

TEST REPORT

FCC ID: 2AFW2B038

Product: 2.4G Wireless Keypad

Model No.: B038

Additional Model No.: B038C

Trade Mark: N/A

Report No.: TCT190404E016

Issued Date: Apr. 17, 2019

Issued for:

Shenzhen DZH Industrial Co., Ltd

**3th Floor, YiTuo Mike Industrial A building, Bu Yong Industrial D zone,
ShaJing, Shenzhen, China**

Issued By:

Shenzhen Tongce Testing Lab.

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Appendix A: Photographs of Test Setup

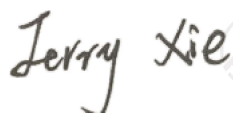
Appendix B: Photographs of EUT

1. Test Certification

Product:	2.4G Wireless Keypad
Model No.:	B038
Additional Model No.:	B038C
Trade Mark:	N/A
Applicant:	Shenzhen DZH Industrial Co., Ltd
Address:	3th Floor, YiTuo Mike Industrial A building, Bu Yong Industrial D zone, ShaJing, Shenzhen, China
Manufacturer:	Shenzhen DZH Industrial Co., Ltd
Address:	3th Floor, YiTuo Mike Industrial A building, Bu Yong Industrial D zone, ShaJing, Shenzhen, China
Date of Test:	Apr. 08, 2019 – Apr. 16, 2019
Applicable Standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.249 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:



Jerry Xie

Date:

Apr. 16, 2019

Reviewed By:



Beryl Zhao

Date:

Apr. 17, 2019

Approved By:



Tomsin

Date:

Apr. 17, 2019

2. Test Result Summary

Requirement	CFR 47 Section	Result
Antenna Requirement	§15.203	PASS
AC Power Line Conducted Emission	§15.207	N/A
Field Strength of Fundamental	§15.249 (a)	PASS
Spurious Emissions	§15.249 (a) (d)/ §15.209	PASS
Band Edge	§15.249 (d)/ §15.205	PASS
20dB Occupied Bandwidth	§15.215 (c)	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

Product:	2.4G Wireless Keypad
Model No.:	B038
Additional Model No.:	B038C
Trade Mark:	N/A
Hardware Version:	KB-B038MA138-12
Software Version:	V1.0
Operation Frequency:	2408MHz - 2474MHz
Number of Channel:	34
Modulation Technology:	FSK
Antenna Type:	PCB Antenna
Antenna Gain:	-3dBi
Power Supply:	1.5V==2.5mA
Remark:	All models above are identical in interior structure, electrical circuits and components, and just model names are different for the marketing requirement.

Operation Frequency Each of Channel

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2408MHz	11	2428MHz	21	2448MHz	31	2468MHz
2	2410MHz	12	2430MHz	22	2450MHz	32	2470MHz
3	2412MHz	13	2432MHz	23	2452MHz	33	2472MHz
4	2414MHz	14	2434MHz	24	2454MHz	34	2474MHz
5	2416MHz	15	2436MHz	25	2456MHz		-
6	2418MHz	16	2438MHz	26	2458MHz		-
7	2420MHz	17	2440MHz	27	2460MHz		-
8	2422MHz	18	2442MHz	28	2462MHz		-
9	2424MHz	19	2444MHz	29	2464MHz		-
10	2426MHz	20	2446MHz	30	2466MHz		-

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:

Channel	Frequency
The lowest channel	2408MHz
The middle channel	2440MHz
The Highest channel	2474MHz

4. General Information

4.1. Test Environment and Mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	54 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Engineering mode:	Keep the EUT in continuous transmitting by select channel
<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 & 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 (Z axis) are shown in Test Results of the following pages.</p>	

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

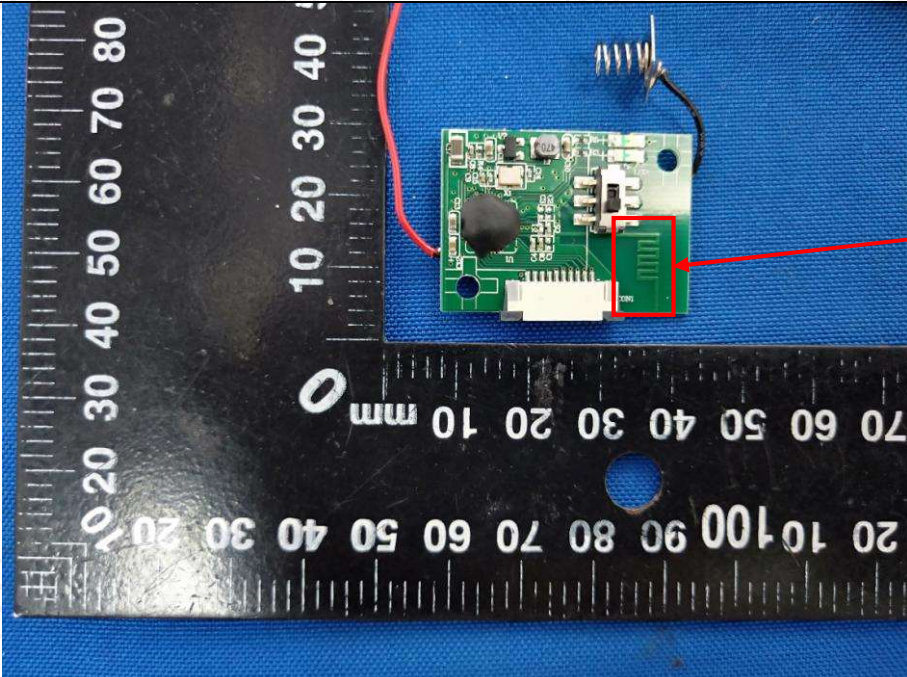
5.3. Measurement Uncertainty

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(<1GHz)	$\pm 3.92\text{dB}$
5	All emissions, radiated(>1GHz)	$\pm 4.28\text{dB}$
6	Temperature	$\pm 0.1\text{ }^{\circ}\text{C}$
7	Humidity	$\pm 1.0\%$

