# TEST REPORT

FCC ID: 2AG68BT-520E Product: Bluetooth Earphone Model No.: BT-520E Additional Model No.: N/A Trade Mark: N/A Report No.: TCT180510E046 Issued Date: May 24, 2018

Issued for:

Dongguan Koppo Electronics Co., Ltd No.2 3 Road, Buxinji Industrial Area, Guanjingtou Village, Fenggang Town, DongGuan, China

Issued By:

Shenzhen Tongce Testing Lab. 1B/F., Building 1, Yibaolai Industrial Park, Qiaotou, Fuyong, Baoan District, Shenzhen, Guangdong, China TEL: +86-755-27673339 FAX: +86-755-27673332

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# 1. Test Certification

Product:	Bluetooth Earphone
Model No.:	BT-520E
Additional Model:	N/A
Trade Mark:	N/A (c) (c)
Applicant:	Dongguan Koppo Electronics Co., Ltd
Address:	No.2 3 Road, Buxinji Industrial Area, Guanjingtou Village, Fenggang Town, DongGuan, China
Manufacturer:	Dongguan Koppo Electronics Co., Ltd
Address:	No.2 3 Road, Buxinji Industrial Area, Guanjingtou Village, Fenggang Town, DongGuan, China
Date of Test:	May 11, 2018 – May 23, 2018
Applicable Standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247

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:

Rleo

Reviewed By:

Beryl Zhao

omsm

Approved By:

Tomsin

Date: May 23, 2018

Date: I

May 24, 2018

May 24, 2018 Date:

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# 2. Test Result Summary

Requirement	CFR 47 Section	Result
Antenna Requirement	§15.203/§15.247 (c)	PASS
AC Power Line Conducted Emission	§15.207	PASS
Conducted Peak Output Power	§15.247 (b)(1) §2.1046	PASS
20dB Occupied Bandwidth	§15.247 (a)(1) §2.1049	PASS
Carrier Frequencies Separation	§15.247 (a)(1)	PASS
Hopping Channel Number	§15.247 (a)(1)	PASS
Dwell Time	§15.247 (a)(1)	PASS
Radiated Emission	§15.205/§15.209 §2.1053, §2.1057	PASS
Band Edge	§15.247(d) §2.1051, §2.1057	PASS
Note: 1. PASS: Test item meets the requir	ement.	
2. Fail: Test item does not meet the		
<ol> <li>N/A: Test case does not apply to</li> <li>The test result judgment is decide</li> </ol>		
. The test result judgment is deside		



# 3. EUT Description

Product Name:	Bluetooth Earphone
Model :	BT-520E
Additional Model:	N/A
Trade Mark:	N/A
Hardware version:	V1.1
Software version:	1.0
Bluetooth version:	V4.2 (This report is for BDR+EDR)
<b>Operation Frequency:</b>	2402MHz~2480MHz
Transfer Rate:	1/2/3 Mbits/s
Number of Channel:	79
Modulation Type:	GFSK, π/4-DQPSK, 8DPSK
Modulation Technology:	FHSS
Antenna Type:	Ceramic Antenna
Antenna Gain:	2dBi
Power Supply:	Rechargeable Li-ion Battery DC 3.7V

#### Operation Frequency each of channel for GFSK, π/4-DQPSK, 8DPSK

Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
2402MHz	20	2422MHz	40	2442MHz	60	2462MHz
2403MHz	21	2423MHz	41	2443MHz	61	2463MHz
2412MHz	30	2432MHz	50	2452MHz	- 70	2472MHz
2413MHz	31	2433MHz	51	2453MHz	71	2473MHz
			·		·	
2420MHz	38	2440MHz	58	2460MHz	78	2480MHz
2421MHz	39	2441MHz	59	2461MHz		-
	2402MHz 2403MHz  2412MHz 2413MHz  2420MHz	2402MHz       20         2403MHz       21             2412MHz       30         2413MHz       31             2420MHz       38	2402MHz         20         2422MHz           2403MHz         21         2423MHz           2412MHz         30         2432MHz           2412MHz         30         2432MHz           2413MHz         31         2433MHz                2420MHz         38         2440MHz	2402MHz       20       2422MHz       40         2403MHz       21       2423MHz       41               2412MHz       30       2432MHz       50         2413MHz       31       2433MHz       51               2420MHz       38       2440MHz       58	2402MHz         20         2422MHz         40         2442MHz           2403MHz         21         2423MHz         41         2443MHz           2403MHz         21         2423MHz         41         2443MHz                  2412MHz         30         2432MHz         50         2452MHz           2413MHz         31         2433MHz         51         2453MHz                  2420MHz         38         2440MHz         58         2460MHz	2403MHz       21       2423MHz       41       2443MHz       61                 2412MHz       30       2432MHz       50       2452MHz       70         2413MHz       31       2433MHz       51       2453MHz       71                 2413MHz       31       2433MHz       51       2453MHz       71                 2420MHz       38       2440MHz       58       2460MHz       78

Remark: Channel 0, 39 &78 have been tested for GFSK,  $\pi$ /4-DQPSK, 8DPSK modulation mode.



