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# FCC Radio Test Report FCC ID: 2AIL4-BH219A

# **Original Grant**

Report No. : TB-FCC159202

**Applicant**: VTIN TECHNOLOGY Co.,Limited

**Equipment Under Test (EUT)** 

**EUT Name** : bluetooth fm transmitter

Model No. : BH219A

Series Model No. : BH219B, BH219C, BH219, BC33

Brand Name : VicTsing

**Receipt Date** : 2018-04-02

**Test Date** : 2018-04-03 to 2018-04-15

**Issue Date** : 2018-04-17

**Standards** : FCC Part 15: 2017, Subpart C(15.247)

**Test Method** : ANSI C63.10: 2013

Conclusions : PASS

In the configuration tested, the EUT complied with the standards specified above,

The EUT technically complies with the FCC requirements

Test/Witness Engineer

**Engineer Supervisor** 

Engineer Manager :

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in the report.



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# **Revision History**

Report No.	Version	Description	Issued Date
TB-FCC159202	Rev.01	Initial issue of report	2018-04-17



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# 1. General Information about EUT

# 1.1 Client Information

Applicant : VTIN TECHNOLOGY Co.,Limited		VTIN TECHNOLOGY Co.,Limited
Address : Unit D, 16/F, One Capital Place, 18 Luard Road, Wan Chai, Hor Kong, China		Unit D, 16/F, One Capital Place, 18 Luard Road, Wan Chai, Hong Kong, China
Manufacturer : SHEN ZHEN SAILING ELECTRONIC CO.,LTD		SHEN ZHEN SAILING ELECTRONIC CO.,LTD
Address : Building 29th, Baotian Industrial zone, Xixiang Town, S City, Guangdong province, China		Building 29th, Baotian Industrial zone, Xixiang Town, Shenzhen City, Guangdong province, China

# 1.2 General Description of EUT (Equipment Under Test)

EUT Name	:	bluetooth fm transmitter			
Models No.	:	BH219A, BH219B, BH219C, BH219, BC33			
Model Difference	:	All these models are identical in the same PCB layout and electrical circuit, the only difference is model name for commercial.			
		Operation Frequency:	Bluetooth V4.2: 2402~2480 MHz		
	:	Number of Channel:	Bluetooth: 79 Channels See Note 2		
Product		Max Peak Output Power:	Bluetooth: 0.196dBm( π /4-DQPSK)		
Description		Antenna Gain:	0dBi PCB Antenna		
		Modulation Type:	GFSK (1 Mbps) π /4-DQPSK (2 Mbps)		
Power Rating	:	Input: DC 12V-24V. Output:5V/4A (Max)			
Software Version		BC33-AC6902C+3433-			
		Main board: YHW-BC33-AC6902C-M-V2-20180317 /			
Hardware Version	:	Power board: YHW-BC33	3-AC6902C-V3-20180317 /		
		3-LED-V2-20180317			
Connecting I/O Port(S)	:	Please refer to the User's I	Manual		

#### Note:

(1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.



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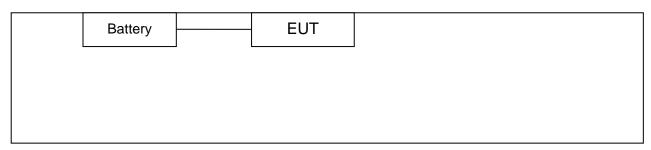
# (2) Channel List:

Bluetooth Channel List								
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)			
00	2402	27	2429	54	2456			
01	2403	28	2430	55	2457			
02	2404	29	2431	56	2458			
03	2405	30	2432	57	2459			
04	2406	31	2433	58	2460			
05	2407	32	2434	59	2461			
06	2408	33	2435	60	2462			
07	2409	34	2436	61	2463			
08	2410	35	2437	62	2464			
09	2411	36	2438	63	2465			
10	2412	37	2439	64	2466			
11	2413	38	2440	65	2467			
12	2414	39	2441	66	2468			
13	2415	40	2442	67	2469			
14	2416	41	2443	68	2470			
15	2417	42	2444	69	2471			
16	2418	43	2445	70	2472			
17	2419	44	2446	71	2473			
18	2420	45	2447	72	2474			
19	2421	46	2448	73	2475			
20	2422	47	2449	74	2476			
21	2423	48	2450	75	2477			
22	2424	49	2451	76	2478			
23	2425	50	2452	77	2479			
24	2426	51	2453	78	2480			
25	2427	52	2454					
26	2428	53	2455					

<sup>(3)</sup> The Antenna information about the equipment is provided by the applicant.

# 1.3 Block Diagram Showing the Configuration of System Tested

## Mode 1





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#### 1.4 Description of Support Units

The EUT has been tested as an independent unit.

## 1.5 Description of Test Mode

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned follow was evaluated respectively.

For Conducted Test					
Final Test Mode	Description				
Mode 1	Normal Working+ TX Mode				

For Radiated Test				
Final Test Mode	Description			
Mode 1	TX GFSK Mode			
Mode 2	TX Mode(GFSK) Channel 00/39/78			
Mode 3	TX Mode( IT /4-DQPSK) Channel 00/39/78			
Mode 4	Hopping Mode(GFSK)			
Mode 5	Hopping Mode( π /4-DQPSK)			

#### Note:

(1) For all test, we have verified the construction and function in typical operation. And all the test modes were carried out with the EUT in transmitting operation in maximum power with all kinds of data rate. We have pretested all the test modes above.

According to ANSI C63.10 standards, the measurements are performed at the highest, middle, lowest available channels, and the worst case data rate as follows:

TX Mode: GFSK (1 Mbps)
TX Mode: π /4-DQPSK (2 Mbps)

(2) The EUT is considered a portable unit; it was pre-tested on the positioned of each 3 axis, X-plane, Y-plane and Z-plane. The worst case was found positioned on X-plane as the normal use. Therefore only the test data of this X-plane was used for radiated emission measurement test.



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### 1.6 Description of Test Software Setting

During testing channel power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of Bluetooth mode.

Test Software Version	FCCAssist_2.4.exe				
Frequency	2402 MHz	2441MHz	2480 MHz		
GFSK	DEF	DEF	DEF		
π /4-DQPSK	DEF	DEF	DEF		

# 1.7 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 %.

Test Item	Parameters	Expanded Uncertainty (U <sub>Lab</sub> )
	Level Accuracy:	±3.42 dB
Conducted Emission	9kHz~150kHz	
	150kHz to 30MHz	±3.42 dB
Radiated Emission	Level Accuracy:	±4.60 dB
Radiated Effission	9kHz to 30 MHz	±4.60 db
Radiated Emission	Level Accuracy:	±4.40 dB
Radiated Emission	30MHz to 1000 MHz	±4.40 db
Radiated Emission	Level Accuracy:	±4.20 dB
Radiated Emission	Above 1000MHz	±4.20 UD



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## 1.8 Test Facility

The testing report were performed by the Shenzhen Toby Technology Co., Ltd., in their facilities located at 1A/F., Bldg.6, Yusheng Industrial Zone, The National Road No.107 Xixiang Section 467, Xixiang, Bao'an, Shenzhen, Guangdong, China. At the time of testing, the following bodies accredited the Laboratory:

#### **CNAS (L5813)**

The Laboratory has been accredited by CNAS to ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories for the competence in the field of testing. And the Registration No.: CNAS L5813.

#### A2LA Certificate No.: 4750.01

The laboratory has been accredited by American Association for Laboratory Accreditation(A2LA) to ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories for the technical competence in the field of Electrical Testing. And the A2LA Certificate No.: 4750.01.

#### IC Registration No.: (11950A-1)

The Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing. The site registration: Site# 11950A-1.



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# 2. Test Summary

	FCC Part 15 Subpart C(15.247)/ RSS 247 Issue 2					
Standard Section		Took Itom	ludam ent	Damauk		
FCC IC		Test Item	Judgment	Remark		
15.203		Antenna Requirement	PASS	N/A		
15.207	RSS-GEN 7.2.2	Conducted Emission	PASS	N/A		
15.205	RSS-Gen 7.2.3	Restricted Bands	PASS	N/A		
15.247(a)(1)	RSS 247 5.1 (2)	Hopping Channel Separation	PASS	N/A		
15.247(a)(1)	RSS 247 5.1 (4)	Dwell Time	PASS	N/A		
15.247(b)(1)	RSS 247 5.4 (2)	Peak Output Power	PASS	N/A		
15.247(b)(1)	RSS 247 5.1 (4)	Number of Hopping Frequency	PASS	N/A		
15.247(d)	RSS 247 5.5	Band Edge	PASS	N/A		
15.247(c)& 15.209	RSS 247 5.5	Radiated Spurious Emission	PASS	N/A		
15.247(a)	RSS 247 5.1 (1)	99% Occupied Bandwidth & 20dB Bandwidth	PASS	99%OBW: GFSK: 815.02kHz π/4-DQPSK: 1156.6kHz		

**Note:** N/A is an abbreviation for Not Applicable.



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3. Test Equipment

Conducted Emission Test								
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date			
EMI Test Receiver	Rohde & Schwarz	ESCI	100321	Jul. 20, 2017	Jul. 19, 2018			
RF Switching Unit	Compliance Direction Systems Inc	RSU-A4	34403	Jul. 20, 2017	Jul. 19, 2018			
AMN	SCHWARZBECK	NNBL 8226-2	8226-2/164	Jul. 20, 2017	Jul. 19, 2018			
LISN	Rohde & Schwarz	ENV216	101131	Jul. 20, 2017	Jul. 19, 2018			
Radiation Emission	n Test							
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date			
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 20, 2017	Jul. 19, 2018			
EMI Test Receiver	Rohde & Schwarz	ESPI	100010/007	Jul. 20, 2017	Jul. 19, 2018			
Bilog Antenna	ETS-LINDGREN	3142E	00117537	Mar.16, 2018	Mar. 15, 2019			
Bilog Antenna	ETS-LINDGREN	3142E	00117542	Mar.16, 2018	Mar. 15, 2019			
Horn Antenna	ETS-LINDGREN	3117	00143207	Mar.16, 2018	Mar. 15, 2019			
Horn Antenna	ETS-LINDGREN	3117	00143209	Mar.16, 2018	Mar. 15, 2019			
Loop Antenna	Laplace instrument	RF300	0701	Mar.16, 2018	Mar. 15, 2019			
Pre-amplifier	Sonoma	310N	185903	Mar.16, 2018	Mar. 15, 2019			
Pre-amplifier	HP	8449B	3008A00849	Mar.16, 2018	Mar. 15, 2019			
Cable	HUBER+SUHNER	100	SUCOFLEX	Mar.16, 2018	Mar. 15, 2019			
Positioning Controller	ETS-LINDGREN	2090	N/A	N/A	N/A			
Antenna Conducte	ed Emission							
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Due Date			
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 20, 2017	Jul. 19, 2018			
Spectrum Analyzer	Rohde & Schwarz	ESCI	100010/007	Jul. 20, 2017	Jul. 19, 2018			
MXA Signal Analyzer	Agilent	N9020A	MY49100060	Oct. 26, 2017	Oct. 25, 2018			
Vector Signal Generator	Agilent	N5182A	MY50141294	Oct. 26, 2017	Oct. 25, 2018			
Analog Signal Generator	Agilent	N5181A	MY50141953	Oct. 26, 2017	Oct. 25, 2018			
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO26	Oct. 26, 2017	Oct. 25, 2018			
DE Dower Correct	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO29	Oct. 26, 2017	Oct. 25, 2018			
RF Power Sensor	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO31	Oct. 26, 2017	Oct. 25, 2018			
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO33	Oct. 26, 2017	Oct. 25, 2018			



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# 4. Conducted Emission Test

#### 4.1 Test Standard and Limit

4.1.1Test Standard FCC Part 15.207

#### 4.1.2 Test Limit

#### **Conducted Emission Test Limit**

Fraguency	Maximum RF Line Voltage (dBμV)				
Frequency	Quasi-peak Level	Average Level			
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *			
500kHz~5MHz	56	46			
5MHz~30MHz	60	50			

#### Notes:

- (1) \*Decreasing linearly with logarithm of the frequency.
- (2) The lower limit shall apply at the transition frequencies.
- (3) The limit decrease in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

# 4.2 Test Setup



#### 4.3 Test Procedure

The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/50uH of coupling impedance for the measuring instrument.

Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.



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I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

LISN at least 80 cm from nearest part of EUT chassis

The bandwidth of EMI test receiver is set at 9kHz, and the test frequency band is from 0.15MHz to 30MHz.

# 4.4 EUT Operating Mode

Please refer to the description of test mode.

#### 4.5 Test Data

Please refer to the Attachment A.



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# 5. Radiated Emission Test

# 5.1 Test Standard and Limit

5.1.1 Test Standard FCC Part 15.209

5.1.2 Test Limit

#### Radiated Emission Limit (9 kHz~1000MHz)

110	dalated Elillosion Elillit (5 Km	2°1000111112)
Frequency (MHz	Field Strength (microvolt/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

# Radiated Emission Limit (Above 1000MHz)

Frequency	Distance Mete	rs(at 3m)
(MHz)	Peak	Average
Above 1000	74	54

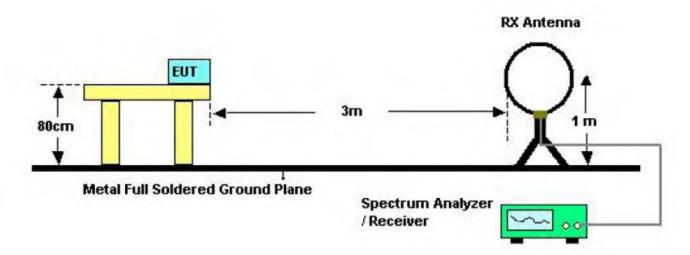
#### Note:

- (1) The tighter limit applies at the band edges.
- (2) Emission Level (dBuV/m)=20log Emission Level (uV/m)

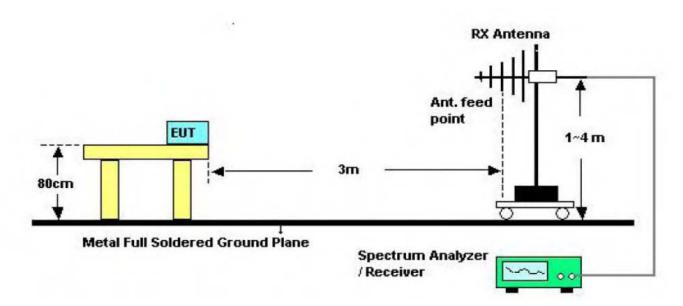


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# 5.2 Test Setup



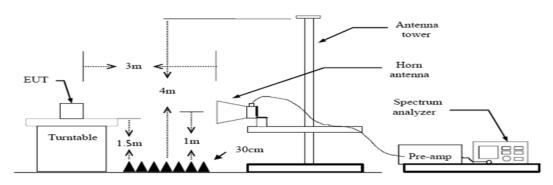
**Below 30MHz Test Setup** 



**Below 1000MHz Test Setup** 



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**Above 1GHz Test Setup** 

#### 5.3 Test Procedure

- (1) The measuring distance of 3m shall be used for measurements at frequency up to 1GHz and above 1 GHz. The EUT was placed on a rotating 0.8m high above ground, the table was rotated 360 degrees to determine the position of the highest radiation.
- (2) Measurements at frequency above 1GHz. The EUT was placed on a rotating 1.5m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.
- (3) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.
- (4) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- (5) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Bellow 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.
- (6) Testing frequency range below 1GHz the measuring instrument use VBW=120 kHz with Quasi-peak detection.
- (7) Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.
- (8) For the actual test configuration, please see the test setup photo.

# 5.4 EUT Operating Condition

The Equipment Under Test was set to Continual Transmitting in maximum power in TX mode.

#### 5.5 Test Data

Remark: During testing above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.

Please refer to the Attachment B.



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# 6. Restricted Bands Requirement

#### 6.1 Test Standard and Limit

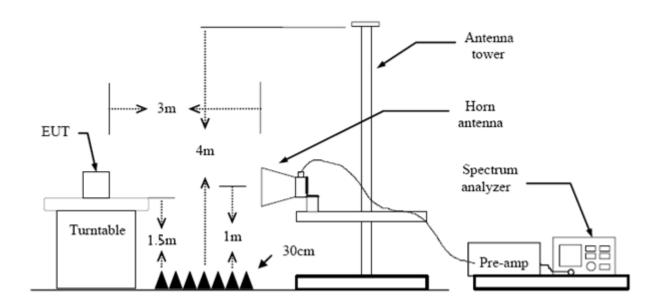
6.1.1 Test Standard FCC Part 15.209 FCC Part 15.205

6.1.2 Test Limit

Restricted Frequency	Distance Meters(at 3m)		
Band (MHz)	Peak	Average	
2310 ~2390	74	54	
2483.5 ~2500	74	54	
Note: All rectriction hands have	a basis tantad, ambitha wasint	!	

Note: All restriction bands have been tested, only the worst case is reported.

#### 6.2 Test Setup



#### 6.3 Test Procedure

- (1) The measuring distance of 3m shall be used for measurements at frequency up to 1GHz and above 1 GHz. The EUT was placed on a rotating 0.8m high above ground, the table was rotated 360 degrees to determine the position of the highest radiation.
- (2) Measurements at frequency above 1GHz. The EUT was placed on a rotating 1.5m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by 3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.



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(3) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.

- (4) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- (5) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Bellow 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.
- (6) Testing frequency range below 1GHz the measuring instrument use VBW=120 kHz with Quasi-peak detection.
- (7) Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with AVG Detector for Average Values.
- (8) For the actual test configuration, please see the test setup photo.

#### 6.4 EUT Operating Condition

The Equipment Under Test was set to Continual Transmitting in maximum power.

#### 6.5 Test Data

Remark: During testing above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.

All restriction bands have been tested, only the worst case is reported.

Please refer to the Attachment C.



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# 7. Number of Hopping Channel

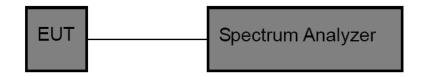
#### 7.1 Test Standard and Limit

6.1.1 Test Standard FCC Part 15.247 (a)(1)

6.1.2 Test Limit

Section	Test Item	Limit
15.247	Number of Hopping Channel	>15

# 7.2 Test Setup



#### 7.3 Test Procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Spectrum Setting: RBW=100 KHz, VBW=100 KHz, Sweep time= Auto.

# 7.4 EUT Operating Condition

The EUT was set to the Hopping Mode by the Customer.

#### 7.5 Test Data

Please refer to the Attachment D.



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# 8. Average Time of Occupancy

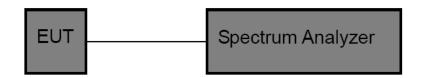
## 8.1 Test Standard and Limit

8.1.1 Test Standard FCC Part 15.247 (a)(1)

8.1.2 Test Limit

Section	Test Item	Limit
15.247(a)(1)	Average Time of Occupancy	0.4 sec

## 8.2 Test Setup



## 8.3 Test Procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Spectrum Setting: RBW=1MHz, VBW=1MHz.
- (3) Use video trigger with the trigger level set to enable triggering only on full pulses.
- (4) Sweep Time is more than once pulse time.
- (5) Set the center frequency on any frequency would be measure and set the frequency span to zero.
- (6) Measure the maximum time duration of one single pulse.
- (7) Set the EUT for packet transmitting.
- (8) Measure the maximum time duration of one single pulse.

# 8.4 EUT Operating Condition

The average time of occupancy on any channel within the Period can be calculated with formulas:

 ${Total of Dwell} = {Pulse Time} * (1600 / X) / {Number of Hopping Frequency} * {Period} = 0.4s * {Number of Hopping Frequency}$ 

Note: X=2 or 4 or 6 (1DH1=2, 1DH3=4, 1DH5=6. 2DH1=2, 2DH3=4, 2DH5=6. 3DH1=2, 3DH3=4, 3DH5=6)

The lowest, middle and highest channels are selected to perform testing to record the dwell time of each occupation measured in this channel, which is called Pulse Time here.

The EUT was set to the Hopping Mode by the Customer.

#### 8.5 Test Data

Please refer to the Attachment E.



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9. Channel Separation and Bandwidth Test

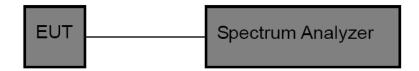
#### 9.1 Test Standard and Limit

9.1.1 Test Standard FCC Part 15.247

9.1.2 Test Limit

Test Item	Limit	Frequency Range(MHz)
Bandwidth	<=1 MHz (20dB bandwidth)	2400~2483.5
Channel Separation	>25KHz or >two-thirds of the 20 dB bandwidth Which is greater	2400~2483.5

#### 9.2 Test Setup



#### 9.3 Test Procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Spectrum Setting:

Channel Separation: RBW=100 kHz, VBW=100 kHz.

Bandwidth: RBW=30 kHz, VBW=100 kHz.

- (3) The bandwidth is measured at an amplitude level reduced 20dB from the reference level. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst -case (i.e the widest) bandwidth.
  - (4) Measure the channel separation the spectrum analyzer was set to Resolution Bandwidth:30 kHz, and Video Bandwidth:100 kHz. Sweep Time set auto.

# 9.4 EUT Operating Condition

The EUT was set to the Hopping Mode for Channel Separation Test and continuously transmitting for the Bandwidth Test.

#### 9.5 Test Data

Please refer to the Attachment F.



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# 10. Peak Output Power Test

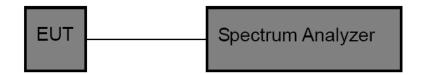
#### 10.1 Test Standard and Limit

10.1.1 Test Standard FCC Part 15.247 (b) (1)

10.1.2 Test Limit

Test Item	Limit	Frequency Range(MHz)
Peak Output Power	Hopping Channels>75 Power<1W(30dBm)	2400~2483.5
	Other <125 mW(21dBm)	

# 10.2 Test Setup



#### 10.3 Test Procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Spectrum Setting:

Peak Detector: RBW=1 MHz, VBW=3 MHz for bandwidth less than 1MHz. RBW=3 MHz, VBW=3 MHz for bandwidth more than 1MHz.

# 10.4 EUT Operating Condition

The EUT was set to continuously transmitting in the max power during the test.

#### 10.5 Test Data

Please refer to the Attachment G.



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# 11. Antenna Requirement

## 11.1 Standard Requirement

11.1.1 Standard FCC Part 15.203

#### 11.1.2 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 shall be considered sufficient to comply with the provisions of this Section. 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.

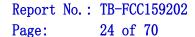
#### 11.2 Antenna Connected Construction

The gains of the antenna used for transmitting is 0dBi, and the antenna connector is de-signed with permanent attachment and no consideration of replacement. Please see the EUT photo for details.

