

TEST REPORT

FCC ID: 2AIKX-F104BV2

Product: TABLET PC

Model No.: F104Bv2

Additional Model No.: F104B, F104Bv2+, F105D, F105D-10, F803B, F704B,

F104E, M116

Trade Mark: N/A

Report No.: TCT180926E009

Issued Date: Oct. 19, 2018

Issued for:

F5CS LTD

19C Trolley Sq, Wilmington, Delaware, 19806 United States

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





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1. Test Certification

Report No.:	TCT180926E009
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Product:	TABLET PC
Model No.:	F104Bv2
Additional Model:	F104B, F104Bv2+, F105D, F105D-10, F803B, F704B, F104E, M116
Trade Mark:	N/A
Applicant:	F5CS LTD
Address:	19C Trolley Sq, Wilmington, Delaware, 19806 United States
Manufacturer:	Top Sky Technology International Co., Ltd
Address:	East 5th of Shangxue Industry Area, Bantian Street, Longgang District, Shenzhen, China
Date of Test:	Sep. 27, 2018 – Oct. 18, 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:	Kerin Huang	Date:	Oct. 18, 2018	
(c)	Kevin Huang	(
Reviewed By:	Bery zhao	Date:	Oct. 19, 2018	
(c) -	Beryl Zhao			
Approved By:	Tomsin	Date:	Oct. 19, 2018	
(, 0,	Tomsin	(.C"	



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 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

	TESTING CENTRE	TECHNOLOGY	Report No.: TCT180926E009
CUT	Dagarin	4:00	

Product Name:	TABLET PC	
Model :	F104Bv2	
Additional Model:	F104B, F104Bv2+, F105D, F105D-10, F803B, F704B, F104E, M116	
Trade Mark:	N/A	
Hardware Version:	S805 E1.0	
Software Version:	Fusion5_F104Bv2.O.V1.8.RC-V01-20180720-4266	
Bluetooth version:	V4.0 (This report is for BDR+EDR)	
Operation Frequency:	2402MHz~2480MHz	
Transfer Rate:	1/2/3 Mbits/s	
Number of Channel:	of Channel: 79	
Modulation Type:	GFSK, π/4-DQPSK, 8DPSK	
Modulation Technology:	FHSS	
Antenna Type:	Internal Antenna	
Antenna Gain:	2.1dBi	
Power Supply:	Rechargeable Li-ion Battery DC 3.8V	
Remark:	All models above are identical in interior structure, electrical circuits and components, and just model names and colors are different for the marketing requirement.	

Operation Frequency each of channel for GFSK, $\pi/4$ -DQPSK, 8DPSK

- ролино		<i>y</i>		. O. O	, = =	,	•
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	20	2422MHz	40	2442MHz	60	2462MHz
9)1	2403MHz	21	2423MHz	41	2443MHz	61	2463MHz
			•••				
10	2412MHz	30	2432MHz	50	2452MHz	70	2472MHz
11	2413MHz	31	2433MHz	51	2453MHz	71	2473MHz
	·						
18	2420MHz	38	2440MHz	58	2460MHz	78	2480MHz
19	2421MHz	39	2441MHz	59	2461MHz		-
D	1						

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



4. General 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
1	1			

Note:

- 1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
- 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%

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6. Test Results and Measurement Data

6.1. Antenna requirement

Standard requirement:

FCC Part15 C Section 15.203 /247(c)

15.203 requirement:

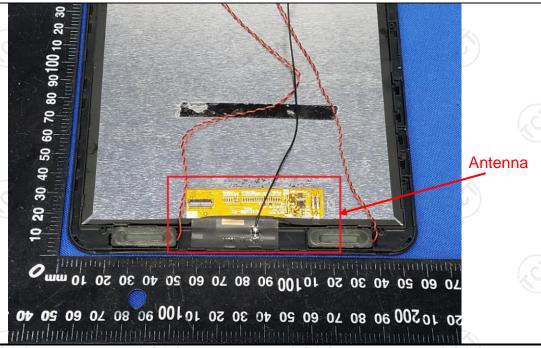
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit 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.

E.U.T Antenna:

The Bluetooth antenna is internal antenna which permanently attached, and the best case gain of the antenna is 2.1dBi.







6.2. Conducted Emission

6.2.1. Test Specification

Test Requirement:	FCC Part15 C Section	15.207	Re		
Test Method:	ANSI C63.10:2013	ANSI C63.10:2013			
Frequency Range:	150 kHz to 30 MHz	(C)	(c ⁽¹⁾)		
Receiver setup:	RBW=9 kHz, VBW=30	kHz, Sweep time	e=auto		
Limits:	Frequency range (MHz) 0.15-0.5 0.5-5 5-30	Limit (Quasi-peak 66 to 56* 56 60	dBuV) Average 56 to 46* 46 50		
Test Setup:	Reference 40cm LU.T AC powe Test table/Insulation plane Remark EU.T: Equipment Under Test LISN: Line Impedence Stabilization Net Test table height-0.8m	80cm LISN Filter			
Test Mode:	Refer to item 4.1				
Test Procedure:	1. The E.U.T is conne impedance stabilize provides a 500hm/5 measuring equipme 2. The peripheral device power through a LI coupling impedance refer to the block photographs). 3. Both sides of A.C. conducted interferer emission, the relative the interface cables ANSI C63.10:2013 of	cation network 50uH coupling im nt. ces are also connects SN that provides with 50ohm terr diagram of the line are checkence. In order to fi e positions of equ must be changed	(L.I.S.N.). This appedance for the ected to the main a 500hm/50uH mination. (Please test setup and ed for maximum and the maximum all of according to		
	PASS				



6.2.2. Test Instruments

Conducted Emission Shielding Room Test Site (843)							
Equipment Manufacturer Model Serial Number Calibration I							
Test Receiver	R&S	ESPI	101401	Aug. 27, 2019			
LISN	Schwarzbeck	hwarzbeck NSLK 8126 8126453		Aug. 27, 2019			
Coax cable (9KHz-30MHz)	тст	CE-05	N/A	Aug. 27, 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).

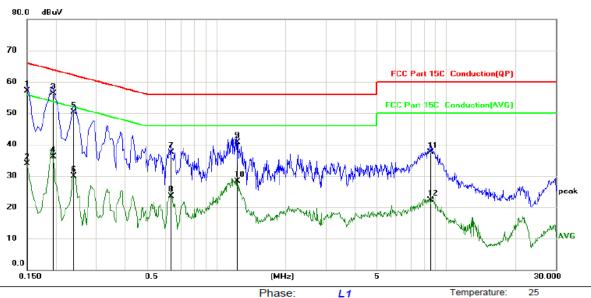




6.2.3. Test data

Please refer to following diagram for individual

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



Limit: FCC Part 15C Conduction(QP)

AC 120V/60Hz Power:

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Humidity: 55 %

No. Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
	MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	0.1500	47.00	10.12	57.12	66.00	-8.88	QP	
2	0.1500	23.79	10.12	33.91	56.00	-22.09	AVG	
3 *	0.1949	46.10	10.12	56.22	63.83	-7.61	QP	
4	0.1949	25.94	10.12	36.06	53.83	-17.77	AVG	
5	0.2400	40.10	10.13	50.23	62.10	-11.87	QP	
6	0.2400	19.75	10.13	29.88	52.10	-22.22	AVG	
7	0.6359	27.30	10.13	37.43	56.00	-18.57	QP	
8	0.6359	13.38	10.13	23.51	46.00	-22.49	AVG	
9	1.2300	30.50	10.12	40.62	56.00	-15.38	QP	
10	1.2300	18.24	10.12	28.36	46.00	-17.64	AVG	
11	8.5380	27.30	10.14	37.44	60.00	-22.56	QP	
12	8.5380	12.26	10.14	22.40	50.00	-27.60	AVG	