# 4. Genera Information

### 4.1. Test environment and mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	56 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Engineering mode:	Keep the EUT in continuous transmitting by select channel and modulations with Fully-charged battery

The sample was placed 0.8m & 1.5m for the measurement below & 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
, 0	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.
- 3. For conducted measurements (Output Power, 20dB Occupied Bandwidth, Carrier Frequencies Separation, Hopping Channel Number, Dwell Time, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.

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





#### Test Results and Measurement Data 6.

## 6.1. Antenna requirement

# FCC Part15 C Section 15.203 /247(c) **Standard requirement:** 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. **E.U.T** Antenna: The Bluetooth antenna is ceramic antenna which permanently attached, and the best case gain of the antenna is 2dBi. Antenna



## 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							
	Frequency range	Limit (	dBuV)					
	(MHz)	Quasi-peak	Áverage					
Limits:	0.15-0.5	66 to 56*	56 to 46*					
	0.5-5	56	46					
	5-30	60	50					
	Reference	e Plane						
Test Setup:	E.U.T AC powe		— AC power					
	Test table/Insulation plane Remark: E.U.T: Equipment Under Test LISN: Line Impedence Stabilization N Test table height=0.8m							
Test Mode:	Remark: E.U.T. Equipment Under Test LISN: Line Impedence Stabilization N Test table height=0.8m Refer to item 4.1	letwork						
	Remark: E.U.T. Equipment Under Test LISN: Line Impedence Stabilization N Test table height=0.8m Refer to item 4.1 1. The E.U.T is conner impedance stabiliz provides a 500hm/s measuring equipme 2. The peripheral device power through a L coupling impedance refer to the block photographs). 3. Both sides of A.C conducted interfere emission, the relative the interface cables	etwork ected to an adapte zation network 50uH coupling im ent. ces are also conne ISN that provides e with 50ohm tern diagram of the . line are checke nce. In order to fin re positions of equ must be changed	(L.I.S.N.). This pedance for the ected to the main a 500hm/50uh nination. (Please test setup and ed for maximum nd the maximum ipment and all o according to					
Test Mode: Test Procedure: Test Result:	Remark: E.U.T. Equipment Under Test LISN Line Impedence Stabilization No Test table height=0.8m Refer to item 4.1 1. The E.U.T is connel impedance stabiliz provides a 500hm/s measuring equipme 2. The peripheral device power through a L coupling impedance refer to the block photographs). 3. Both sides of A.C conducted interfere emission, the relative	etwork ected to an adapte zation network 50uH coupling im ent. ces are also conne ISN that provides e with 50ohm tern diagram of the . line are checke nce. In order to fin re positions of equ must be changed	(L.I.S.N.). This pedance for the ected to the main a 500hm/50uh nination. (Please test setup and ed for maximun nd the maximun ipment and all o according to					

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#### 6.2.2. Test Instruments

Conducted Emission Shielding Room Test Site (843)											
Equipment	Manufacturer	Model	Calibration Due								
Test Receiver	R&S	ESPI	101401	Jun. 12, 2018							
LISN	Schwarzbeck	NSLK 8126	8126453	Sep. 27, 2018							
Coax cable (9KHz-30MHz)	тст	CE-05	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).

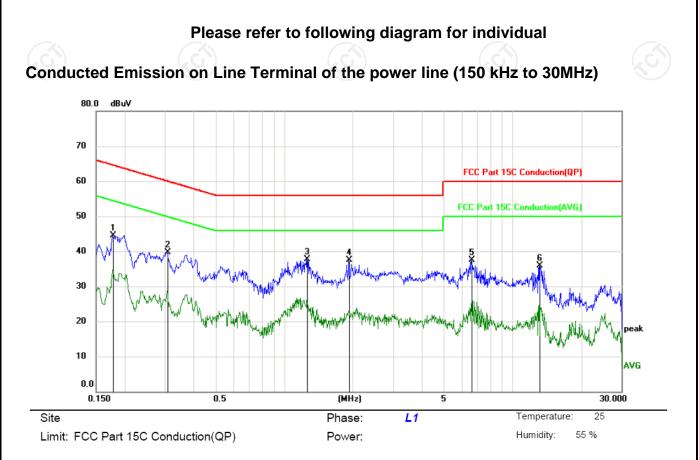
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#### 6.2.3. Test data



