

TEST REPORT

FCC ID: 2AFW2B009

Product: 2.4G Wireless Keyboard

Model No.: B009 2.4G

Additional Model: T09 2.4G

Trade Mark: N/A

Report No.: TCT180409E001

Issued Date: Apr. 13, 2018

Issued for:

Shenzhen DZH Industrial Co., Ltd
3th Floor, YiTuo Mike Industrial A building, Bu Yong Industrial D zone,
ShaJing, Shenzhen, China

Issued By:

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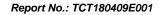




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1. Test Certification

Product:	2.4G Wireless Keyboard
Model No.:	B009 2.4G
Additional Model:	T09 2.4G
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. 09, 2018 –Apr. 12, 2018
Applicable Standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.249

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:) m Wang	Date:	Apr. 12, 2018
eviewed By:	Jin Wang Bery Juw	Date:	Apr. 13, 2018
	Beryl Zhao		

Approved By: Date: Apr. 13, 2018

Tomsin



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	§2.1053 §15.249 (a) (d)/ §15.209	PASS
Band Edge	§2.1053 §15.249 (d)/ §15.205	PASS
20dB Occupied Bandwidth	§2.1049 §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 Keyboard	
Model No.:	B009 2.4G	
Additional Model:	T09 2.4G	
Trade Mark:	N/A	
Hardware Version:	V1.1	
Software Version:	5.3	
Operation Frequency:	2405MHz - 2470MHz	
Number of Channel:	8	
Modulation Technology:	GFSK	
Antenna Type:	PCB Antenna	
Antenna Gain:	0dBi	
Power Supply:	DC 3V (AAA 1.5V*2 Battery)	
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

Operation Frequency each of channel								
Channel	Channel Frequency Channel Frequency Channel Frequency							
1 2405MHz 4 2430MHz 7 2460Ml								
2	2413MHz	5	2440 MHz	8	2470MHz			
3	2422 MHz	6	2450 MHz					
Remark: Channel 1, 4 and 8 are selected to perform the tests.								

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	2405MHz
The middle channel	2430MHz
The Highest channel	2470MHz





4. Genera 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

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.

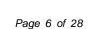
4.2. Description of Support Units

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	
1	1	1	(6) 1		

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 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
	Conducted Emission	±2.56dB
2	RF power, conducted	±0.12dB
3	Spurious emissions, conducted	±0.11dB
4	All emissions, radiated(<1GHz)	±3.92dB
5	All emissions, radiated(>1GHz)	±4.28dB
6	Temperature	±0.1°C
7	Humidity	±1.0%



6. Test Results and Measurement Data

6.1. Antenna Requirement

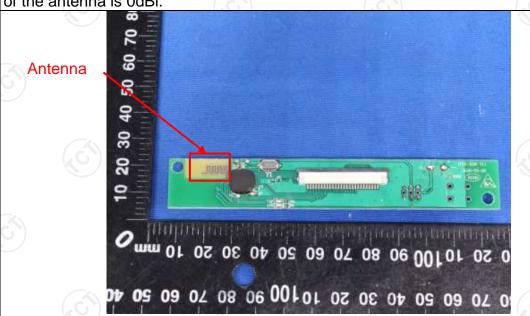
Standard requirement: FCC Part15 C Section 15.203

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:

The EUT antenna is PCB antenna which permanently attached, and the best case gain of the antenna is 0dBi.

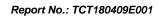




6.2.Conducted Emission

6.2.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.207				
Test Method:	ANSI C63.10:2013				
Frequency Range:	150 kHz to 30 MHz	C ⁽)	(c')		
Receiver setup:	RBW=9 kHz, VBW=30	kHz, Sweep time	e=auto		
Limits:	Frequency range (MHz) 0.15-0.5	Limit (Quasi-peak 66 to 56*			
	0.5-5 5-30	56 60	46 50		
Test Setup:	AUX Equipment E.U Test table/Insulation pla	AUX Filter AC power Equipment E.U.T Test table/Insulation plane Remark			
Test Mode:	Transmitting mode with modulation				
Test Procedure:	 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. 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). 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. 				
Test Result:	N/A, Power supply is DC 3V from AAA 1.5V*2 Battery, so not applicable.				