6. Test Results and Measurement Data

6.1. 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:	
<p>The EUT antenna is PCB antenna which permanently attached, and the best case gain of the antenna is -3dBi.</p>	
	

6.2. Conducted Emission

6.2.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.207		
Test Method:	ANSI C63.10:2013		
Frequency Range:	150 kHz to 30 MHz		
Receiver setup:	RBW=9 kHz, VBW=30 kHz, Sweep time=auto		
Limits:	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 with modulation		
Test Procedure:	<div><ol style="list-style-type: none">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 C63.10:2013 on conducted measurement.</div>		
Test Result:	N/A; Because the EUT is powered by the battery, so the item is not applicable.		

6.3. Radiated Emission Measurement

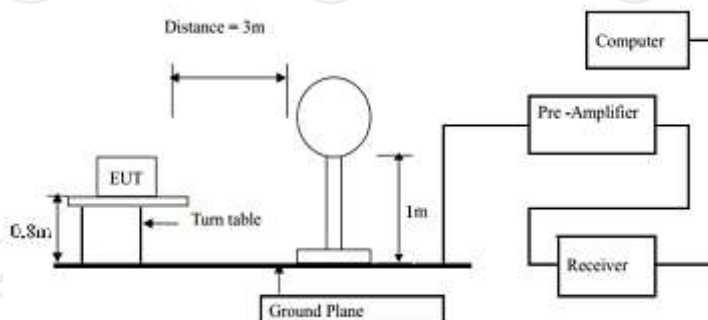
6.3.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.209				
Test Method:	ANSI C63.10:2013				
Frequency Range:	9 kHz to 25 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	120kHz	300kHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
Peak		1MHz	10Hz	Average Value	
Limit(Field strength of the fundamental signal):	Frequency		Limit (dBuV/m @3m)		Remark
	2400MHz-2483.5MHz		94.00		Average Value
			114.00		Peak Value
Limit(Spurious Emissions):	Frequency		Limit (dBuV/m @3m)		Remark
	0.009-0.490		2400/F(KHz)		Quasi-peak Value
	0.490-1.705		24000/F(KHz)		Quasi-peak Value
	1.705-30		30		Quasi-peak Value
	30MHz-88MHz		40.0		Quasi-peak Value
	88MHz-216MHz		43.5		Quasi-peak Value
	216MHz-960MHz		46.0		Quasi-peak Value
	960MHz-1GHz		54.0		Quasi-peak Value
	Above 1GHz		54.0		Average Value
74.0			Peak Value		
Limit (band edge) :	Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.				
Test Procedure:	<div>1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber 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</div>				

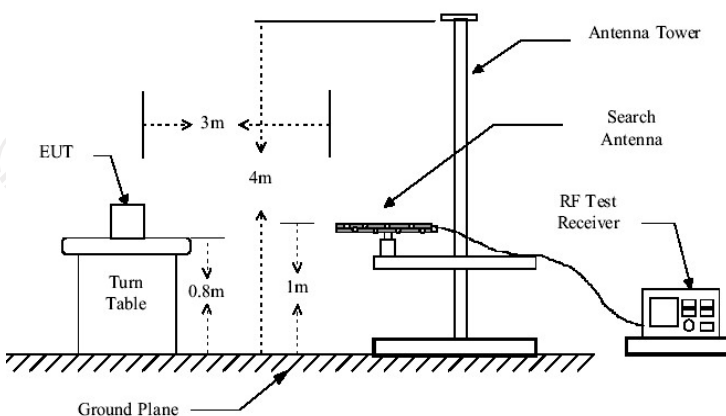
Test setup:

- the measurement.
- 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.
 - The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
 - 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.