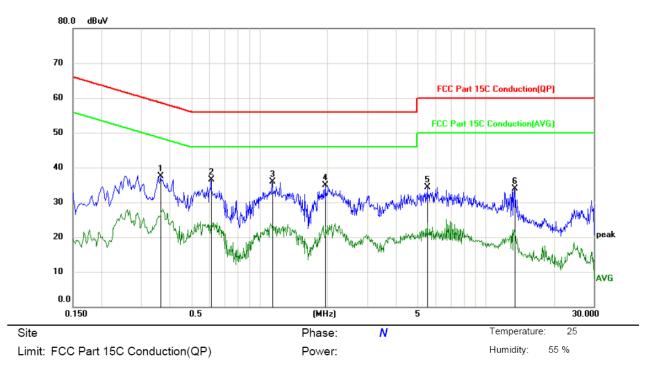
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1770	33.11	11.48	44.59	64.63	-20.04	peak	
2		0.3075	28.35	11.42	39.77	60.04	-20.27	peak	
3	*	1.2569	26.36	11.33	37.69	56.00	-18.31	peak	
4		1.9184	25.82	11.66	37.48	56.00	-18.52	peak	
5		6.6030	26.56	10.88	37.44	60.00	-22.56	peak	
6		13.1100	24.39	11.53	35.92	60.00	-24.08	peak	

#### Note:

Freq. = Emission frequency in MHz Reading level  $(dB\mu V)$  = Receiver reading Corr. Factor (dB) = Antenna factor + Cable loss Measurement  $(dB\mu V)$  = Reading level  $(dB\mu V)$  + Corr. Factor (dB)Limit  $(dB\mu V)$  = Limit stated in standard Margin (dB) = Measurement  $(dB\mu V)$  – Limits  $(dB\mu V)$ Q.P. =Quasi-Peak AVG = average

\* is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz

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#### Conducted Emission on Neutral Terminal of the power line (150 kHz to 30MHz)

No. Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
	MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	0.3660	26.10	11.38	37.48	58.59	-21.11	peak	
2 *	0.6134	25.18	11.26	36.44	56.00	-19.56	peak	
3	1.1400	24.69	11.28	35.97	56.00	-20.03	peak	
4	1.9589	23.22	11.68	34.90	56.00	-21.10	peak	
5	5.5185	23.64	10.70	34.34	60.00	-25.66	peak	
6	13.4070	22.25	11.56	33.81	60.00	-26.19	peak	

#### Note1:

Freq. = Emission frequency in MHz Reading level  $(dB\mu V)$  = Receiver reading Corr. Factor (dB) = Antenna factor + Cable loss Measurement  $(dB\mu V)$  = Reading level  $(dB\mu V)$  + Corr. Factor (dB)Limit  $(dB\mu V)$  = Limit stated in standard Margin (dB) = Measurement  $(dB\mu V)$  – Limits  $(dB\mu V)$ Q.P. =Quasi-Peak AVG =average

\* is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.

#### Note2:

Measurements were conducted in all three channels (high, middle, low) and three modulation (GFSK, Pi/4 DQPSK, 8DPSK), and the worst case Mode (Highest channel and GFSK) was submitted only.

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## 6.3. Conducted Output Power

#### 6.3.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.10:2013
Limit:	Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.
Test Setup:	Spectrum Analyzer EUT
Test Mode:	Transmitting mode with modulation
Test Procedure:	Use the following spectrum analyzer settings: Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel RBW > the 20 dB bandwidth of the emission being measured VBW ≥ RBW Sweep = auto Detector function = peak Trace = max hold Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission.
Test Result:	PASS

#### 6.3.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 27, 2018
RF Cable (9KHz-26.5GHz)	тст	RE-06	N/A	Sep. 27, 2018
Antenna Connector	тст	RFC-01	N/A	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).

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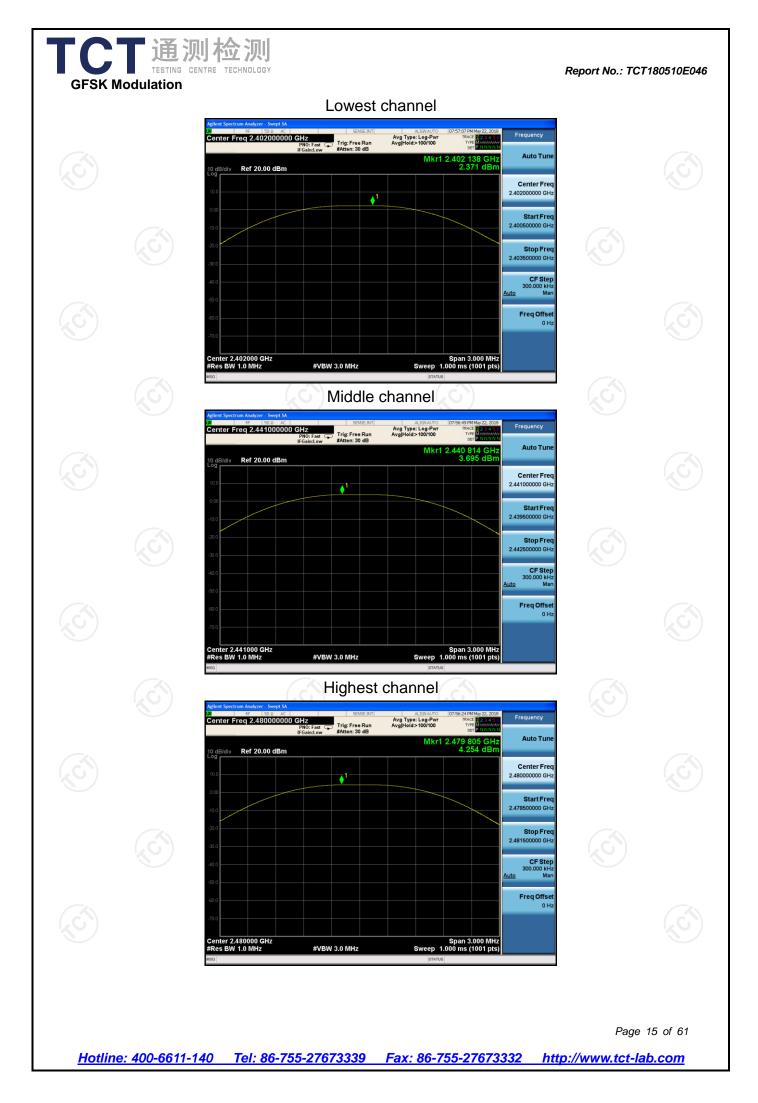
### 6.3.3. Test Data