6.3. Radiated Emission Measurement

6.3.1. Test Specification

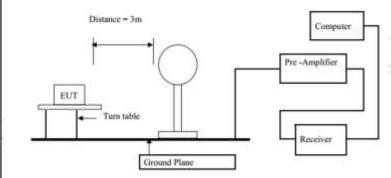
Tost Poquiromont	FCC Part15 C Section 15.209/ Part 2 J Section 2.1053				
Test Requirement:					
Test Method:	ANSI C63.10:2013				
Frequency Range:	9 kHz to 25	GHz	C ⁽¹⁾		
Measurement Distance:	3 m				
Antenna Polarization:	Horizontal 8	& Vertical			
	Frequency 9kHz- 150kHz	Detector Quasi-peak	RBW 200Hz	VBW 1kHz	Remark Quasi-peak Value
Receiver Setup:	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
	Above 10112	Peak	1MHz	10Hz	Average Value
Limit/Field etrapath of the	Freque	ency	Limit (dBu\	//m @3m)	Remark
Limit(Field strength of the			94.	/ 41	Average Value
fundamental signal):	2400MHz-24	483.5MHZ	114.00		Peak Value
	Freque	ancy	Limit (dRu)	//m @3m)	Remark
	Frequency 0.009-0.490		Limit (dBuV/m @3m) 2400/F(KHz)		Quasi-peak Value
	0.490-1.705		2400/F(KHz)		Quasi-peak Value
	1.705-30		30		Quasi-peak Value
Limit/Correiona Emissisma).	201117 001117		40.0		Quasi-peak Value
Limit(Spurious Emissions):	88MHz-216MHz		43	.5	Quasi-peak Value
	216MHz-9	60MHz	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:	 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. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 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.

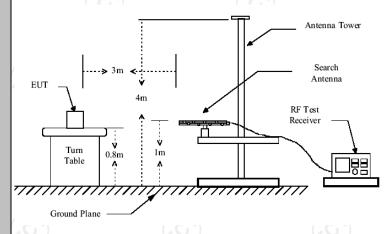
- 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified 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.

For radiated emissions below 30MHz



30MHz to 1GHz

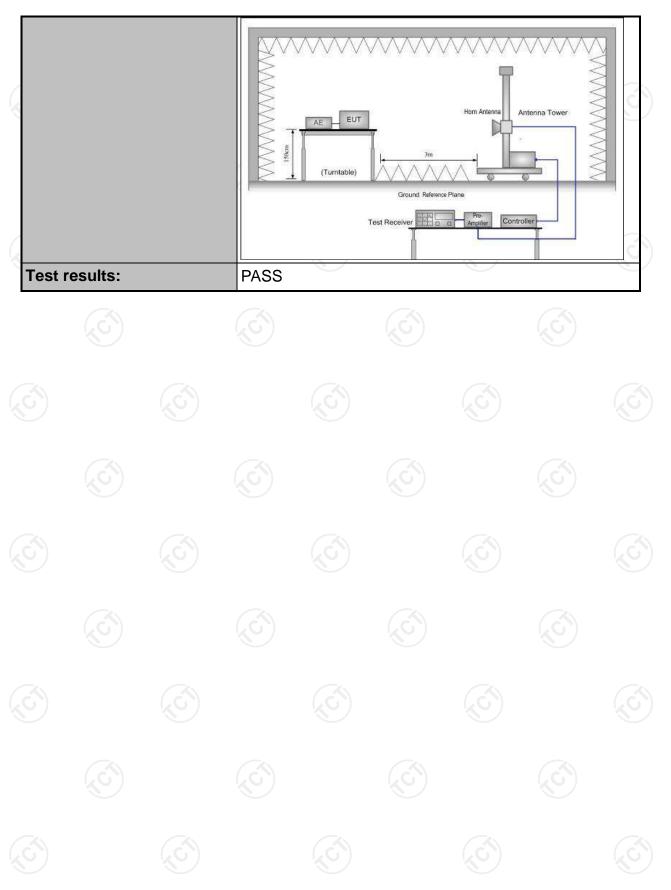
Test setup:



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.)