For radiated emissions below 30MHz

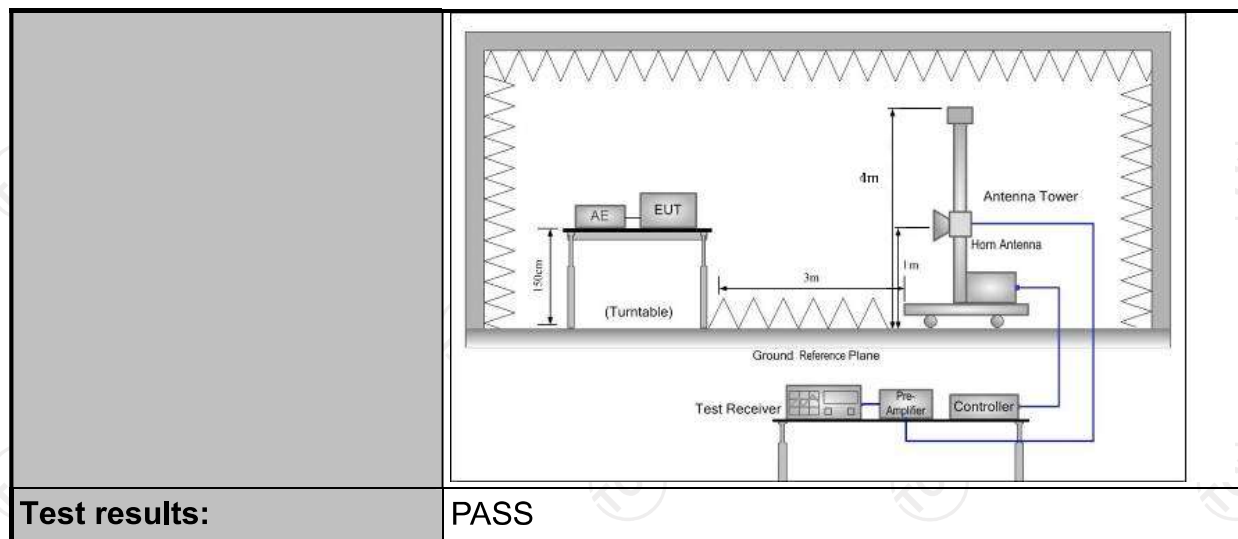


30MHz to 1GHz



Above 1GHz

(The diagram below shows the test setup that is utilized to make the measurements for emission from 1GHz to the tenth harmonic of the highest fundamental frequency or to 40GHz emissions, whichever is lower.)



6.3.2. Test Instruments

Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Test Receiver	ROHDE&SCHW ARZ	ESIB7	100197	Jul. 17, 2019
Spectrum Analyzer	ROHDE&SCHW ARZ	FSQ40	200061	Sep. 20, 2019
Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Sep. 16, 2019
Pre-amplifier	HP	8447D	2727A05017	Sep. 16, 2019
Loop antenna	ZHINAN	ZN30900A	12024	Oct. 20, 2019
Broadband Antenna	Schwarzbeck	VULB9163	340	Sep. 02, 2019
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Oct. 20, 2019
Horn Antenna	A-INFO	LB-180400-KF	J211020657	Sep. 16, 2019
Antenna Mast	Keleto	RE-AM	N/A	N/A
Coax cable (9KHz-1GHz)	TCT	RE-low-01	N/A	Sep. 16, 2019
Coax cable (9KHz-40GHz)	TCT	RE-high-02	N/A	Sep. 16, 2019
Coax cable (9KHz-1GHz)	TCT	RE-low-03	N/A	Sep. 16, 2019
Coax cable (9KHz-40GHz)	TCT	RE-high-04	N/A	Sep. 16, 2019
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 (MHz)	Emission PK (dBuV/m)	Horizontal /Vertical	Limits PK (dBuV/m)	Margin (dB)
2408	81.26	H	114	-32.74
2408	73.01	V	114	-40.99
2440	80.68	H	114	-33.32
2440	71.72	V	114	-42.28
2474	79.85	H	114	-34.15
2474	70.66	V	114	-43.34

Frequency (MHz)	Emission AV (dBuV/m)	Horizontal /Vertical	Limits AV (dBuV/m)	Margin (dB)
2408	68.57	H	94	-25.43
2408	56.27	V	94	-37.73
2440	66.85	H	94	-27.15
2440	54.66	V	94	-39.34
2474	64.02	H	94	-29.98
2474	51.76	V	94	-42.24

Spurious Emissions

Frequency Range (9 kHz-30MHz)

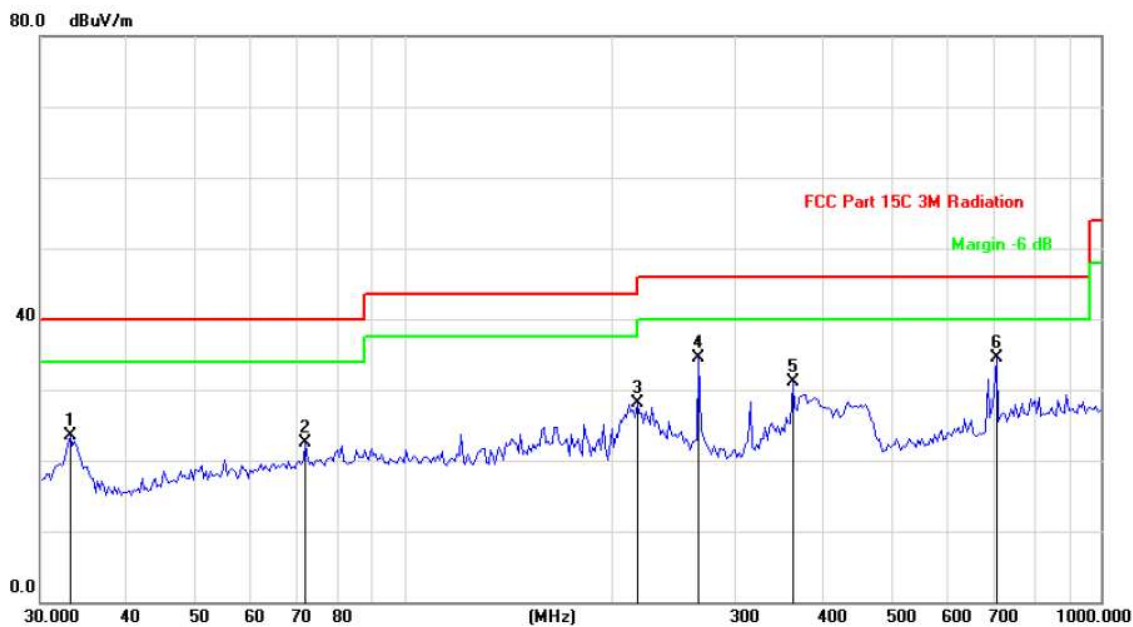
Frequency (MHz)	Level@3m (dBμV/m)	Limit@3m (dBμV/m)
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--	--	--
--	--	--
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Note: 1. Emission Level=Reading+ Cable loss-Antenna factor-Amp factor