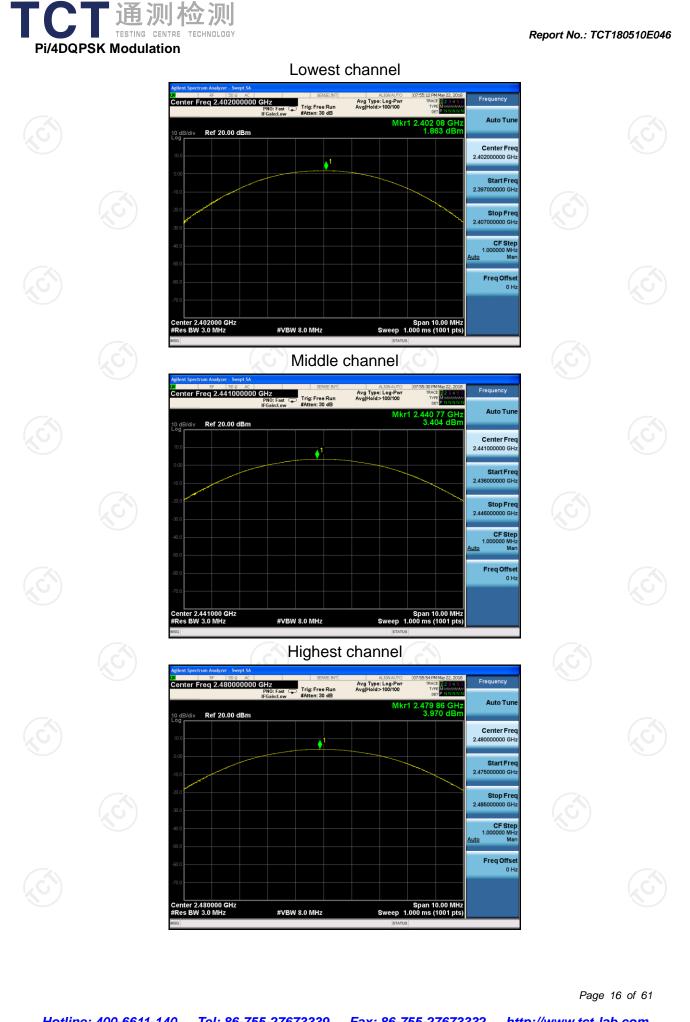
	GFSK mode			
6	Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
	Lowest	2.37	30.00	PASS
	Middle	3.70	30.00	PASS
	Highest	4.25	30.00	PASS

	Pi/4DQPSK mode			
(X)	Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
	Lowest	1.86	21.00	PASS
	Middle	3.40	21.00	PASS
	Highest	3.97	21.00	PASS