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)

 $Limit (dB\mu V) = Limit stated in standard$

 $Margin (dB) = Measurement (dB\mu V) - Limits (dB\mu V)$

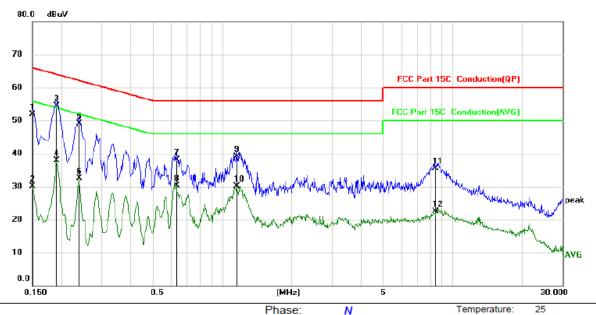
Q.P. =Quasi-Peak

AVG =average

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



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



Site Phase: N Temperature: 25
Limit: FCC Part 15C Conduction(QP) Power: AC 120V/60Hz Humidity: 55 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1500	41.70	10.12	51.82	66.00	-14.18	QP	
2		0.1500	19.96	10.12	30.08	56.00	-25.92	AVG	
3	*	0.1905	44.30	10.12	54.42	64.01	-9.59	QP	
4		0.1905	27.83	10.12	37.95	54.01	-16.06	AVG	
5		0.2400	39.00	10.13	49.13	62.10	-12.97	QP	
6		0.2400	22.34	10.13	32.47	52.10	-19.63	AVG	
7		0.6360	28.00	10.13	38.13	56.00	-17.87	QP	
8		0.6360	20.11	10.13	30.24	46.00	-15.76	AVG	
9		1.1580	28.90	10.12	39.02	56.00	-16.98	QP	
10		1.1580	19.95	10.12	30.07	46.00	-15.93	AVG	
11		8.3760	25.30	10.14	35.44	60.00	-24.56	QP	
12		8.3760	12.28	10.14	22.42	50.00	-27.58	AVG	

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 (Middle channel and GFSK) was submitted only.



6.3. Conducted Output Power

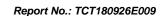
6.3.1. Test Specification

	1201					
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 outpower 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	R&S	FSU	200054	Aug. 27, 2019
RF Cable (9KHz-26.5GHz)	ТСТ	RE-06	N/A	Aug. 27, 2019
Antenna Connector	тст	RFC-01	N/A	Aug. 27, 2019

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

GFSK mode						
Test channel Peak Output Power (dBm) Re						
Lowest	6.11	30.00	PASS			
Middle	Middle 5.82		PASS			
Highest	5.44	30.00	PASS			

Pi/4DQPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	5.23	21.00	PASS
Middle	4.98	21.00	PASS
Highest	4.55	21.00	PASS

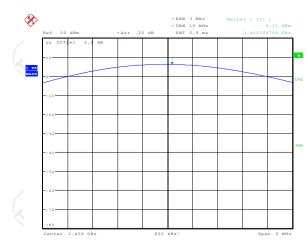
8DPSK mode							
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result				
Lowest	5.27	21.00	PASS				
Middle	5.02	21.00	PASS				
Highest	4.63	21.00	PASS				

Test plots as follows:

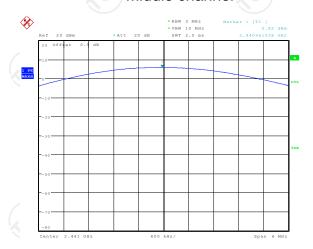




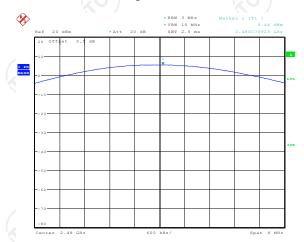
Lowest channel







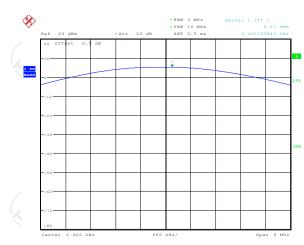
Pate: 18.007.2018 09:43:41 Highest channel



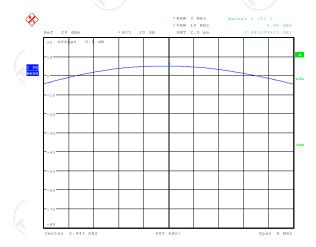
Date: 18.OCT.2018 09:44:03



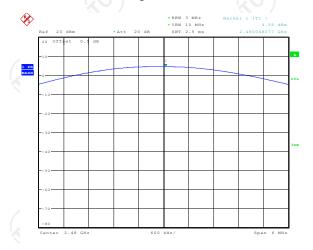
Lowest channel







Highest channel

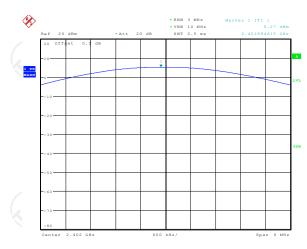


Date: 18.OCT.2018 09:52:59

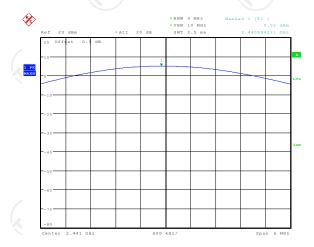
Date: 18.OCT.2018 09:51:46



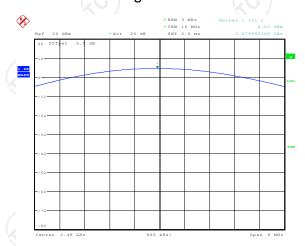
Lowest channel







Highest channel



Date: 18.OCT.2018 09:57:10

Date: 18.OCT.2018 09:56:39





6.4. 20dB Occupy Bandwidth

6.4.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)					
Test Method:	ANSI C63.10:2013					
Limit:	N/A					
Test Setup:	Spectrum Analyzer EUT					
Test Mode:	Transmitting mode with modulation					
Test Procedure:	 The testing follows ANSI C63.10:2013 Measurement Guidelines. 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. 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 5 times the 20 dB bandwidth, centered on a hopping channel; 1% RBW ≤5% of the 20 dB bandwidth; VBW≥3RBW; Sweep = auto; Detector function = peak; Trace = max hold. Measure and record the results in the test report. 					
Test Result:	PASS					

6.4.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Aug. 27, 2019
RF Cable (9KHz-26.5GHz)	тст	RE-06	N/A	Aug. 27, 2019
Antenna Connector	TCT	RFC-01	N/A	Aug. 27, 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

Toot obonnol	20dB Occupy Bandwidth (kHz)					
Test channel	GFSK	π/4-DQPSK	8DPSK	Conclusion		
Lowest	836.54	1121.79	1173.08	PASS		
Middle	836.54	1121.79	1173.08	PASS		
Highest	836.54	1121.79	1169.87	PASS		
			/			

Test plots as follows:

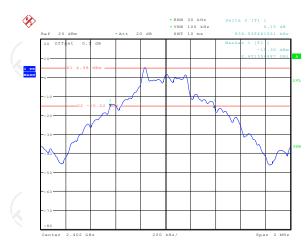


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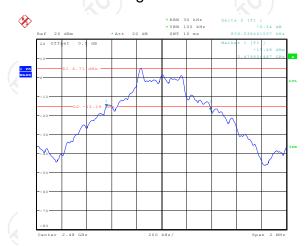
Lowest channel







Highest channel

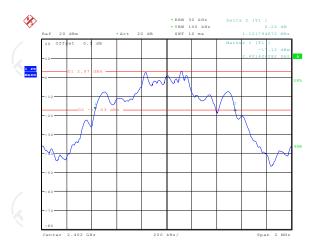


Date: 18.OCT.2018 09:33:45

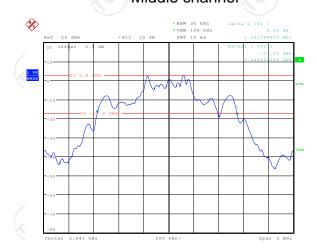
Date: 18.OCT.2018 09:32:39



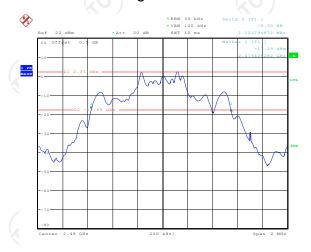
Lowest channel



Date: 18.0CT.2018 09;34:50 Middle channel



Date: 18.0CT.2018 09:35:59 Highest channel



Date: 18.OCT.2018 09:38:22



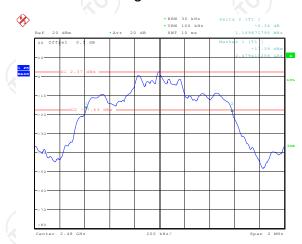
Lowest channel



Date: 18.0CT.2018 09;39:58 Middle channel



Date: 18.00T.2018 09:40:53 Highest channel



Date: 18.OCT.2018 09:42:30



6.5. Carrier Frequencies Separation

6.5.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Limit:	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.
Test Setup:	Spectrum Analyzer EUT
Test Mode:	Hopping mode
Test Procedure:	 The testing follows ANSI C63.10:2013 Measurement Guidelines. 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. Set to the maximum power setting and enable the EUT transmit continuously. Enable the EUT hopping function. Use the following spectrum analyzer settings: Span = wide enough to capture the peaks of two adjacent channels; RBW is set to approximately 30% of the channel spacing, adjust as necessary to best identify the center of each individual channel; VBW≥RBW; Sweep = auto;
Test Result:	PASS

6.5.2. Test Instruments

	Equipment	Manufacturer	Model	Serial Number	Calibration Due
	Spectrum Analyzer	R&S	FSU	200054	Aug. 27, 2019
	RF Cable (9KHz-26.5GHz)	тст	RE-06	N/A	Aug. 27, 2019
1.	Antenna Connector	тст	RFC-01	N/A	Aug. 27, 2019

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



6.5.3. Test data

GFSK mode				
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result	
Lowest	1000.00	836.54	PASS	
Middle	1000.00	836.54	PASS	
Highest	1000.00	836.54	PASS	

Pi/4 DQPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1000.00	747.86	PASS
Middle	1000.00	747.86	PASS
Highest	1000.00	747.86	PASS

8DPSK mode				
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result	
Lowest	1000.00	782.05	PASS	
Middle	1000.00	782.05	PASS	
Highest	1000.00	782.05	PASS	

Note: According to section 6.4

Note. According to section 0.4		
Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
GFSK	836.54	836.54
π/4-DQPSK	1121.79	747.86
8DPSK	1173.08	782.05

Test plots as follows:





Lowest channel



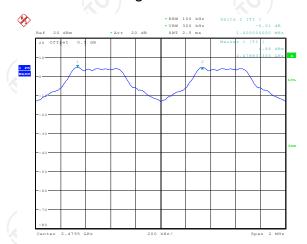


Middle channel



Date: 18.OCT.2018 10:00:37

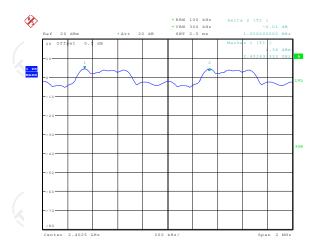
Highest channel



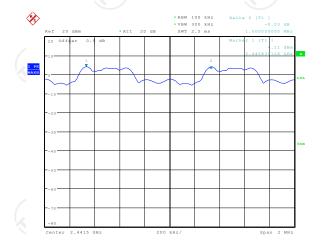
Date: 18.OCT.2018 10:02:10



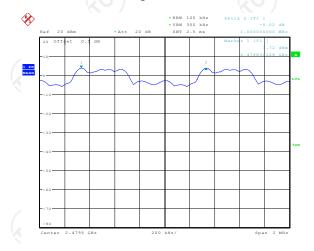
Lowest channel







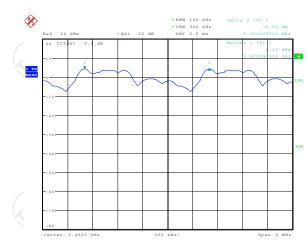
Pate: 18.0CT.2018 10:05:28 Highest channel



Date: 18.OCT.2018 10:07:29

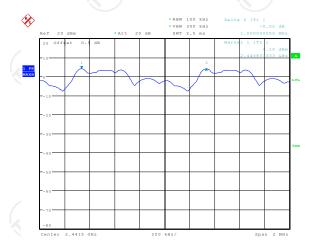


Lowest channel



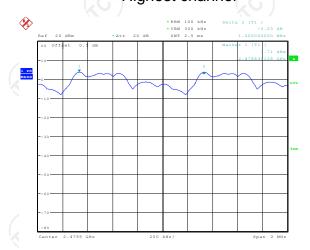
Date: 18.OCT.2018 10:08:55

Middle channel



Date: 18.OCT.2018 10:10:46

Highest channel



Date: 18.OCT.2018 10:14:22



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:	 The testing follows ANSI C63.10:2013 Measurement Guidelines. 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. Set to the maximum power setting and enable the EUT transmit continuously. Enable the EUT hopping function. 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. The number of hopping frequency used is defined as the number of total channel. Record the measurement data in report.
Test Result:	PASS

6.6.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Aug. 27, 2019
RF Cable (9KHz-26.5GHz)	тст	RE-06	N/A	Aug. 27, 2019
Antenna Connector	TCT	RFC-01	N/A	Aug. 27, 2019