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

Frequency Range (30MHz-1GHz)

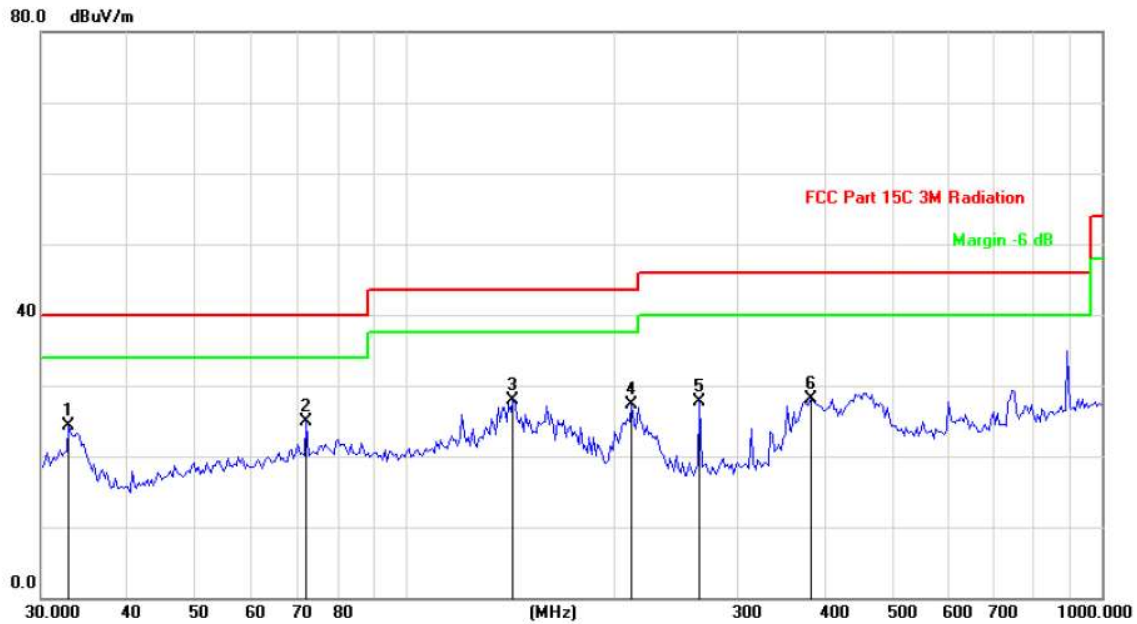
Horizontal:



Site: Polarization: **Horizontal** Temperature: 25
 Limit: FCC Part 15C 3M Radiation Power: DC 1.5V Humidity: 55 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	cm	degree	Comment
1		33.1015	34.43	-11.02	23.41	40.00	-16.59	peak		
2		72.2111	38.36	-15.87	22.49	40.00	-17.51	peak		
3		216.1197	41.74	-13.55	28.19	46.00	-17.81	peak		
4		264.9709	46.51	-12.07	34.44	46.00	-11.56	peak		
5		360.9775	40.57	-9.53	31.04	46.00	-14.96	peak		
6	*	708.6941	39.83	-5.30	34.53	46.00	-11.47	peak		

Vertical:



Site: Polarization: **Vertical** Temperature: 25
 Limit: FCC Part 15C 3M Radiation Power: DC 1.5V Humidity: 55 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	cm	degree	Comment
1		32.8697	35.36	-11.02	24.34	40.00	-15.66	peak		
2	*	72.2111	40.70	-15.87	24.83	40.00	-15.17	peak		
3		142.7692	44.00	-16.13	27.87	43.50	-15.63	peak		
4		211.6112	41.07	-13.67	27.40	43.50	-16.10	peak		
5		264.9709	39.72	-12.07	27.65	46.00	-18.35	peak		
6		381.8520	37.39	-9.21	28.18	46.00	-17.82	peak		

Note: 1, Measurements were conducted in all channels (high, middle, low), and the worst case (low channel) was submitted only.

2, Any value more than 10dB below limit have not been specifically reported.

