

# TEST REPORT

FCC ID: 2ABNBHX-P160

IC: 12171A-HXP160

Product: HMDX Geo

Model No.: HX-P160

Additional Model: N/A

Trade Mark: HMDX

Report No.: TCT160114E013

Issued Date: Jan. 28, 2016

Issued for:

GOLDEN CHINA AUDIO (HK) PRODUCT LIMITED (AOK)  
UNIT 2509, 25/F HO KING COMM CTR 2-16 FA YUEN ST KLN  
HONG KONG

Issued By:

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**Appendix A: Photographs of Test Setup****Appendix B: Photographs of EUT**

## 1. Test Certification

<b>Product:</b>	HMDX Geo
<b>Model No.:</b>	HX-P160
<b>Additional Model:</b>	N/A
<b>Applicant:</b>	GOLDEN CHINA AUDIO (HK) PRODUCT LIMITED (AOK)
<b>Address:</b>	UNIT 2509, 25/F HO KING COMM CTR 2-16 FA YUEN ST KLN HONG KONG
<b>Manufacturer:</b>	GOLDEN CHINA AUDIO (HK) PRODUCT LIMITED (AOK)
<b>Address:</b>	UNIT 2509, 25/F HO KING COMM CTR 2-16 FA YUEN ST KLN HONG KONG
<b>Date of Test:</b>	Jan. 14 - Jan. 27, 2016
<b>Applicable Standards:</b>	FCC CFR Title 47 Part 15 Subpart C Section 15.247 §RSS GEN, §RSS 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:

*Neil Wong*

Date:

*Jan. 26, 2016*

Reviewed By:

*Zhou*

Date:

*Jan. 28, 2016*

Approved By:

*Tomsin*

Date:

*Jan. 28, 2016*

## 2. Test Result Summary

Requirement	CFR 47/ IC Section	Result
Antenna Requirement	§15.203/§15.247 (c); §RSS Gen sect. 8.3	PASS
AC Power Line Conducted Emission	§15.207; §RSS Gen sect. 8.8	PASS
Conducted Peak Output Power	§15.247 (b)(1); §RSS 247 sect. 5.4(2)	PASS
20dB Occupied Bandwidth 99% Occupied Bandwidth	§15.247 (a)(1); §RSS 247 sect. 5.1(3); §RSS Gen sect. 6.6	PASS
Carrier Frequencies Separation	§15.247 (a)(1); §RSS 247 sect. 5.1(2)	PASS
Hopping Channel Number	§15.247 (a)(1); §RSS 247 sect. 5.1(4)	PASS
Dwell Time	§15.247 (a)(1); §RSS 247 sect. 5.1(4)	PASS
Radiated Emission	§15.205/§15.209; §RSS Gen sect. 8.9	PASS
Band Edge	§15.247(d); §RSS 247 sect. 5.5	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

<b>Product Name:</b>	HMDX Geo
<b>Model :</b>	HX-P160
<b>Additional Model:</b>	N/A
<b>Trade Mark:</b>	<b>HMDX</b>
<b>Operation Frequency:</b>	2402MHz~2480MHz
<b>Transfer Rate:</b>	1/2/3Mbits/s
<b>Number of Channel:</b>	79
<b>Modulation Type:</b>	GFSK, $\pi/4$ -DQPSK, 8DPSK
<b>Modulation Technology:</b>	FHSS
<b>Antenna Type:</b>	Internal Antenna
<b>Antenna Gain:</b>	2.1dBi
<b>Power Supply:</b>	DC 3.7V

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

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	20	2422MHz	40	2442MHz	60	2462MHz
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	-	-

Remark: Channel 0, 39 & 78 have been tested for GFSK,  $\pi/4$ -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
<p>The sample was placed 1.5m 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 &amp; 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.</p>	

### 4.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
Notebook	G485	/	/	Lenovo

#### Note:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.
3. For conducted measurements (Output Power, 20dB Occupied Bandwidth, Carrier Frequencies Separation, Hopping Channel Number, Dwell Time, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.

## 5. Facilities and Accreditations

### 5.1. Facilities

The test facility is recognized, certified, or accredited by the following organizations:

- FCC - Registration No.: 572331

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

- CNAS - Registration No.: CNAS L6165

Shenzhen TCT Testing Technology Co., Ltd. is accredited to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L6165.

### 5.2. Location

Shenzhen Tongce Testing Lab

Address: 1F, Leinuo Watch Building, Fuyong Town, Baoan Dist, Shenzhen, China

Tel: 86-755-36638142

### 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	$\pm 2.56\text{dB}$
2	RF power, conducted	$\pm 0.12\text{dB}$
3	Spurious emissions, conducted	$\pm 0.11\text{dB}$
4	All emissions, radiated(<1G)	$\pm 3.92\text{dB}$
5	All emissions, radiated(>1G)	$\pm 4.28\text{dB}$
6	Temperature	$\pm 0.1^\circ\text{C}$
7	Humidity	$\pm 1.0\%$

## 6. Test Results and Measurement Data

### 6.1. Antenna requirement

<b>Standard requirement:</b>	FCC Part15 C Section 15.203 /247(c); RSS Gen section 8.3
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The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level.<sup>9</sup> When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

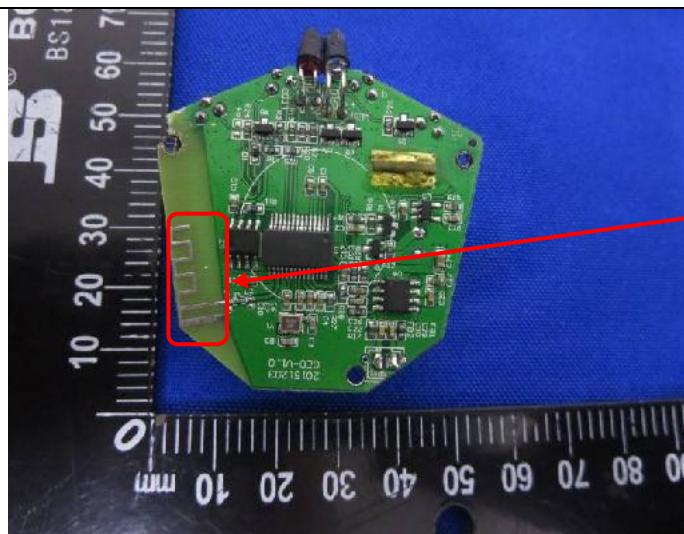
User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

*This radio transmitter (identify the device by certification number or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.*

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

#### E.U.T Antenna:

The Bluetooth antenna is an 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

<b>Test Requirement:</b>	FCC Part15 C Section 15.207; RSS Gen														
<b>Test Method:</b>	ANSI C63.4:2014														
<b>Frequency Range:</b>	150 kHz to 30 MHz														
<b>Receiver setup:</b>	RBW=9 kHz, VBW=30 kHz, Sweep time=auto														
<b>Limits:</b>	<table border="1"> <thead> <tr> <th rowspan="2">Frequency range (MHz)</th> <th colspan="2">Limit (dBuV)</th> </tr> <tr> <th>Quasi-peak</th> <th>Average</th> </tr> </thead> <tbody> <tr> <td>0.15-0.5</td> <td>66 to 56*</td> <td>56 to 46*</td> </tr> <tr> <td>0.5-5</td> <td>56</td> <td>46</td> </tr> <tr> <td>5-30</td> <td>60</td> <td>50</td> </tr> </tbody> </table>	Frequency range (MHz)	Limit (dBuV)		Quasi-peak	Average	0.15-0.5	66 to 56*	56 to 46*	0.5-5	56	46	5-30	60	50
Frequency range (MHz)	Limit (dBuV)														
	Quasi-peak	Average													
0.15-0.5	66 to 56*	56 to 46*													
0.5-5	56	46													
5-30	60	50													
<b>Test Setup:</b>	<p>Reference Plane</p> <p>E.U.T      AC power      LISN      Filter      AC power</p> <p>Test table/Insulation plane</p> <p>40cm      80cm</p> <p>EMI Receiver</p> <p>Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p>														
<b>Test Mode:</b>	Refer to item 4.1														
<b>Test Procedure:</b>	<ol style="list-style-type: none"> <li>The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.</li> <li>The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).</li> <li>Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.</li> </ol>														
<b>Test Result:</b>	PASS														

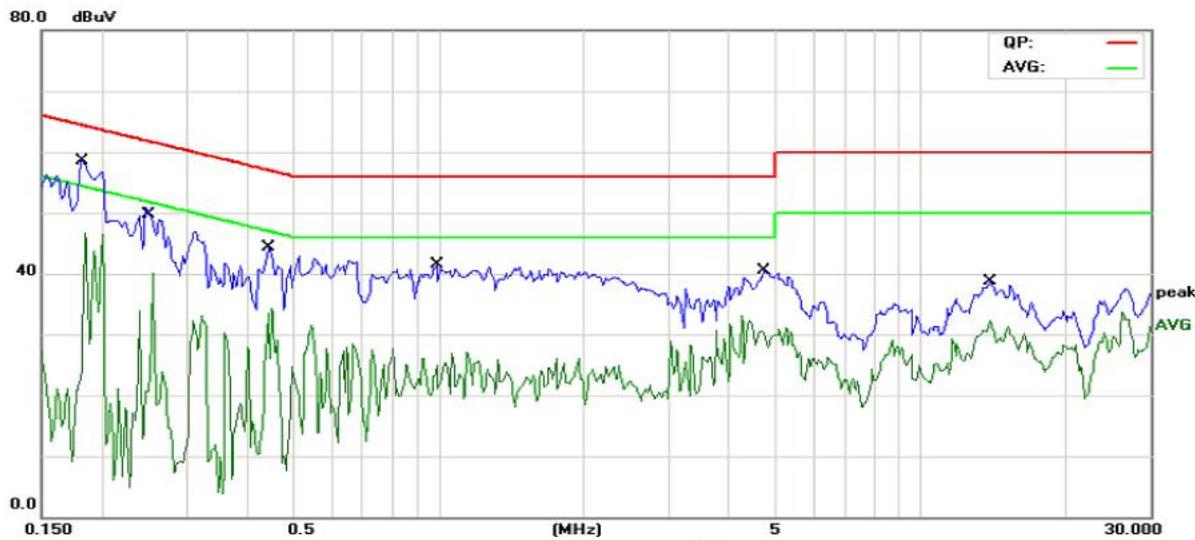
### 6.2.2. Test Instruments

Conducted Emission Shielding Room Test Site (843)				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESCS30	100139	Sep. 11, 2016
LISN	Schwarzbeck	NSLK 8126	8126453	Sep. 16, 2016
Coax cable	TCT	CE-05	N/A	Sep. 11, 2016
EMI Test Software	Shurples 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)**



Site Chamber #2				Phase:	L1	Temperature:	23 (C)
Limit: FCC Part 15B Class B Conduction(QP)				Power:	AC 110V/60Hz	Humidity:	54 %
No.	Mk.	Reading Level	Correct Factor	Measurement	Limit	Over	
		MHz	dBuV	dB	dBuV	dB	Detector
1	*	0.1852	43.66	11.50	55.16	-9.08	QP
2		0.1852	27.08	11.50	38.58	-15.66	AVG
3		0.2535	35.13	11.45	46.58	-15.06	QP
4		0.2535	17.79	11.45	29.24	-22.40	AVG
5		0.4469	28.65	11.34	39.99	-16.94	QP
6		0.4469	14.20	11.34	25.54	-21.39	AVG
7		0.9938	25.70	11.18	36.88	-19.12	QP
8		0.9938	10.04	11.18	21.22	-24.78	AVG
9		4.7227	24.47	10.72	35.19	-20.81	QP
10		4.7227	13.36	10.72	24.08	-21.92	AVG
11		13.9180	21.70	11.57	33.27	-26.73	QP
12		13.9180	13.65	11.57	25.22	-24.78	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

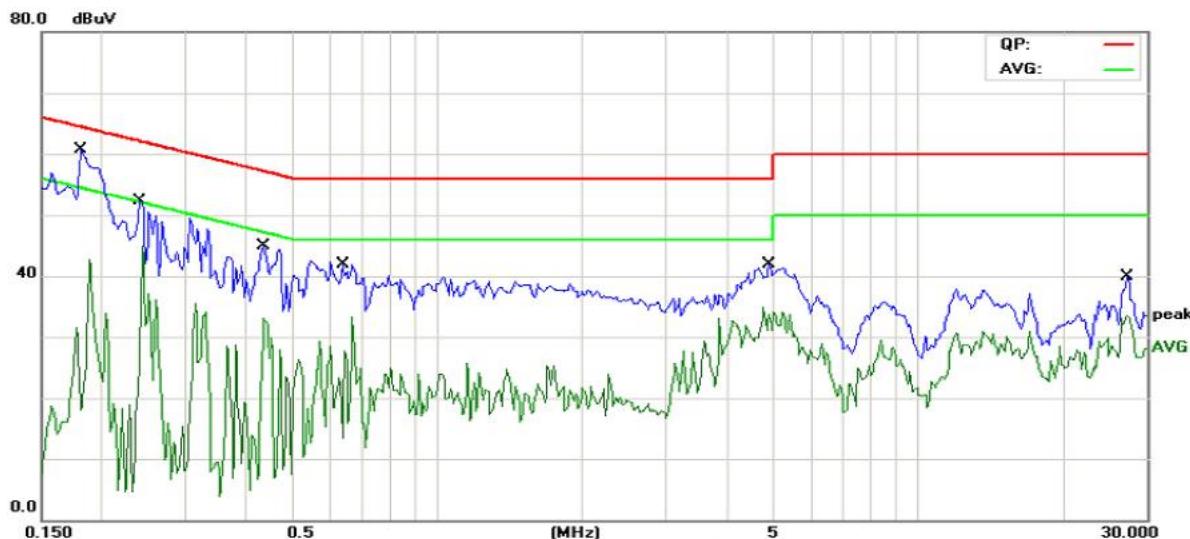
Margin (dB) = Measurement (dB $\mu$ V) - Limits (dB $\mu$ V)

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 Chamber #2				Phase: <i>N</i>			Temperature: 23 (C)	
Limit: FCC Part 15B Class B Conduction(QP)				Power: AC 110V/60Hz			Humidity: 54 %	
No.	Mk.	Freq. MHz	Reading Level dB $\mu$ V	Correct Factor dB	Measure- ment dB $\mu$ V	Limit dB $\mu$ V	Over Detector	Comment
1 *		0.1812	45.45	11.50	56.95	64.43	-7.48	QP
2		0.1812	25.72	11.50	37.22	54.43	-17.21	AVG
3		0.2398	35.34	11.46	46.80	62.10	-15.30	QP
4		0.2398	14.67	11.46	26.13	52.10	-25.97	AVG
5		0.4352	29.10	11.34	40.44	57.15	-16.71	QP
6		0.4352	15.37	11.34	26.71	47.15	-20.44	AVG
7		0.6344	25.12	11.24	36.36	56.00	-19.64	QP
8		0.6344	8.03	11.24	19.27	46.00	-26.73	AVG
9		4.9023	25.97	10.66	36.63	56.00	-19.37	QP
10		4.9023	15.12	10.66	25.78	46.00	-20.22	AVG
11		27.3984	21.74	10.71	32.45	60.00	-27.55	QP
12		27.3984	14.20	10.71	24.91	50.00	-25.09	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

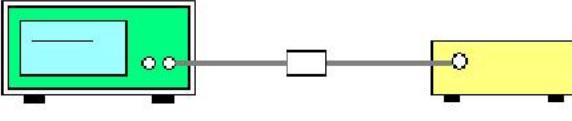
\* is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.