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



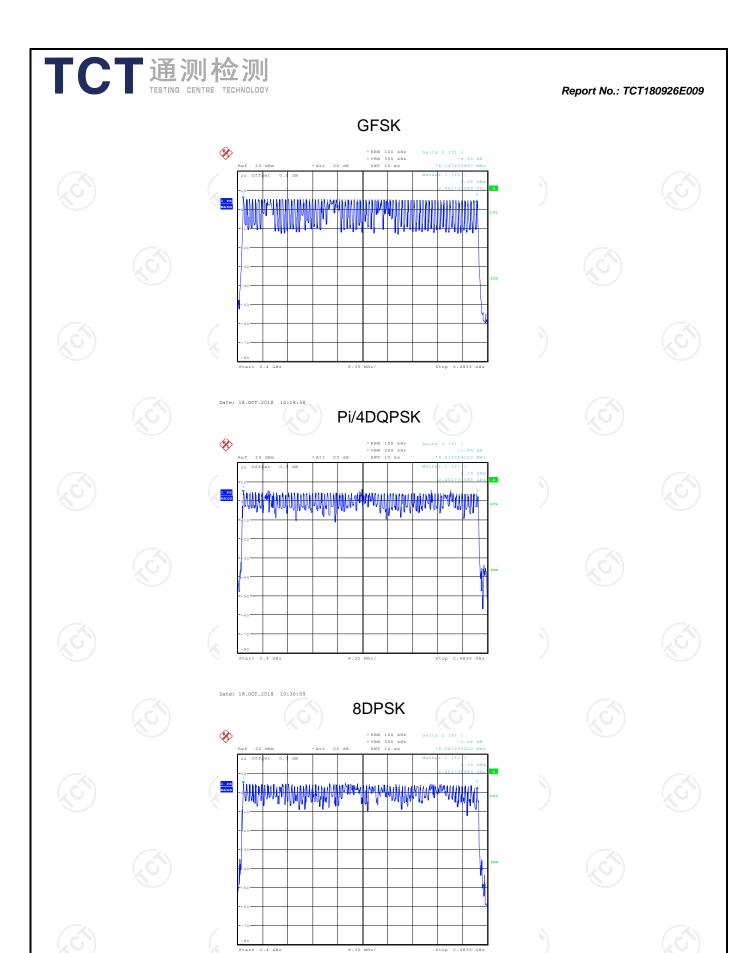
6.6.3. Test data

REDUIT NO.: 1 C I 100920E009	Report	No.:	TCT180926E009
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Mode	Hopping channel numbers	Limit	Result
GFSK, Pi/4DQPSK, 8DPSK	79	15	PASS

Test plots as follows:





Date: 18.0CT.2018 10:33:10



6.7. Dwell Time

6.7.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Limit:	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.
Test Setup:	Spectrum Analyzer EUT
Test Mode:	Hopping mode
Test Procedure:	 The testing follows ANSI C63.10:2013 Measurement Guidelines. 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. Set to the maximum power setting and enable the EUT transmit continuously. Enable the EUT hopping function. 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 >> 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. Measure and record the results in the test report.
Test Result:	PASS

6.7.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Aug. 27, 2019
RF Cable (9KHz-26.5GHz)	тст	RE-06	N/A	Aug. 27, 2019
Antenna Connector	TCT	RFC-01	N/A	Aug. 27, 2019

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

Report No.	: 1C1160920E009	

Mode	Packet	Hops Over Occupancy Time (hops)	Package Transfer Time (ms)	Dwell time (second)	Limit (second)	Result
GFSK	DH1	320	0.391	0.125	0.4	PASS
GFSK	DH3	160	1.699	0.272	0.4	PASS
GFSK	DH5	106.67	2.947	0.314	0.4	PASS
Pi/4 DQPSK	2-DH1	320	0.410	0.131	0.4	PASS
Pi/4 DQPSK	2-DH3	160	1.670	0.267	0.4	PASS
Pi/4 DQPSK	2-DH5	106.67	2.934	0.313	0.4	PASS
8DPSK	3-DH1	320	0.410	0.131	0.4	PASS
8DPSK	3-DH3	160	1.684	0.269	0.4	PASS
8DPSK	3-DH5	106.67	2.921	0.312	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 (0.4×79) (s), Hops Over Occupancy Time comes to $(1600/2/79) \times (0.4 \times 79) = 320$ hops

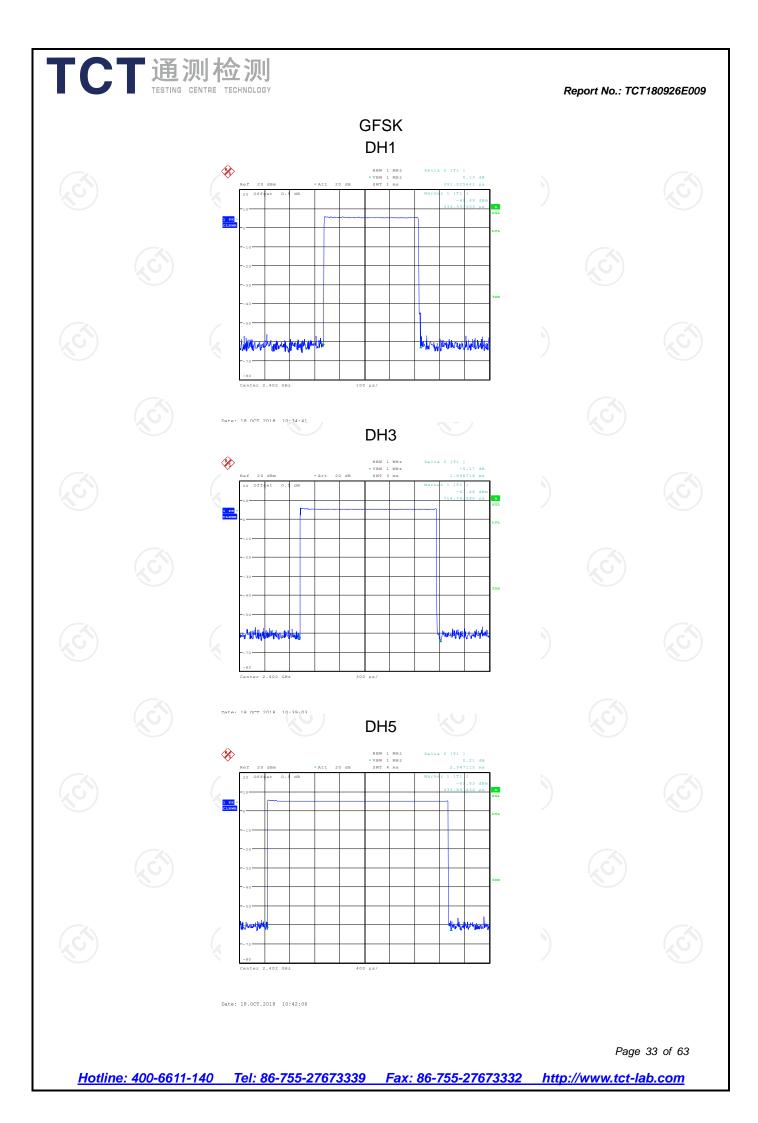
For DH3, With channel hopping rate (1600/6/79) in Occupancy Time Limit (0.4×79) (s), Hops Over Occupancy Time comes to $(1600/4/79) \times (0.4 \times 79) = 160$ hops