Above 1GHz

Low channel: 2408MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dB μ V)	AV reading (dB μ V)	Correction Factor (dB/m)	Emission Level		Peak limit (dB μ V/m)	AV limit (dB μ V/m)	Margin (dB)
					Peak (dB μ V/m)	AV (dB μ V/m)			
2387.50	H	52.05	---	-4.20	47.85	---	74	54	-6.15
4816.00	H	51.31	---	-3.94	47.37	---	74	54	-6.63
7224.00	H	48.67	---	0.52	49.19	---	74	54	-4.81
---	---	---	---	---	---	---	---	---	---
2387.50	V	50.96	---	-4.20	46.76	---	74	54	-7.24
4816.00	V	49.47	---	-3.94	45.53	---	74	54	-8.47
7224.00	V	46.88	---	0.52	47.40	---	74	54	-6.60
---	---	---	---	---	---	---	---	---	---

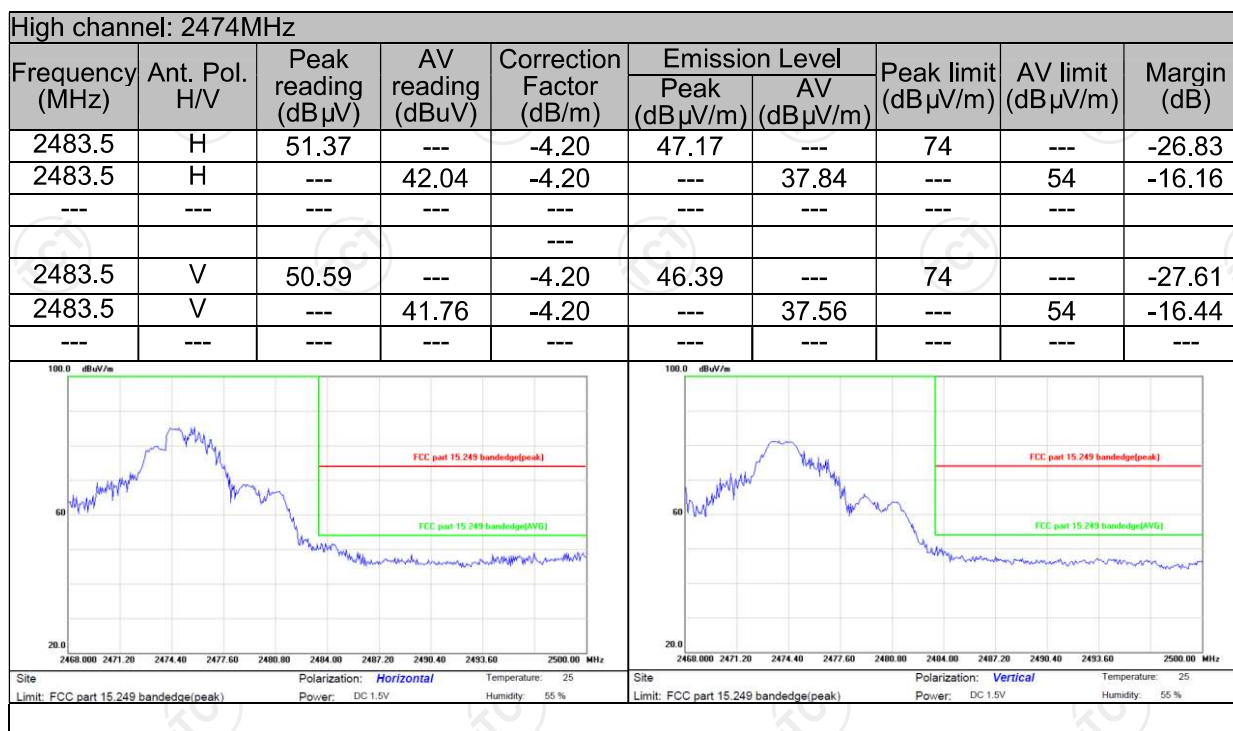
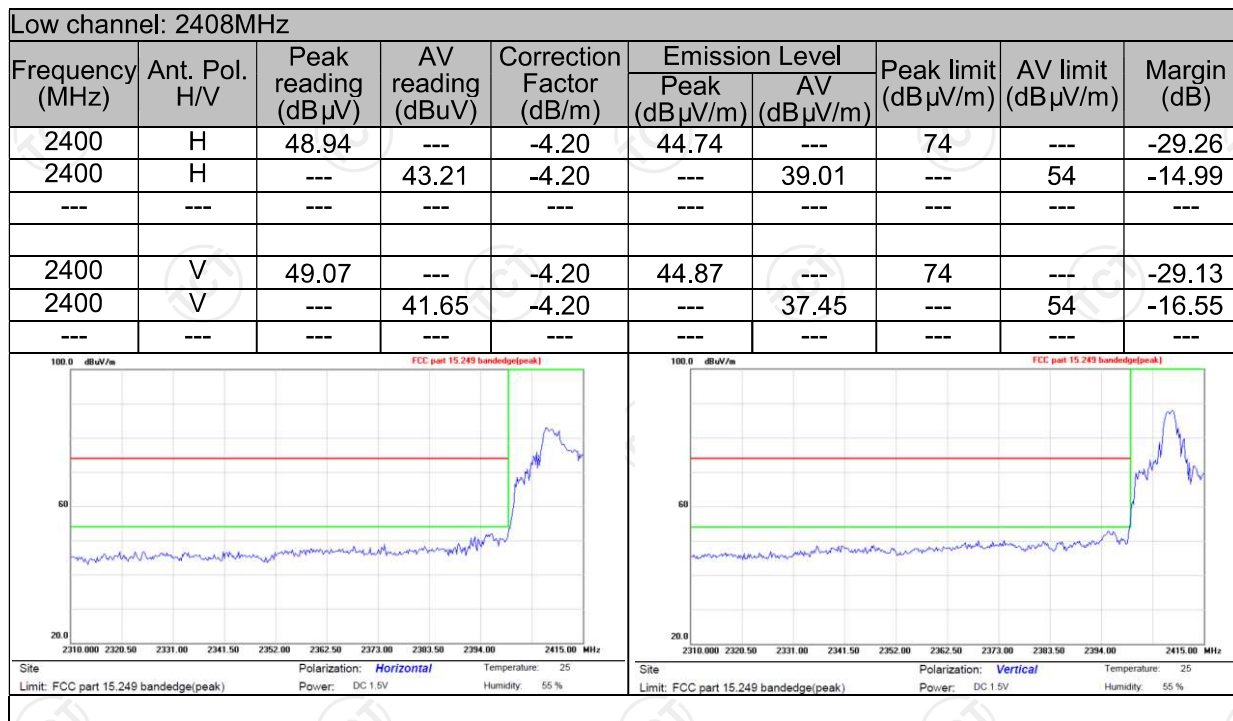
Middle channel: 2440MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dB μ V)	AV reading (dB μ V)	Correction Factor (dB/m)	Emission Level		Peak limit (dB μ V/m)	AV limit (dB μ V/m)	Margin (dB)
					Peak (dB μ V/m)	AV (dB μ V/m)			
4880.00	H	50.79	---	-3.98	46.81	---	74	54	-7.19
7320.00	H	49.02	---	0.57	49.59	---	74	54	-4.41
---	---	---	---	---	---	---	---	---	---
---	---	---	---	---	---	---	---	---	---
---	---	---	---	---	---	---	---	---	---
4880.00	V	52.15	---	-3.98	48.17	---	74	54	-5.83
7320.00	V	47.84	---	0.57	48.41	---	74	54	-5.59
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High channel: 2474MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dB μ V)	AV reading (dB μ V)	Correction Factor (dB/m)	Emission Level		Peak limit (dB μ V/m)	AV limit (dB μ V/m)	Margin (dB)
					Peak (dB μ V/m)	AV (dB μ V/m)			
2483.51	H	51.07	---	-2.38	48.69	---	74	54	-5.31
4948.00	H	52.34	---	-3.98	48.36	---	74	54	-5.64
7422.00	H	49.21	---	0.57	49.78	---	74	54	-4.22
---	---	---	---	---	---	---	---	---	---
2483.51	V	51.46	---	-2.38	49.08	---	74	54	-4.92
4948.00	V	52.19	---	-3.98	48.21	---	74	54	-5.79
7422.00	V	48.74	---	0.57	49.31	---	74	54	-4.69
---	---	---	---	---	---	---	---	---	---