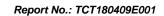




6.3.2. Test Instruments

	Radiated Em	ission Test Si	te (966)	
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Test Receiver	ROHDE&SCHW ARZ	ESVD	100008	Sep. 27, 2018
Spectrum Analyzer	ROHDE&SCHW ARZ	FSQ	200061	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
Horn Antenna	Schwarzbeck	BBH 9170	582	Jun. 07, 2018
Antenna Mast	Keleto	CC-A-4M	N/A	N/A
Coax cable (9KHz-1GHz)	тст	RE-low-01	N/A	Sep. 27, 2018
Coax cable (9KHz-40GHz)	тст	RE-high-02	N/A	Sep. 27, 2018
Coax cable (9KHz-1GHz)	тст	RE-low-03	N/A	Sep. 27, 2018
Coax cable (9KHz-40GHz)	тст	RE-high-04	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 (MHz)	Emission PK/AV (dBuV/m)	Horizontal /Vertical	Limits PK/AV (dBuV/m)	Margin (dB)
2405	89.00(PK)	Н	114/94	-25.00
2405	84.84(AV)	Н	114/94	-9.16
2430	89.71(PK)	Н	114/94	-24.29
2430	85.72(AV)	Н	114/94	-8.28
2470	87.43(PK)	(C)H	114/94	-26.57
2470	85.12(AV)	Н	114/94	-8.88
2405	84.19(PK)	V	114/94	-29.81
2405	82.07(AV)	V	114/94	-11.93
2430	84.51(PK)	V	114/94	-29.49
2430	80.42(AV)	V	114/94	-13.58
2470	82.09(PK)	V	114/94	-31.91
2470	79.58(AV)	V	114/94	-14.42

Spurious Emissions

Frequency Range (9 kHz-30MHz)

Frequency (MHz)	Level@3m (dBµV/m)	Limit@3m (dBµV/m)
(
	C	(1)
(, G) - -	(6) (6)	-(.G)

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

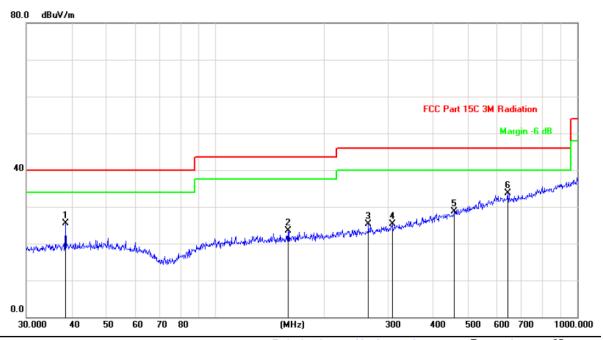
2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement

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Frequency Range (30MHz-1GHz)

Horizontal:



Site Polarization: Horizontal Temperature: 25

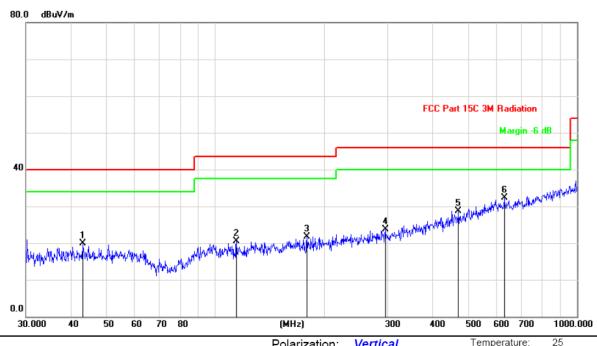
Limit: FCC Part 15C 3M Radiation Power: DC 3V Humidity: 55 %

	No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height	Table Degree	
			MHz	dBu∀	dB	dBuV/m	dB/m	dB	Detector	cm	degree	Comment
	1		38.4808	38.50	-12.98	25.52	40.00	-14.48	peak			
_	2		158.6676	38.77	-15.27	23.50	43.50	-20.00	peak			
	3		264.7456	35.56	-10.18	25.38	46.00	-20.62	peak			
	4		307.8312	33.85	-8.47	25.38	46.00	-20.62	peak			
_	5		457.5072	32.88	-4.25	28.63	46.00	-17.37	peak			
	6	*	642.8613	34.08	-0.45	33.63	46.00	-12.37	peak			