#### 11.3 Result

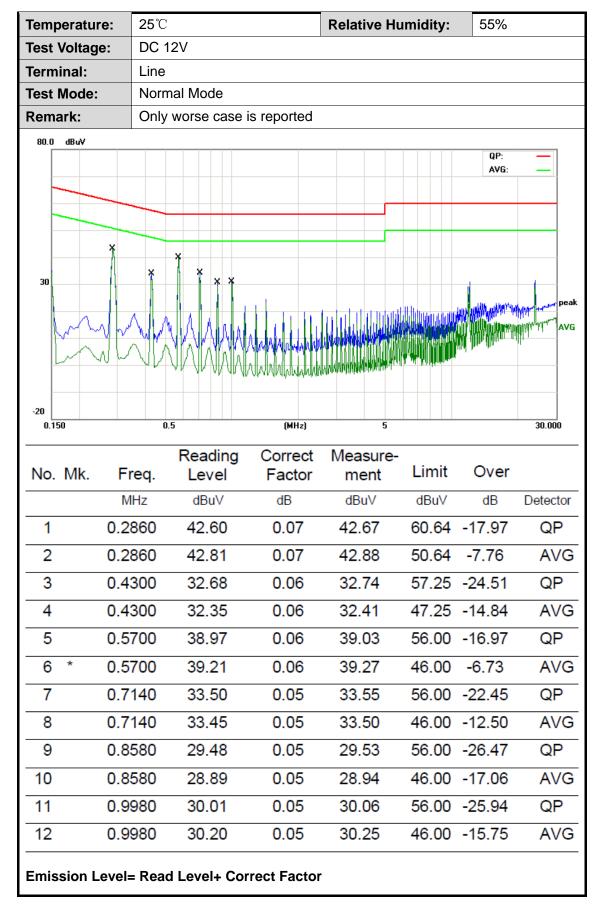
The EUT antenna is a PCB Antenna. It complies with the standard requirement.

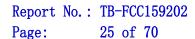
Antenna Type					
	□ Permanent attached antenna				
	Unique connector antenna				
	Professional installation antenna				





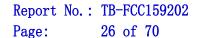
# **Attachment A-- Conducted Emission Test Data**







25℃ 55% Temperature: **Relative Humidity: DC 12V Test Voltage:** Terminal: Neutral Normal Mode **Test Mode:** Remark: Only worse case is reported 80.0 dBuV QP: AVG: 30 ΔVG -20 (MHz) 30.000 0.150 Reading Correct Measure-Limit Over No. Mk. Freq. Level Factor ment MHz dBuV dΒ dBuV dBuV dΒ Detector 1 0.2860 42.50 0.07 42.57 60.64 -18.07 QΡ 2 0.2860 42.72 0.07 42.79 50.64 -7.85 AVG 3 32.67 32.73 57.33 -24.60 QΡ 0.4260 0.06 4 0.4260 32.32 0.06 32.38 47.33 -14.95 AVG 5 0.5700 39.93 56.00 -16.01 QΡ 0.06 39.99 40.25 -5.75 AVG 6 0.5700 40.19 0.06 46.00 7 0.7100 32.59 0.05 32.64 56.00 -23.36 QΡ 46.00 -13.50 0.7100 32.45 0.05 32.50 AVG 8 9 27.39 56.00 -28.56 QΡ 0.8580 0.05 27.44 10 0.8580 26.67 0.05 26.72 46.00 -19.28 AVG 11 28.73 56.00 -27.27 QΡ 0.9940 28.68 0.05 12 0.9940 28.79 0.05 28.84 46.00 -17.16 AVG **Emission Level= Read Level+ Correct Factor** 



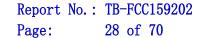


25℃ 55% Temperature: **Relative Humidity: DC 24V Test Voltage:** Terminal: Line Normal Mode **Test Mode:** Remark: Only worse case is reported 80.0 dBuV QP: AVG: 30 AVG -20 0.150 0.5 (MHz) 30.000 Reading Correct Measure-Limit Over No. Mk. Freq. Level Factor ment dBuV MHz dΒ dBuV dBuV dΒ Detector 60.64 -16.64 0.2860 43.93 0.07 44.00 QΡ 1 2 0.2860 44.17 0.07 44.24 50.64 -6.40AVG 3 0.4300 41.47 0.06 41.53 57.25 -15.72 QP 4 0.4300 41.71 0.06 41.77 47.25 -5.48AVG 5 0.5740 37.06 0.06 37.12 56.00 -18.88 QΡ 37.29 37.35 AVG 6 0.5740 0.06 46.00 -8.65 7 0.7140 18.57 0.05 18.62 56.00 -37.38 QΡ 0.7140 18.32 0.05 18.37 46.00 -27.63 AVG 8 9 1.0020 21.03 0.05 21.08 56.00 -34.92 QΡ 1.0020 20.99 0.05 21.04 46.00 -24.96 AVG 10 11 1.1460 21.54 0.05 21.59 56.00 -34.41 QΡ 12 1.1460 21.38 0.05 21.43 46.00 -24.57 AVG Emission Level= Read Level+ Correct Factor





25℃ 55% Temperature: **Relative Humidity: DC 24V Test Voltage:** Terminal: Neutral Normal Mode **Test Mode:** Remark: Only worse case is reported 80.0 dBuV QP: AVG: 30 -20 0.5 30.000 0.150 (MHz) Reading Correct Measure-Limit Over No. Mk. Freq. Level Factor ment dBu∀ dΒ MHz dBuV dΒ dBuV Detector 1 0.2900 44.55 0.03 44.58 60.52 -15.94 QΡ 2 0.2900 44.81 0.03 44.84 50.52 -5.68 AVG 3 42.38 0.02 57.18 -14.78 QΡ 0.4340 42.40 4 0.4340 42.62 0.02 42.64 47.18 -4.54 AVG 5 0.5780 38.46 0.02 38.48 56.00 -17.52 QΡ 38.70 0.02 38.72 46.00 -7.28 AVG 6 0.5780 7 1.0100 32.32 0.01 32.33 56.00 -23.67 QΡ 8 1.0100 32.39 0.01 32.40 46.00 -13.60 AVG 9 1.1539 33.77 0.01 33.78 56.00 -22.22 QΡ 10 1.1539 33.95 33.96 46.00 -12.04 0.01 AVG 11 56.00 -25.02 QΡ 1.2980 30.97 0.01 30.98 12 1.2980 31.11 0.01 31.12 46.00 -14.88 AVG **Emission Level= Read Level+ Correct Factor** 





**Attachment B-- Radiated Emission Test Data** 

#### 9KHz~30MHz

From 9KHz to 30MHz: Conclusion: PASS

Note: The amplitude of spurious emissions which are attenuated by more than 20dB

below the permissible value has no need to be reported.

# $30MHz\sim1GHz$

Ten	nperatu	ıre:	25°C	C		Relative H	lumidity:	55%	
Tes	t Volta	ge:	DC	12V					
Ant	. Pol.		Hori	izontal					
Tes	t Mode	:	TX (	GFSK Mode	2402MHz				
Rei	mark:		Only	y worse case	is reported				
80.	0 dBuV/m								
-20	T. M. P. Wall And Mark Control	-trassic A News		July Mary Mary Mary Mary Mary Mary Mary Mar		5 *		Margin -6	dB
31	0.000 4	0 50	60 7	0 80	(MHz)	300	400 500	600 700	1000.000
1	No. Mk	c. Fre	eq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MI	Ηz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		143.8	3295	56.83	-20.74	36.09	43.50	-7.41	QP
2		167.2	2368	56.87	-20.22	36.65	43.50	-6.85	QP
3	*	191.7	450	59.24	-19.62	39.62	43.50	-3.88	QP
4	ļ	216.0	240	59.64	-18.75	40.89	46.00	-5.11	QP
5		239.9	874	56.10	-17.77	38.33	46.00	-7.67	QP
6	ļ	287.9	904	57.99	-16.39	41.60	46.00	-4.40	QP
*:N	laximum d	ata x:O	ver limi	t !:over margin	_				



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	rature:	25℃				Relative H	lumidity:	55%	
est Vo	oltage:	DC 1	2V						
nt. Po	ol.	Verti	cal						
est M	ode:	TX G	FSK N	∕lode 2₄	402MHz				
emar	k:	Only	worse	case is	s reported				
80.0 dl	BuV/m								
							(RF)FCC 15	iC 3M Radiation	
								Margin -6	gB
					2 *		4 5 0		
30	1				1	<u> </u>	3 4 5 6 4 X X	I 1.	k n
				1 1				William Market	HARLINA POR
HOTOLOGI		N .	l. li.	J. A. J. W	JAMIN ALLA BALLING	#####WILIA /ALA/**\JAP	Ministra		
10.46.1	wanter the sales	The party	rational property	de alterna	dlal sorti				
		1. LAN.	** ***						
-									
20									
20 30.000	40 5	50 60	70 80		(MHz)	300	400 50	00 600 700	1000.00
	40 5	50 60		ading	(MHz)	300 Measure-	400 50	00 600 700	1000.0
30.000		Freq.	Rea	ading			400 50 Limit	00 600 700 Over	1000.0
30.000			Rea Le		Correct	Measure-			
30.000 No.	Mk.	Freq.	Rea Le	evel	Correct Factor	Measure- ment	Limit	Over	Detect
30.000	Mk.	Freq.	Rea Le	evel BuV	Correct Factor	Measure- ment dBuV/m	Limit dBuV/m	Over	Detect
30.000 No.	Mk. 49 * 19	Freq. MHz	Rea Le dl 49	evel BuV 9.14	Correct Factor dB/m -23.53	Measure- ment dBuV/m 25.61	Limit dBuV/m 40.00	Over dB -14.39	Detecti QP QP
No. 1	Mk. 49 * 19	Freq. MHz .3594 1.7450	Rea Le dl 49 56	evel BuV 9.14 3.12	Correct Factor dB/m -23.53 -19.62	Measure- ment dBuV/m 25.61 36.50	Limit dBuV/m 40.00 43.50	Over dB -14.39 -7.00	Detection QP QP
No. 1 2 3	Mk.  49 * 19 330 383	Freq. MHz 0.3594 1.7450 6.0352	Rea Le dl 49 56 45	9.14 3.12 5.70	Correct Factor dB/m -23.53 -19.62 -14.67	Measure- ment dBuV/m 25.61 36.50 31.03	Limit dBuV/m 40.00 43.50 46.00	Over dB -14.39 -7.00 -14.97	Detection QP QP QP
No. 1 2 3 4	Mk.  49  * 19  336  383  406	Freq. MHz 0.3594 1.7450 6.0352 3.9318	Rea Le dl 49 56 45 43	evel BuV 9.14 6.12 5.70 8.97	Correct Factor dB/m -23.53 -19.62 -14.67 -12.30	Measure- ment dBuV/m 25.61 36.50 31.03 31.67	Limit dBuV/m 40.00 43.50 46.00 46.00	Over dB -14.39 -7.00 -14.97 -14.33	Detector QP QP QP QP
No. 1 2 3 4 5	Mk.  49  * 19  336  383  406	Freq. MHz 0.3594 1.7450 6.0352 3.9318 8.9460	Rea Le dl 49 56 45 43	9.14 6.12 5.70 8.97	Correct Factor dB/m -23.53 -19.62 -14.67 -12.30 -11.34	Measure- ment dBuV/m 25.61 36.50 31.03 31.67 30.22	Limit dBuV/m 40.00 43.50 46.00 46.00	Over dB -14.39 -7.00 -14.97 -14.33 -15.78	Detector QP QP QP QP
No. 1 2 3 4 5	Mk.  49  * 19  330  383  400  455	Freq. MHz 0.3594 1.7450 6.0352 3.9318 8.9460	Rea Le dl 49 56 45 43 41	9.14 6.12 5.70 8.97	Correct Factor dB/m -23.53 -19.62 -14.67 -12.30 -11.34	Measure- ment dBuV/m 25.61 36.50 31.03 31.67 30.22	Limit dBuV/m 40.00 43.50 46.00 46.00	Over dB -14.39 -7.00 -14.97 -14.33 -15.78	Detection QP QP QP QP



 ${\tt Report\ No.:\ TB-FCC159202}$ 

26500.00 MHz

21400.00

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# Above 1GHz (Only worse case is reported)

Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	DC 12V		
Ant. Pol.	Horizontal		
Test Mode:	TX GFSK Mode 2402MHz		
Remark:	No report for the emission wh	ich more than 10 dB be	elow the
	prescribed limit.		