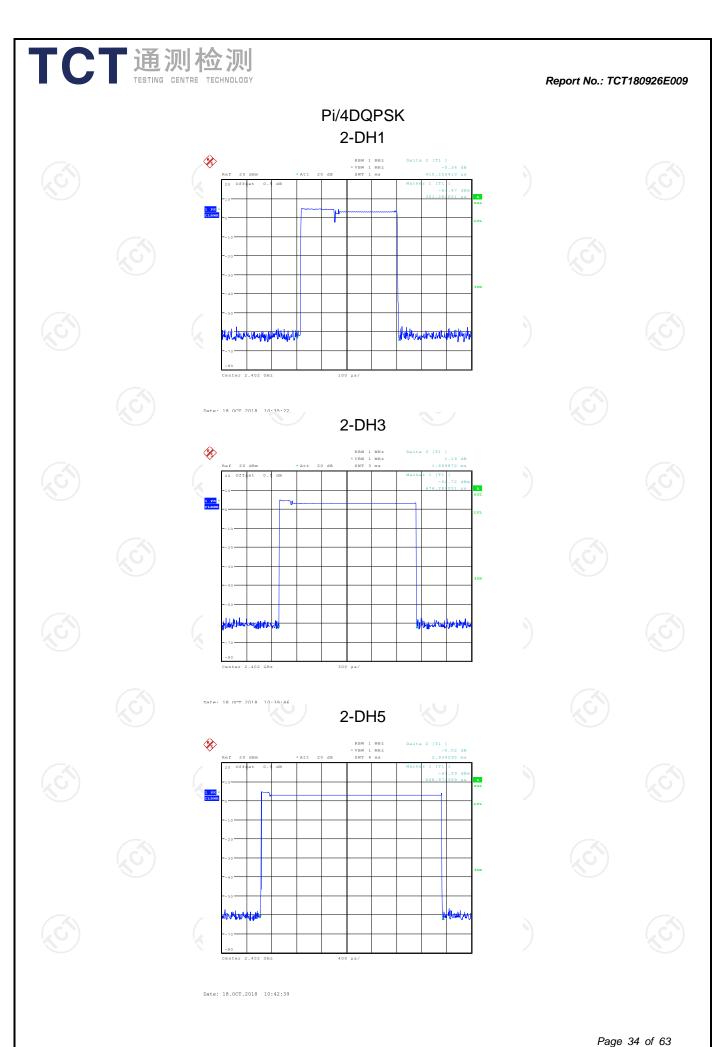
For DH5, With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit (0.4×79) (s), Hops Over Occupancy Time comes to $(1600 / 6 / 79) \times (0.4 \times 79) = 106.67$ hops

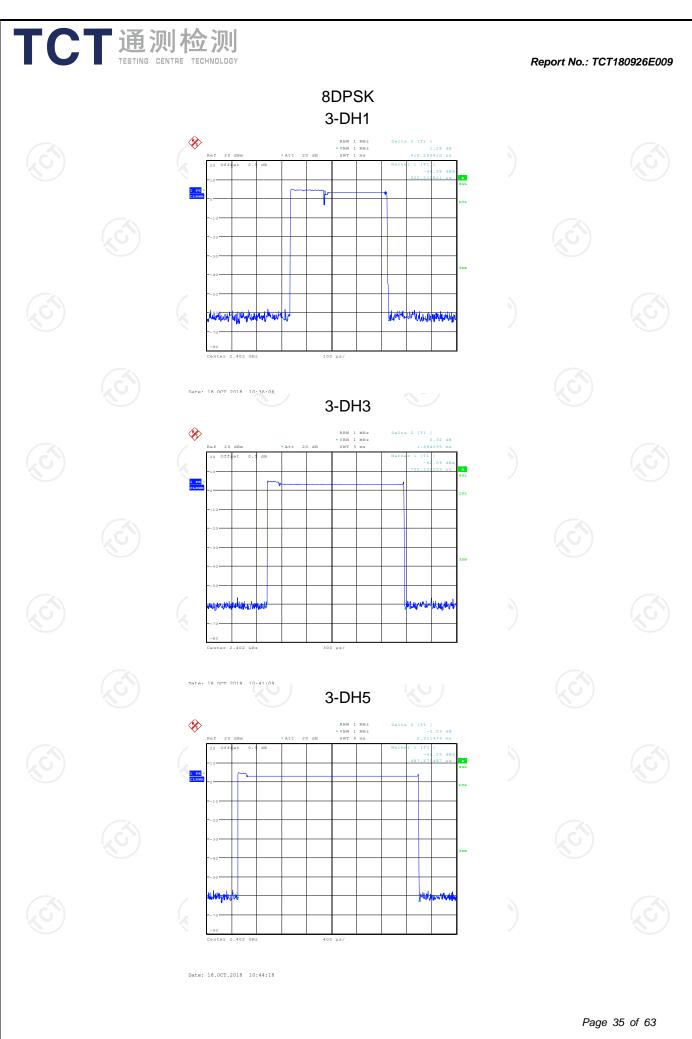
2. Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

Test plots as follows:











6.8. Pseudorandom Frequency Hopping Sequence

Test Requirement: FCC Part15 C Section 15.247 (a)(1) requirement:

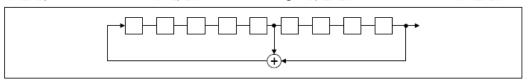
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively. Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence

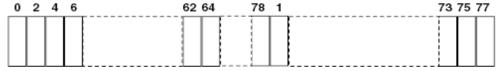
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence: 29-1 = 511 bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter. The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.



6.9. Conducted Band Edge Measurement

6.9.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Limit:	In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.
Test Setup:	Spectrum Analyzer EUT
Test Mode:	Transmitting mode with modulation
Test Procedure:	 The testing follows the guidelines in Band-edge Compliance of RF Conducted Emissions of ANSI C63.10:2013 Measurement Guidelines. Set to the maximum power setting and enable the EUT transmit continuously. Set RBW = 100 kHz (≥1% span=10MHz), VBW = 300 kHz (≥RBW). Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used. Enable hopping function of the EUT and then repeat step 2 and 3. Measure and record the results in the test report.
Test Result:	PASS

6.9.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Aug. 27, 2019
RF Cable (9KHz-26.5GHz)	тст	RE-06	N/A	Aug. 27, 2019
Antenna Connector	TCT	RFC-01	N/A	Aug. 27, 2019

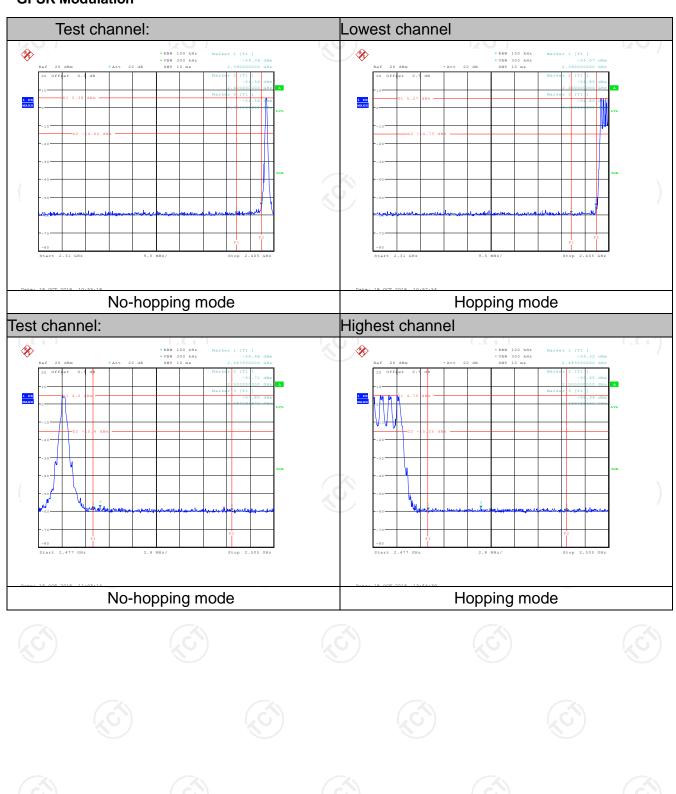
Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).