Vertical:



Site	Polarization: Vertical	remperature.	20
Limit: ECC Part 15C 3M Padiation	Power: DC 3V	Humidity: 55	%

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector	cm	degree	Comment
1		43.0505	32.76	-12.77	19.99	40.00	-20.01	peak			
2		114.5146	33.79	-13.25	20.54	43.50	-22.96	peak			
3		179.3863	35.75	-14.00	21.75	43.50	-21.75	peak			
4		295.1469	32.65	-8.90	23.75	46.00	-22.25	peak			
5		470.5232	32.65	-3.89	28.76	46.00	-17.24	peak			
6	*	629.4772	32.92	-0.55	32.37	46.00	-13.63	peak			

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





Above 1GHz

	Low channel: 2405 MHz								
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBuV)	Correction Factor (dB/m)	Peak	n Level AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)
4810.00	Н	52.41		-3.94	48.47		74.00	54.00	-5.53
7215.00	Н	47.62		0.52	48.14		74.00	54.00	-5.86
4810.00	V	48.33		-3.94	44.39		74.00	54.00	-9.61
7215.00	V	45.27	-120	0.52	45.79	(C) 1 }-	74.00	54.00	-8.21

			M	liddle chann	el: 2430 M	lHz			
Frequency	Ant Dol	Peak	AV	Correction	Emissio	on Level	Peak limit	۸\/ limit	Margin
(MHz)	H/V	reading	reading	Factor	Peak			(dBµV/m)	
(IVITZ)	□/ V	(dBµV)	(dBµV)	(dB/m)	(dBµV/m)	(dBµV/m)	(ασμν/ιιι)	(ασμ ۷/ΙΙΙ)	(dB)
4860.00	Н	53.22		-3.98	49.24		74.00	54.00	-4.76
7290.00	H	48.26		0.57	48.83		74.00	54.00	-5.17
			- -		(.G\ \ -		(c)	
	/			/		<i></i>			
4860.00	V	51.11	<u> </u>	-3.98	47.13	1	74.00	54.00	-6.87
	•	7		/					
7290.00	V	50.25		0.57	50.82		74.00	54.00	-3.18
					/				

	High channel: 2470 MHz										
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBµV)	Correction Factor (dB/m)	Emission Peak (dBµV/m)	n Level AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)		
4940.00	Н	50.67		-3.98	46.69		74.00	54.00	-7.31		
7410.00	Н	49.26		0.57	49.83		74.00	54.00	-4.17		
4940.00	V	51.86		-3.98	47.88		74.00	54.00	-6.12		
7410.00	V	48.21	-+.c	0.57	48.78	<u> </u>	74.00	54.00	-5.22		
	/			/	'	<u>-</u>		4			

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

Low chann	Low channel: 2405 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBuV)	Correction Factor (dB/m)	Emissic Peak (dBµV/m)	n Level AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)	
2400	Н	49.25		-4.2	45.05		74.00		-28.95	
2400	Н		42.57	-4.2		38.37		54.00	-15.63	
			/							
	(CO.)		1	(C_{i})		(C_{i})		NO.		
2400	V	48.63		-4.2	44.43		74.00		-29.57	
2400	V		39.25	-4.2		35.05		54.00	-18.95	
					-					

High chann	High channel: 2470 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBuV)	Correction Factor (dB/m)	Emissic Peak (dBµV/m)	AV	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)	
2483.5	KH /	50.15	'	-4.2	45.95	()/	74.00		-28.05	
2483.5	Н		41.67	-4.2		37.47		54.00	-16.53	
		-			1	-				
2483.5	V	49.41)	-4.2	45.21		74.00		-28.79	
2483.5	V		40.87	-4.2		36.67	77	54.00	-17.33	

Note:

- 1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss Pre-amplifier
- 2. $Margin (dB) = Emission Level (Peak/Average)(dB\mu V/m)-(Peak/Average) limit (dB\mu V/m)$
- 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.