No	. Mk	. Freq.			Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4802.656	33.44	13.57	47.01	54.00	-6.99	AVG
2		4805.284	47.52	13.59	61.11	74.00	-12.89	peak

11200.00 13750.00 16300.00 18850.00

#### **Emission Level= Read Level+ Correct Factor**

1000.000 3550.00

6100.00

8650.00



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Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	DC 12V		
Ant. Pol.	Vertical		
Test Mode:	TX GFSK Mode 2402MHz		
Remark:	No report for the emission prescribed limit.	which more than 10 dE	below the

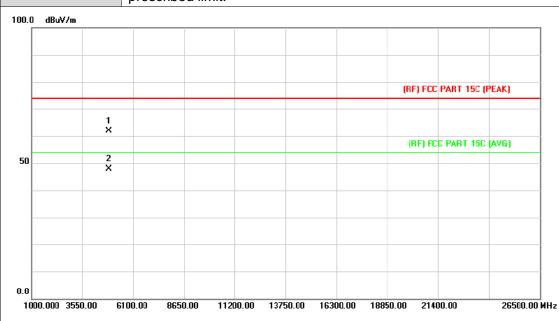


No	. Mk	Freq.			Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4802.500	33.44	13.57	47.01	54.00	-6.99	AVG
2		4803.370	47.46	13.59	61.05	74.00	-12.95	peak



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Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	DC 12V		
Ant. Pol.	Horizontal		
Test Mode:	TX GFSK Mode 2441MHz		
Remark:	No report for the emission prescribed limit.	which more than 10 dE	B below the
	prescribed limit.		

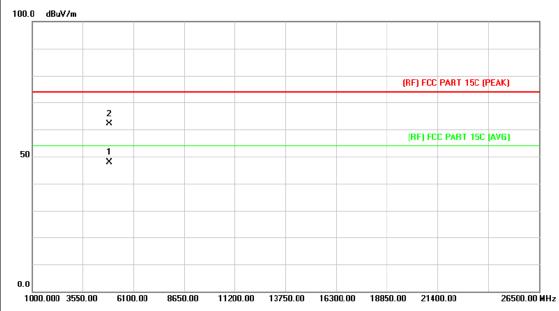


No.	Mk.	Freq.	Reading Level		Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4881.667	47.93	13.98	61.91	74.00	-12.09	peak
2	*	4883.341	33.90	13.98	47.88	54.00	-6.12	AVG



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Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	DC 12V		
Ant. Pol.	Vertical		
Test Mode:	TX GFSK Mode 2441MHz		
Remark:	No report for the emission wh prescribed limit.	ich more than 10 dB be	elow the
	1		



No.	Mk.	Freq.	Reading Level		Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4880.974	33.86	13.98	47.84	54.00	-6.16	AVG
2		4883.224	48.20	13.98	62.18	74.00	-11.82	peak



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Temperature:	25℃	Relative Humidity:	55%			
Test Voltage:	DC 12V					
Ant. Pol.	Ant. Pol. Horizontal					
Test Mode:	TX GFSK Mode 2480MHz					
Remark: No report for the emission which more than 10 dB below the prescribed limit.						



No.	Mk.	Freq.			Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4958.746	48.10	14.37	62.47	74.00	-11.53	peak
2	*	4959.604	33.83	14.38	48.21	54.00	-5.79	AVG



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Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	DC 12V		
Ant. Pol.	Vertical		
Test Mode:	TX GFSK Mode 2480MHz		
Remark:	No report for the emission w prescribed limit.	hich more than 10 dB	pelow the

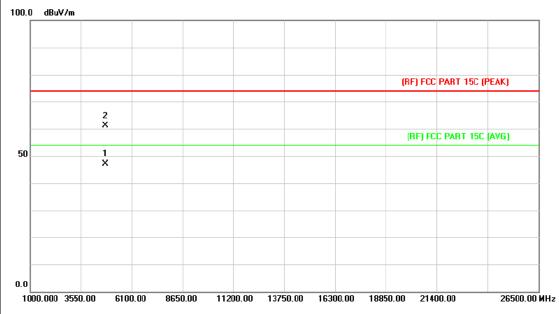


No.	Mk.	Freq.	Reading Level		Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4959.640	48.58	14.38	62.96	74.00	-11.04	peak
2	*	4961.026	33.86	14.38	48.24	54.00	-5.76	AVG



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Temperature:	25℃	Relative Humidity:	55%			
Test Voltage:	DC 12V					
Ant. Pol.	Horizontal					
Test Mode:	TX π /4-DQPSK Mode 2402	MHz				
Remark: No report for the emission which more than 10 dB below the prescribed limit.						

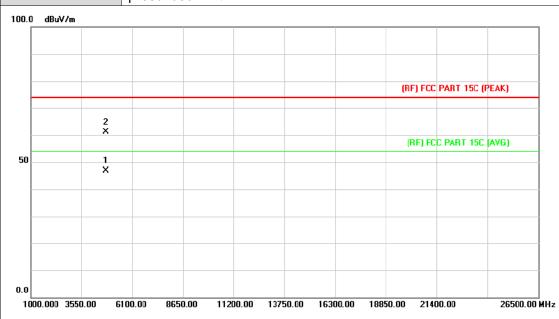


No.	Mk.	Freq.	Reading Level		Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4802.500	33.44	13.57	47.01	54.00	-6.99	AVG
2		4805.341	47.58	13.59	61.17	74.00	-12.83	peak



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Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	DC 12V		
Ant. Pol.	Vertical		
Test Mode:	TX π /4-DQPSK Mode 240	2MHz	
Remark:	No report for the emission prescribed limit.	which more than 10 dE	3 below the



No	. Mk	. Freq.			Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4802.656	33.40	13.57	46.97	54.00	-7.03	AVG
2		4805.026	47.52	13.59	61.11	74.00	-12.89	peak



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Temperature:	25℃	Relative Humidity:	55%					
Test Voltage:	DC 12V							
Ant. Pol.	Horizontal							
Test Mode:	TX π /4-DQPSK Mode 2441	X π /4-DQPSK Mode 2441MHz						
Remark:	No report for the emission w prescribed limit.	hich more than 10 dB l	below the					

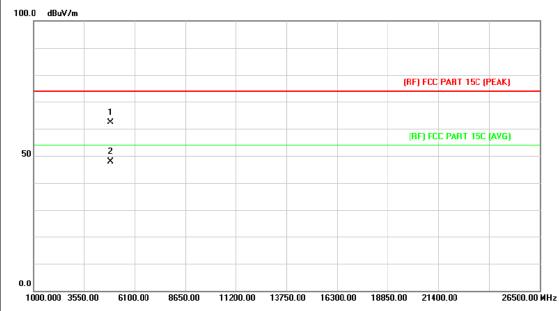


	No.	Mk.	Freq.			Measure- ment	Limit	Over	
			MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	1		4881.996	47.90	13.98	61.88	74.00	-12.12	peak
2	2	*	4881.998	33.86	13.98	47.84	54.00	-6.16	AVG



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Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	DC 12V		
Ant. Pol.	Vertical		
Test Mode:	TX π /4-DQPSK Mode 2441	MHz	
Remark:	No report for the emission was prescribed limit.	hich more than 10 dB l	pelow the

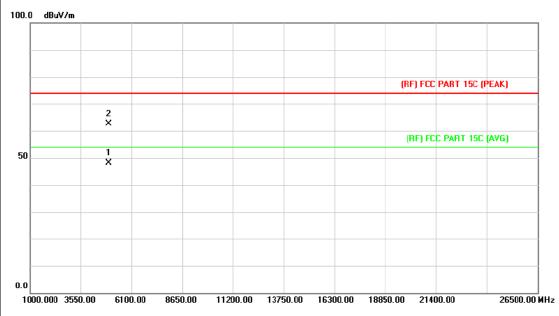


No.	Mk.	Freq.			Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4881.999	48.37	13.98	62.35	74.00	-11.65	peak
2	*	4882.004	33.85	13.98	47.83	54.00	-6.17	AVG



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25℃	Relative Humidity:	55%					
DC 12V							
Horizontal							
TX $\pi$ /4-DQPSK Mode 2480M	ΓX π /4-DQPSK Mode 2480MHz						
No report for the emission whi prescribed limit.	ich more than 10 dB be	slow the					
	DC 12V Horizontal TX π /4-DQPSK Mode 2480M No report for the emission wh	DC 12V Horizontal  TX π /4-DQPSK Mode 2480MHz  No report for the emission which more than 10 dB be					

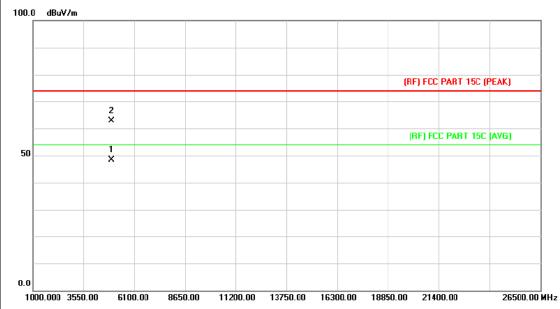


No.	Mk.	Freq.	Reading Level		Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4959.998	33.86	14.38	48.24	54.00	-5.76	AVG
2		4960.004	48.26	14.38	62.64	74.00	-11.36	peak



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Temperature:	25℃	Relative Humidity:	55%						
Test Voltage:	DC 12V								
Ant. Pol.	Vertical								
Test Mode:	TX π /4-DQPSK Mode 2480M	ΓX π /4-DQPSK Mode 2480MHz							
Remark:	No report for the emission wh prescribed limit.	ich more than 10 dB be	elow the						



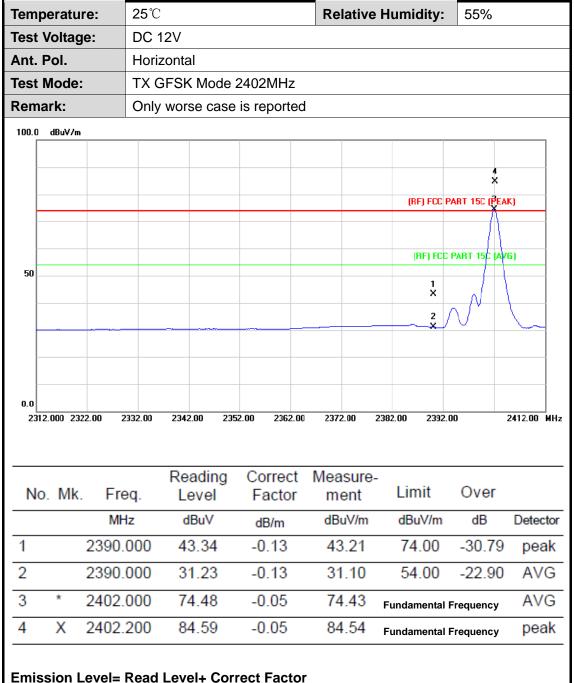
No	. Mk	Freq.			Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	4960.000	33.88	14.38	48.26	54.00	-5.74	AVG
2		4960.003	48.57	14.38	62.95	74.00	-11.05	peak