Note:

1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
2. Margin (dB) = Emission Level (Peak) (dB μ V/m)-Average limit (dB μ V/m)
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency.
5. Data of measurement shown “---“in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.

Band Edge Requirement

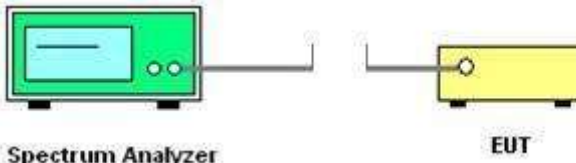


Note:

- Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
- Margin (dB) = Emission Level (Peak/Average)(dBμV/m)-(Peak/Average) limit (dBμV/m)
- The emission levels of other frequencies are very lower than the limit and not show in test report.
- Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency.
- Data of measurement shown "—" in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.

6.4. 20dB Occupied Bandwidth

6.4.1. 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\geq1% of the 20 dB bandwidth; VBW\geqRBW; Sweep = auto; Detector function = peak; Trace = max hold. 4. Measure and record the results in the test report.
Test setup:	 <p>The diagram illustrates the test setup. On the left is a green Spectrum Analyzer with a screen and two knobs. A cable connects its output to the input of a yellow rectangular box on the right, which is labeled 'EUT'.</p>
Test Mode:	Transmitting mode with modulation
Test results:	PASS

6.4.2. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Sep. 20, 2019

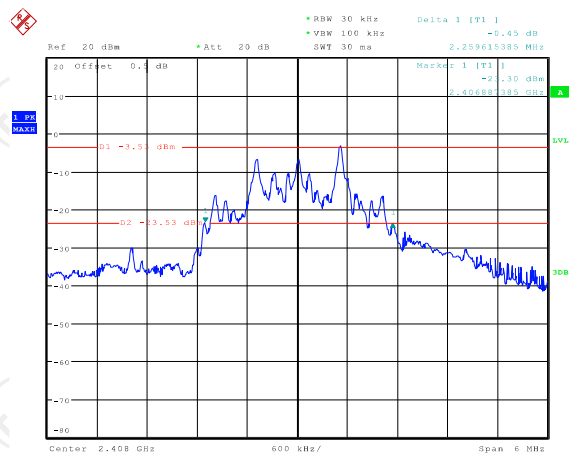
Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.4.3. Test data

Test Channel	20dB Occupy Bandwidth (kHz)	Limit	Conclusion
Lowest	2259.62	---	PASS
Middle	2259.62	---	PASS
Highest	2246.38	---	PASS