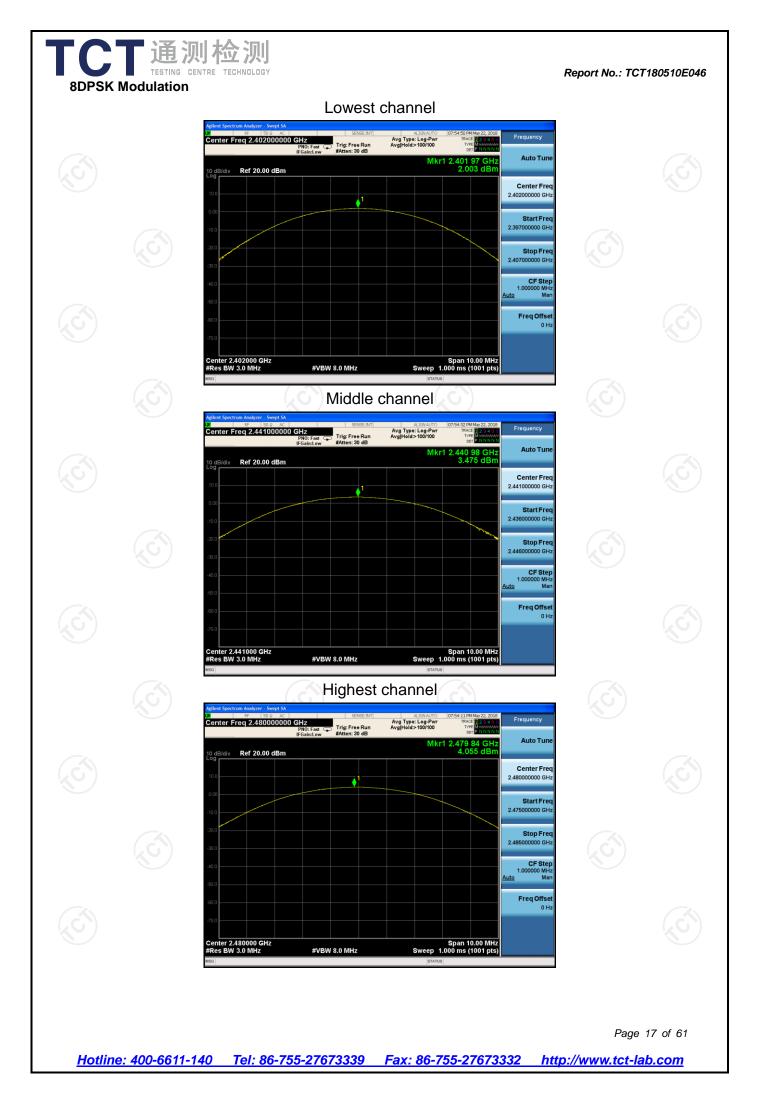
8DPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	2.00	21.00	PASS
Middle	3.48	21.00	PASS
Highest	4.06	21.00	PASS

Test plots as follows:





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# 6.4. 20dB Occupy Bandwidth

#### 6.4.1. Test Specification

Test Requirement:	FCC Part15 C Section 1	5.247 (a)(1)	
Test Method:	ANSI C63.10:2013		
Limit:	N/A	×)	
Test Setup:	Spectrum Analyzer	EUT	e C
Test Mode:	Transmitting mode with	modulation	
Test Procedure:	<ol> <li>The testing follows AN Guidelines.</li> <li>The RF output of EUT analyzer by RF cable was compensated to measurement.</li> <li>Set to the maximum p EUT transmit continu</li> <li>Use the following spe Bandwidth measurer Span = approximatel bandwidth, centered ≤5% of the 20 dB ba Sweep = auto; Detect hold.</li> <li>Measure and record t</li> </ol>	F was connected to e and attenuator. The the results for each ower setting and en- uously. ctrum analyzer setting trum analyzer setting on a hopping chan andwidth; VBW≥3F ctor function = peak	o the spectrum he path loss th enable the tings for 20dB 20 dB anel; 1% ≪RBW RBW; c; Trace = max
Test Result:	PASS		

#### 6.4.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 27, 2018
RF Cable (9KHz-26.5GHz)	тст	RE-06	N/A	Sep. 27, 2018
Antenna Connector	TCT	RFC-01	N/A	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	20	dB Occupy Band	dwidth (kHz)		
rest channel	GFSK	π/4-DQPSK	8DPSK	Conclusion	
Lowest	871.5	1222	1212	PASS	
Middle	865.5	1254	1220	PASS	
Highest	859.9	1258	1221	PASS	
					•

Test plots as follows:

		ws.						
Hotline	e: 400-6611-	-140 Tel: 8	36-755-27673	1339 Fax:	<u>86-755-2767</u>	<u>3332 http</u>	Page <b>://www.tct-la</b>	19 of 61 1 <b>b.com</b>











# 6.5. Carrier Frequencies Separation

#### 6.5.1. Test Specification

FCC Part15 C Section 1	5.247 (a)(1)
ANSI C63.10:2013	
carrier frequencies separ the 20 dB bandwidth of the is greater. Alternatively, for operating in the 2400-24 hopping channel carrier for by 25 kHz or two-thirds of hopping channel, whiche	ems shall have hopping channe ated by a minimum of 25 kHz of he hopping channel, whicheve requency hopping systems 83.5 MHz band may have frequencies that are separated of the 20 dB bandwidth of the ever is greater, provided the output power no greater than
Spectrum Analyzer	EUT
Hopping mode	
<ul> <li>Guidelines.</li> <li>2. The RF output of EUT was analyzer by RF cable and compensated to the result 3. Set to the maximum power transmit continuously.</li> <li>4. Enable the EUT hopping</li> <li>5. Use the following spectrue Span = wide enough to a channels; RBW is set to spacing, adjust as necessive each individual channel; Detector function = peak</li> <li>6. Use the marker-delta fund between the peaks of the</li> </ul>	as connected to the spectrum d attenuator. The path loss was lts for each measurement. er setting and enable the EUT function. Im analyzer settings: capture the peaks of two adjacent approximately 30% of the channel ssary to best identify the center of VBW≥RBW; Sweep = auto;
PASS	
	Frequency hopping syste carrier frequencies separ the 20 dB bandwidth of th is greater. Alternatively, f operating in the 2400-24 hopping channel carrier f by 25 kHz or two-thirds of hopping channel, whiches systems operate with an 125 mW. Spectrum Analyzer Hopping mode 1. The testing follows ANSI Guidelines. 2. The RF output of EUT wa analyzer by RF cable and compensated to the resu 3. Set to the maximum pow transmit continuously. 4. Enable the EUT hopping 5. Use the following spectru Span = wide enough to of channels; RBW is set to spacing, adjust as necess each individual channel; Detector function = peak 6. Use the marker-delta fun

