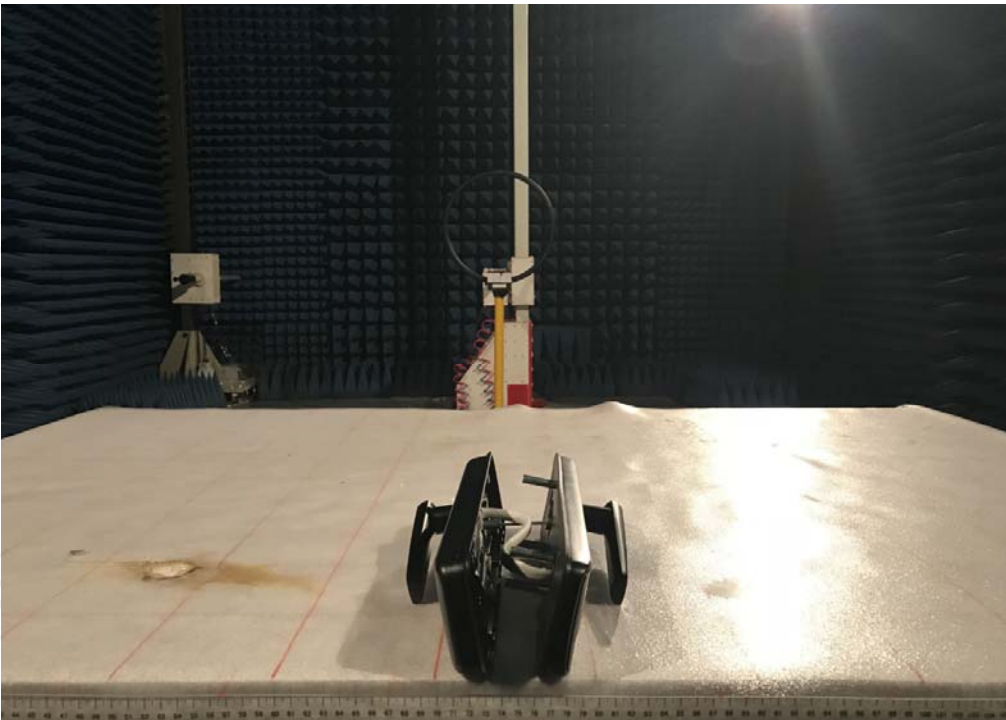


**Appendix A: Photographs of Test Setup**

Product: Igloohome Smart Mortise

Model: IGM1

Radiated Emission