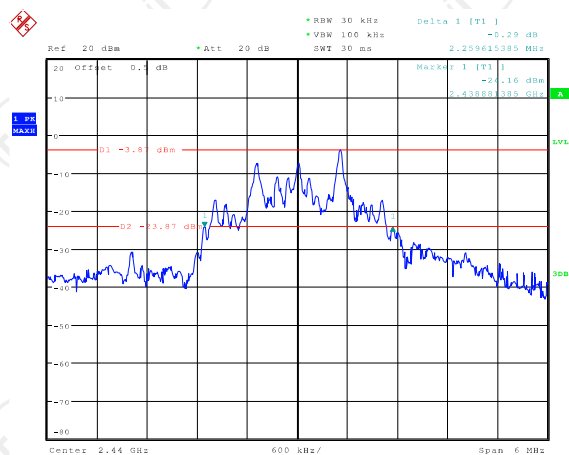
Test plots as follows:

Lowest channel



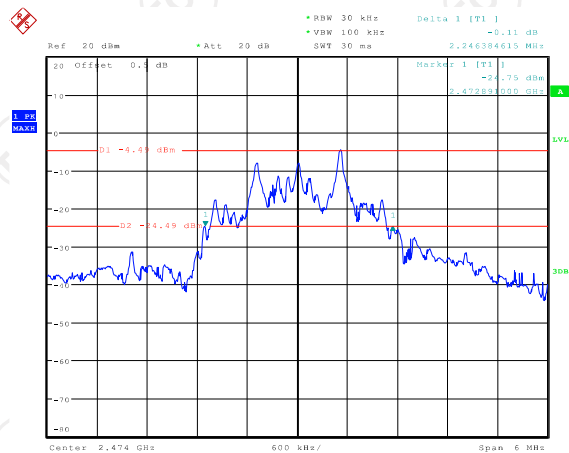
Date: 15.APR.2019 10:52:48

Middle channel



Date: 15.APR.2019 10:54:27

Highest channel



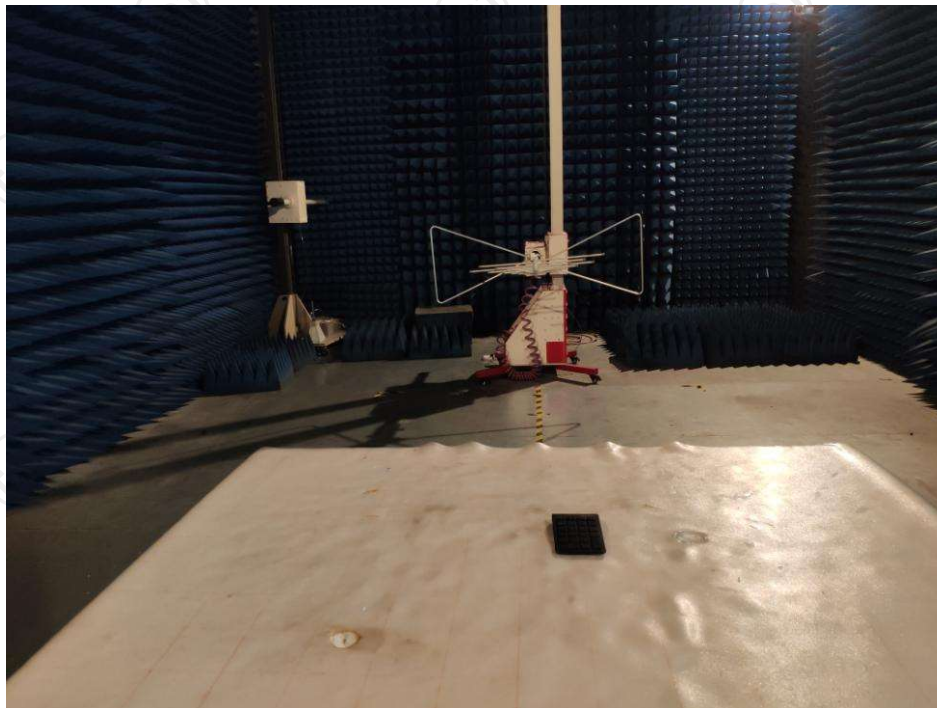
Date: 15.APR.2019 10:57:12

Appendix A: Photographs of Test Setup

Product: 2.4G Wireless Keypad

Model: B038