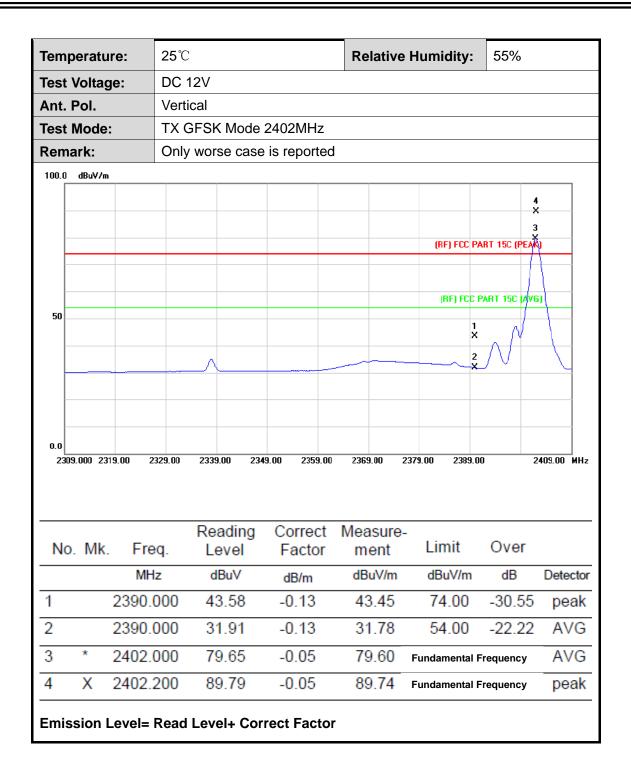
**Attachment C-- Restricted Bands Requirement Test Data** 

# (1) Radiation Test





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Temperature:	25℃	Relative Humidity:	55%				
Test Voltage:	DC 12V						
Ant. Pol.	Horizontal						
Test Mode:	TX GFSK Mode 2480 MHz						
Remark:	Only worse case is reported						
100.0 dBuV/m							
2 X							
1							
, A		(RF) FCC PA	ART 15C (PEAK)				

		2 K							
	j						(RF) FCC	PART 150 (	PEAK)
		3					(RF) FC	C PART 15C	(AVG)
0		4							
	1	Ü	 	 	-				
0									

N	lo. Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	*	2480.000	79.91	0.34	80.25	Fundamental	Frequency	AVG
2	X	2480.200	90.03	0.34	90.37	Fundamental	Frequency	peak
3		2483.500	53.17	0.36	53.53	74.00	-20.47	peak
4		2483.500	40.79	0.36	41.15	54.00	-12.85	AVG



 ${\tt Report\ No.:\ TB-FCC159202}$ 

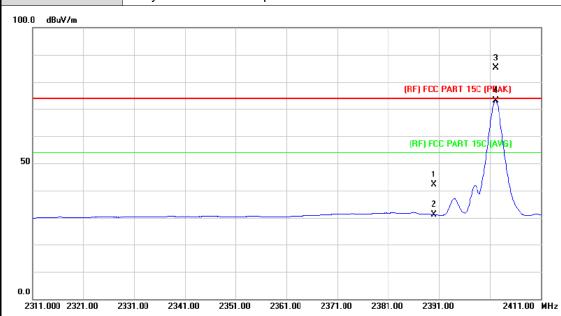
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Ton	perati	Iro.	25℃	۲				RA	lativ	e Hum	idity:	55%		
	t Volta		DC					IXC	iativ	c mann	idity.	0070		
		ge.	Vert											
	. Pol.													
	t Mode	<b>):</b>		GFSK I										
Ren	nark:		Only	/ worse	e case	e is rep	orted							
100.	0 dBuV/r	n												7
		2												
														]
		1								(1	RF) FCC	PART 15C (PE	AK)	
		\												
50	$\vdash \!$	3 X									(RF) FC	C PART 15C (A	(VG)	
30		1												
	+f'-	*												
	$\vdash$	$\sim$								^				
0.0 24	472.000 24	482.00 2	492.00	2502.0	0 25	12.00	2522.00	2532	2.00	2542.00	2552	.00	2572.00	MHz
				Read	ding	Cor	rect	Mea	sure					
N	o. Mk	. Fre	q.	Lev	/el	Fac	ctor	me	ent	Lir	nit	Over		
		MH	Z	dBı	ı۷	dB/	m	dBu	uV/m	dB	uV/m	dB	Detec	ctor
1	*	2480.0	000	77.	83	0.3	34	78	.17	Funda	mental	Frequency	AV	G
2	X	2480.	100	87.	97	0.3	34	88	.31	Funda	mental	Frequency	pea	ak
3		2483.	500	51.	63	0.3	36	51	.99	74	1.00	-22.01	l pea	ak
4		2483.	500	39.	33	0.3	36	39	.69	54	1.00	-14.31	I AV	G
Emi	ission	Level=	Read	Level	+ Coı	rrect F	actor							



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Temperature:	<b>25</b> ℃	Relative Humidity:	55%				
Test Voltage:	DC 12V						
Ant. Pol.	Horizontal						
Test Mode:	TX π /4-DQPSK Mode 2402	TX π /4-DQPSK Mode 2402MHz					
Remark:	Only worse case is reported						

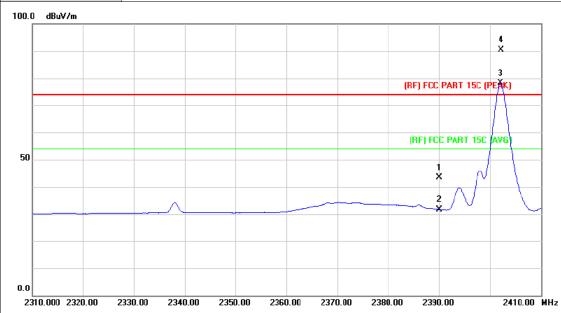


No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		2390.000	42.30	-0.13	42.17	74.00	-31.83	peak
2		2390.000	31.25	-0.13	31.12	54.00	-22.88	AVG
3	X	2402.100	85.13	-0.05	85.08	Fundamental	Frequency	peak
4	*	2402.100	73.11	-0.05	73.06	Fundamental	Frequency	AVG

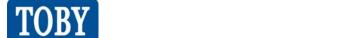


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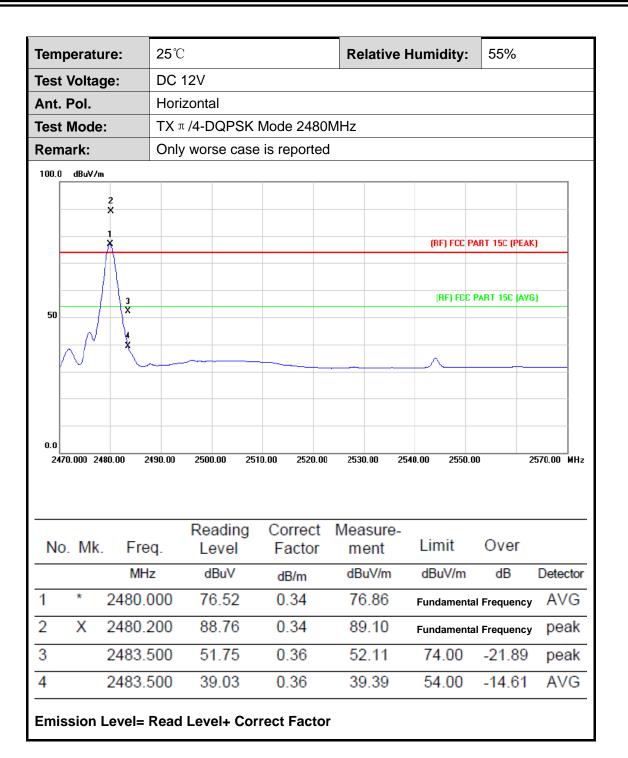
Temperature:	25℃	Relative Humidity:	55%					
Test Voltage:	DC 12V							
Ant. Pol.	Vertical							
Test Mode:	TX π /4-DQPSK Mode 2402M	TX π /4-DQPSK Mode 2402MHz						
Remark:	Only worse case is reported							

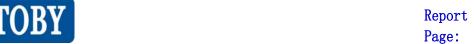


No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		2390.000	43.40	-0.13	43.27	74.00	-30.73	peak
2		2390.000	31.83	-0.13	31.70	54.00	-22.30	AVG
3	*	2402.100	78.28	-0.05	78.23	Fundamental	Frequency	AVG
4	Χ	2402.200	90.36	-0.05	90.31	Fundamental	Frequency	peak



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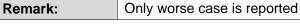
 Temperature:
 25 °C
 Relative Humidity:
 55%

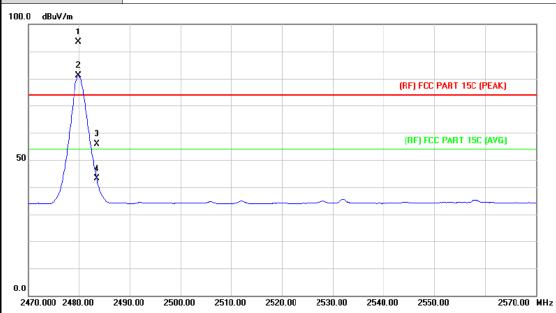
 Test Voltage:
 DC 12V

 Ant. Pol.
 Vertical

 Test Mode:
 TX π /4-DQPSK Mode 2480MHz

 Remark:
 Only worse case is reported.

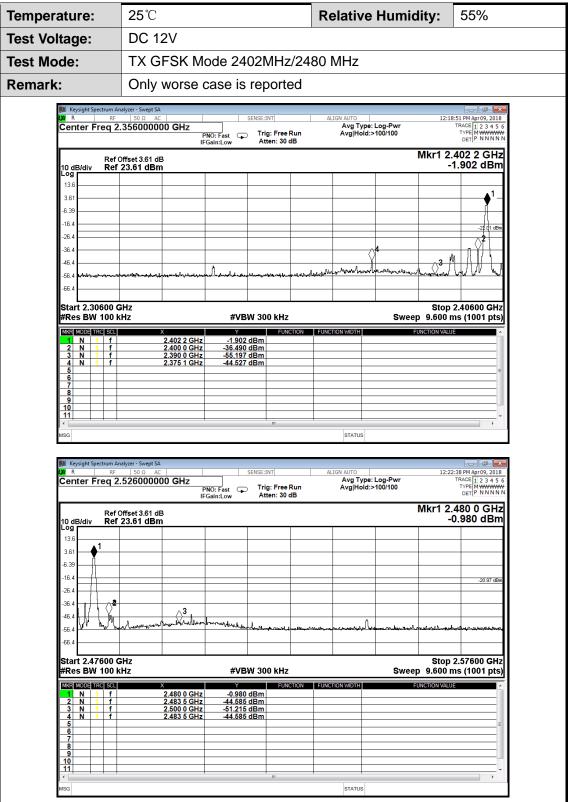




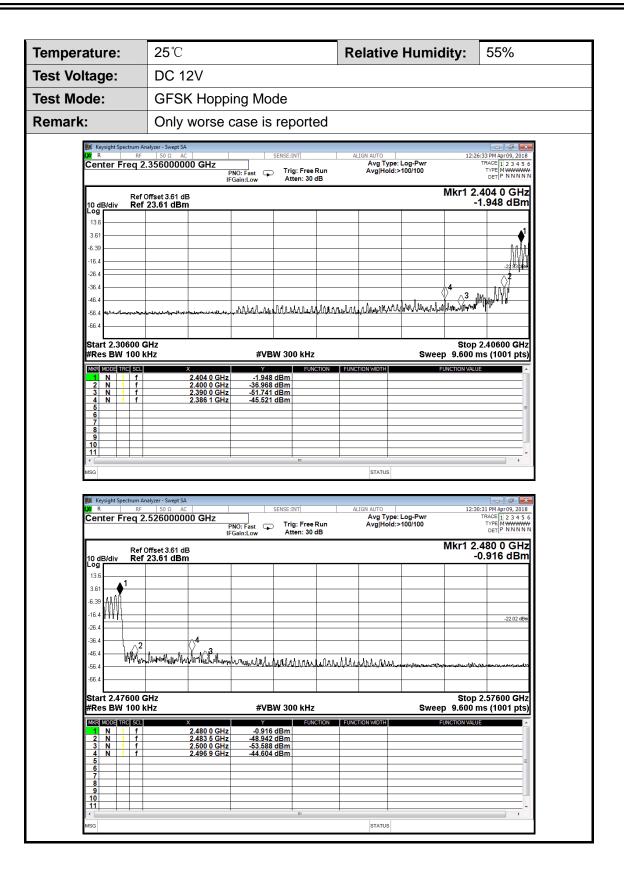
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1	X	2479.900	91.97	1.38	93.35	Fundamenta	I Frequency	peak
2	*	2479.900	79.70	1.38	81.08	Fundamenta	I Frequency	AVG
3		2483.500	54.39	1.40	55.79	74.00	-18.21	peak
4		2483.500	41.65	1.40	43.05	54.00	-10.95	AVG