**Appendix B: Photographs of EUT**  
**Product: Igloohome Smart Mortise**  
**Model No.: IGM1**  
**External photos**





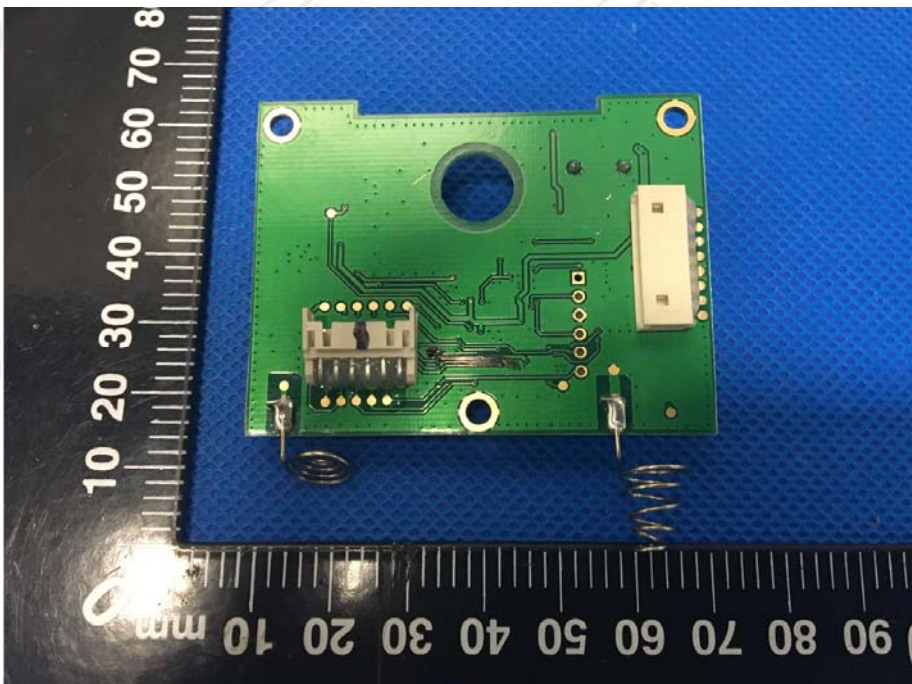
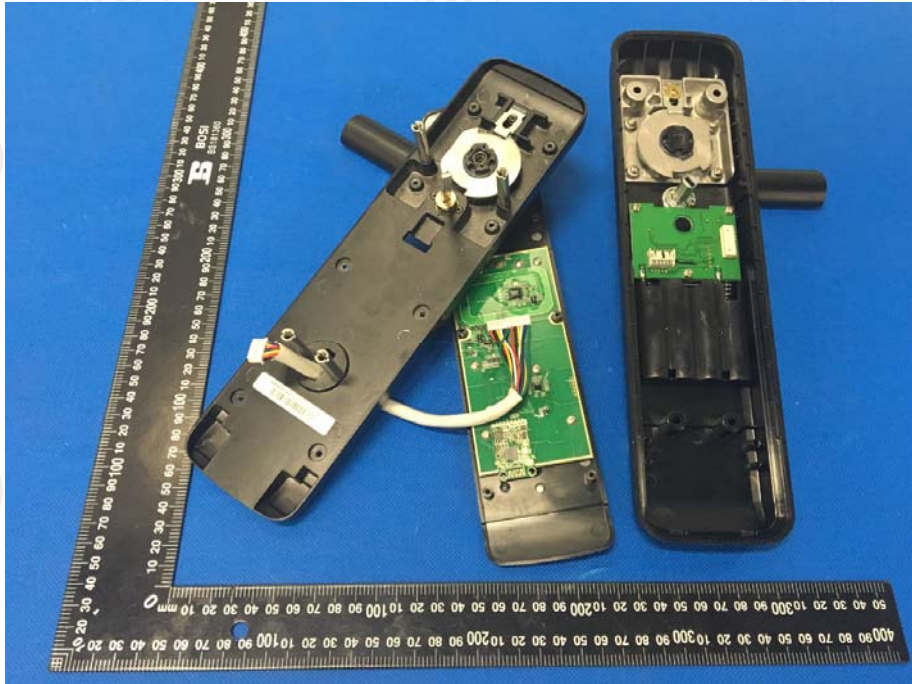