#### 6.5.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 27, 2018
RF Cable (9KHz-26.5GHz)	🕑 тст	RE-06	N/A	Sep. 27, 2018
Antenna Connector	ТСТ	RFC-01	N/A	Sep. 27, 2018

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to



#### 6.5.3. Test data

	GFSK mod	le	
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	998	871.5	PASS
Middle	1002	871.5	PASS
Highest	1000	871.5	PASS
	$(\tilde{a})$	(G)	
	Pi/4 DQPSK n	node	
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1000	838.67	PASS
Middle	1000	838.67	PASS
Highest	1002	838.67	PASS

8DPSK mode									
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result						
Lowest	1000	814.00	PASS						
Middle	1002	814.00	PASS						
Highest	1000	814.00	PASS						

#### Note: According to section 6.4

	Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)			
	GFSK	871.5	871.5			
~	π/4-DQPSK	1258	838.67			
	8DPSK	1221	814.00			

Test plots as follows:







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# 6.6. Hopping Channel Number

#### 6.6.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Limit:	Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Setup:	
	Spectrum Analyzer EUT
Test Mode:	Hopping mode
Test Procedure:	<ol> <li>The testing follows ANSI C63.10:2013 Measurement Guidelines.</li> <li>The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.</li> <li>Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>Enable the EUT hopping function.</li> <li>Use the following spectrum analyzer settings: Span = the frequency band of operation; set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller; VBW≥RBW; Sweep = auto; Detector function = peak; Trace = max hold.</li> <li>The number of hopping frequency used is defined as the number of total channel.</li> <li>Record the measurement data in report.</li> </ol>
Test Result:	PASS

#### 6.6.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due		
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 27, 2018		
RF Cable (9KHz-26.5GHz)	тст	RE-06	N/A	Sep. 27, 2018		
Antenna Connector	TCT	RFC-01	N/A	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).

# TCT 通测检测 TESTING CENTRE TECHNOLOGY 6.6.3. Test data

Ν	/lode	Hopping chann numbers	Li	nit F	Result
GFSK, Pi/4-	DQPSK, 8DPSK	79	1	5	PASS
Test plots as follo	ows:				
					Page 29 of 61

	-30.0 -40.0					Start Freq 2.40000000 GHz		
	-50.0					Stop Freq 2.483500000 GHz		
	#Re	MODE TRC SCL X	VBW 300 kHz		Stop 2.48350 GHz 2.000 ms (1001 pts) FUNCTION VALUE	CF Step 8.350000 MHz <u>Auto</u> Man		
	2 4 5 6 7 8 9	N 1 f 2.4019710 GHz N 1 f 2.479 993 0 GHz	z -1.302 dBm z 2.418 dBm			Freq Offset 0 Hz		
	10 « MSG			STATUS	5			
							Page	30 of 61
Hotline	: 400-6611-140	Tel: 86-755-27	7673339 F	ax 86-7	55-27673	332 htt	n·//www.tct-la	h com

tart Freq 2.400000000 GHz

Ref 20.00 dBm

TCT 通测检测 TESTING CENTRE TECHNOLOGY

RF			SENSE:		ALIGNAUTO	08:00:32 PM		Frequency
Start Freq 2.4	100000000 GHz		Trig: Free R	A1	g Type: Log-Pwr alHold>100/100		123456 Mwwwww	Frequency
		NO: Fast 🖵 Gain:Low	#Atten: 30 dl		girioid.s roor roo	DET	PNNNNN	
					Mkr2.2	.479 993	0 GHz	Auto Tun
10 dB/div Rei	f 20.00 dBm				1011112		8 dBm	
	20.00 UBIII						0 0 0 0	
10.0							2_	Center Fre
					0444 - 0481 I I A	10.0010.004	LANDA	2.441750000 G
MMMM	uwww.www	thadaaalah a	handelaneder	iteed a cheed	กตกคลายลาใก้กกุล	anlinakakak	ervy)	2.441700000 01
10.0								
-20.0								Start Fr
-30.0							- Y	2.400000000 G
40.0								2.40000000000
50.0							۲.	
							M	Stop Fr
-60.0								2.483500000 G
-70.0								2.400000000000
Start 2.40000						Stop 2.48	350 GHz	CF St
Res BW 100	KHZ	#VBW	300 kHz		Sweep 8	1.000 ms (1	001 pts)	8.350000 M
MKR MODE TRC SCL			Y	FUNCTION	FUNCTION WIDTH	FUNCTION	VALUE	Auto M
1 N 1 f	2.401 971 2.479 993	0 GHz	-1.548 dBm					
2 N 1 f	2.479 993	UGHZ	2.708 dBm					Freq Offs
4								0
6							-	
7								
8								
9								
11							~	
¢			u .				>	
SG					STATU	e		