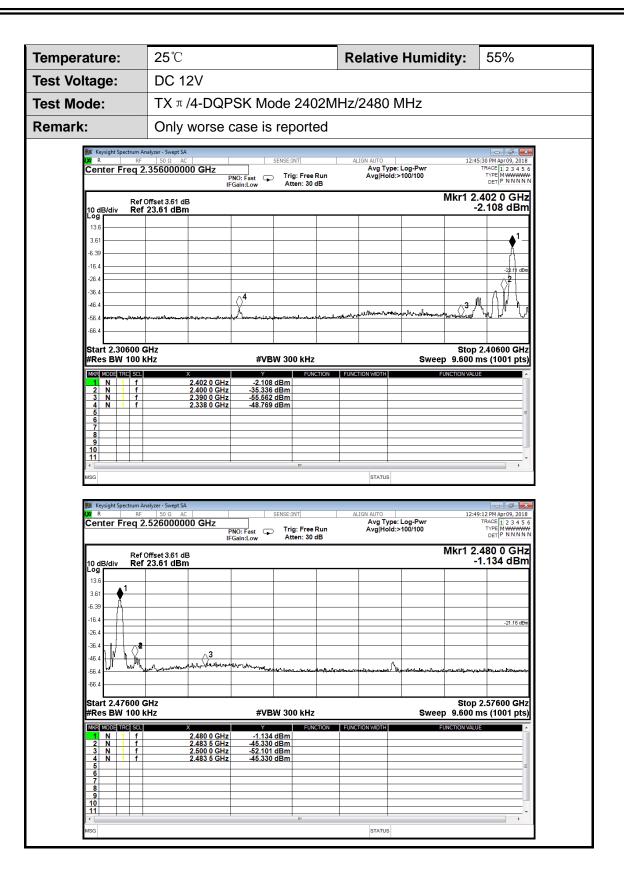
(2) Conducted Test



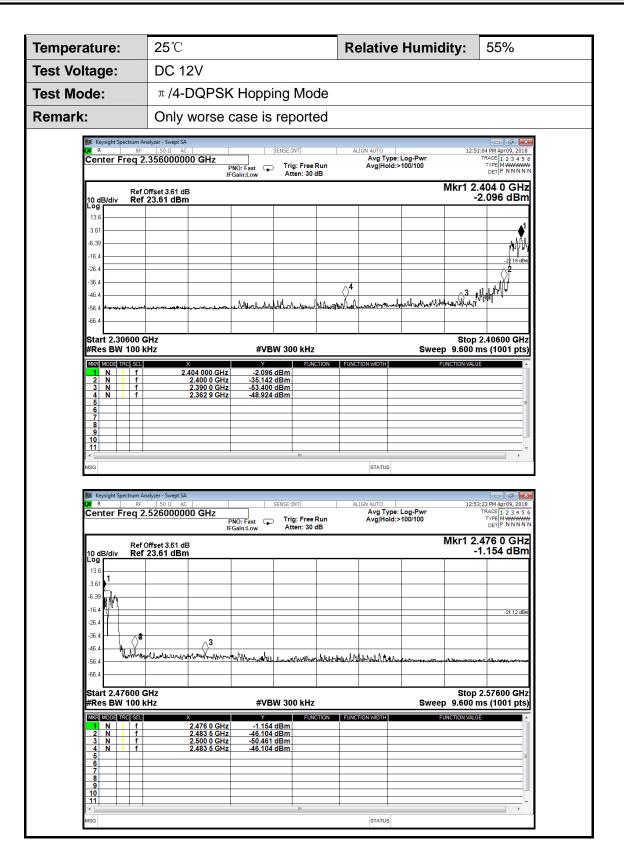


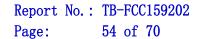








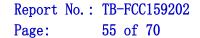






**Attachment D-- Number of Hopping Channel Test Data** 

emperature:	2	5℃			Relative	Humidity	<b>/:</b> 55%	6
est Voltage:	D	C 12V						
est Mode:	H	lopping	Mode					
Frequency F	Range	Те	est Mode	Q	uantity of l Chanr			Limit
2402MHz~24	80MH-	,	GFSK		79			>15
1402IVII 12~24	OUIVII 12	π /-	4-DQPSK		79			713
				GFSK M	ode			
OR I		50 Ω AC	) CU2	SENSE:INT	ALIGN AUTO AVI TUDE:	Log-Pwr	12:29:04 PM Apr 09, 2018 TRACE 12 3 4 5 6	
Cel	nter Freq 2	2.44175000	PNO: Fast IFGain:Low	Trig: Free Ru Atten: 30 dB	Avg Type: n Avg Hold:>		TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P NNNNN	
10 c	Ref dB/div <b>R</b> ef	Offset 3.59 dB 23.59 dBm				MKr1 2.40	01 837 0 GHz -2.570 dBm	
13.5 3.5	9 ▲1						♦²	
-6.4 -16.								
-26. -36.	4							
-46. -56.	4						Work	
-66.	<u> </u>							
#R	es BW 100	GHz kHz	#\	VBW 300 kHz		Sweep 8.00	op 2.48350 GHz 00 ms (1001 pts)	
<u></u>	MODE TRC SCL	2.401	937 0 CH2 2 6		ON FUNCTION WIDTH	FUNCTION 1		
2	N 1 f	2.479	837 0 GHz -2.5 993 0 GHz -2.0	570 dBm )28 dBm		ronction		
3 4 5	N 1 f	2.479	993 0 GHz -2.0	770 dBm )28 dBm		PONCHON		
3 4 5 6 7 7 8 9	N i f	2,475	993 0 GHz -2.0	570 dBm 128 dBm		Constitution	F E	
3 4 5 6 7 8		2.475	993 0 GHz -2.0	770 dBm 128 dBm		Johnson	F .	
3 4 5 6 7 8 9 9		2.475		т	STATUS	onerion		
3 4 5 6 6 7 7 8 9 10 11 11				4-DQPSI	STATUS	Oriental	, ,	
3 4 5 6 7 7 8 9 9 10 11 11	ieysight Spectrum A R		π / <i>a</i>	4-DQPSI	status (Mode		12:52:21 PM Agr09, 2018	
3 4 5 6 7 7 8 9 9 10 11 11	esylight Spectrum A R R R RF Freq Z	nalyzer - Swept SA   30 Q	π /-	4-DQPSI	K Mode	Log-Pwr 100/100	12:52:21 PM Apr 09, 2018 TRACE [1:2:3 4 5 6 5 TYPE MONTHS OF P NNNNN	
3 4 5 6 6 7 7 8 9 9 10 11 11 	eysight Spectrum A Ref	nalyzer - Swept SA   30 Ω AC	π /a	4-DQPSI  SENSE INT    Trig: Free Ru	status (Mode	Log-Pwr 100/100	12:52:21 PM April 9: 2018 TRACE [1:2:45:6	
3 4 5 6 6 7 7 8 9 10 11 11 11 10	egyight Spectrum A	nalyzer - Swept SA   50 0	TI /4 D GHz PNO: Fast IFGain:Low	4-DQPSI SENSE:INT  Trig: Free Ru Atten: 30 dB	ALION AUTO AUG Type: Avg Hold:>	Log-Pwr 100/100 Mkr1 2.40	12:52:21 PM Agroy, 2018 TRACE [1:2:3:4:5:6 TYPE MANNIN D1 920 5 GHz -4.101 dBm	
3 4 5 5 6 6 7 7 8 9 10 11 11 4 Cel	sysight Spectrum A Ref	nalyzer - Swept SA   50 0	TI /4 D GHz PNO: Fast IFGain:Low	4-DQPSI SENSE:INT  Trig: Free Ru Atten: 30 dB	status (Mode	Log-Pwr 100/100 Mkr1 2.40	12:52:21 PM Agroy, 2018 TRACE [1:2:3:4:5:6 TYPE MANNIN D1 920 5 GHz -4.101 dBm	
3 4 6 6 7 8 9 10 11 11 Cel	icysight Spectrum A Ref	nalyzer - Swept SA   50 0	TI /4 D GHz PNO: Fast IFGain:Low	4-DQPSI SENSE:INT  Trig: Free Ru Atten: 30 dB	ALION AUTO AUG Type: Avg Hold:>	Log-Pwr 100/100 Mkr1 2.40	12:52:21 PM Agroy, 2018 TRACE [1:2:3:4:5:6 TYPE MANNIN D1 920 5 GHz -4.101 dBm	
3 4 5 6 6 7 8 9 10 11 11 11 10 10 10 13 3 3 5 6 4 4 16 16 16 17 18 18 18 18 18 18 18 18 18 18 18 18 18	eysight Spectrum A Ref	nalyzer - Swept SA   50 0	TI /4 D GHz PNO: Fast IFGain:Low	4-DQPSI SENSE:INT  Trig: Free Ru Atten: 30 dB	ALION AUTO AUG Type: Avg Hold:>	Log-Pwr 100/100 Mkr1 2.40	12:52:21 PM Agroy, 2018 TRACE [1:2:3:4:5:6 TYPE MANNIN D1 920 5 GHz -4.101 dBm	
3 4 6 6 7 8 9 100 111 ( MSG 10 10 10 10 10 10 10 10 10 10 10 10 10	eysight Spectrum A Ref	malyzer - Swept SA   50 @ AC 2.441750001	TI /4 D GHz PNO: Fast IFGain:Low	4-DQPSI SENSE:INT  Trig: Free Ru Atten: 30 dB	ALION AUTO AUG Type: Avg Hold:>	Log-Pwr 100/100 Mkr1 2.40	12:52:21 PM Agro9, 2018 TRACE [] 2:3 4 5 6 TYPE BOOK TO THE BOOK T	
10 cells 13 3 5 6 4 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	eysight Spectrum A Ref	nalyzer - 5wept SA   50 ⊕ AC 2.441750000 Offset 3.59 dBm	D GHZ PNO: Fast IF Galintow	4-DQPSI SENSE:INT  Trig: Free Ru Atten: 30 dB	ALION AUTO AUG Type: Avg Hold:>	Log-Pwr 100/100 Mkr1 2.40	12:52:21 PM Agro9, 2018 TRACE [] 2:3 4 5 6 TYPE BOOK TO THE BOOK T	
3.3 4.5 6.6 7.7 8.9 9.0 10.11 1 MSG  Cei	sysight Spectrum A Ref	nalyzer - 5wept SA   50 ⊕ AC 2.4417500001 Offset 3.59 dBm 23.59 dBm GHz KHz	D GHZ PNO: Fast IF Galintow  ##	4-DQPSI  SENSEJNTI  Trig: Free Ru Atten: 30 dB	ALION AUTO AUG Type: Avg Hold:>	Log-Pwr 100/100 Mkr1 2.40	12:52:21 PM Apr09, 2018 TRACE   12:34:55 POET P NNNN  01 920 5 GHz -4.101 dBm	
10 cells   10 cells	Refull Re	nalyzer - 5wept SA   50 ⊕ AC 2.4417500001 Offset 3.59 dBm 23.59 dBm GHz KHz	D GHZ PNO: Fast IF Galint.ow  ##  920 5 GHz 4.1	4-DQPSI  Trig: Free Ru Atten: 30 dB	ALIGN AUTO  ALIGN AUTO  AVIG Types  AVIG HOLDS	Log-Pwr 100/100 Mkr1 2.40	12:52:21 PM Apr09, 2018 TRACE   12:34:55 POET P NNNN  01 920 5 GHz -4.101 dBm	
3 4 5 6 6 7 8 9 10 11 11 11 12 12 13 3 5 5 6 4 6 4 6 6 6 6 6 6 6 6 6 6 6 6 6 6	Refull Re	nalyzer - 5wept SA   50 ⊕ AC 2.4417500001 Offset 3.59 dBm 23.59 dBm GHz KHz	D GHZ PNO: Fast IF Galint.ow  ##  920 5 GHz 4.1	4-DQPSI  Trig: Free Ru Atten: 30 dB	ALIGN AUTO  ALIGN AUTO  AVIG Types  AVIG HOLDS	Log-Pwr 100/100 Mkr1 2.40	12:52:21 PM Apr09, 2018 TRACE   12:34:55 POET P NNNN  01 920 5 GHz -4.101 dBm	