#### Note2:

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

## 6.3. Conducted Output Power

### 6.3.1. Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.247 (b)(3); RSS 247 sect. 5.4(2)
<b>Test Method:</b>	ANSI C63.10:2013 and DA00-705
<b>Limit:</b>	Section 5.4 (2) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.
<b>Test Setup:</b>	 Spectrum Analyzer      EUT
<b>Test Mode:</b>	Transmitting mode with modulation
<b>Test Procedure:</b>	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 $VBW \geq RBW$ 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.
<b>Test Result:</b>	PASS

### 6.3.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Sep. 11, 2016
RF Cable	TCT	RE-06	N/A	Sep. 12, 2016
Antenna Connector	TCT	RFC-01	N/A	Sep. 12, 2016

**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**

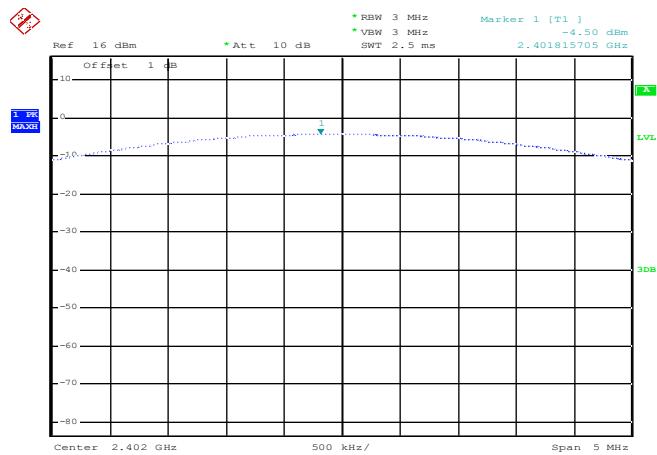
GFSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	-4.50	21.00	PASS
Middle	-3.79	21.00	PASS
Highest	-4.20	21.00	PASS

Pi/4DQPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	-5.40	21.00	PASS
Middle	-5.16	21.00	PASS
Highest	-5.36	21.00	PASS

8DPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	-5.48	21.00	PASS
Middle	-5.16	21.00	PASS
Highest	-5.36	21.00	PASS

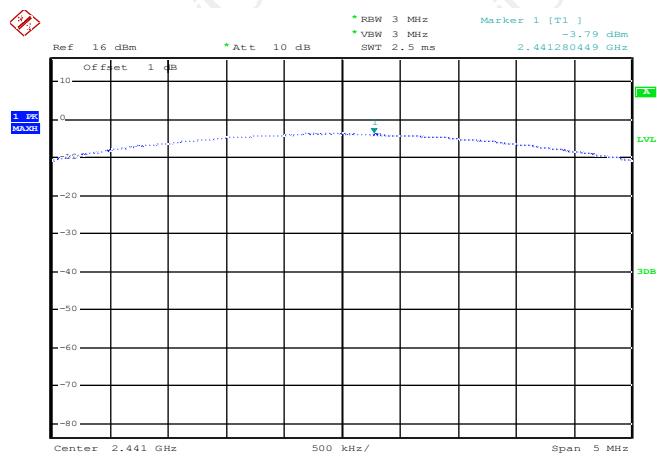
**Test plots as follows:**

### Lowest channel



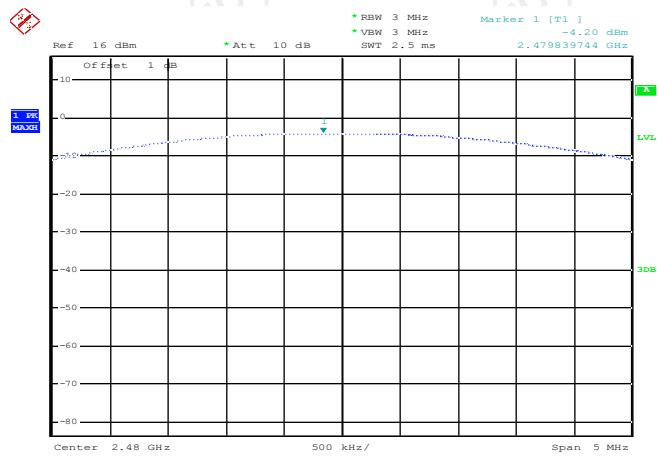
Date: 27.JAN.2016 09:22:24

### Middle channel



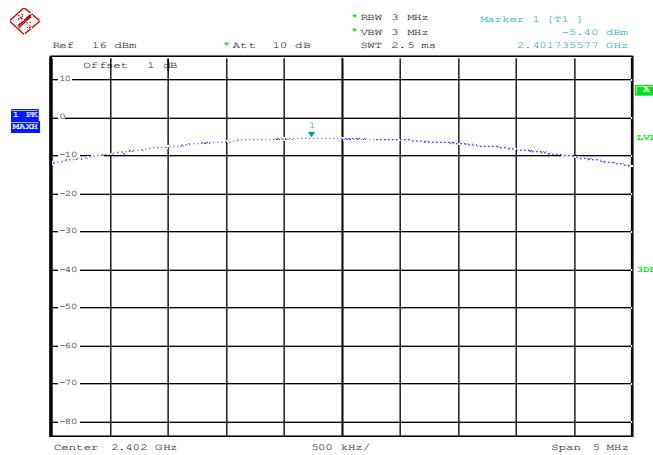
Date: 27.JAN.2016 09:25:13

### Highest channel



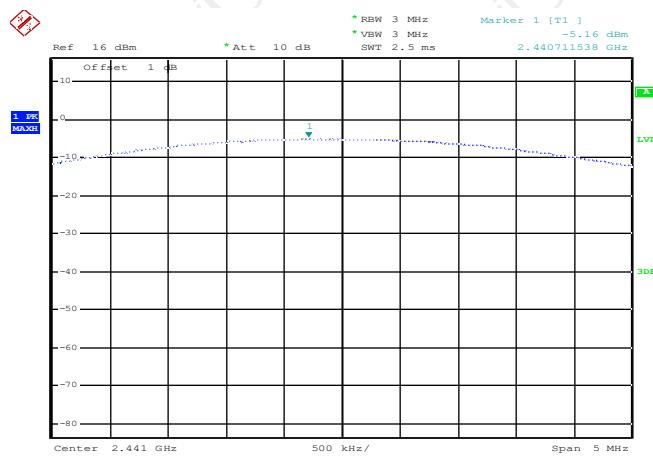
Date: 27.JAN.2016 09:25:45

### Lowest channel



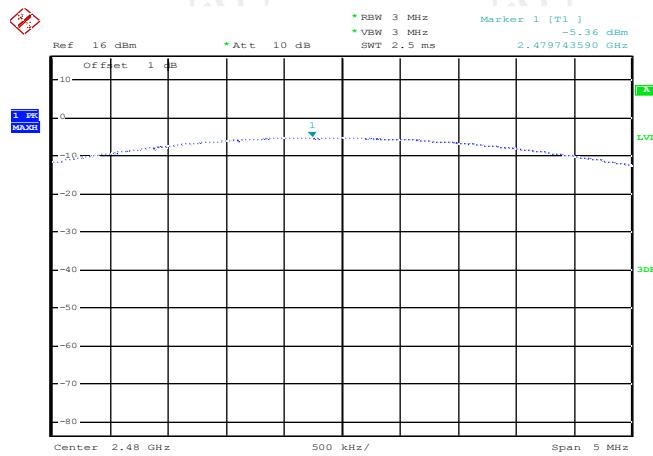
Date: 27.JAN.2016 09:23:06

### Middle channel



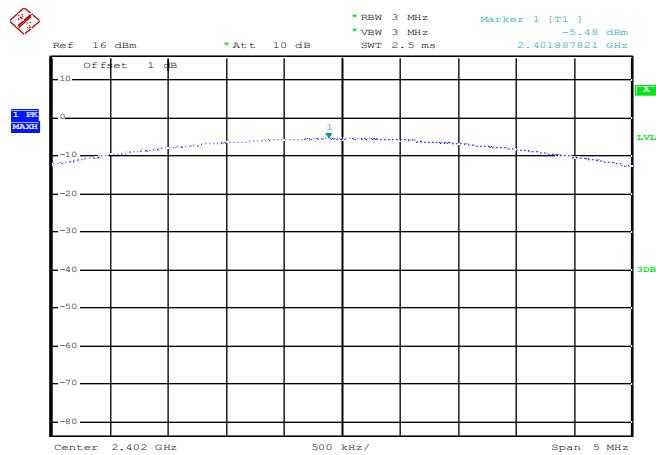
Date: 27.JAN.2016 09:24:44

### Highest channel



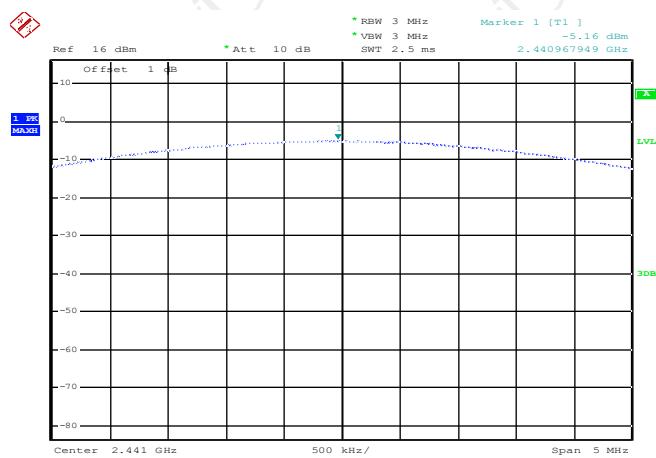
Date: 27.JAN.2016 09:26:15

### Lowest channel



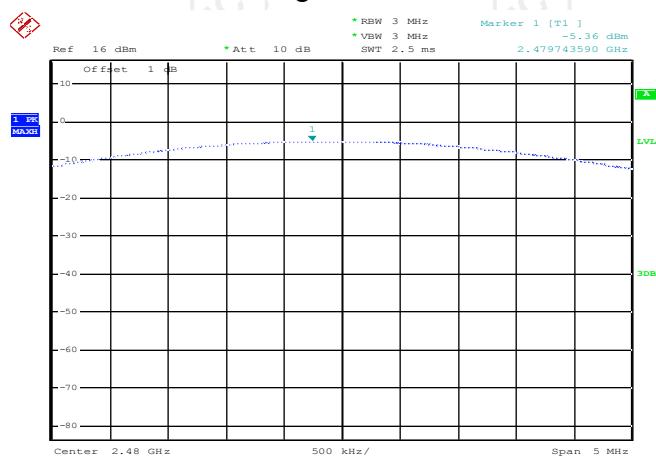
Date: 27.JAN.2016 09:23:34

### Middle channel



Date: 27.JAN.2016 09:24:10

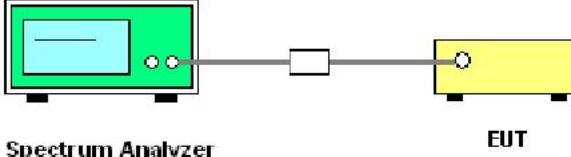
### Highest channel



Date: 27.JAN.2016 09:26:58

#### 6.4. 20dB & 99% Occupy Bandwidth

#### **6.4.1. Test Specification**

<b>Test Requirement:</b>	FCC Part15 C Section 15.247 (a)(1); RSS 247 sect. 5.1(3), RSS Gen sect. 6.6
<b>Test Method:</b>	ANSI C63.10:2013 and DA00-705
<b>Limit:</b>	N/A
<b>Test Setup:</b>	 <p style="text-align: center;"><b>Spectrum Analyzer</b>                            <b>EUT</b></p>
<b>Test Mode:</b>	Transmitting mode with modulation
<b>Test Procedure:</b>	<ol style="list-style-type: none"> <li>1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.</li> <li>2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.</li> <li>3. Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>4. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.            Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel; RBW<math>\geq</math>1% of the 20 dB bandwidth; VBW<math>\geq</math>RBW; Sweep = auto; Detector function = peak; Trace = max hold.            Use the power bandwidth function to measure 99% bandwidth.</li> <li>5. Measure and record the results in the test report.</li> </ol>
<b>Test Result:</b>	PASS

### **6.4.2. Test Instruments**

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Sep. 11, 2016
RF cable	TCT	RE-06	N/A	Sep. 12, 2016
Antenna Connector	TCT	RFC-01	N/A	Sep. 12, 2016

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

**6.4.3. Test data**

Test channel	20dB Occupy Bandwidth (kHz)			
	GFSK	$\pi/4$ -DQPSK	8DPSK	Conclusion
Lowest	1044.87	1128.21	1208.33	PASS
Middle	1044.87	1128.21	1211.54	PASS
Highest	1044.87	1128.21	1205.13	PASS

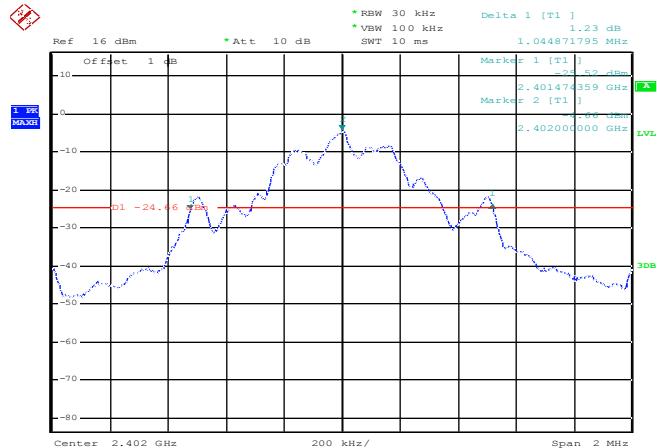
Test channel	99% Occupy Bandwidth (kHz)			
	GFSK	$\pi/4$ -DQPSK	8DPSK	Conclusion
Lowest	974.36	977.56	974.36	PASS
Middle	977.56	971.15	974.36	PASS
Highest	971.15	1070.51	1141.03	PASS

Test plots as follows:

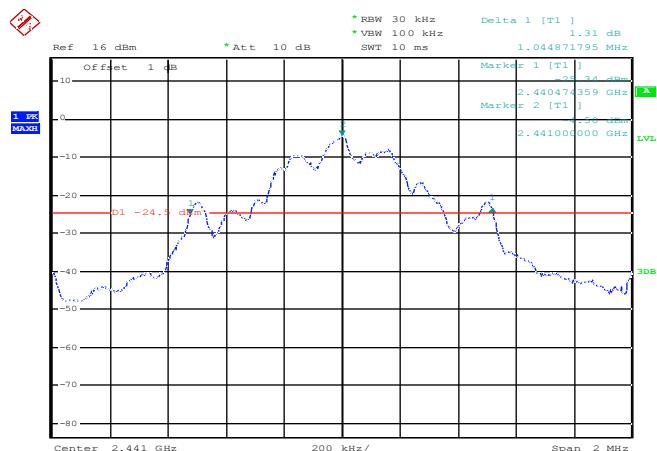
## 20dB Occupy Bandwidth

### GFSK Modulation

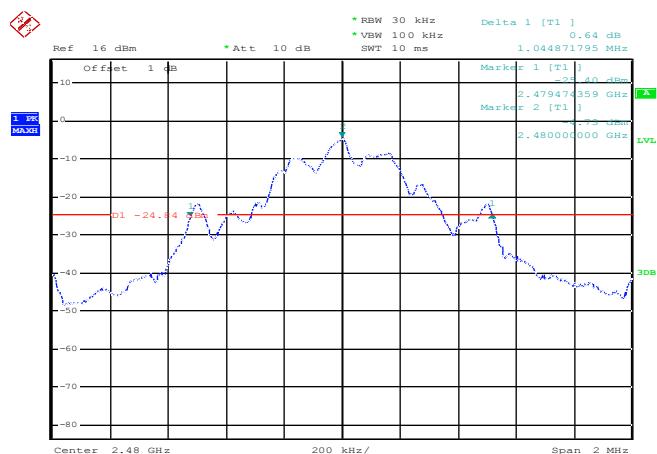
#### Lowest channel



#### Middle channel

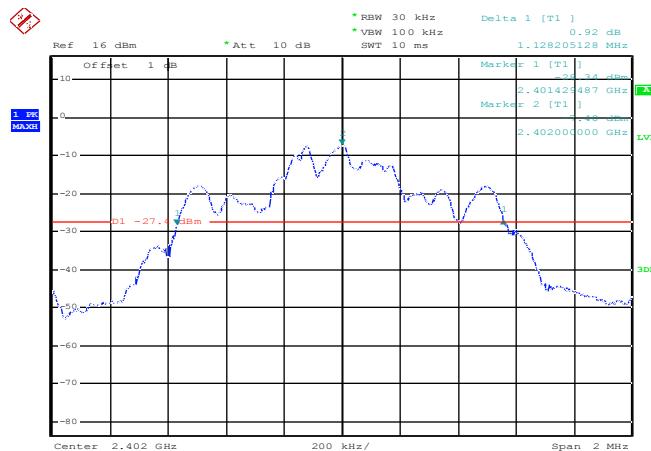


#### Highest channel



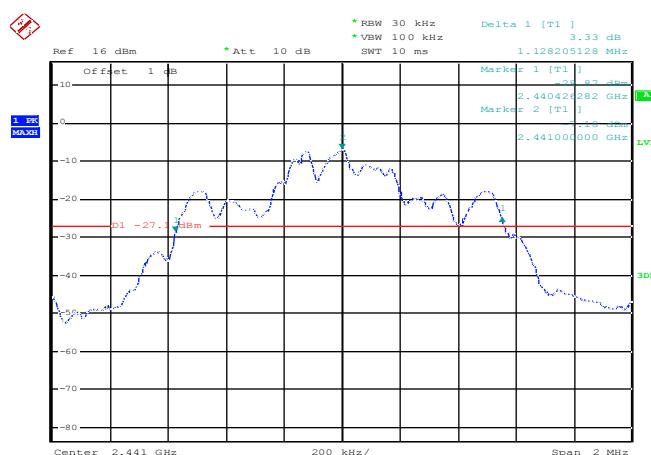
## Pi/4DQPSK Modulation

### Lowest channel



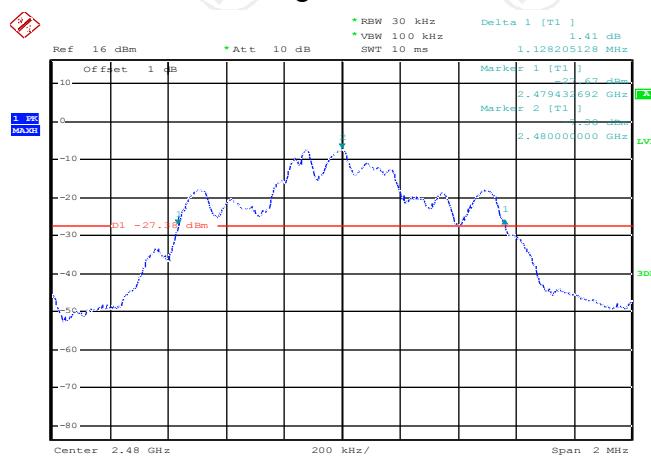
Date: 27.JAN.2016 09:30:06

### Middle channel



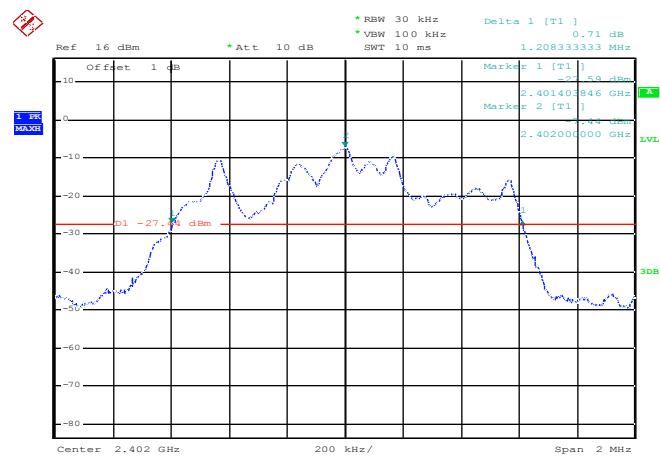
Date: 27.JAN.2016 09:33:09

### Highest channel

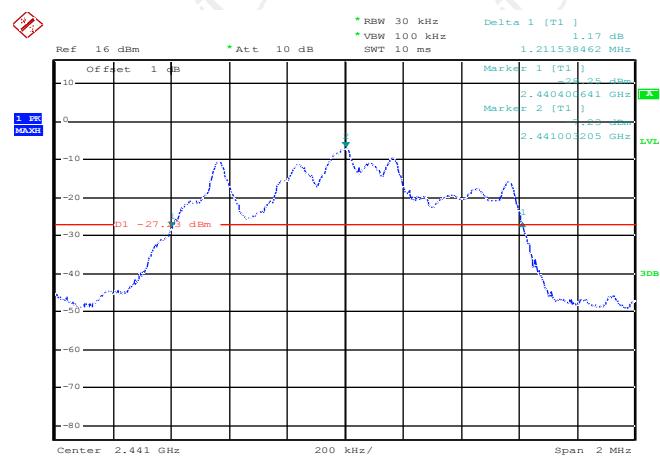


Date: 27.JAN.2016 09:35:36

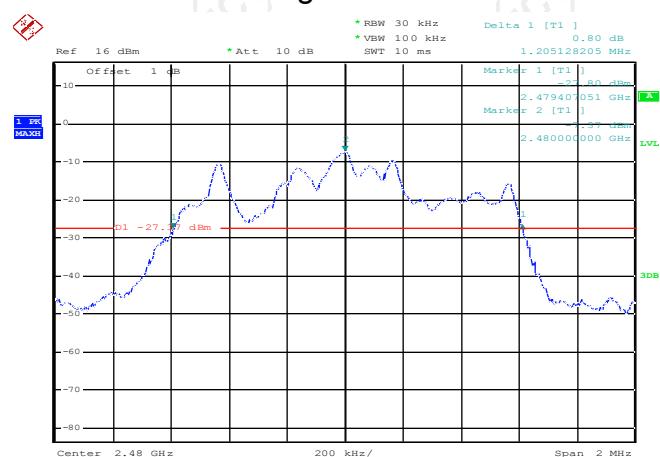
### Lowest channel



### Middle channel

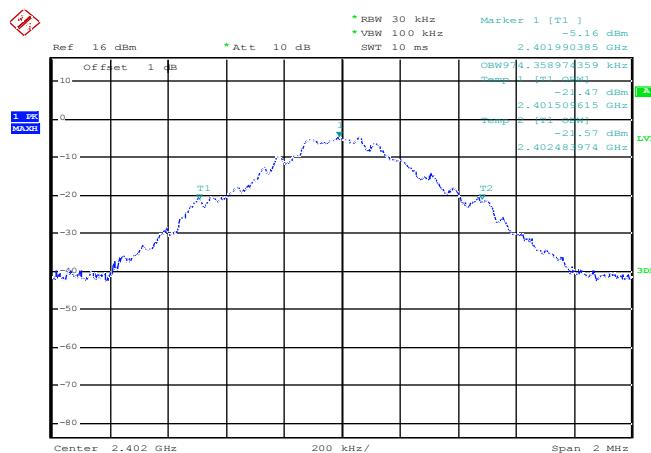


### Highest channel

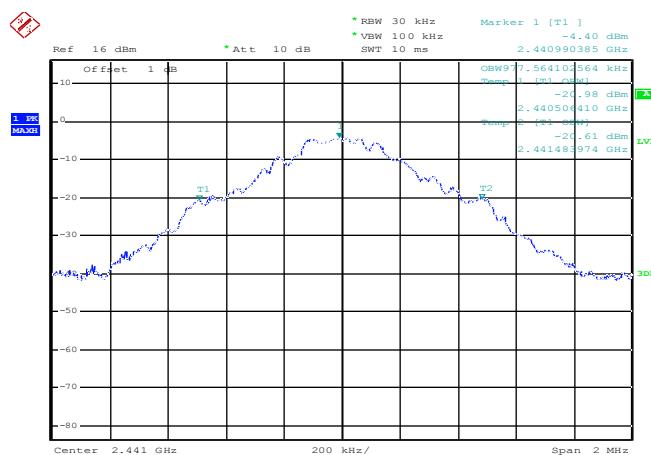


**GFSK Modulation**

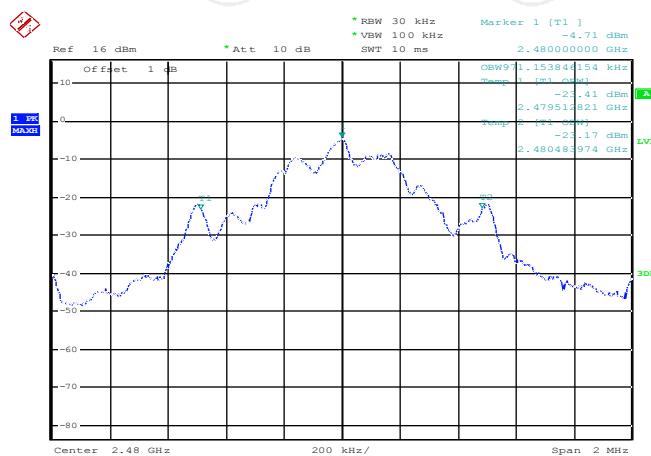
99% Occupy Bandwidth

**Lowest channel**


Date: 27.JAN.2016 09:50:50

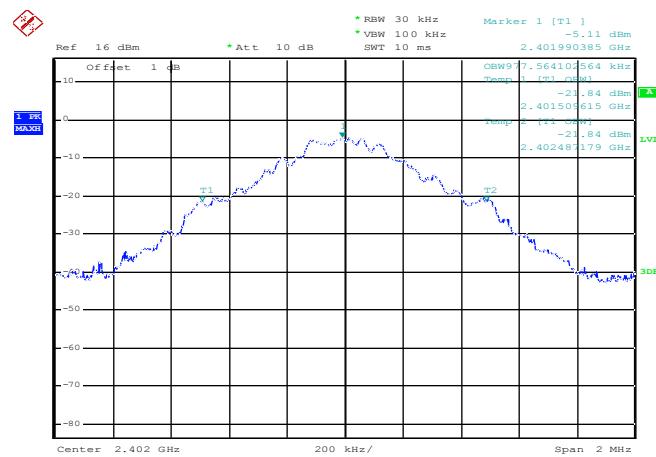
**Middle channel**


Date: 27.JAN.2016 09:48:03

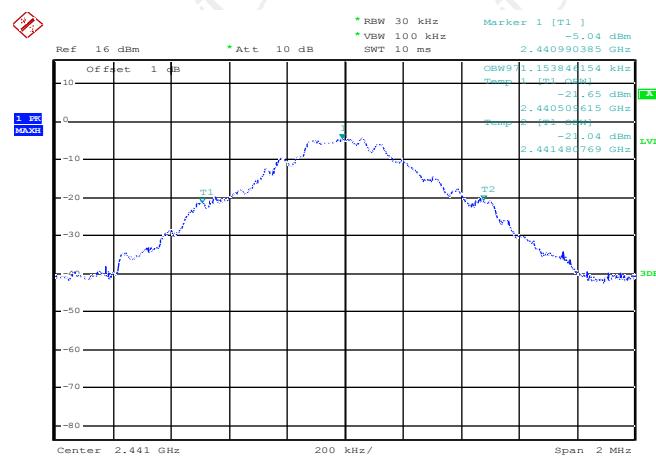
**Highest channel**


Date: 27.JAN.2016 09:47:02

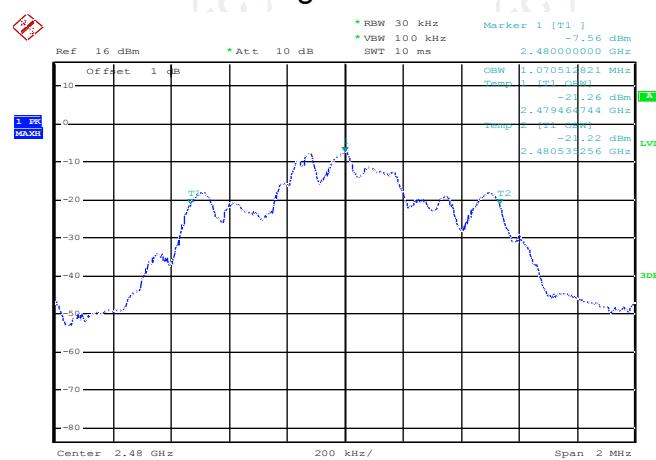
### Lowest channel



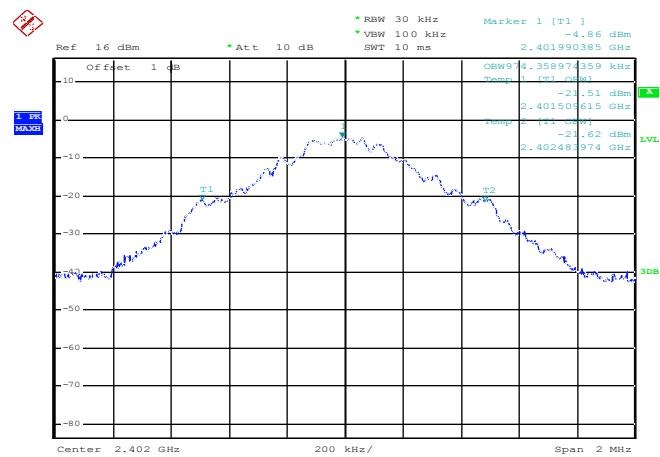
### Middle channel



### Highest channel

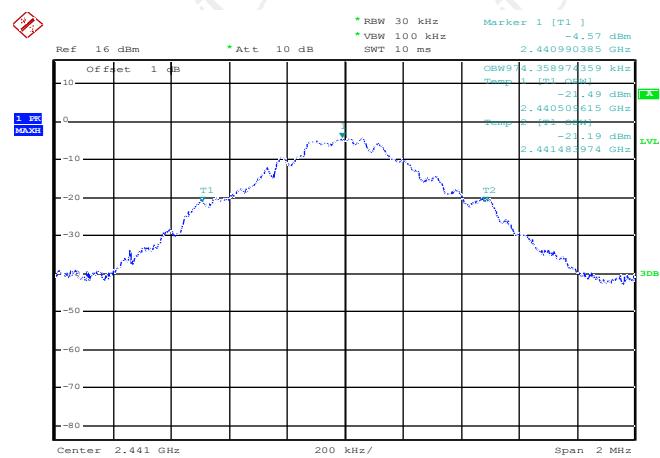


### Lowest channel



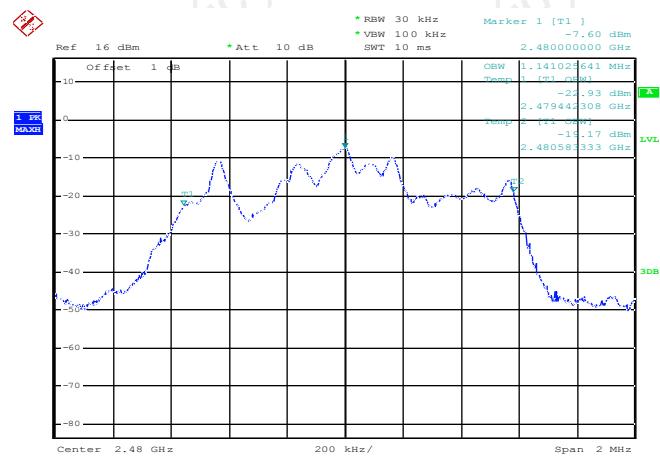
Date: 27.JAN.2016 09:49:48

### Middle channel



Date: 27.JAN.2016 09:49:16

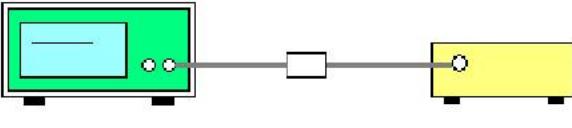
### Highest channel



Date: 27.JAN.2016 09:46:00

## 6.5. Carrier Frequencies Separation

### 6.5.1. Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.247 (a)(1); RSS 247 sect. 5.1(2)
<b>Test Method:</b>	ANSI C63.10:2013 and DA00-705
<b>Limit:</b>	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.
<b>Test Setup:</b>	 <p>The diagram illustrates the test setup. A green 'Spectrum Analyzer' is connected via an RF cable to a white 'Attenuator', which is then connected to a yellow 'EUT' (Equipment Under Test).</p>
<b>Test Mode:</b>	Hopping mode
<b>Test Procedure:</b>	<ol style="list-style-type: none"> <li>1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.</li> <li>2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.</li> <li>3. Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>4. Enable the EUT hopping function.</li> <li>5. Use the following spectrum analyzer settings: Span = wide enough to capture the peaks of two adjacent channels; RBW<math>\geq</math>1% of the span; VBW<math>\geq</math>RBW; Sweep = auto; Detector function = peak; Trace = max hold.</li> <li>6. Measure and record the results in the test report.</li> </ol>
<b>Test Result:</b>	PASS

### 6.5.2. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Sep. 11, 2016
RF cable	TCT	RE-06	N/A	Sep. 12, 2016
Antenna Connector	TCT	RFC-01	N/A	Sep. 12, 2016