6.4.20dB Occupied Bandwidth

6.4.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.215(c)/ Part 2 J Section 2.1049
Test Method:	ANSI C63.10: 2013
Limit:	N/A
	 According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT. Set to the maximum power setting and enable the EUT transmit continuously. 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. Measure and record the results in the test report.
Test setup:	Spectrum Analyzer EUT
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. 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

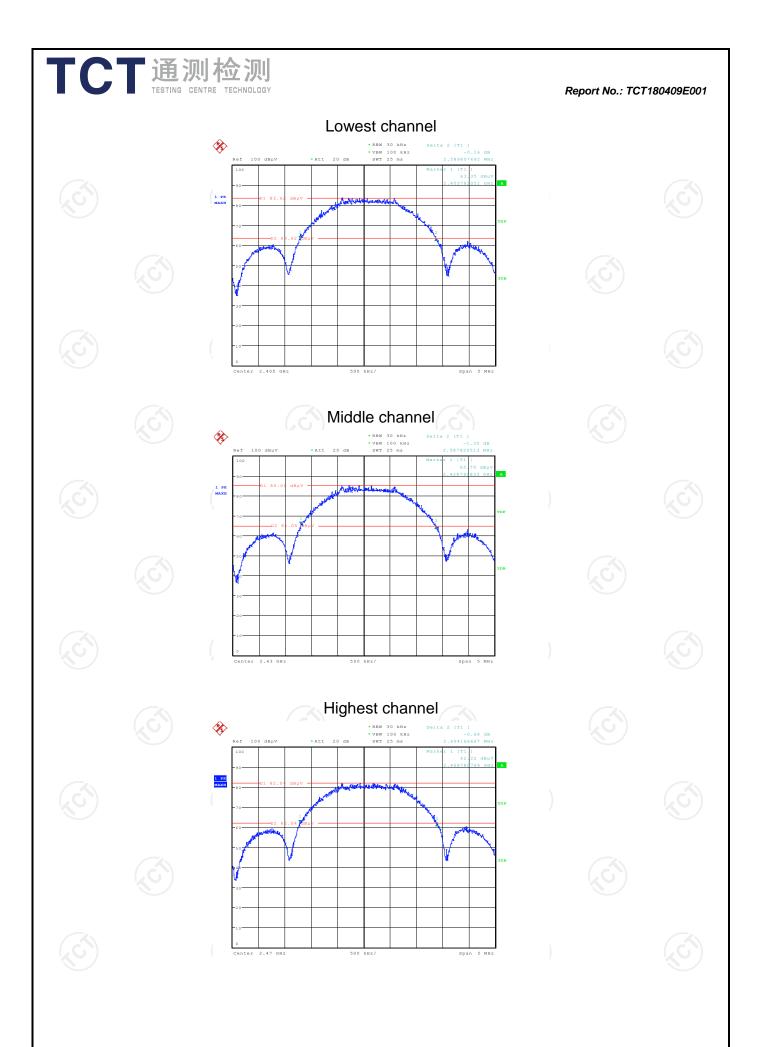
Test Channel	20dB Occupy Bandwidth (kHz) Limit		Conclusion
Lowest	2589.81		PASS
Middle	2587.82		PASS
Highest	2604.17	(A)	PASS

Test plots as follows:



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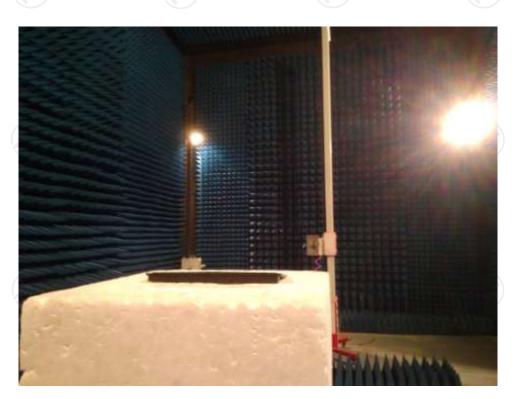
Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com





Appendix A: Photographs of Test Setup Product: 2.4G Wireless Keyboard Model: B009 2.4G Radiated Emission







Appendix B: Photographs of EUT Product: 2.4G Wireless Keyboard

Model: B009 2.4G External Photos





















Appendix B: Photographs of EUT Product: 2.4G Wireless Keyboard Model: B009 2.4G

Internal Photos





TCT通测检测
TESTING CENTRE TECHNOLOGY

Report No.: TCT180409E001