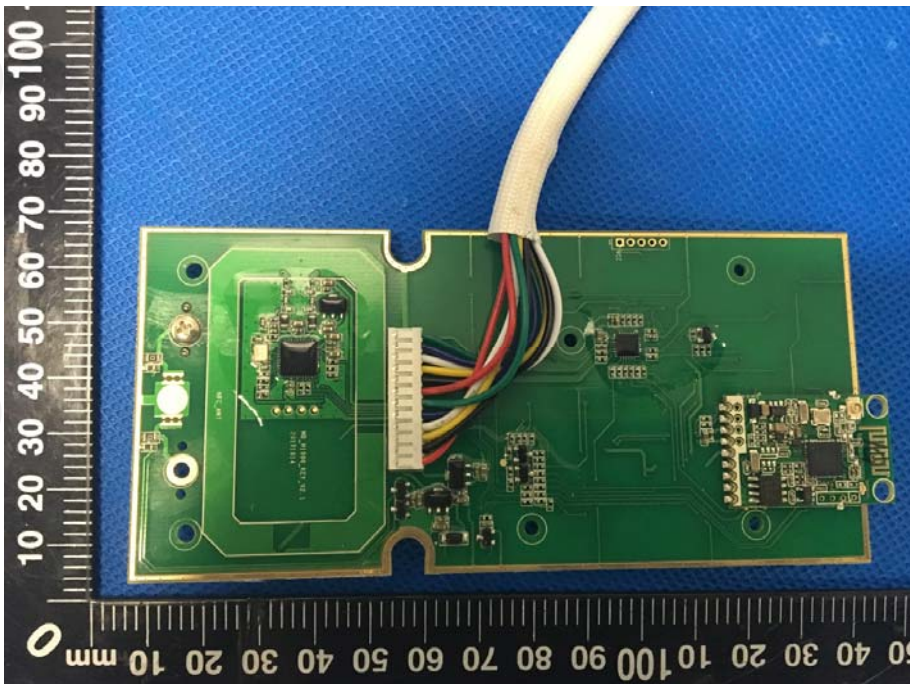
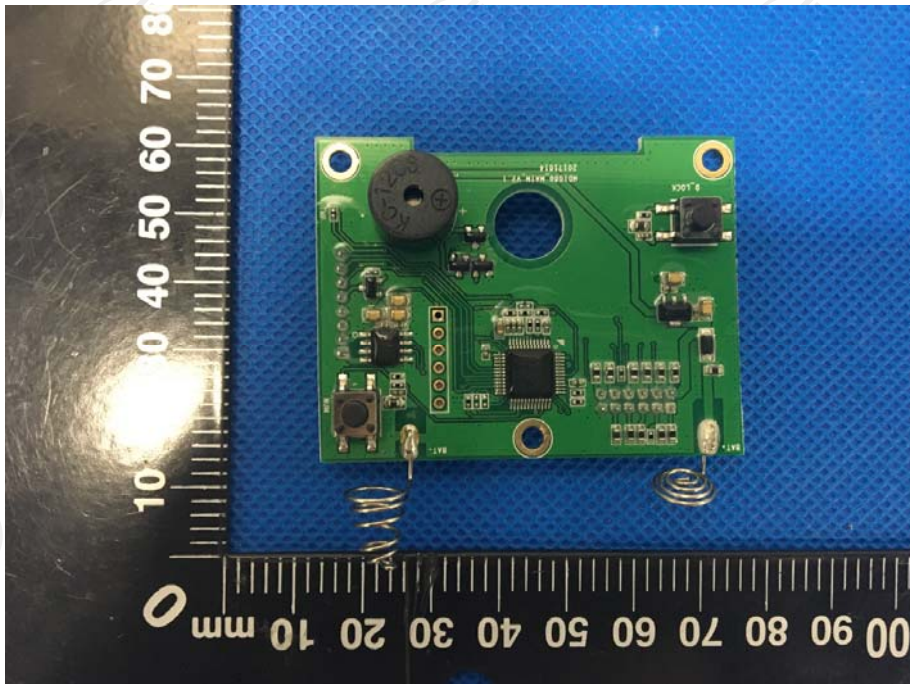