**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	696.58	PASS
Middle	1000	696.58	PASS
Highest	1000	696.58	PASS

Pi/4 DQPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1000	752.14	PASS
Middle	1000	752.14	PASS
Highest	1000	752.14	PASS

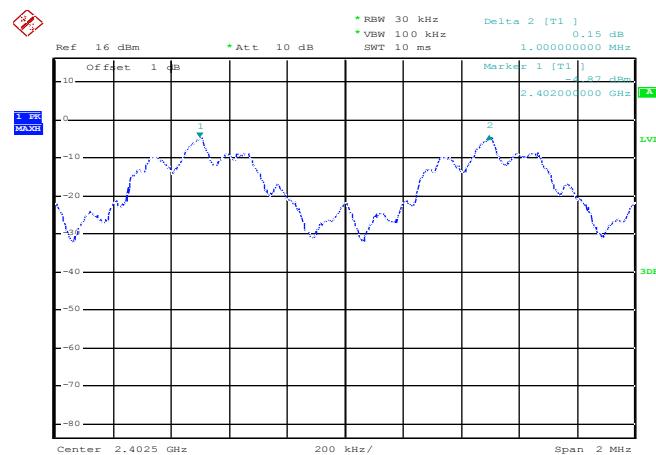
8DPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1000	807.69	PASS
Middle	1000	807.69	PASS
Highest	1000	807.69	PASS

Note: According to section 6.4

Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
GFSK	1044.87	696.58
$\pi/4$ -DQPSK	1128.21	752.14
8DPSK	1211.54	807.69

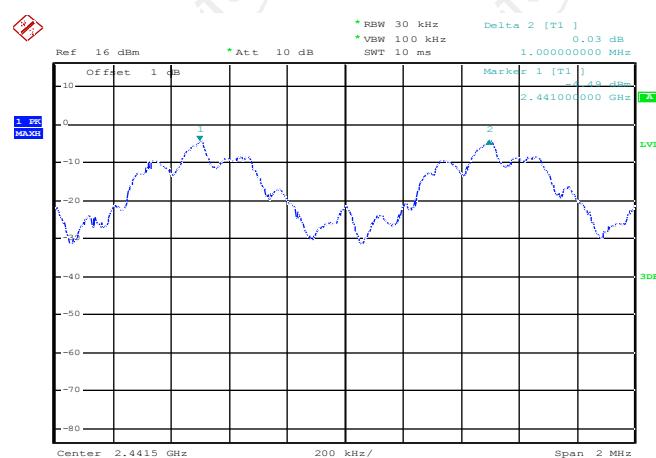
Test plots as follows:

### Lowest channel



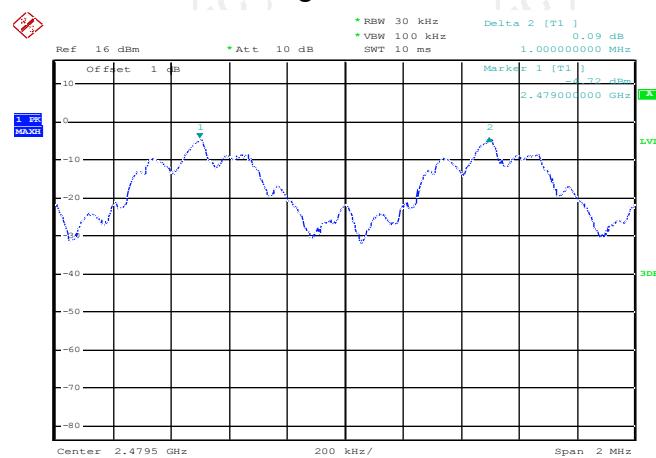
Date: 27.JAN.2016 09:37:22

### Middle channel



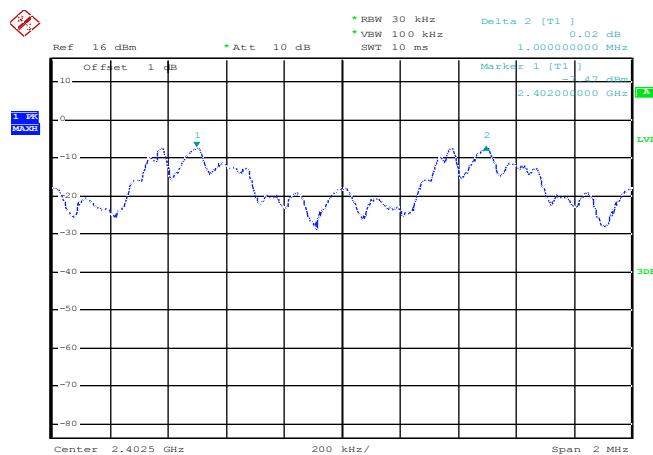
Date: 27.JAN.2016 09:42:08

### Highest channel



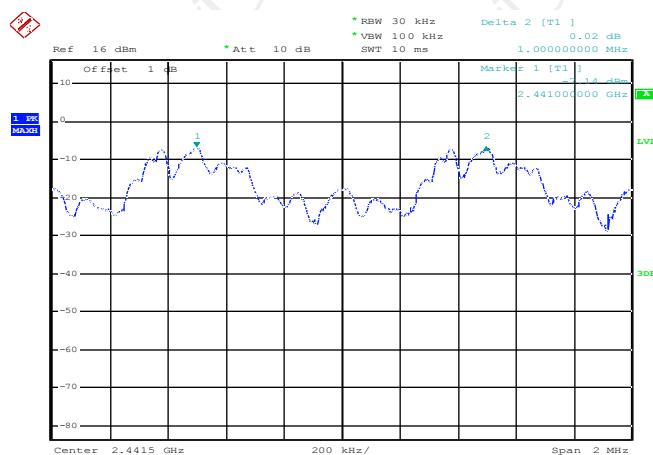
Date: 27.JAN.2016 09:42:59

### Lowest channel



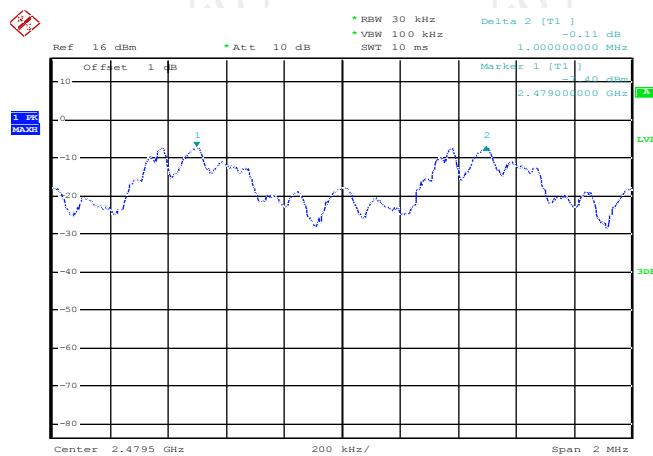
Date: 27.JAN.2016 09:38:12

### Middle channel



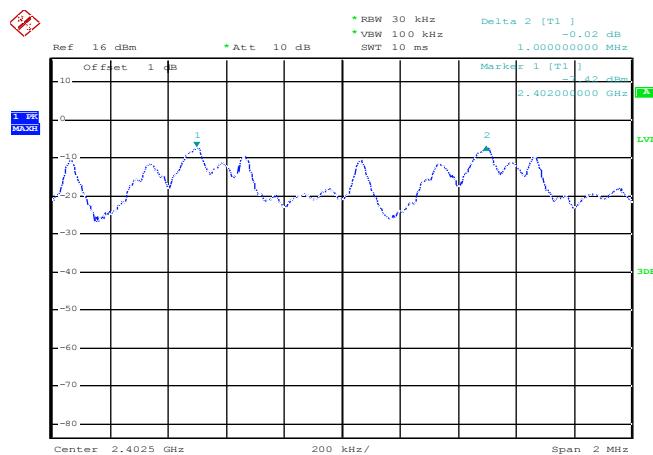
Date: 27.JAN.2016 09:41:17

### Highest channel



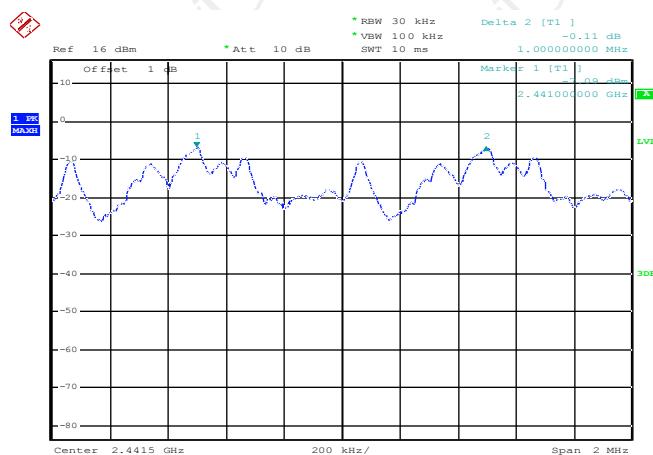
Date: 27.JAN.2016 09:43:55

### Lowest channel



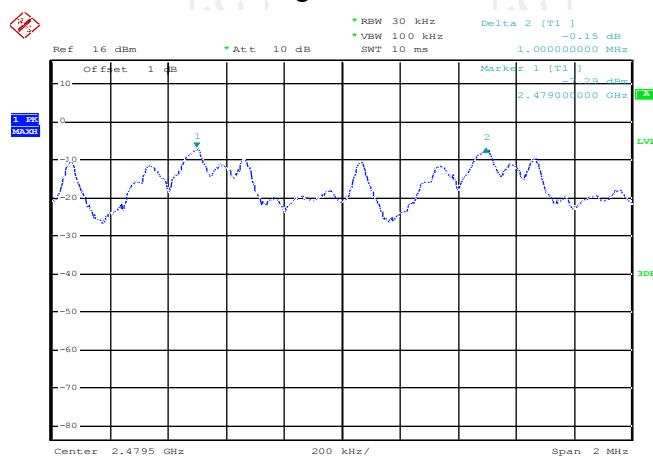
Date: 27.JAN.2016 09:39:07

### Middle channel



Date: 27.JAN.2016 09:40:14

### Highest channel



Date: 27.JAN.2016 09:44:50

## 6.6. Hopping Channel Number

### 6.6.1. Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.247 (a)(1); RSS 247 sect. 5.1(4)
<b>Test Method:</b>	ANSI C63.10:2013 and DA00-705
<b>Limit:</b>	Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
<b>Test Setup:</b>	<p>The diagram illustrates the test setup. A green 'Spectrum Analyzer' is connected by a grey RF cable to a white 'Attenuator'. This is followed by another grey RF cable leading to a yellow 'EUT' (Equipment Under Test).</p>
<b>Test Mode:</b>	Hopping mode
<b>Test Procedure:</b>	<ol style="list-style-type: none"> <li>1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.</li> <li>2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.</li> <li>3. Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>4. Enable the EUT hopping function.</li> <li>5. Use the following spectrum analyzer settings: Span = the frequency band of operation; RBW <math>\geq</math> 1% of the span; VBW <math>\geq</math> RBW; Sweep = auto; Detector function = peak; Trace = max hold.</li> <li>6. The number of hopping frequency used is defined as the number of total channel.</li> <li>7. Record the measurement data derived from spectrum analyzer.</li> </ol>
<b>Test Result:</b>	PASS

### 6.6.2. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Sep. 11, 2016
RF cable	TCT	RE-06	N/A	Sep. 12, 2016
Antenna Connector	TCT	RFC-01	N/A	Sep. 12, 2016

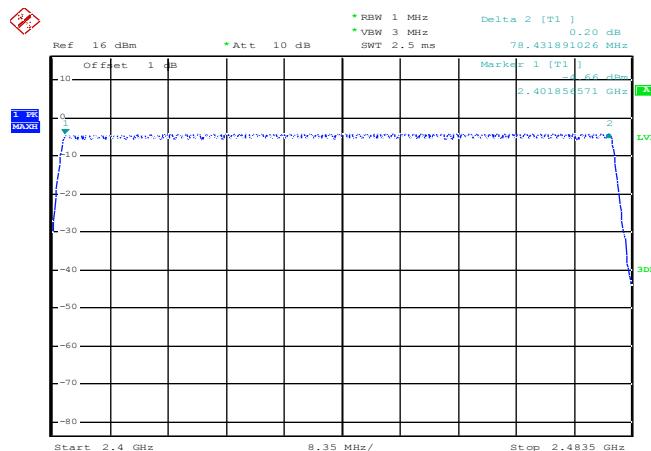
**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