6.9.3. Test Data

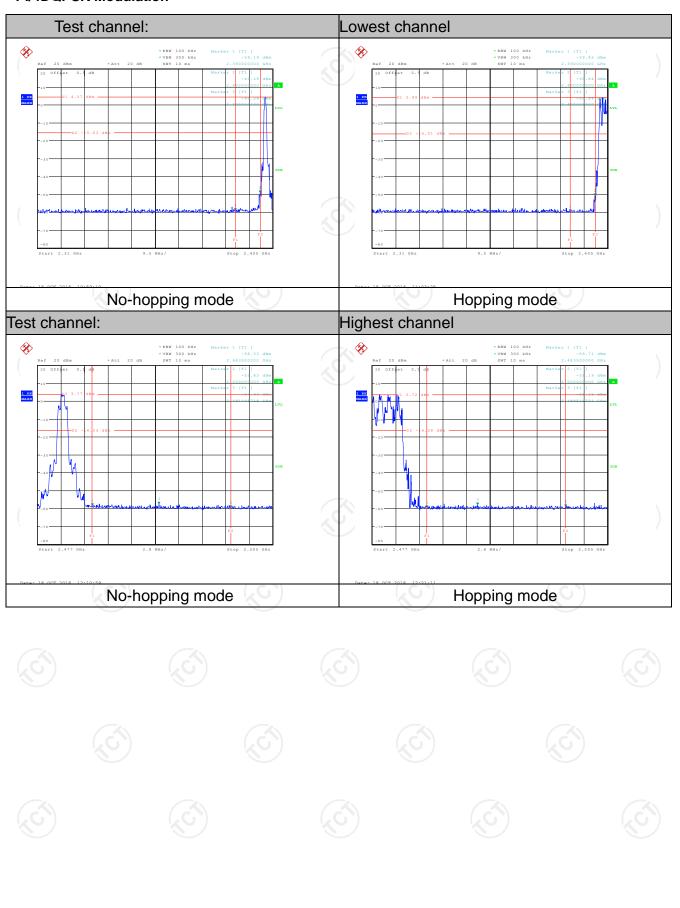
3 Tost Data

GFSK Modulation



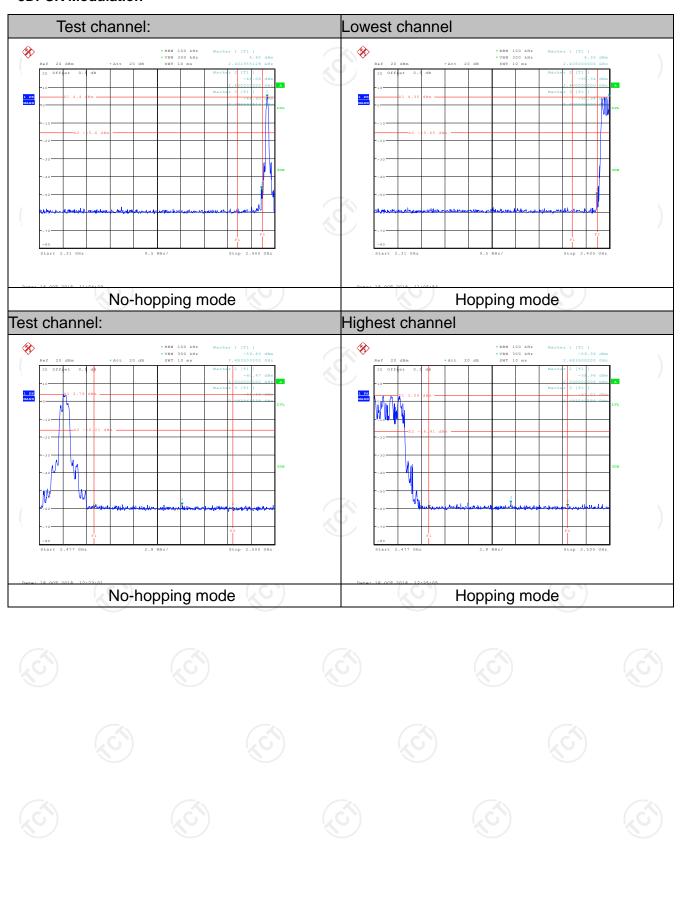


Pi/4DQPSK Modulation





8DPSK Modulation





6.10. Conducted Spurious Emission Measurement

6.10.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Limit:	In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.
Test Setup:	Spectrum Analyzer EUT
Test Mode:	Transmitting mode with modulation
Test Procedure:	 The testing follows the guidelines in Spurious RF Conducted Emissions of ANSI C63.10:2013 Measurement Guidelines 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. Set to the maximum power setting and enable the EUT transmit continuously. Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. Measure and record the results in the test report. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
Test Result:	PASS
	17.00

6.10.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due	
Spectrum Analyzer	R&S	FSU	200054	Aug. 27, 2019	
Spectrum Analyzer	ROHDE&SCH WARZ	FSQ	200061	Aug. 27, 2019	
RF Cable (9KHz-26.5GHz)	тст	RE-06	N/A	Aug. 27, 2019	
Antenna Connector	тст	RFC-01	N/A	Aug. 27, 2019	

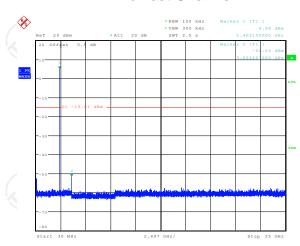
Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).