400

31.60

**PASS** 



1DH5

**Attachment E-- Average Time of Occupancy Test Data** 

Temper	Temperature: 25°C Relative Humidity: 55%								
Test Voltage: DC 12V									
Test Mode: Hopping Mode (GFSK)									
Test	Channel		nel Pulse Total		ell	Period Time	I	Limit	Result
Mode	(MHz)		Time (ms)	(ms)		(s)		(ms)	Resuit
1DH1	2441		0.367	117.44		31.60		400	PASS
1DH3	244	1	1.620	259.20		31.60		400	PASS

1DH1 Total of Dwell= Pulse Time\*(1600/2)\*31.6/79

2.871

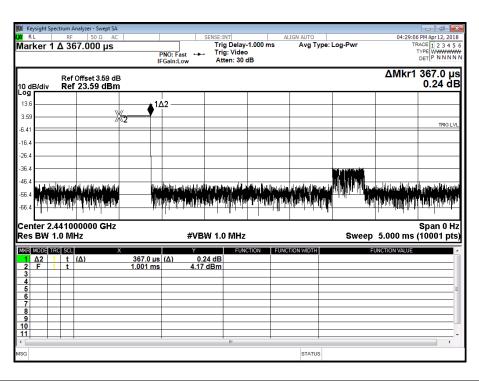
2441

1DH3 Total of Dwell= Pulse Time\*(1600/4)\*31.6/79

1DH5 Total of Dwell= Pulse Time\*(1600/6)\*31.6/79

# **GFSK Hopping Mode 1DH1**

306.24

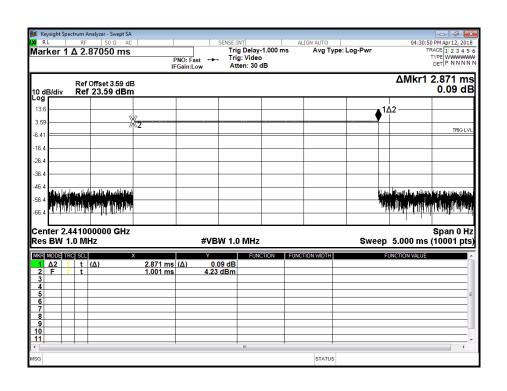






**GFSK Hopping Mode 1DH3** 2441 MHz Trig Delay-1.000 ms Trig: Video Atten: 30 dB Avg Type: Log-Pwr Marker 1 Δ 1.62000 ms ΔMkr1 1.620 ms 0.02 dB Ref Offset 3.59 dB Ref 23.59 dBm **♦**1Δ2 13.6 16.4 -36.4 -56.4 -66.4 Center 2.441000000 GHz Res BW 1.0 MHz Span 0 Hz Sweep 5.000 ms (10001 pts) **#VBW 1.0 MHz** MKR MODE TRC SCL 1 Δ2 1 t (Δ) 2 F 1 t 1.620 ms (Δ) 1.001 ms STATUS

# **GFSK Hopping Mode 1DH5**





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Temperature:	25℃	Relative Humidity:	55%
Test Voltage:	DC 12V		

**Test Mode:** Hopping Mode ( $\pi$ /4-DQPSK)

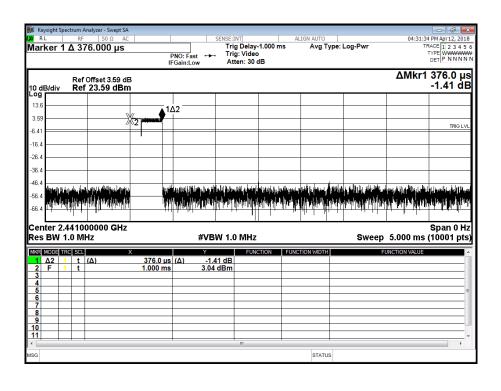
Test	Channel	Pulse	Total of Dwell	Period Time	Limit	Popult
Mode	(MHz)	Time (ms)	(ms)	(s)	(ms)	Result
2DH1	2441	0.376	120.32	31.60	400	PASS
2DH3	2441	1.628	260.48	31.60	400	PASS
2DH5	2441	2.876	306.77	31.60	400	PASS

2DH1 Total of Dwell= Pulse Time\*(1600/2)\*31.6/79

2DH3 Total of Dwell= Pulse Time\*(1600/4)\*31.6/79

2DH5 Total of Dwell= Pulse Time\*(1600/6)\*31.6/79

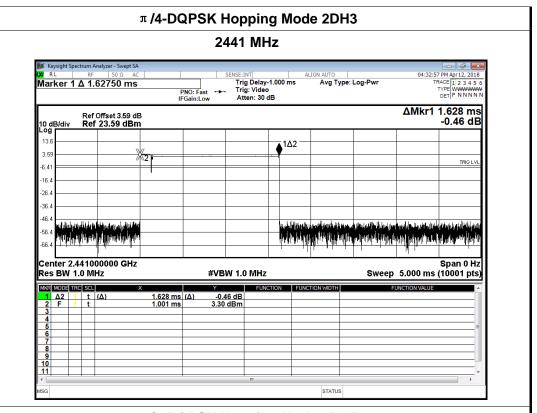
# $\pi$ /4-DQPSK Hopping Mode 2DH1



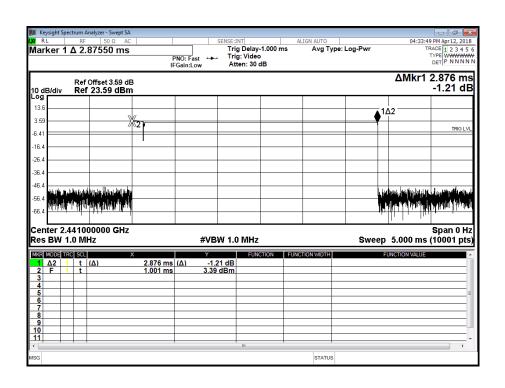




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## π/4-DQPSK Hopping Mode 2DH5







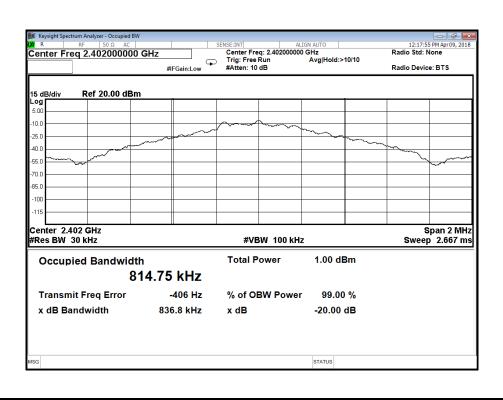
**Data** 

Attachment F-- Channel Separation and Bandwidth Test

Temperature: 25°C		C	Relative Humidity:	55%
Test Voltage:	DC	12V		
Test Mode:	TX	Mode (GFSK)		
Channel frequency (MHz)		99% OBW (kHz)	20dB Bandwidth (kHz)	20dB Bandwidth *2/3 (kHz)
2402	814.75		836.8	
2441		815.54	834.0	
2480		812.34	836.6	







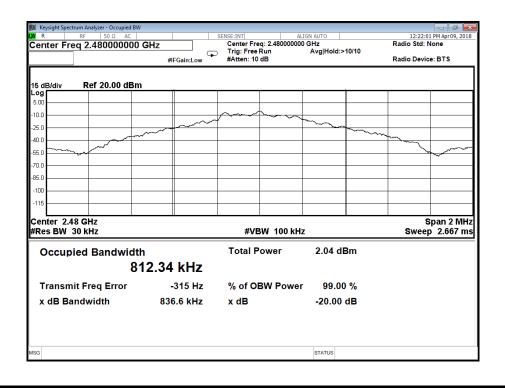




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### **GFSK TX Mode** 2441 MHz NSE:INT ALIGN AUTO Center Freq: 2.441000000 GHz Trig: Free Run Avg|Hold:>10/10 #Atten: 10 dB Center Freq 2.441000000 GHz Radio Device: BTS #IFGain:Low Ref 20.00 dBm 10.0 25.0 40.0 55.0 zn r -100 Span 2 MHz Sweep 2.667 ms Center 2.441 GHz #Res BW 30 kHz **#VBW 100 kHz Total Power** 2.04 dBm Occupied Bandwidth 815.54 kHz Transmit Freq Error 1.151 kHz % of OBW Power 99.00 % x dB Bandwidth 834.0 kHz x dB -20.00 dB STATUS

#### **GFSK TX Mode**



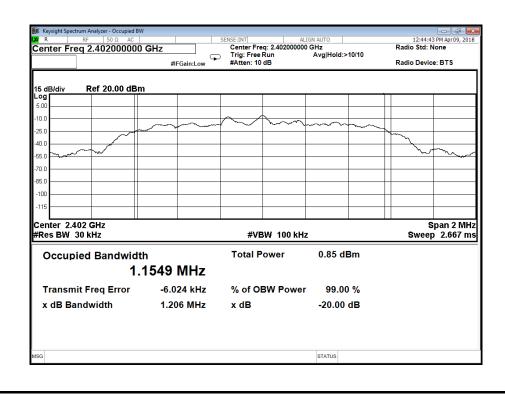


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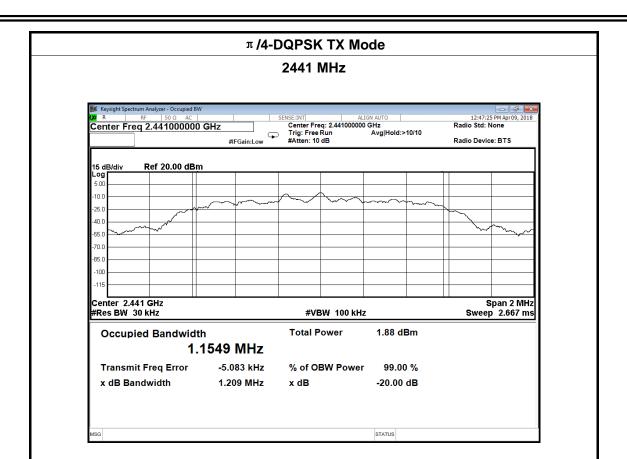
Temperature:	25°	C	Relative Humidity:	55%
Test Voltage:	DC	12V		
Test Mode:	TX	Mode (π/4-DQPSK)		
	•			204B

Channel frequency (MHz)	99% OBW (kHz)	20dB Bandwidth (kHz)	20dB Bandwidth *2/3 (kHz)
2402	1154.9	1206	804
2441	1154.9	1209	806
2480	1156.1	1203	802