**6.6.3. Test data**

Mode	Hopping channel numbers	Limit	Result
GFSK, P/4-DQPSK,8DPSK	79	15	PASS

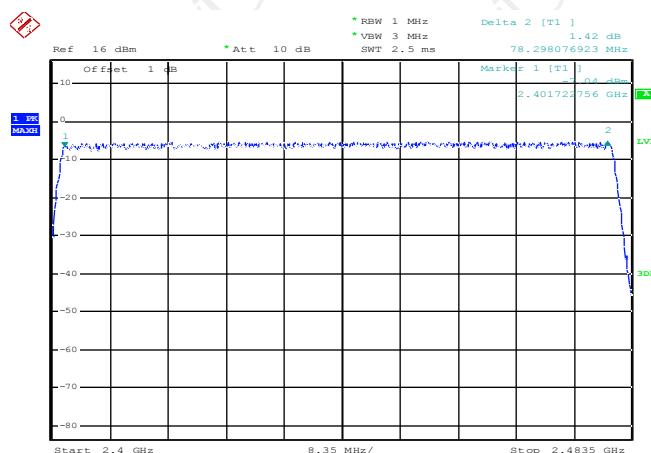
**Test plots as follows:**

## GFSK



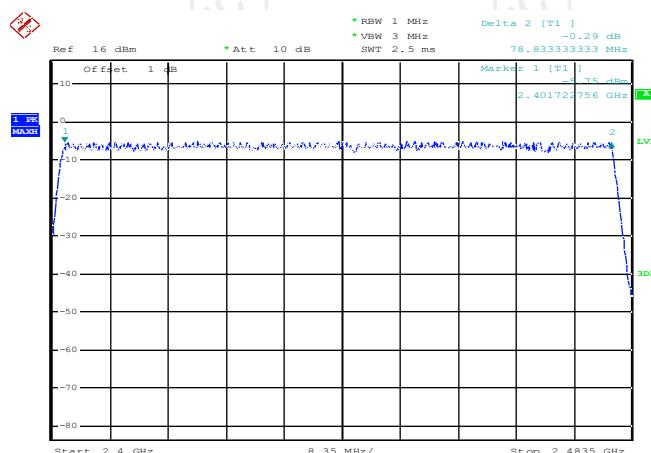
Date: 27.JAN.2016 09:52:10

## Pi/4DQPSK



Date: 27.JAN.2016 09:53:40

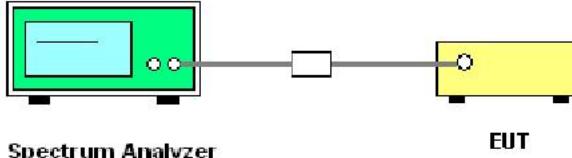
## 8DPSK



Date: 27.JAN.2016 09:54:39

## 6.7. Dwell Time

### 6.7.1. Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.247 (a)(1); RSS 247 sect. 5.1(4)
<b>Test Method:</b>	ANSI C63.10:2013 and DA00-705
<b>Limit:</b>	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.
<b>Test Setup:</b>	 <p style="text-align: center;"><b>Spectrum Analyzer</b>                           <b>EUT</b></p>
<b>Test Mode:</b>	Hopping mode
<b>Test Procedure:</b>	<ol style="list-style-type: none"> <li>1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.</li> <li>2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.</li> <li>3. Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>4. Enable the EUT hopping function.</li> <li>5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW≥RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.</li> <li>6. Measure and record the results in the test report.</li> </ol>
<b>Test Result:</b>	PASS

### 6.7.2. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Sep. 11, 2016
RF cable	TCT	RE-06	N/A	Sep. 12, 2016
Antenna Connector	TCT	RFC-01	N/A	Sep. 12, 2016

**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

Mode	Packet	Hops Over Occupancy Time (hops)	Package Transfer Time (ms)	Dwell time (second)	Limit (second)	Result
GFSK	DH5	106.67	2.997	0.320	0.4	PASS
Pi/4 DQPSK	2-DH5	106.67	3.006	0.321	0.4	PASS
8DPSK	3-DH5	106.67	3.006	0.321	0.4	PASS

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

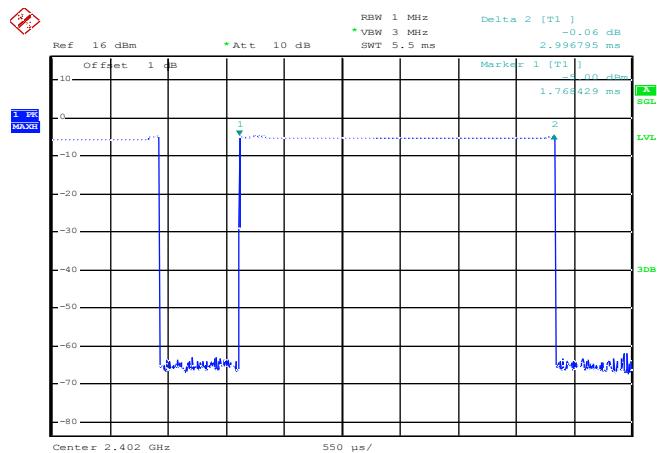
With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit (0.4 x 79) (s), Hops Over Occupancy Time comes to  $(1600 / 6 / 79) \times (0.4 \times 79) = 106.67$  hops

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

Test plots as follows:

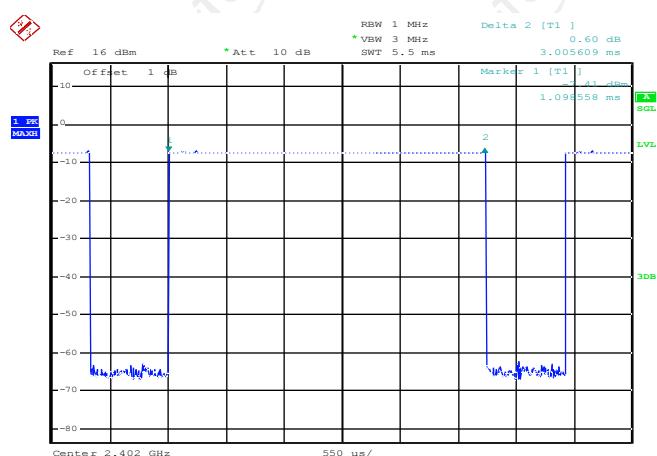


## GFSK



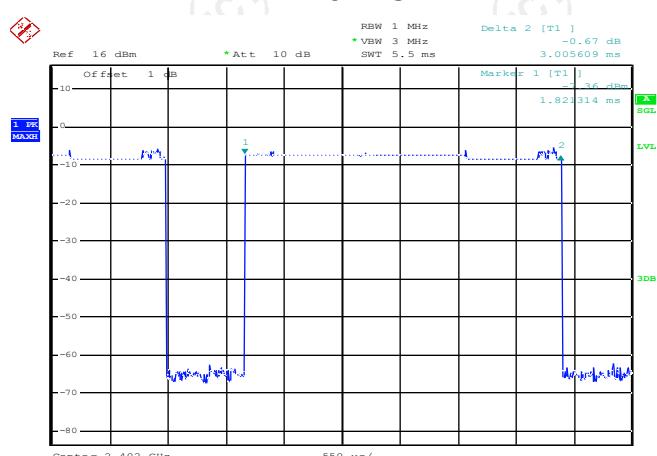
Date: 27.JAN.2016 09:55:34

## Pi/4DQPSK



Date: 27.JAN.2016 09:56:12

## 8DPSK



Date: 27.JAN.2016 09:56:54

## 6.8. Pseudorandom Frequency Hopping Sequence

<b>Test Requirement:</b>	FCC Part15 C Section 15.247 (a)(1) requirement; RSS 247 sect. 5.1(2) requirement
--------------------------	---

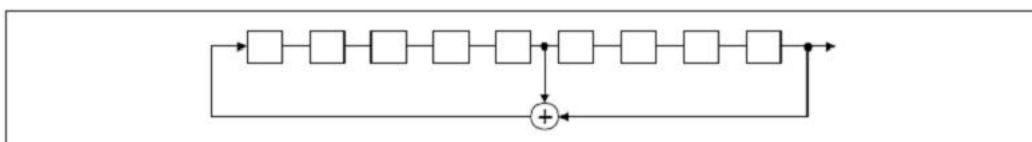
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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

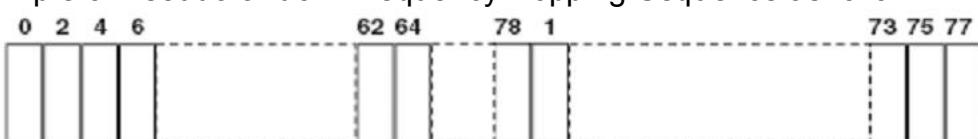
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones; i.e. the shift register is initialized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

- Number of shift register stages: 9
- Length of pseudo-random sequence:  $2^9 - 1 = 511$  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**

### **6.9.2. Test Instruments**

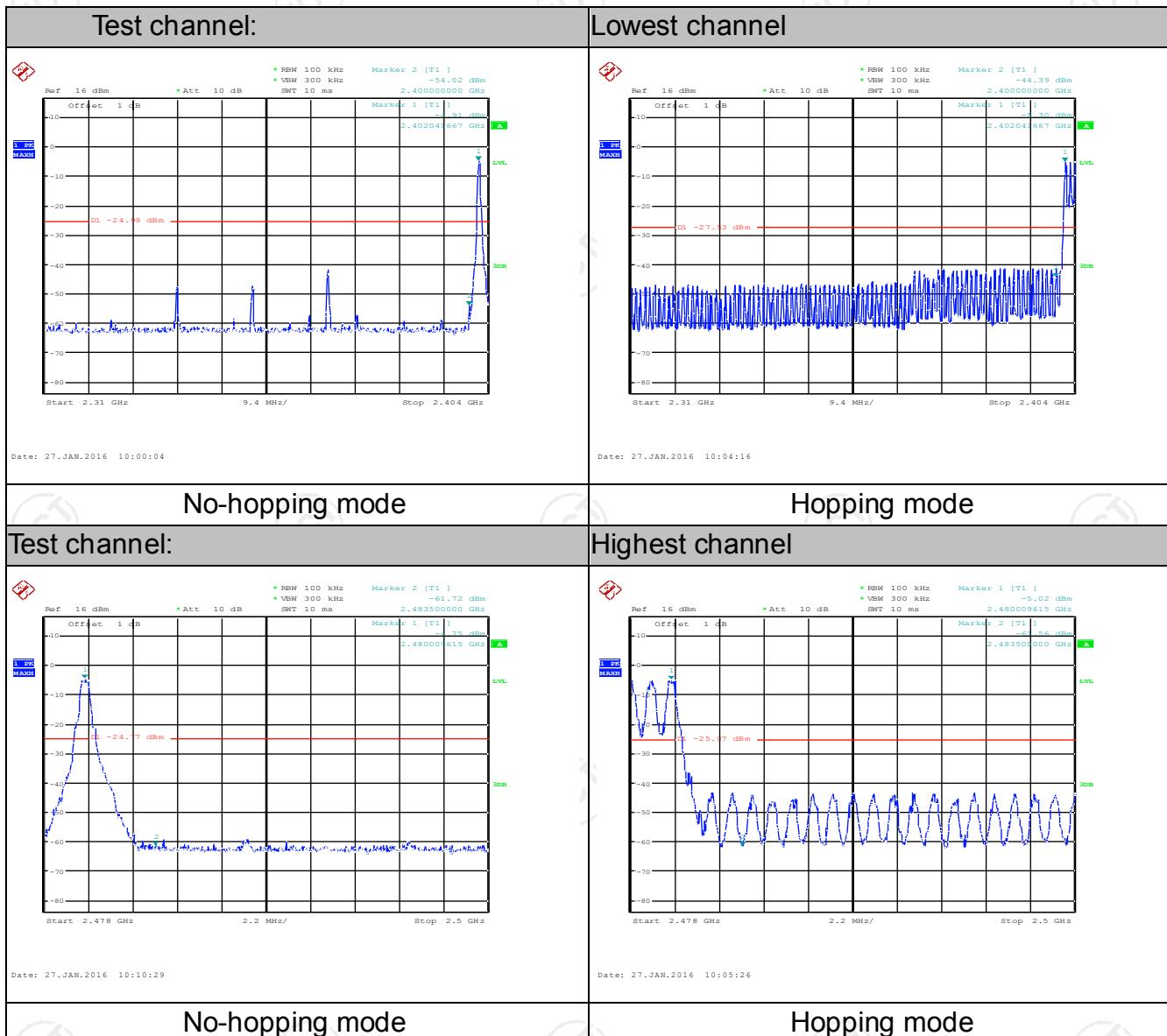
RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Sep. 11, 2016
RF cable	TCT	RE-06	N/A	Sep. 12, 2016
Antenna Connector	TCT	RFC-01	N/A	Sep. 12, 2016

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

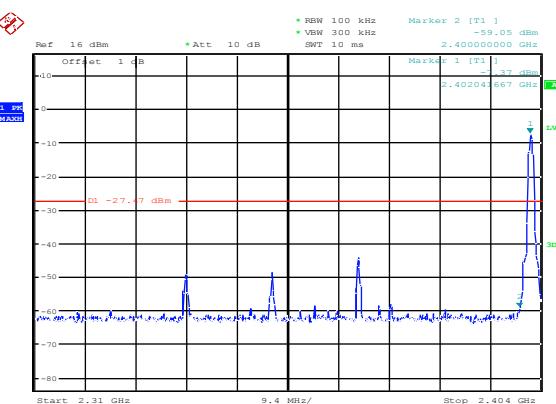
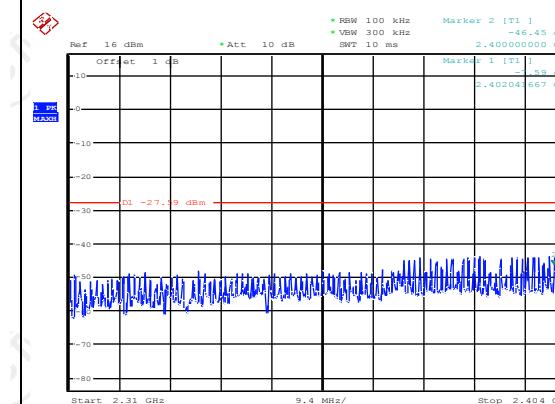
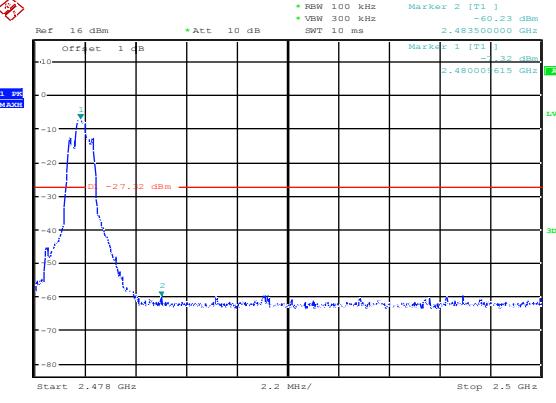
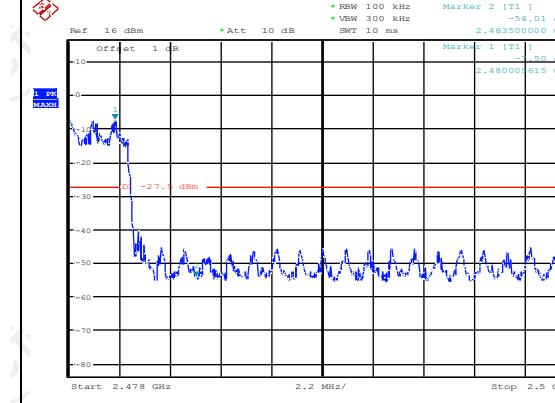
international system unit (SI).