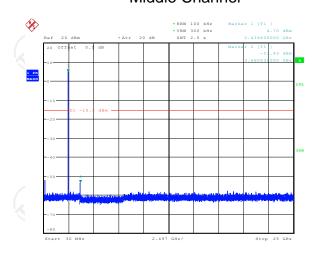
6.10.3. Test Data

GFSK mode

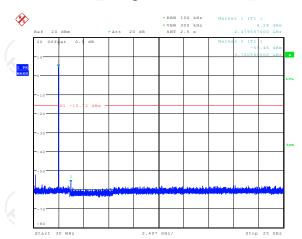
Lowest Channel



Middle Channel



Highest Channel

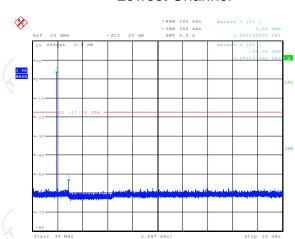


Date: 18.00T.2018 13:36:49



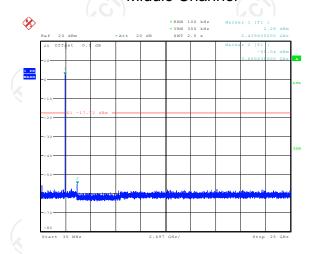
Pi/4DQPSK mode

Lowest Channel



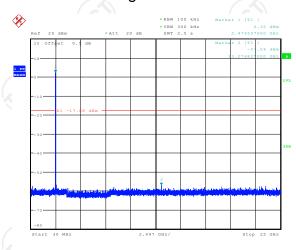
Date: 18.OCT.2018 13:38:42

Middle Channel



Date: 18.OCT.2018 13:39:29

Highest Channel

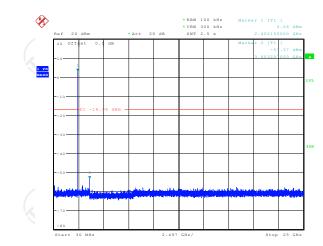


Date: 18.OCT.2018 13:40:30



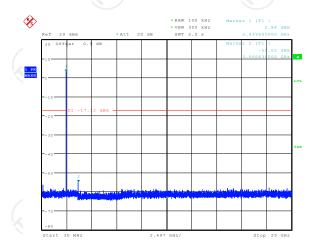
8DPSK mode

Lowest Channel

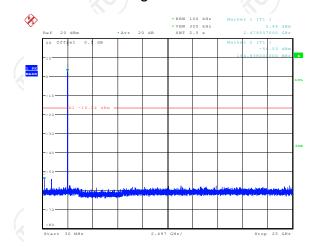


Date: 18.OCT.2018 13:41:30

Middle Channel



Highest Channel



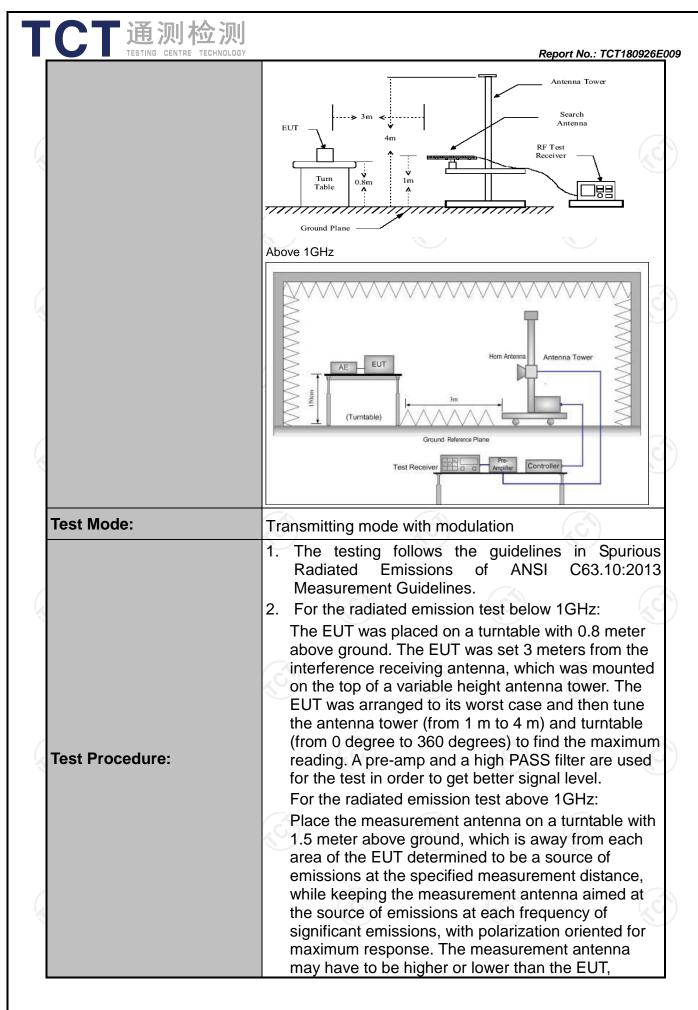
Date: 18.OCT.2018 13:43:2

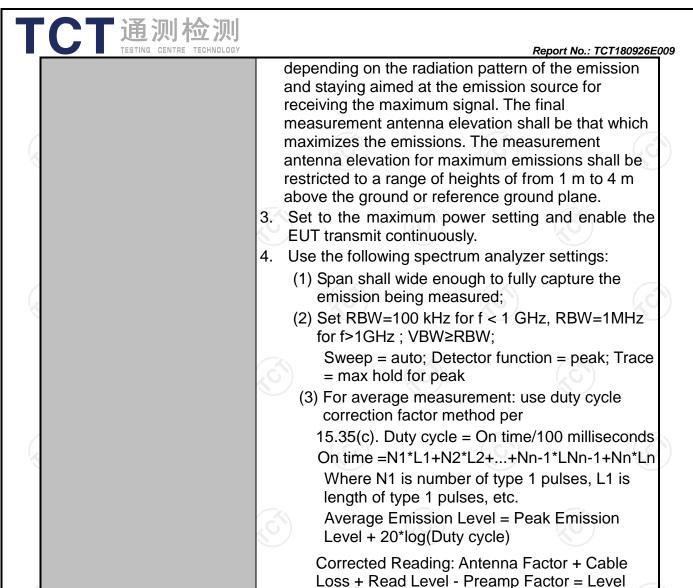


6.11. Radiated Spurious Emission Measurement

6.11.1. Test Specification

6.11.1. Test Specification		X	(
Test Requirement:	FCC Part15	FCC Part15 C Section 15.209						
Test Method:	ANSI C63.10	0:2013						
Frequency Range:	9 kHz to 25 (GHz			C			
Measurement Distance:	3 m	X			100			
Antenna Polarization:	Horizontal &	Vertical						
	Frequency 9kHz- 150kHz	Detector Quasi-pea		VBW 1kHz	Quas	Remark i-peak Value		
Receiver Setup:	150kHz- 30MHz	Quasi-pea	k 9kHz	30kHz	Quas	i-peak Value		
	30MHz-1GHz	Quasi-pea		300KHz	1 0	i-peak Value		
	Above 1GHz	Peak	1MHz	3MHz		eak Value		
		Peak	1MHz	10Hz	Ave	rage Value		
	Frequen	ісу	Field Stre	-	Measurement Distance (meters)			
	0.009-0.4		2400/F(KHz)		300			
	0.490-1.7	24000/F(KHz)		30				
	1.705-3	30		30				
	30-88		100		3			
1.1	88-216		150		3			
Limit:	216-96		200			3		
	Above 9	60	500			3		
	Frequency		Field Strength (microvolts/meter)		ment ce rs)	Detector		
	Above 1GHz	,	500	3		Average		
	Above IGII		5000			Peak		
	For radiated emis	ssions below	/ 30MHz		(6)			
	Di	stance = 3m			Comput	er		
	t			Pre -	Amplifier			
Test setup:	EUT							
	30MHz to 1GHz	Groun	d Plane					
		- 1						

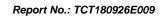






PASS

Test results:





6.11.2. 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	Aug. 27, 2019	
Spectrum Analyzer	ROHDE&SCHW ARZ	FSQ	200061	Aug. 27, 2019	
Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Aug. 27, 2019	
Pre-amplifier	HP	8447D	2727A05017	Aug. 27, 2019	
Loop antenna	ZHINAN	ZN30900A	12024	Aug. 27, 2019	
Broadband Antenna	Schwarzbeck	VULB9163	340	Aug. 27, 2019	
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Aug. 27, 2019	
Horn Antenna	Schwarzbeck	BBH 9170	582	Aug. 27, 2019	
Antenna Mast	Keleto	CC-A-4M	N/A	N/A	
Coax cable (9KHz-1GHz)	тст	RE-low-01	N/A	Aug. 27, 2019	
Coax cable (9KHz-40GHz)	тст	RE-high-02	N/A	Aug. 27, 2019	
Coax cable (9KHz-1GHz)	тст	RE-low-03	N/A	Aug. 27, 2019	
Coax cable (9KHz-40GHz)	тст	RE-high-04	N/A	Aug. 27, 2019	
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A	

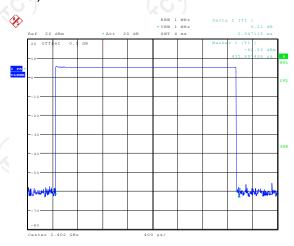
Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).