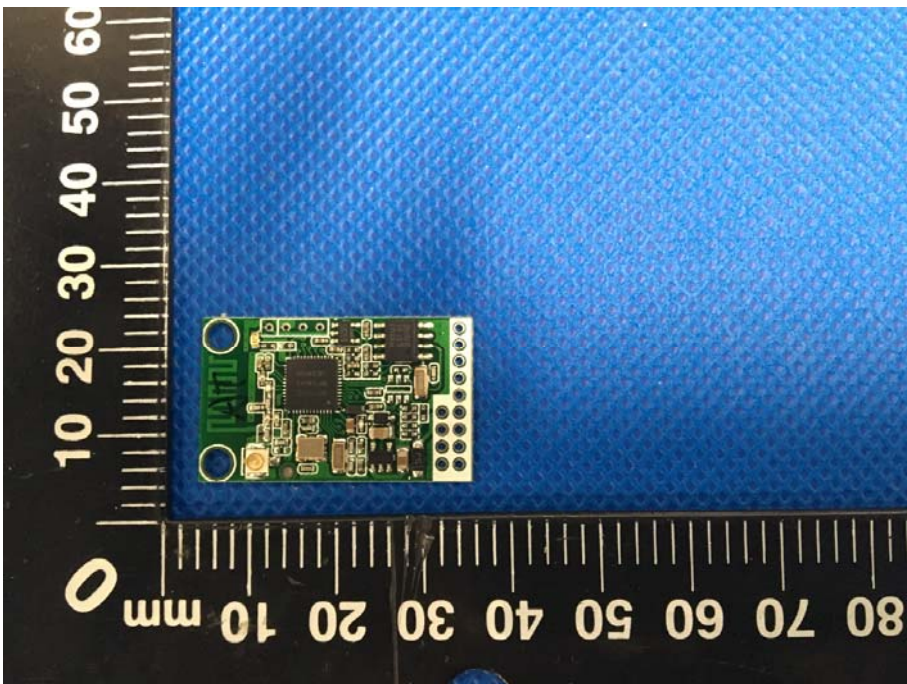
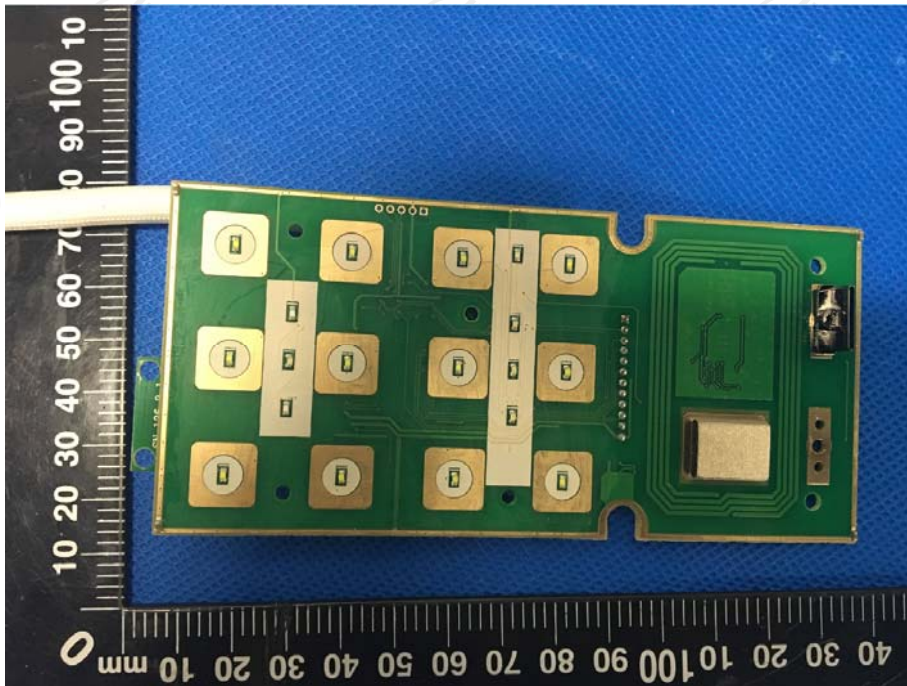


### Internal Photos

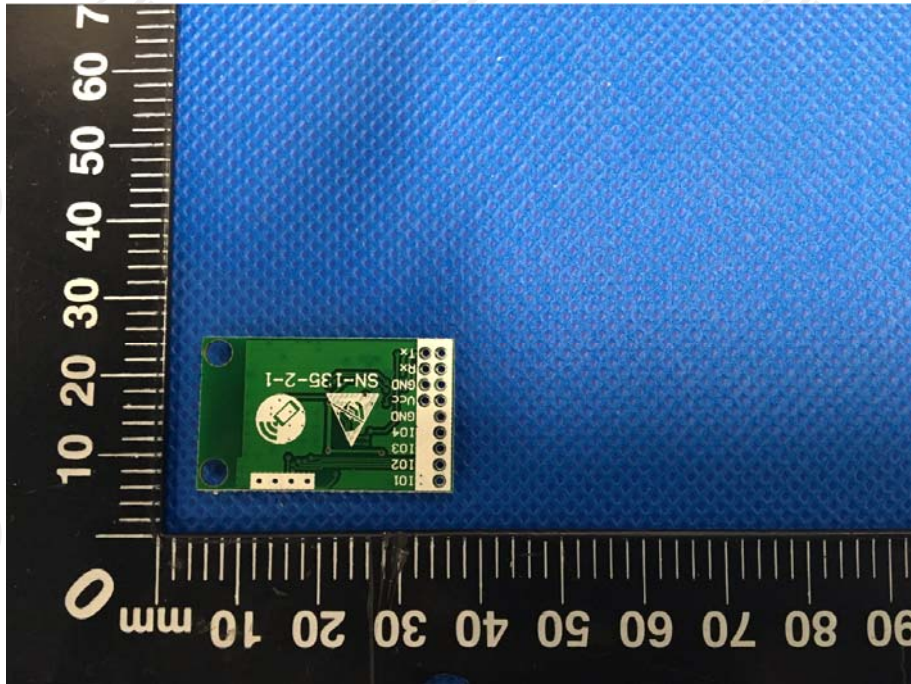












**\*\*\*\*\*END OF REPORT\*\*\*\*\***