### 6.9.3. Test Data

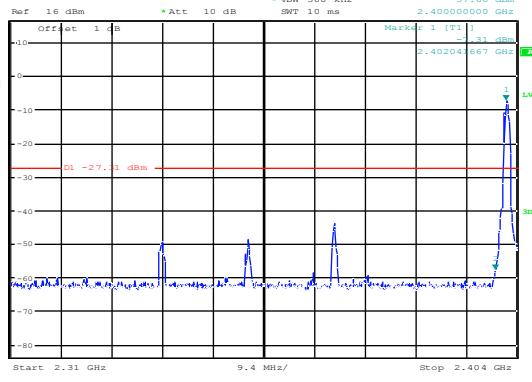
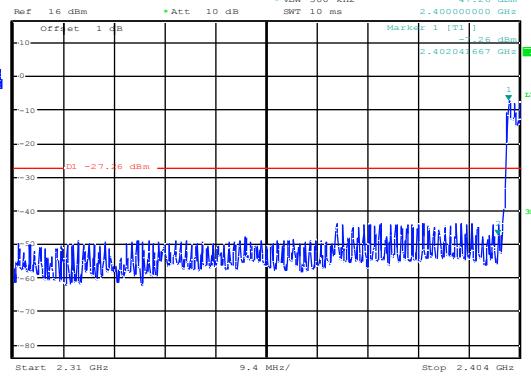
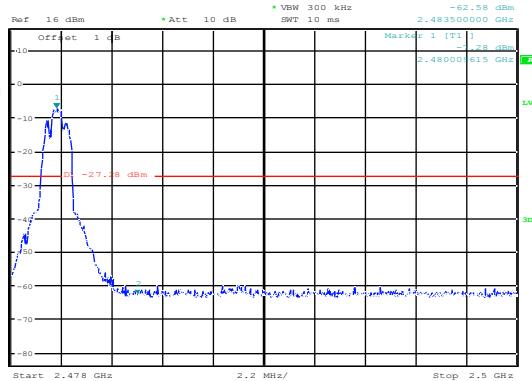
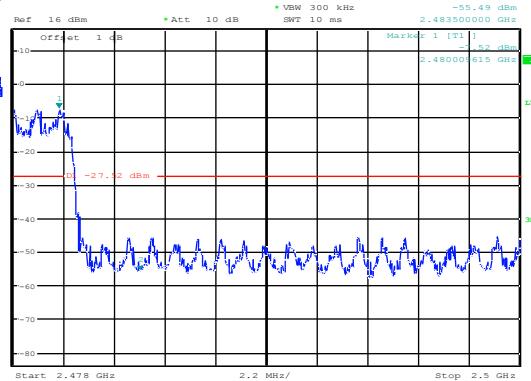
#### GFSK Modulation



Pi/4DQPSK Modulation

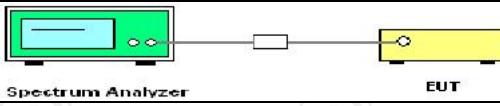
Test channel:	Lowest channel
 <p>Ref 16 dBm Att 10 dB Offset 1 dB SMT 10 ms Marker 1 (T1) -59.05 dBm 2.40204667 GHz Marker 2 (T1) -46.45 dBm 2.40204667 GHz RBW 100 kHz VSW 300 kHz Start 2.31 GHz Stop 2.404 GHz</p> <p>Date: 27.JAN.2016 10:00:40</p>	 <p>Ref 16 dBm Att 10 dB Offset 1 dB SMT 10 ms Marker 1 (T1) -59.05 dBm 2.40204667 GHz Marker 2 (T1) -46.45 dBm 2.40204667 GHz RBW 100 kHz VSW 300 kHz Start 2.31 GHz Stop 2.404 GHz</p> <p>Date: 27.JAN.2016 10:03:15</p>
No-hopping mode	Hopping mode
Test channel:	Highest channel
 <p>Ref 16 dBm Att 10 dB Offset 1 dB SMT 10 ms Marker 1 (T1) -60.23 dBm 2.48350615 GHz Marker 2 (T1) -54.01 dBm 2.48350615 GHz RBW 100 kHz VSW 300 kHz Start 2.478 GHz Stop 2.5 GHz</p> <p>Date: 27.JAN.2016 10:09:50</p>	 <p>Ref 16 dBm Att 10 dB Offset 1 dB SMT 10 ms Marker 1 (T1) -60.23 dBm 2.48350615 GHz Marker 2 (T1) -54.01 dBm 2.48350615 GHz RBW 100 kHz VSW 300 kHz Start 2.478 GHz Stop 2.5 GHz</p> <p>Date: 27.JAN.2016 10:07:16</p>
No-hopping mode	Hopping mode

## 8DPSK Modulation

Test channel:	Lowest channel
	
Date: 27.JAN.2016 10:01:17	Date: 27.JAN.2016 10:02:21
No-hopping mode	Hopping mode
Test channel:	Highest channel
	
Date: 27.JAN.2016 10:09:09	Date: 27.JAN.2016 10:08:25
No-hopping mode	Hopping mode

## 6.10. Conducted Spurious Emission Measurement

### 6.10.1. Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.247 (d);RSS 247 sect. 5.5
<b>Test Method:</b>	ANSI C63.10:2013 and DA00-705
<b>Limit:</b>	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.
<b>Test Setup:</b>	 <p>Spectrum Analyzer                                  EUT</p>
<b>Test Mode:</b>	Transmitting mode with modulation
<b>Test Procedure:</b>	<ol style="list-style-type: none"> <li>The testing follows the guidelines in Spurious RF Conducted Emissions of FCC Public Notice DA 00-705 Measurement Guidelines</li> <li>The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.</li> <li>Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>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.</li> <li>Measure and record the results in the test report.</li> <li>The RF fundamental frequency should be excluded against the limit line in the operating frequency band.</li> </ol>
<b>Test Result:</b>	PASS

### 6.10.2. Test Instruments

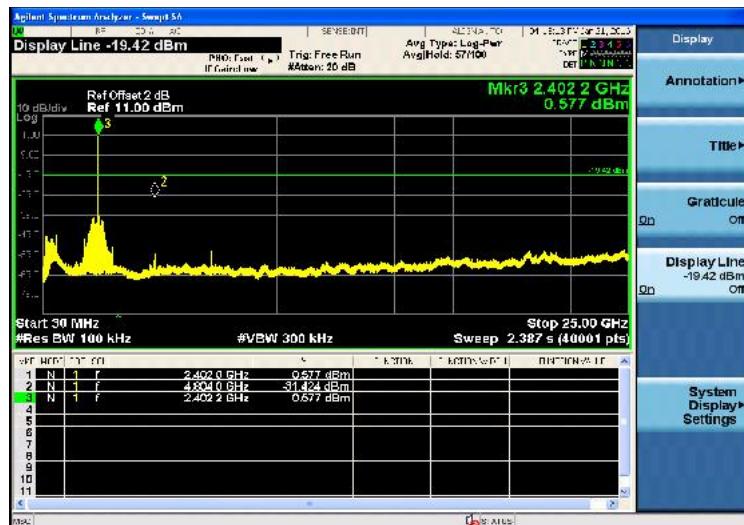
RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 12, 2016
RF cable	TCT	RE-06	N/A	Sep. 12, 2016
Antenna Connector	TCT	RFC-01	N/A	Sep. 12, 2016