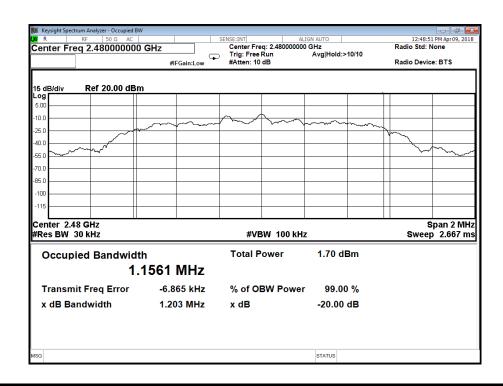
# π/4-DQPSK TX Mode







# π/4-DQPSK TX Mode

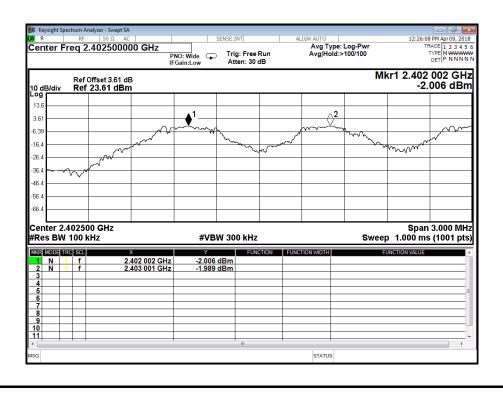


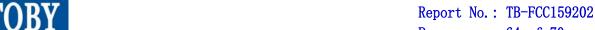


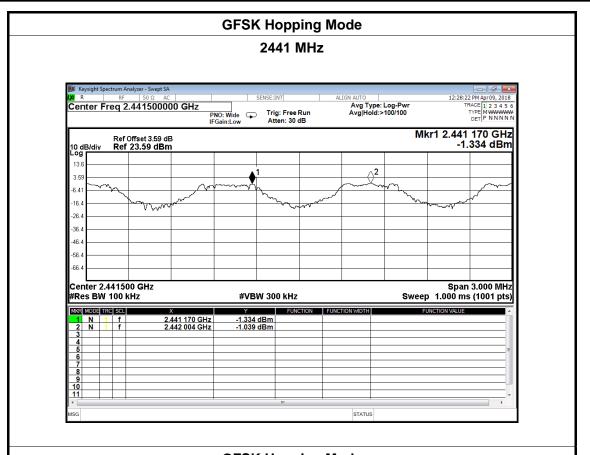
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Temperature:	25℃		Relative Humidity:		55%
Test Voltage:	DC 12V				
Test Mode:	Hopping Mode (GFSK)				
Channel frequ	uency	Separation Read Value		Separation Limit	
(MHz)		(kHz)		(kHz)	
2402		999		836.8	
2441		834		834.0	
2480		1002			836.6

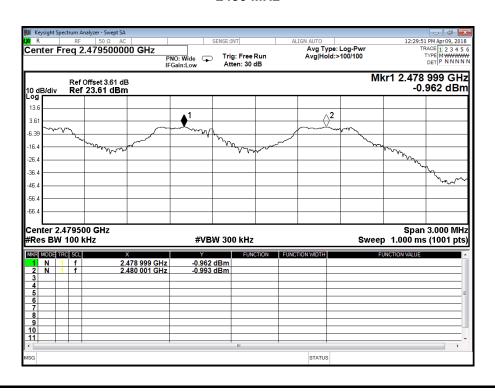
# **GFSK Hopping Mode**







# **GFSK Hopping Mode**



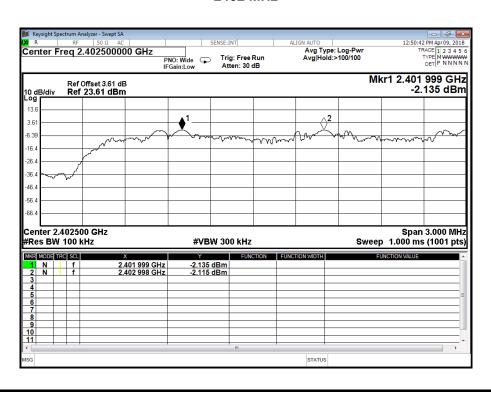


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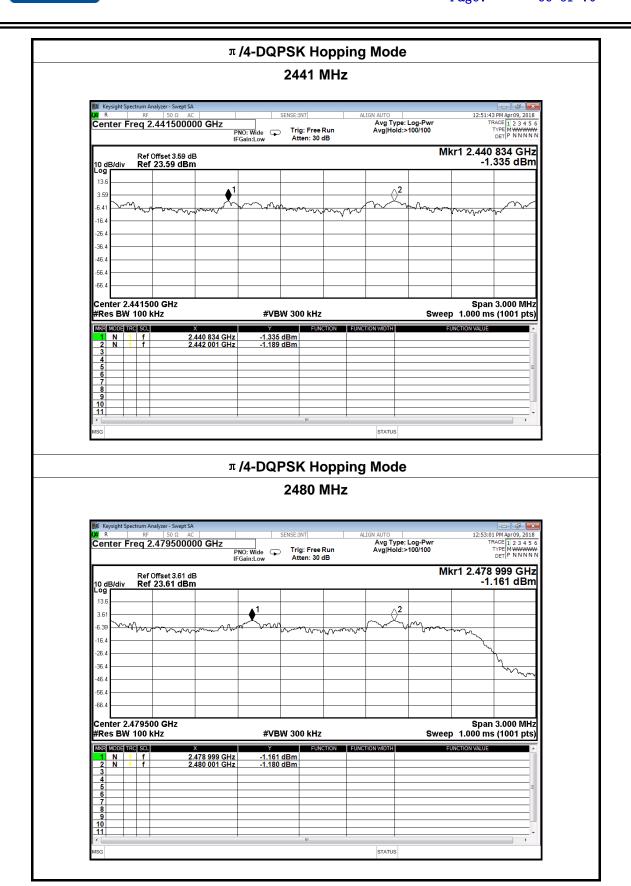
Temperature:	25℃	Relative Humidity:	55%	
Test Voltage:	DC 12V			
Test Mode:	Hopping Mode ( π /4-DQPSK)			

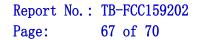
	,		
Channel frequency	Separation Read Value	Separation Limit	
(MHz)	(kHz)	(kHz)	
2402	999	804	
2441	1167	806	
2480	1002	802	

# $\pi$ /4-DQPSK Hopping Mode









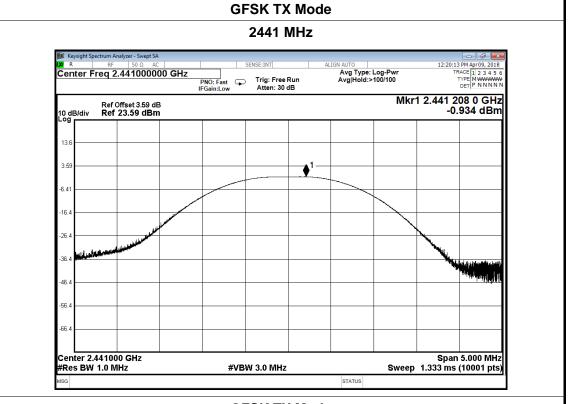


**Attachment G-- Peak Output Power Test Data** 

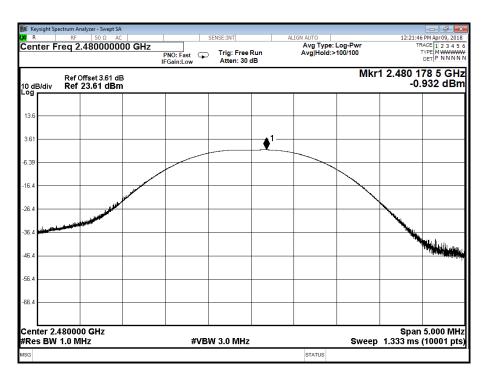
erature:	25℃		Relative	Relative Humidity:		
/oltage:	DC 12V					
Mode:	TX Mode	(GFSK)				
nel frequen	cy (MHz)	Test Resu	It (dBm)	L	.imit (dBm	
2402		-1.9	40			
2441		-0.9	34		30	
2480		-0.9	32		-	
		GFSK T	( Mode			
		2402	MHz			
Keysight Spectrum Ar	nalyzer - Swept SA	SENSE:INT	ALIGN AUTO		12:18:18 PM Apr 09, 2018	
	.402000000 GHz	:	Avg Typ	e: Log-Pwr d:>100/100	TRACE 1 2 3 4 5 6	
		PNO: Fast Trig: Free IFGain:Low Atten: 30	dB Avgirion		DET P N N N N	
Ref	Offset 3.61 dB			Mkr1 2.4	02 150 5 GHz	
10 dB/div Ref	23.61 dBm				-1.940 dBm	
13.6						
3.61			▲1			
-6.39						
-16.4						
-10.4	w/www					
-26.4	The state of the s					
	a sind back before				.   <b> </b>	
-36.4	Awa.				<b>~</b>	
-46.4					White the same of	
-56.4						
-66.4						
Center 2.40200		/// (B) (A) (A) (A)			Span 5.000 MHz	
#Res BW 1.0 M	HZ	#VBW 3.0 MHz		Sweep 1.33	3 ms (10001 pts)	
MSG			STATUS			



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#### **GFSK TX Mode**



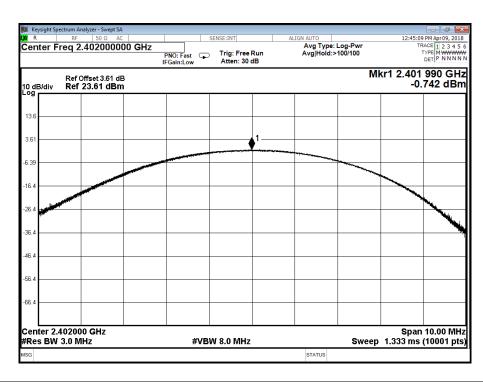


 ${\tt Report\ No.:\ TB-FCC159202}$ 

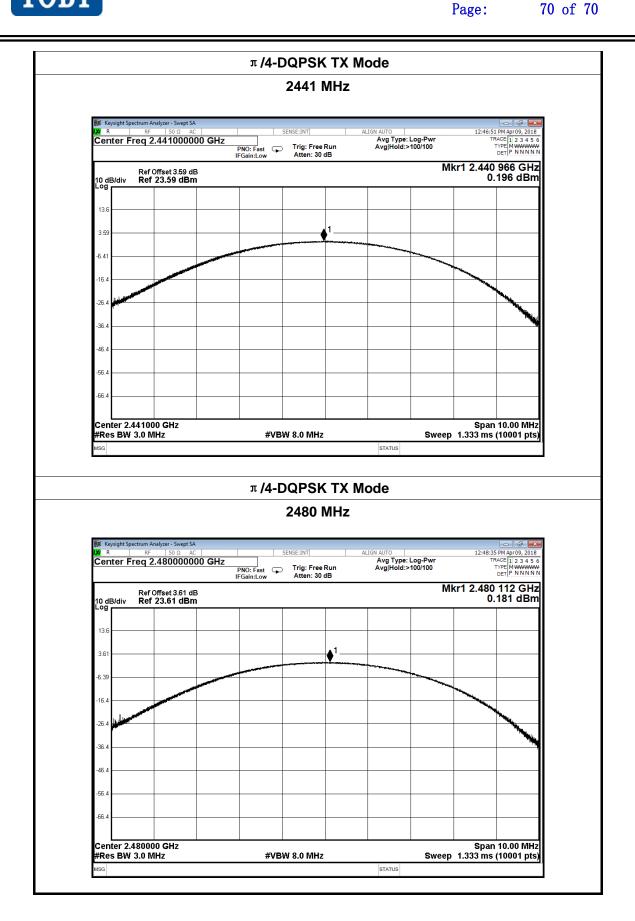
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Temperature:	25℃		Relative Humidity:	55%		
Test Voltage:	DC 12V					
Test Mode:	TX Mode	TX Mode ( π /4-DQPSK)				
Channel frequen	cy (MHz)	Test Result (dBm)		Limit (dBm)		
2402		-0.742				
2441		0.196		21		
2480		0.181				
T //-DOPSK TY Mode						

### π/4-DQPSK TX Mode







# ----END OF REPORT----