6.11.3. Test Data

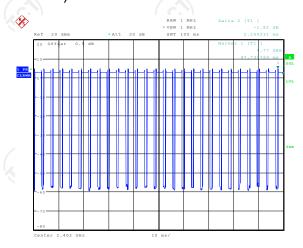
Duty cycle correction factor for average measurement

DH5 on time (One Pulse) Plot on Channel 00



Date: 18.OCT.2018 10:42:06

DH5 on time (Count Pulses) Plot on Channel 00



Note:

- 1. Worst case Duty cycle = on time/100 milliseconds = (2.947*26+2.269)/100=0.7889
- 2. Worst case Duty cycle correction factor = 20*log (Duty cycle) = -2.06dB
- 3. DH5 has the highest duty cycle worst case and is reported.

Date: 18.OCT.2018 10:46:54

4. The average levels were calculated from the peak level corrected with duty cycle correction factor (-2.06dB) derived from 20log (dwell time/100ms). This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

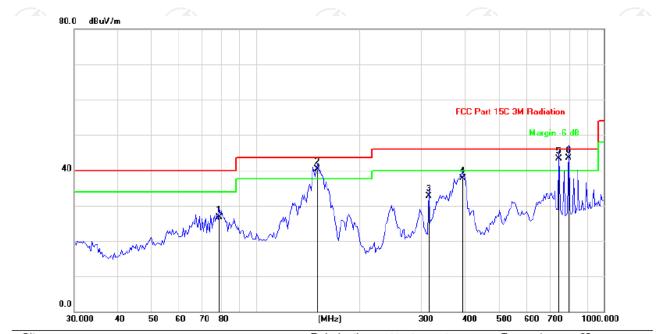


Please refer to following diagram for individual

Report No.: TCT180926E009

Below 1GHz

Horizontal:



Site Polarization: Horizontal Temperature: 25
Limit: FCC Part 15C 3M Radiation Power: AC 120V/60Hz Humidity: 55 %

No.	Mł	c. 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		78.5644	43.25	-16.55	26.70	40.00	-13.30	QP			
2	ļ	149.9676	56.32	-16.01	40.31	43.50	-3.19	QP			
3		313.6482	42.33	-9.53	32.80	46.00	-13.20	QP			
4		392.7375	45.42	-7.74	37.68	46.00	-8.32	QP			
5	ļ	744.4265	45.25	-1.91	43.34	46.00	-2.66	QP			
6	*	793.0281	45.33	-1.88	43.45	46.00	-2.55	QP			





Vertical:



Site Polarization: Vertical Temperature: 25
Limit: FCC Part 15C 3M Radiation Power: AC 120V/60Hz Humidity: 55 %

No. M	k. 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	50.8172	40.25	-10.21	30.04	40.00	-9.96	QP			
2	63.1857	45.15	-13.42	31.73	40.00	-8.27	QP			
3 *	76.9256	50.22	-16.38	33.84	40.00	-6.16	QP			
4	152.0902	50.02	-15.89	34.13	43.50	-9.37	QP			
5	395.5071	39.66	-7.69	31.97	46.00	-14.03	QP			
6	793.0281	37.25	-1.88	35.37	46.00	-10.63	QP			

Note: 1.The low frequency, which started from 9KHz~30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported

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





Above 1GHz

Modulation	Type: GF	SK							
Low chann	el: 2402 M	1Hz							
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)
2390	Н	47.28		-8.27	39.01		74	54	-14.99
4804	Н	46.06		0.66	46.72		74	54	-7.28
7206	H	37.19		9.50	46.69		74	54	-7.31
	,CH		- (- , C)		(.C `}-		(- -	
				/	× ×				
2390	V	45.85		-8.27	37.58		74	54	-16.42
4804	V	43.27		0.66	43.93		74	54	-10.07
7206	V	38.43		9.50	47.93		74	54	-6.07
O')	V			/)		(COL)		120

Middle cha	nnel: 2441	MHz							
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBµV)	Correction Factor (dB/m)	Emissic Peak (dBµV/m)	AV	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)
4882	Ĥ	48.51		0.99	49.50	<u></u>	74	54	-4.50
7323	Н	36.32		9.87	46.19		74	54	-7.81
	Η								-
									()
4882	V	47.64		0.99	48.63		74	54	-5.37
7323	V	39.20		9.87	49.07		74	54	-4.93
	V								

High chann	nel: 2480 N	ЛHz	(.C)			·C')		(.C)	
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBµV)	Correction Factor (dB/m)	Peak	n Level AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)
2483.5	Н	48.12	(uDp v)	-7.83	40.29		74	54	-13.71
4960	Н	47.33		1.33	48.66		74	54	-5.34
7440	Н	37.84		10.22	48.06		74	54	-5.94
	Н								
2483.5	V	47.05		-7.83	39.22		74	54	-14.78
4960	CV	49.37	-4,0	1.33	50.70	(0-7	74	54	-3.30
7440	V	36.08		10.22	46.30	<u></u>	74	54	-7.70
	V								

Note:

- 1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss Pre-amplifier
- 2. $Margin (dB) = Emission Level (Peak) (dB\mu V/m)-Average limit (dB\mu V/m)$
- 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. Measurements were conducted in all three modulation (GFSK, Pi/4 DQPSK, 8DPSK), and the worst case Mode (GFSK) was submitted only.



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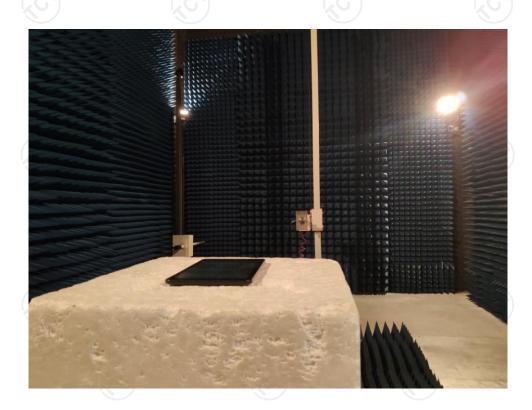
Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com



Appendix A: Photographs of Test Setup Product: TABLET PC

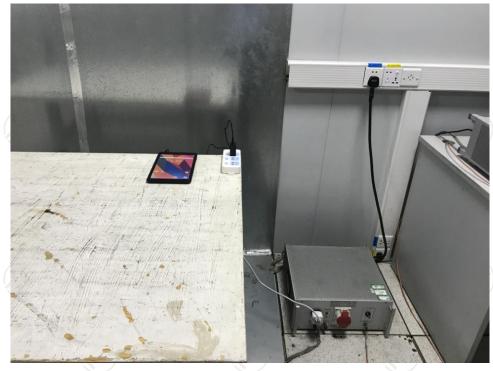
Product: TABLET PC Model: F104Bv2 Radiated Emission







Conducted Emission



























































Appendix B: Photographs of EUT Product: TABLET PC

Product: TABLET PC Model: F104Bv2 External Photos























Product: TABLET PC Model: F104Bv2 Internal Photos