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

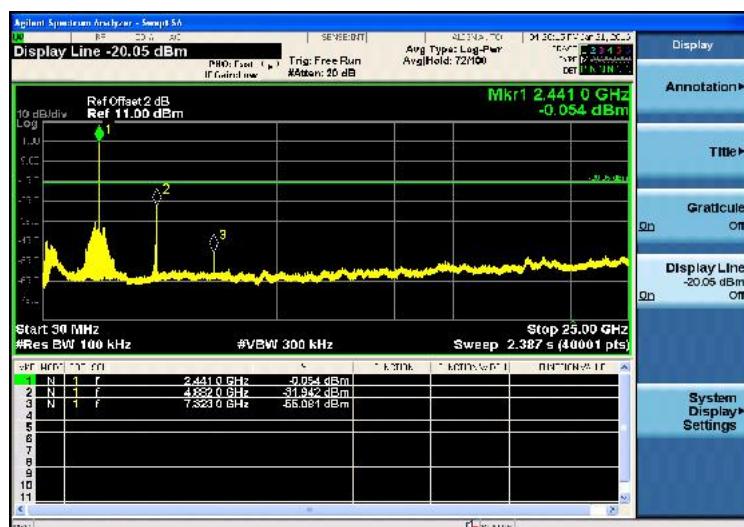
### 6.10.3. Test Data

GFSK mode

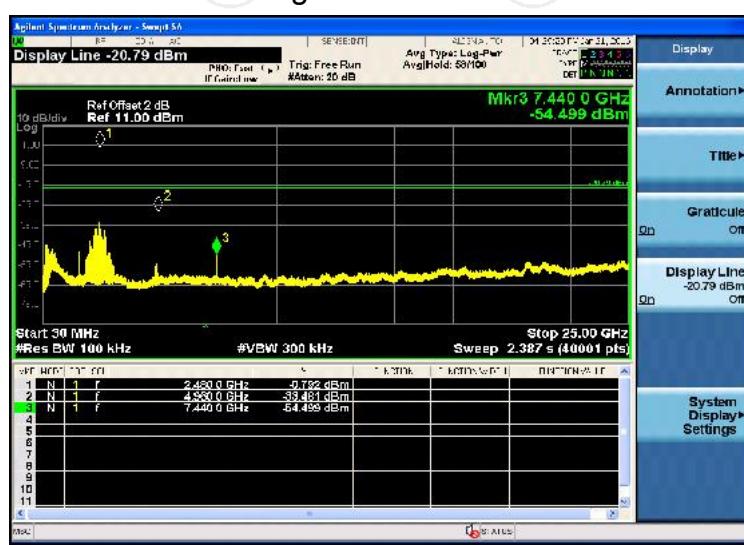
Lowest Channel



Middle Channel

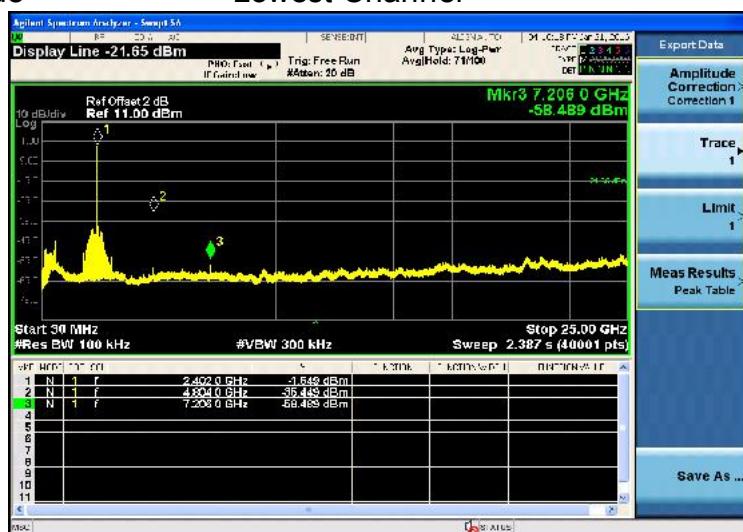


Highest Channel

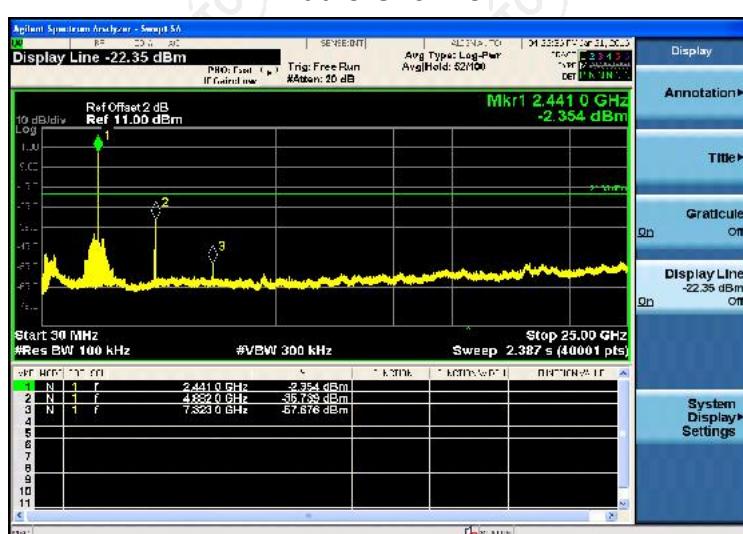


## Pi/4DQPSK mode

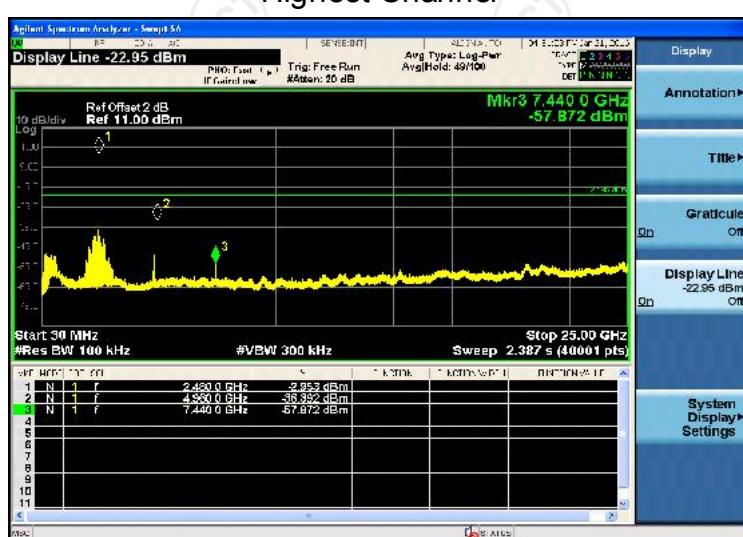
## Lowest Channel



## Middle Channel



## Highest Channel

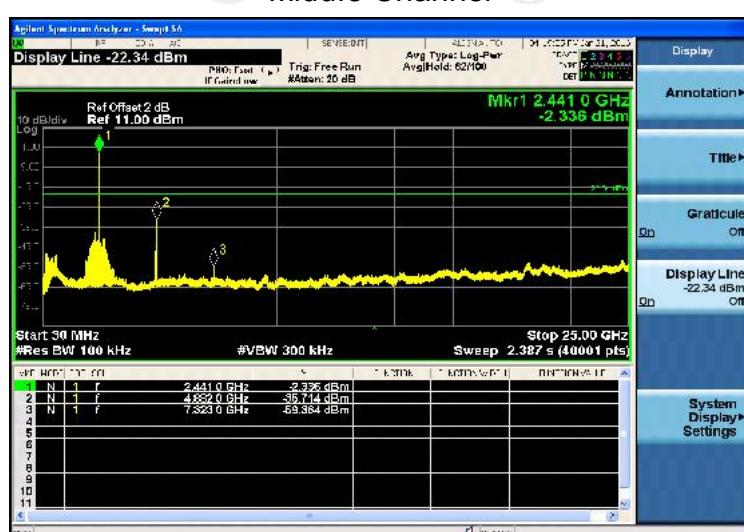


8DPSK mode

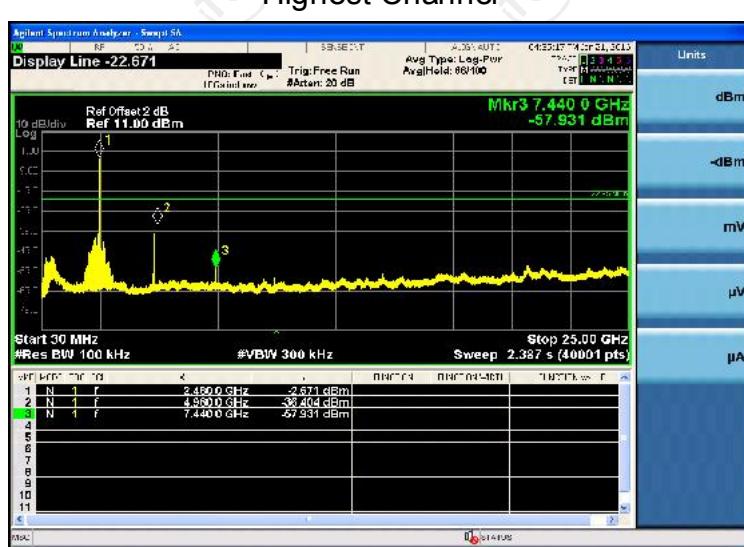
Lowest Channel



Middle Channel



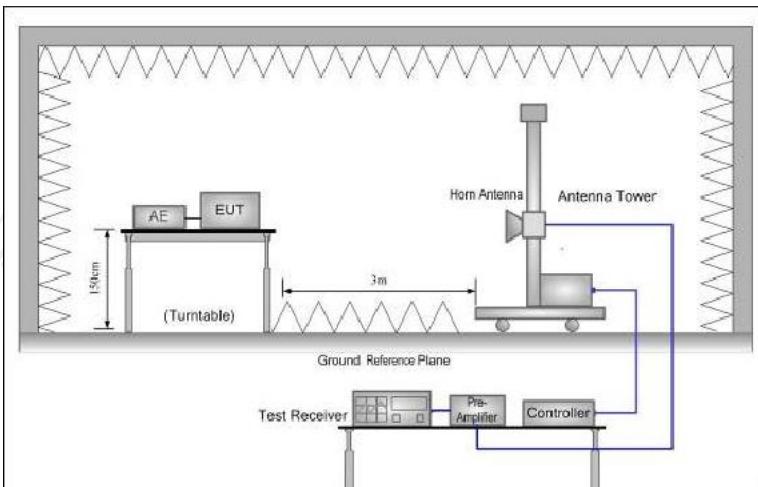
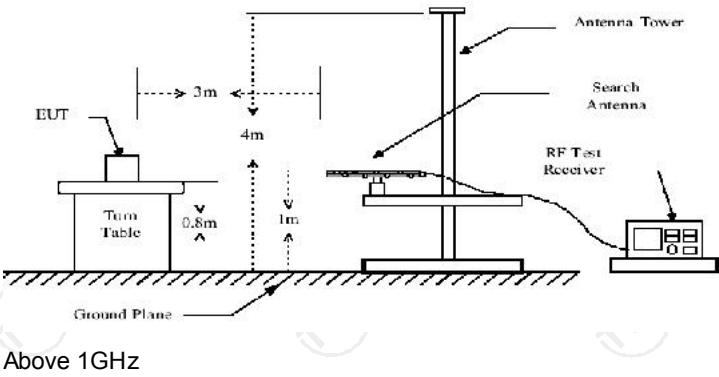
Highest Channel



## 6.11. Radiated Spurious Emission Measurement

### 6.11.1. Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.209; RSS Gen sect. 8.9																																	
<b>Test Method:</b>	ANSI C63.4: 2014 and ANSI C63.10: 2013																																	
<b>Frequency Range:</b>	9 kHz to 25 GHz																																	
<b>Measurement Distance:</b>	3 m																																	
<b>Antenna Polarization:</b>	Horizontal & Vertical																																	
<b>Receiver Setup:</b>	<table border="1"> <thead> <tr> <th>Frequency</th> <th>Detector</th> <th>RBW</th> <th>VBW</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td>9kHz- 150kHz</td> <td>Quasi-peak</td> <td>200Hz</td> <td>1kHz</td> <td>Quasi-peak Value</td> </tr> <tr> <td>150kHz- 30MHz</td> <td>Quasi-peak</td> <td>9kHz</td> <td>30kHz</td> <td>Quasi-peak Value</td> </tr> <tr> <td>30MHz-1GHz</td> <td>Quasi-peak</td> <td>100KHz</td> <td>300KHz</td> <td>Quasi-peak Value</td> </tr> <tr> <td rowspan="2">Above 1GHz</td><td>Peak</td> <td>1MHz</td> <td>3MHz</td> <td>Peak Value</td> </tr> <tr> <td>Peak</td> <td>1MHz</td> <td>10Hz</td> <td>Average Value</td> </tr> </tbody> </table>					Frequency	Detector	RBW	VBW	Remark	9kHz- 150kHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value	150kHz- 30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value	30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak Value	Above 1GHz	Peak	1MHz	3MHz	Peak Value	Peak	1MHz	10Hz	Average Value
Frequency	Detector	RBW	VBW	Remark																														
9kHz- 150kHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value																														
150kHz- 30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value																														
30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak Value																														
Above 1GHz	Peak	1MHz	3MHz	Peak Value																														
	Peak	1MHz	10Hz	Average Value																														
<b>Limit:</b>	<table border="1"> <thead> <tr> <th>Frequency</th> <th>Field Strength (microvolts/meter)</th> <th>Measurement Distance (meters)</th> </tr> </thead> <tbody> <tr> <td>0.009-0.490</td> <td>2400/F(KHz)</td> <td>300</td> </tr> <tr> <td>0.490-1.705</td> <td>24000/F(KHz)</td> <td>30</td> </tr> <tr> <td>1.705-30</td> <td>30</td> <td>30</td> </tr> <tr> <td>30-88</td> <td>100</td> <td>3</td> </tr> <tr> <td>88-216</td> <td>150</td> <td>3</td> </tr> <tr> <td>216-960</td> <td>200</td> <td>3</td> </tr> <tr> <td>Above 960</td> <td>500</td> <td>3</td> </tr> </tbody> </table>					Frequency	Field Strength (microvolts/meter)	Measurement Distance (meters)	0.009-0.490	2400/F(KHz)	300	0.490-1.705	24000/F(KHz)	30	1.705-30	30	30	30-88	100	3	88-216	150	3	216-960	200	3	Above 960	500	3					
Frequency	Field Strength (microvolts/meter)	Measurement Distance (meters)																																
0.009-0.490	2400/F(KHz)	300																																
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1.705-30	30	30																																
30-88	100	3																																
88-216	150	3																																
216-960	200	3																																
Above 960	500	3																																
<b>Test setup:</b>	<p>For radiated emissions below 30MHz</p> <p>Distance = 3m</p> <p>EUT</p> <p>Turn table</p> <p>Ground Plane</p> <p>Computer</p> <p>Pre -Amplifier</p> <p>Receiver</p> <p>30MHz to 1GHz</p>																																	



<b>Test Mode:</b>	Transmitting mode with modulation
<b>Test Procedure:</b>	<p>1. The testing follows the guidelines in Spurious Radiated Emissions of FCC Public Notice DA 00-705 Measurement Guidelines.</p> <p>2. For the radiated emission test below 1GHz: The EUT was placed on a turntable with 1.5 meter above ground. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.</p> <p>For the radiated emission test above 1GHz: Place the measurement antenna on a turntable with 1.5 meter above ground, which is away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT,</p>

	<p>depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.</p> <p>3. Set to the maximum power setting and enable the EUT transmit continuously.</p> <p>4. Use the following spectrum analyzer settings:</p> <ul style="list-style-type: none"> <li>(1) Span shall wide enough to fully capture the emission being measured;</li> <li>(2) Set RBW=100 kHz for <math>f &lt; 1</math> GHz, RBW=1MHz for <math>f &gt; 1</math> GHz ; <math>VBW \geq RBW</math>; Sweep = auto; Detector function = peak; Trace = max hold for peak</li> <li>(3) For average measurement: use duty cycle correction factor method per 15.35(c). Duty cycle = On time/100 milliseconds On time = <math>N_1 \cdot L_1 + N_2 \cdot L_2 + \dots + N_{n-1} \cdot L_{n-1} + N_n \cdot L_n</math> Where <math>N_1</math> is number of type 1 pulses, <math>L_1</math> is length of type 1 pulses, etc. Average Emission Level = Peak Emission Level + <math>20 \cdot \log(\text{Duty cycle})</math> Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level</li> </ul>
<b>Test results:</b>	PASS

### 6.11.2. Test Instruments

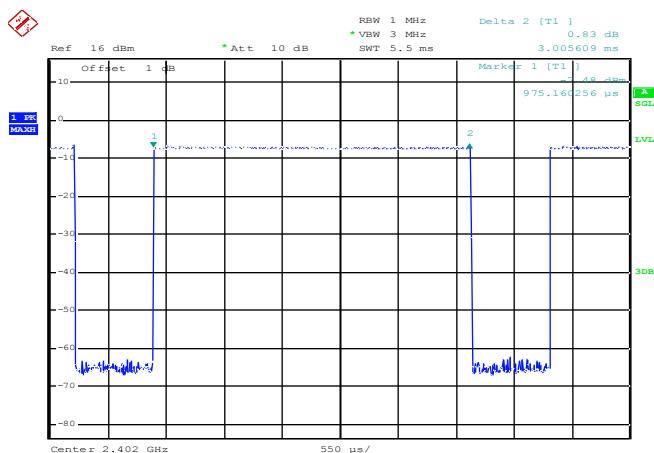
Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
ESPI Test Receiver	ROHDE&SCHW ARZ	ESVD	100008	Sep. 11, 2016
Spectrum Analyzer	ROHDE&SCHW ARZ	FSEM	848597/001	Sep. 11, 2016
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 12, 2016
Spectrum Analyzer	R&S	FSU	200054	Sep. 11, 2016
Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Sep. 11, 2016
Pre-amplifier	HP	8447D	2727A05017	Sep. 11, 2016
Loop antenna	ZHINAN	ZN30900A	12024	Sep. 13, 2016
Broadband Antenna	Schwarzbeck	VULB9163	340	Sep. 13, 2016
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Sep. 13, 2016
Horn Antenna	Schwarzbeck	BBHA 9170	373	Sep. 13, 2016
Antenna Mast	CCS	CC-A-4M	N/A	N/A
Coax cable	TCT	RE-low-01	N/A	Sep. 11, 2016
Coax cable	TCT	RE-high-02	N/A	Sep. 11, 2016
Coax cable	TCT	RE-low-03	N/A	Sep. 11, 2016
Coax cable	TCT	RE-high-04	N/A	Sep. 11, 2016
EMI Test Software	Shurples 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

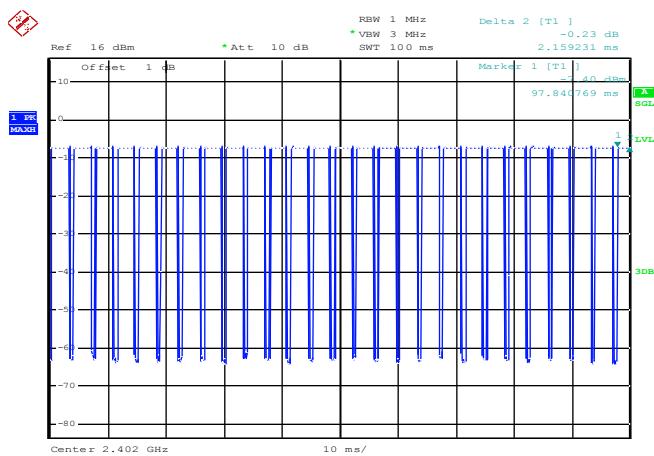
#### Duty cycle correction factor for average measurement

DH5 on time (One Pulse) Plot on Channel 39



Date: 27.JAN.2016 09:57:36

DH5 on time (Count Pulses) Plot on Channel 39



Date: 27.JAN.2016 09:59:03

#### Note:

1. Worst case Duty cycle = on time/100 milliseconds  $= (3.006*26+2.159)/100=0.80315$
2. Worst case Duty cycle correction factor =  $20*\log (\text{Duty cycle}) = -1.90\text{dB}$
3. DH5 has the highest duty cycle worst case and is reported.
4. The average levels were calculated from the peak level corrected with duty cycle correction factor (-1.90dB) derived from  $20\log (\text{dwell time}/100\text{ms})$ . 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

**Below 1GHz**

Horizontal:



Site

Polarization: **Horizontal**

Temperature: 23

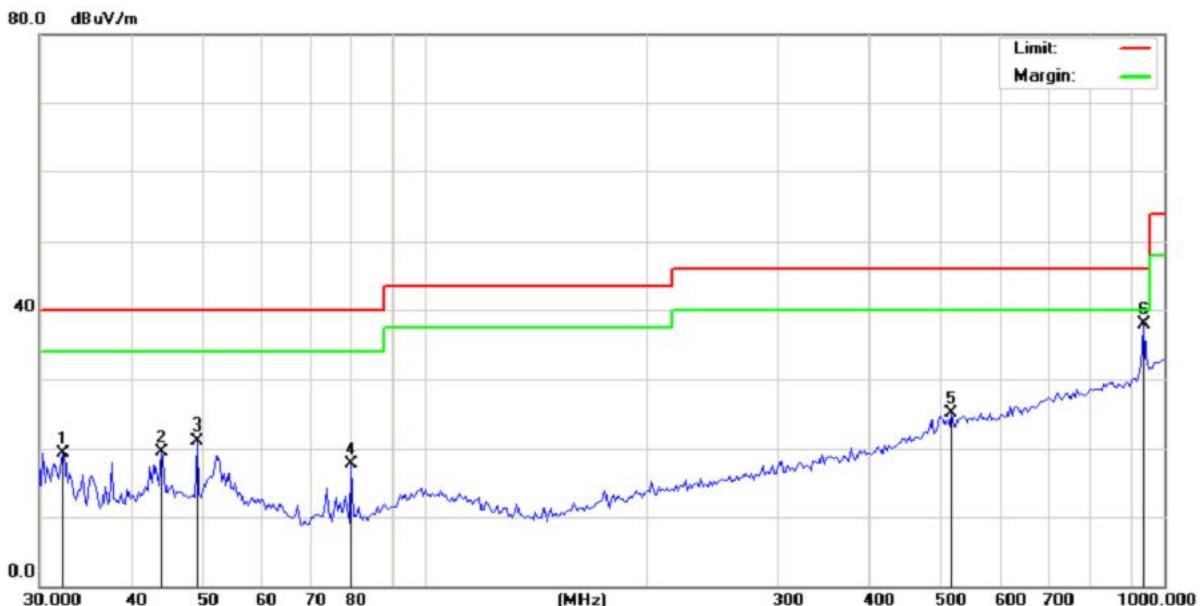
Limit: FCC Part 15B Class B RE\_3 m

Power:

Humidity: 54 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Antenna Height cm	Table Degree	Comment
1		31.2920	31.44	-13.56	17.88	40.00	-22.12	peak		0	
2		55.2883	27.44	-12.45	14.99	40.00	-25.01	peak		0	
3		99.7676	25.98	-11.47	14.51	43.50	-28.99	peak		0	
4		336.4817	26.76	-7.49	19.27	46.00	-26.73	peak		0	
5		602.9287	27.45	-1.87	25.58	46.00	-20.42	peak		0	
6	*	938.7140	32.64	3.99	36.63	46.00	-9.37	peak		0	

Vertical:



Site		Polarization: <b>Vertical</b>				Temperature: 23		
Limit: FCC Part 15B Class B RE_3 m		Power:				Humidity: 54 %		
No.	Mk.	Reading Level	Correct Factor	Measure-ment	Limit	Over	Antenna Height	Table Degree
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm degree
1	32.1840	32.72	-13.44	19.28	40.00	-20.72	peak	0
2	43.8452	31.78	-12.30	19.48	40.00	-20.52	peak	0
3	49.0627	33.17	-12.08	21.09	40.00	-18.91	peak	0
4	79.6764	34.11	-16.35	17.76	40.00	-22.24	peak	0
5	516.5651	27.76	-2.79	24.97	46.00	-21.03	peak	0
6 *	938.7140	33.84	3.99	37.83	46.00	-8.17	peak	0

**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 (Lowest channel and 8DPSK) was submitted only.

## Above 1GHz

Modulation Type: 8DPSK

Low channel: 2402 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dB $\mu$ V)	AV reading (dB $\mu$ V)	Correction Factor (dB/m)	Emission Level		Peak limit (dB $\mu$ V/m)	AV limit (dB $\mu$ V/m)	Margin (dB)
					Peak (dB $\mu$ V/m)	AV (dB $\mu$ V/m)			
2390	H	46.04	---	-8.23	37.81	---	74	54	-16.19
4804	H	44.63	---	6.59	51.22	---	74	54	-2.78
7206	H	35.71	---	12.87	48.58	---	74	54	-5.42
---	H	---	---	---	---	---	---	---	---
2390	V	38.20	---	-8.23	29.97	---	74	54	-24.03
4804	V	43.51	---	6.59	50.10	---	74	54	-3.90
7206	V	35.50	---	12.87	48.37	---	74	54	-5.63
---	V	---	---	---	---	---	---	---	---

Middle channel: 2441 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dB $\mu$ V)	AV reading (dB $\mu$ V)	Correction Factor (dB/m)	Emission Level		Peak limit (dB $\mu$ V/m)	AV limit (dB $\mu$ V/m)	Margin (dB)
					Peak (dB $\mu$ V/m)	AV (dB $\mu$ V/m)			
4882	H	42.79	---	7.01	49.80	---	74	54	-4.20
7323	H	33.32	---	13.21	46.53	---	74	54	-7.47
---	H	---	---	---	---	---	---	---	---
4882	V	43.80	---	7.01	50.81	---	74	54	-3.19
7323	V	34.60	---	13.21	47.81	---	74	54	-6.19
---	V	---	---	---	---	---	---	---	---

High channel: 2480 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dB $\mu$ V)	AV reading (dB $\mu$ V)	Correction Factor (dB/m)	Emission Level		Peak limit (dB $\mu$ V/m)	AV limit (dB $\mu$ V/m)	Margin (dB)
					Peak (dB $\mu$ V/m)	AV (dB $\mu$ V/m)			
2483.5	H	40.82	---	-7.52	33.30	---	74	54	-20.70
4960	H	43.41	---	7.44	50.85	---	74	54	-3.15
7440	H	33.64	---	13.54	47.18	---	74	54	-6.82
---	H	---	---	---	---	---	---	---	---
2483.5	V	40.20	---	-7.52	32.68	---	74	54	-21.32
4960	V	42.33	---	7.44	49.77	---	74	54	-4.23
7440	V	34.46	---	13.54	48.00	---	74	54	-6.00
---	V	---	---	---	---	---	---	---	---

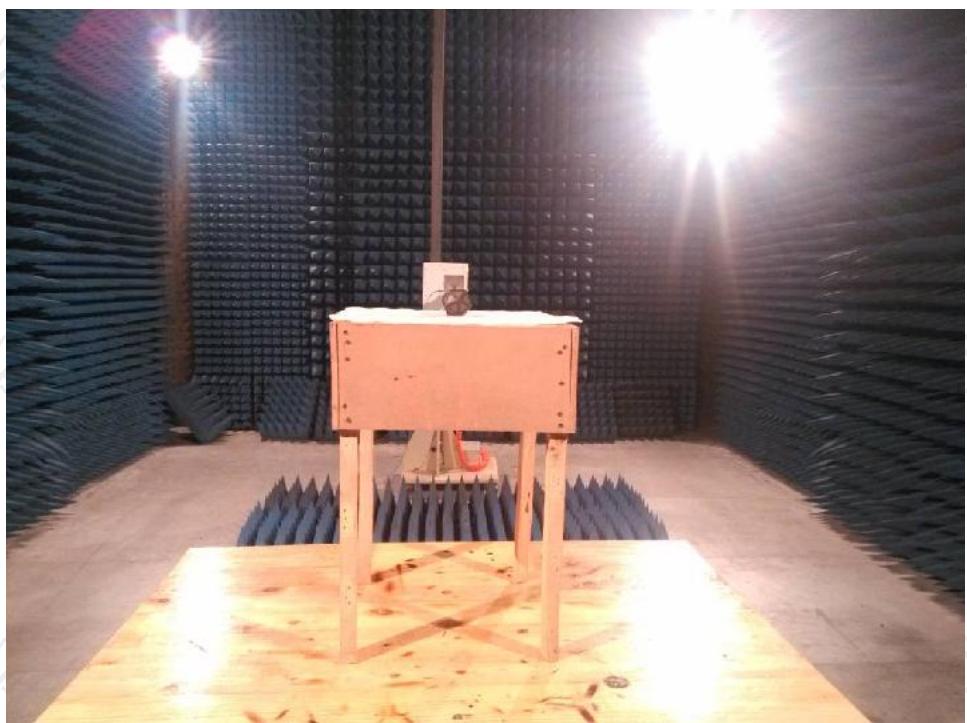
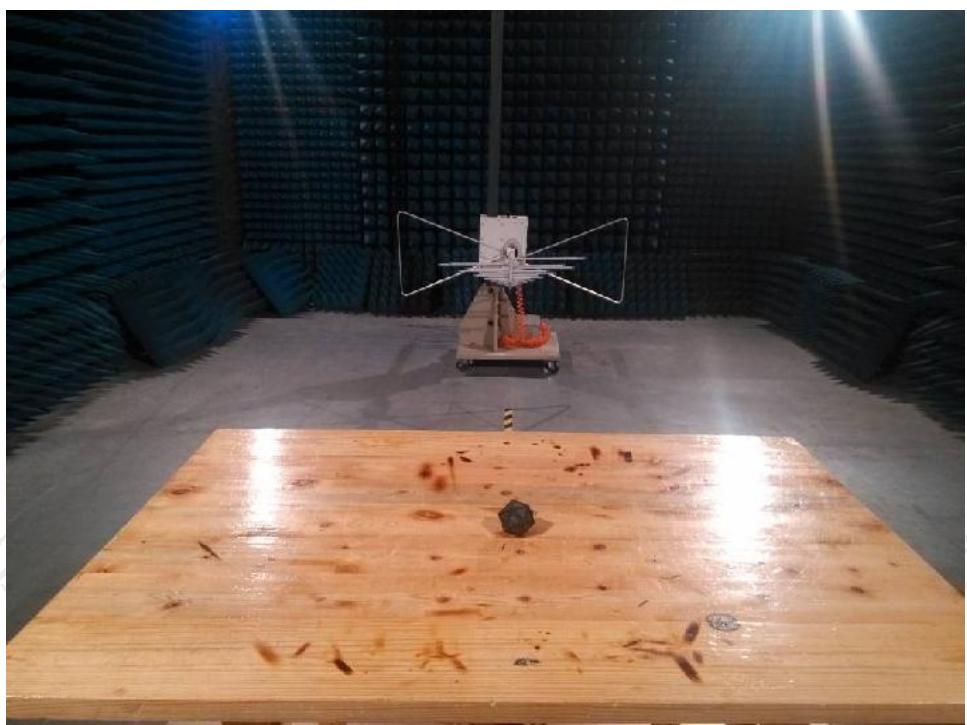
**Note:**

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 (8DPSK) was submitted only.

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

## Appendix A: Photographs of Test Setup

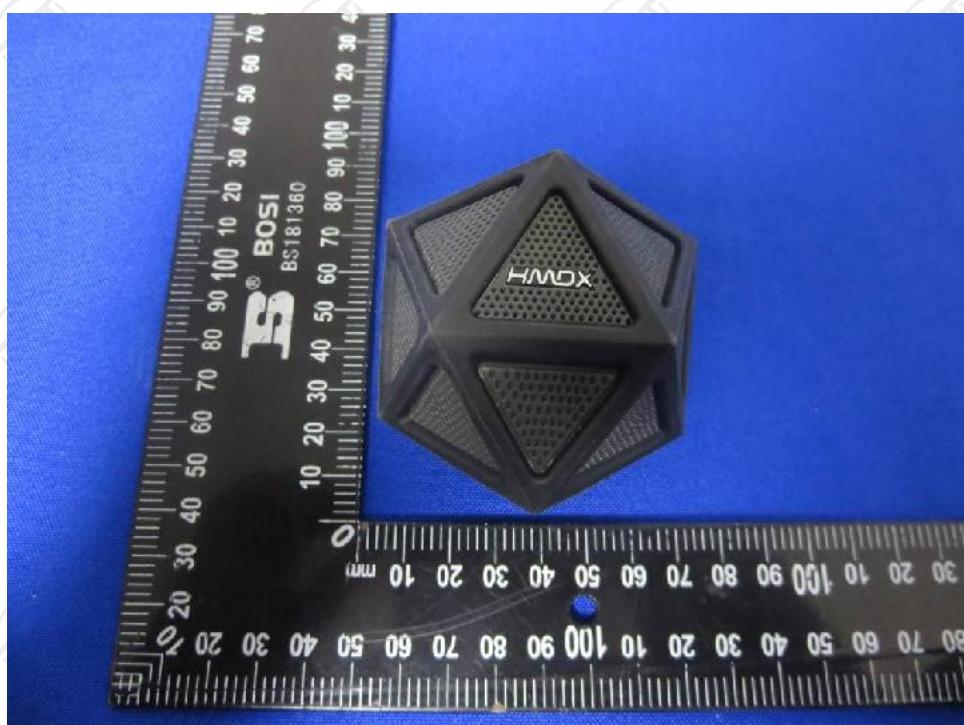
### Radiated Emission

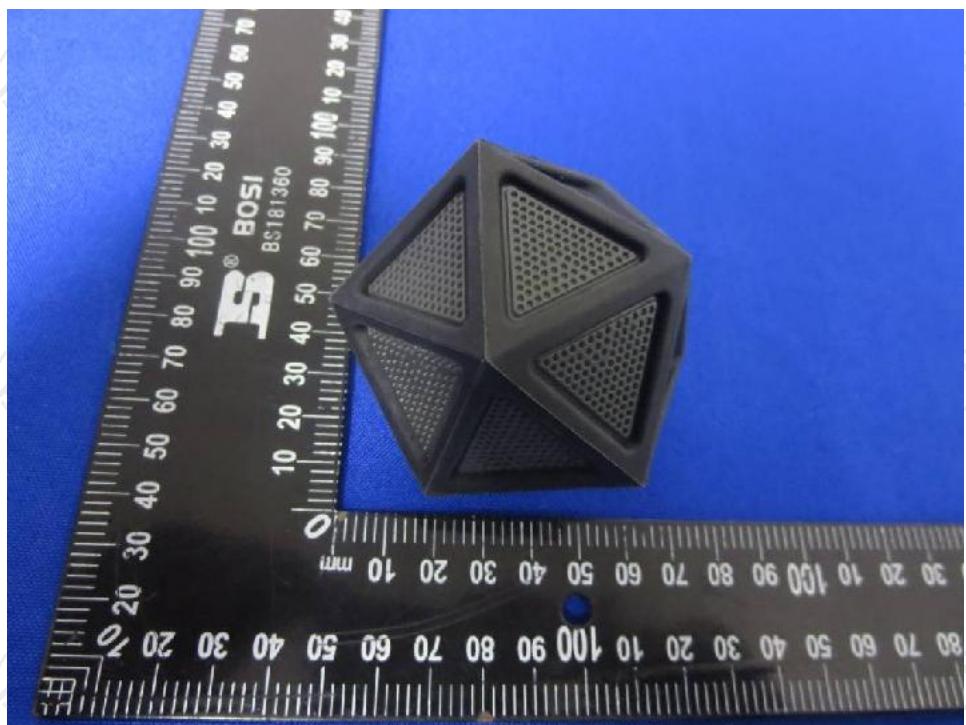
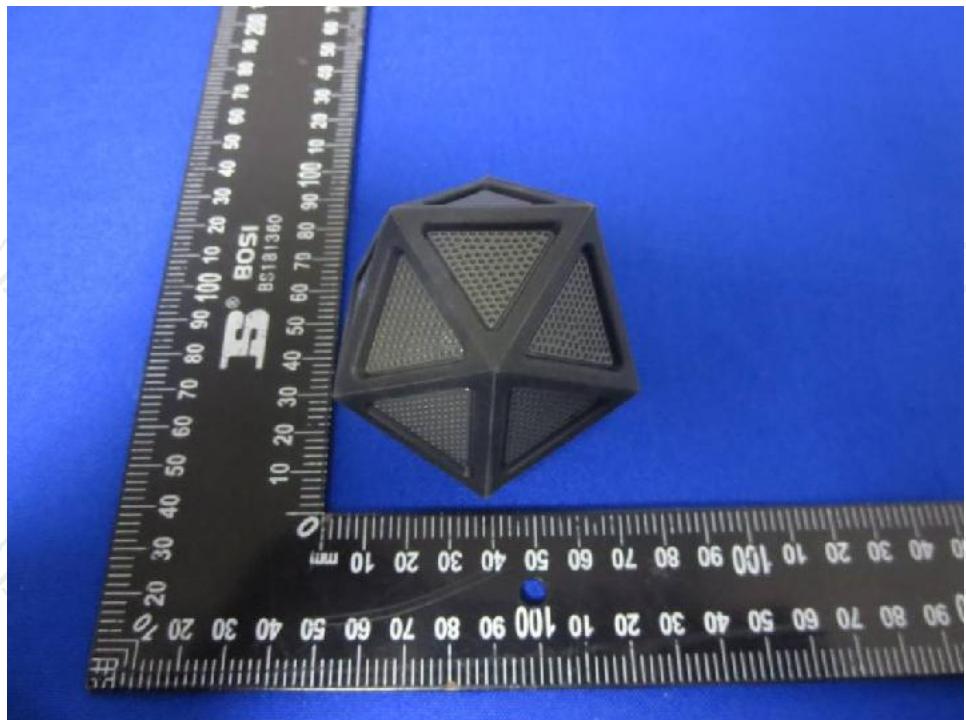


CE



**Appendix B: Photographs of EUT  
Model: HX-P160  
External Photos**





**Model: HX-P160  
Internal Photos**