Radiated Emission



Appendix B: Photographs of EUT

Product: 2.4G Wireless Keypad

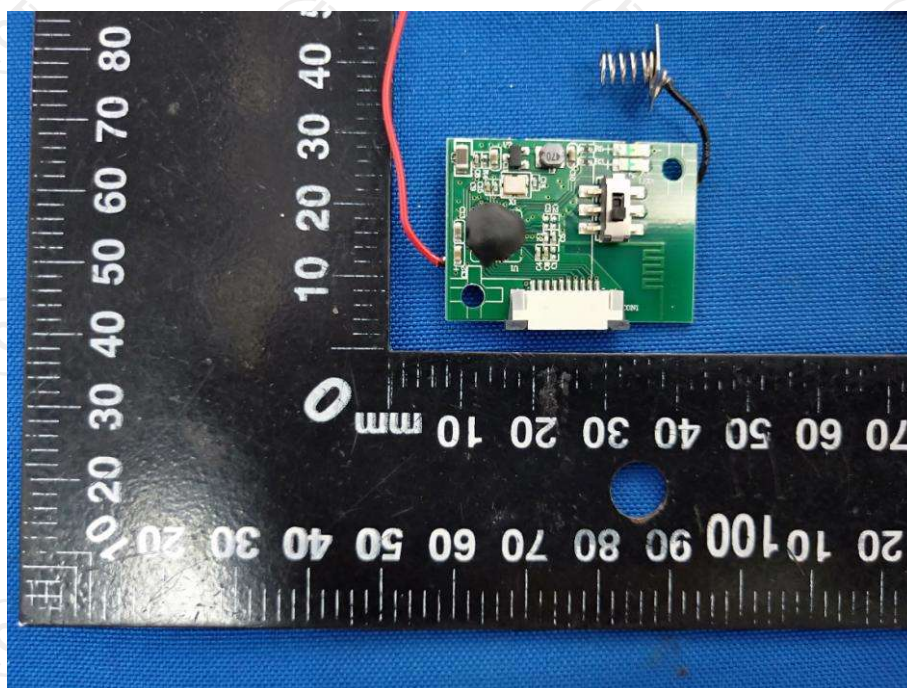
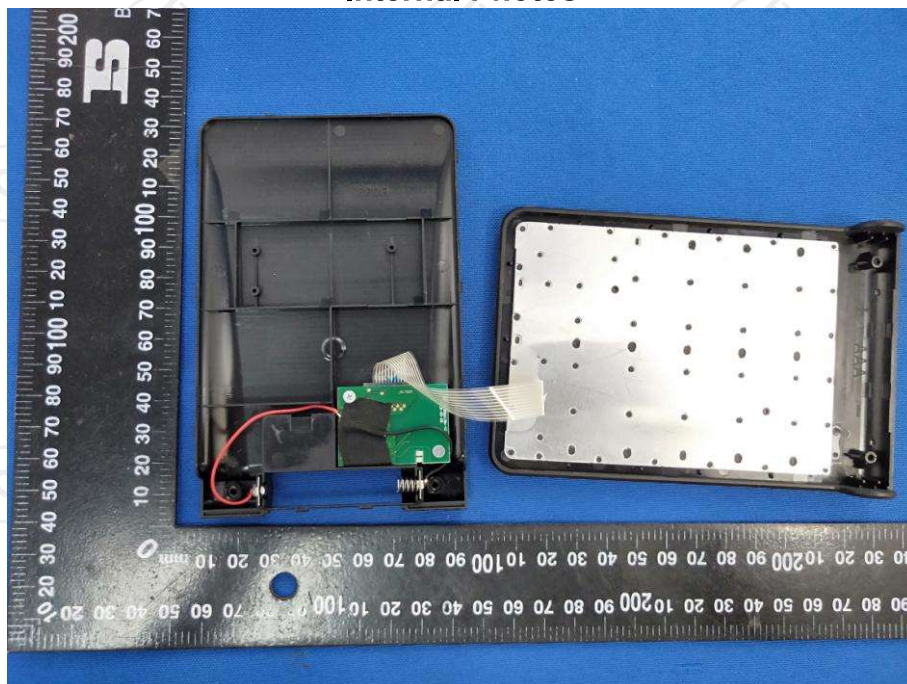
Model: B038

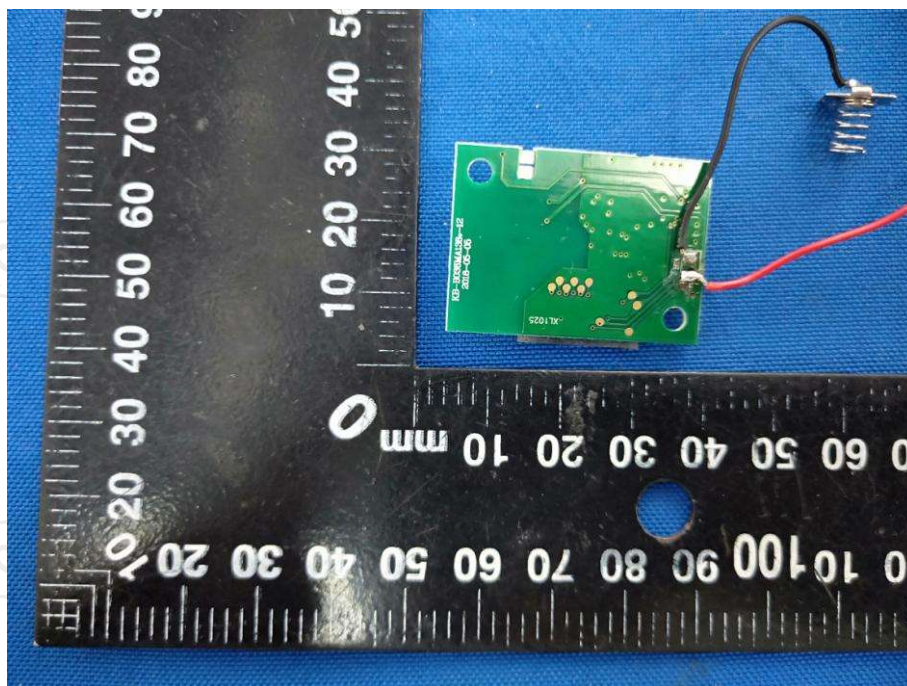
External Photos





Product: 2.4G Wireless Keypad
Model: B038
Internal Photos





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