GFSK

J: Fast 🖵 Trig: Free Run #Atten: 30 dB

in the second second

Avg Type: Log-Pwr Avg|Hold>100/100

Mkr2 2.48

0 076 5 GI 2.850 dB

Stop 2.48350 GHz

Frequency

Center Freq 2.441750000 GHz

Start Freq 2.40000000 GHz

Stop Fred 2.483500000 GH:

CF Step 8.350000 ML

Freq Offset 0 Hz

Freq GHz

Auto Tun

## 8DPSK

F	M May 22, 2018	08:01:45 PI	ALIGNAUTO		INT	ENSE:	SE		AC		RF		L)XI
Frequency	CE 123456	TRAC	: Log-Pwr >100/100	Avg Type Avg Hold:	m	e Ri	Trig: Fre	0: Fast 🕟	00 GHz	000000	q 2.4	t Fre	Star
	ET P NNNN	D					#Atten: 3	ain:Low					
Auto T	3 0 GHz		Mkr2 2										
	18 dBm	2.4							Bm	20.00 d	Re	B/div	10 d
Center F	.2												Log 10.0
2.441750000		100.4440	00010 14									0	0.00
2.441750000	AAAAAA	WANNA	RANARA	งจภิกิลกกิ	VYNYVY	NV.	Anderna	1 MAY ANY ANY	MANANAN	wwww	WWW	M	-10.0
													-20.0
Start F	l.											l I	
2.40000000													-30.0
	1											ř –	-40.0
Stop F	Ĭ												-50.0
2.483500000													-60.0
2.40000000												<u> </u>	-70.0
05.0	8350 GHz	Stop 2.45								287	1000	t 2.40	Star
CF S 8.350000	1001 pts)			:		z	300 kHz	#VBW				s BW	
Auto	ON VALUE	FUNCTIO	CTION WIDTH	ON FUE	FUNC	_	Y		×		RC SCI	MODE TF	MKR
						iBm	-1.302 d	GHz	2.401 971 0		f	N 1	1
Freq Of						dBm	2.418 d	GHz	2.479 993 0		l f	N 1	2
													4
	-												5
													7
													9
													10
	>						ш						<
		1	STATUS										MSG

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# 6.7. Dwell Time

## 6.7.1. Test Specification

FCC Part15 C Section 15.247 (a)(1)
ANSI C63.10:2013
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.
Spectrum Analyzer EUT
Hopping mode
<ol> <li>The testing follows ANSI C63.10:2013 Measurement Guidelines.</li> <li>The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.</li> <li>Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>Enable the EUT hopping function.</li> <li>Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW shall be ≤ channel spacing and where possible RBW should be set &gt;&gt; 1 / T, where T is the expected dwell time per channel; VBW≥RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.</li> <li>Measure and record the results in the test report.</li> </ol>
PASS

#### 6.7.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due		
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 27, 2018		
RF Cable (9KHz-26.5GHz)	тст	RE-06	N/A	Sep. 27, 2018		
Antenna Connector	тст	RFC-01	N/A	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).

#### 6.7.3. Test Data

I							
	Mode	Packet	Hops Over Occupancy Time (hops)	Package Transfer Time (ms)	Dwell time (second)	Limit (second)	Result
1	GFSK	DH1	320	0.441	0.141	0.4	PASS
	GFSK	DH3	160	1.695	0.271	0.4	PASS
	GFSK	DH5	106.67	2.984	0.318	0.4	PASS
	Pi/4 DQPSK	2-DH1	320	0.460	0.147	0.4	PASS
	Pi/4 DQPSK	2-DH3	160	1.725	0.276	0.4	PASS
	Pi/4 DQPSK	2-DH5	106.67	2.976	0.317	0.4	PASS
	8DPSK	3-DH1	320	0.453	0.145	0.4	PASS
	8DPSK	3-DH3	160	1.707	0.273	0.4	PASS
	8DPSK	3-DH5	106.67	2.991	0.319	0.4	PASS

Note: 1. In normal mode, hopping rate is 1600 hops/s with 6 slots in 79 hopping channels.

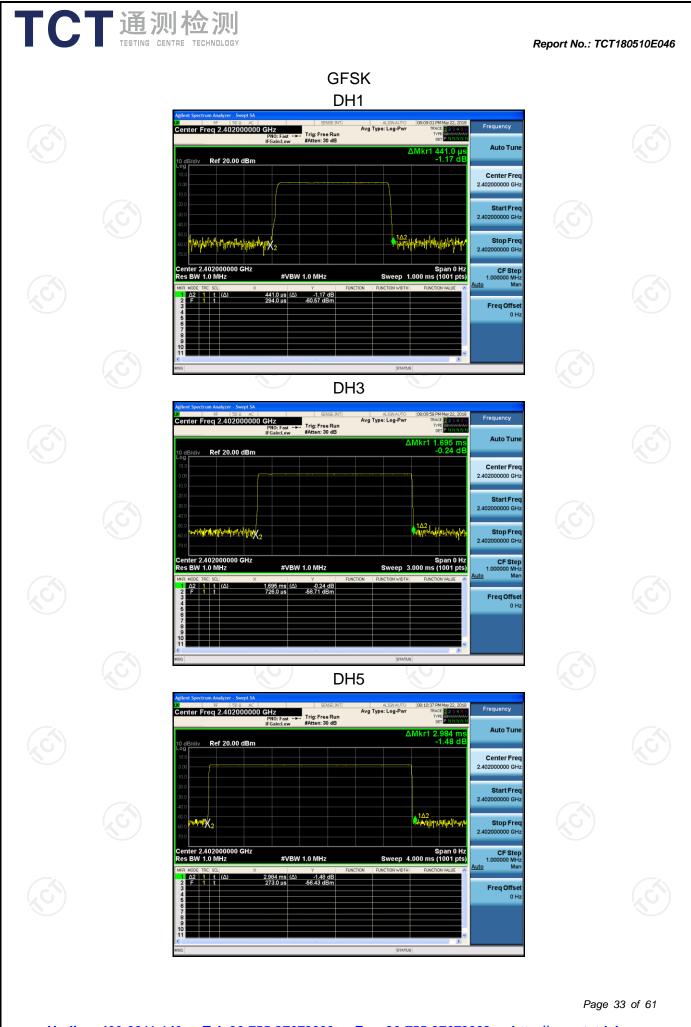
For DH1, With channel hopping rate (1600 / 2 / 79) in Occupancy Time Limit  $(0.4 \times 79)$  (s), Hops Over Occupancy Time comes to  $(1600 / 2 / 79) \times (0.4 \times 79) = 320$  hops

For DH3, With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit (0.4 x 79) (s), Hops Over Occupancy Time comes to  $(1600 / 4 / 79) \times (0.4 \times 79) = 160$  hops

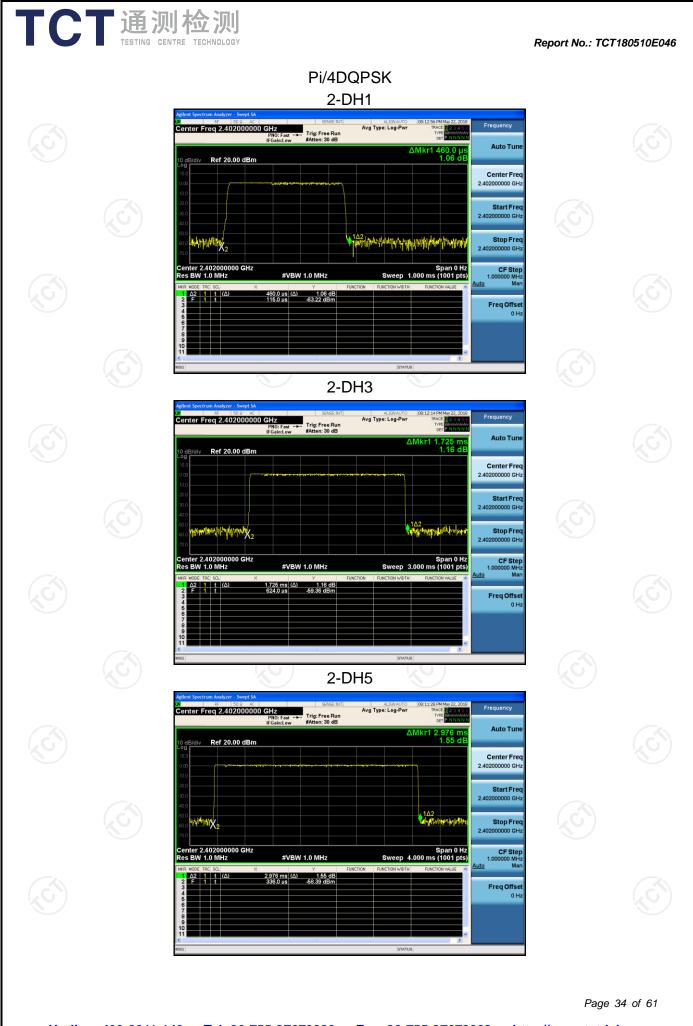
For DH5, With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit  $(0.4 \times 79)$  (s), Hops Over Occupancy Time comes to  $(1600 / 6 / 79) \times (0.4 \times 79) = 106.67$  hops

2. Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

#### Test plots as follows:



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