

# RF TEST REPORT



Report No.: 17071405-FCC-R3

Supersede Report No.: N/A

Applicant	ASKA ELECTRONICS CO., LIMITED	
Product Name	Bluetooth ANC headphone	
Model No.	F5AS	
Serial No.	F5HA	
Test Standard	FCC Part 15.247: 2016, ANSI C63.10: 2013	
Test Date	December 13 to 29, 2017	
Issue Date	December 30, 2017	
Test Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
Equipment complied with the specification <input checked="" type="checkbox"/>		
Equipment did not comply with the specification <input type="checkbox"/>		
Aarron Liang Test Engineer	David Huang Checked By	
This test report may be reproduced in full only Test result presented in this test report is applicable to the tested sample only		

Issued by:

SIEMIC (SHENZHEN-CHINA) LABORATORIES

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## Laboratories Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.



In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

### Accreditations for Conformity Assessment

Country/Region	Scope
USA	EMC, RF/Wireless, SAR, Telecom
Canada	EMC, RF/Wireless, SAR, Telecom
Taiwan	EMC, RF, Telecom, SAR, Safety
Hong Kong	RF/Wireless, SAR, Telecom
Australia	EMC, RF, Telecom, SAR, Safety
Korea	EMI, EMS, RF, SAR, Telecom, Safety
Japan	EMI, RF/Wireless, SAR, Telecom
Singapore	EMC, RF, SAR, Telecom
Europe	EMC, RF, SAR, Telecom, Safety

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## 1. Report Revision History

Report No.	Report Version	Description	Issue Date
17071405-FCC-R3	NONE	Original	December 30, 2017

## 2. Customer information

Applicant Name	ASKA ELECTRONICS CO., LIMITED
Applicant Add	ROOM A 11/F HO LEE COMMERCIAL BUILDING38-44 D' AGUILAR STREET CENTRAL HK
Manufacturer	ASKA Electronics Co., Ltd
Manufacturer Add	3F, building 19#, Road Da Ling Bian, Shahu Community, Tangxia Town, Dongguan, China

## 3. Test site information

Test Lab A:

Lab performing tests	SIEMIC (Shenzhen-China) LABORATORIES
Lab Address	Zone A, Floor 1, Building 2 Wan Ye Long Technology Park South Side of Zhoushi Road, Bao' an District, Shenzhen, Guangdong China 518108
FCC Test Site No.	535293
IC Test Site No.	4842E-1
Test Software	Radiated Emission Program-To Shenzhen v2.0

Test Lab B:

Lab performing tests	SIEMIC (Nanjing-China) Laboratories
Lab Address	2-1 Longcang Avenue Yuhua Economic and Technology Development Park, Nanjing, China
FCC Test Site No.	694825
IC Test Site No.	4842B-1
Test Software	EZ_EMC(ver.lcp-03A1)

Note: We just perform Radiated Spurious Emission above 18GHz in the test Lab. B.

## 4. Equipment under Test (EUT) Information

Description of EUT: Bluetooth ANC headphone

Main Model: F5AS

Serial Model: F5HA

Date EUT received: December 12, 2017

Test Date(s): December 13 to 29, 2017

Equipment Category : DSS

Antenna Gain: Bluetooth: 2.0dBi

Antenna Type: PCB antenna

Type of Modulation: Bluetooth: GFSK,  $\pi/4$ DQPSK, 8DPSK

RF Operating Frequency (ies): Bluetooth: 2402-2480 MHz

Max. Output Power: 7.811dBm

Number of Channels: Bluetooth: 79CH

Port: USB Port

Input Power: Battery  
Spec: 3.7V, 270mAh

Trade Name : ASKA

FCC ID: 2ACXHF5AS

## 5. Test Summary

The product was tested in accordance with the following specifications.

All testing has been performed according to below product classification:

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.247(a)(1)	Channel Separation	Compliance
§15.247(a)(1)	20 dB Bandwidth	Compliance
§15.247(b)(1)	Peak Output Power	Compliance
§15.247(a)(1)(iii)	Number of Hopping Channel	Compliance
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance
§15.247(d)	Band Edge& Restricted Band	Compliance
§15.207(a)	AC Line Conducted Emissions	N/A
§15.205, §15.209, §15.247(d)	Radiated Emissions& Restricted Band	Compliance

### Measurement Uncertainty

Emissions		
Test Item	Description	Uncertainty
Band Edge& Restricted Band and Radiated Emissions& Restricted Band	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+5.6dB/-4.5dB
-	-	-

## **6. Measurements, Examination And Derived Results**

### **6.1 Antenna Requirement**

#### **Applicable Standard**

According to § 15.203, 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 user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### **Antenna Connector Construction**

The EUT has 1 antenna:

A permanently attached PCB antenna for Bluetooth, the gain is 2.0dBi for Bluetooth.

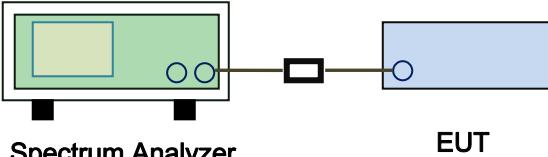
**The antenna meets up with the ANTENNA REQUIREMENT.**

**Result:** Compliance.

## 6.2 Channel Separation

Temperature	27°C
Relative Humidity	55%
Atmospheric Pressure	1023mbar
Test date :	December 22, 2017
Tested By :	Aarron Liang

### Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247(a)(1)	a)	Channel Separation < 20dB BW and 20dB BW < 25KHz ; Channel Separation Limit=25KHz Chanel Separation < 20dB BW and 20dB BW > 25kHz ; Channel Separation Limit=2/3 20dB BW	<input checked="" type="checkbox"/>
Test Setup		 <b>Spectrum Analyzer</b> <b>EUT</b>	
Test Procedure		<p>The test follows FCC Public Notice DA 00-705 Measurement Guidelines.</p> <p><u>Use the following spectrum analyzer settings:</u></p> <ul style="list-style-type: none"> <li>- The EUT must have its hopping function enabled</li> <li>- Span = wide enough to capture the peaks of two adjacent channels</li> <li>- Resolution (or IF) Bandwidth (RBW) <math>\geq</math> 1% of the span</li> <li>- Video (or Average) Bandwidth (VBW) <math>\geq</math> RBW</li> <li>- Sweep = auto</li> <li>- Detector function = peak</li> <li>- Trace = max hold</li> <li>- Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.</li> </ul>	

Remark		
Result	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Test Data	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> N/A
Test Plot	<input checked="" type="checkbox"/> Yes (See below)	<input type="checkbox"/> N/A

### Channel Separation measurement result

Type/ Modulation	CH	CH Frequency (MHz)	CH Separation (MHz)	Limit (MHz)	Result
CH Separation GFSK	Low Channel	2402	1.002	0.911	Pass
	Adjacency Channel	2403			
	Mid Channel	2440			
	Adjacency Channel	2441	0.990	0.871	Pass
	High Channel	2480			
	Adjacency Channel	2479			
CH Separation $\pi/4$ DQPSK	Low Channel	2402	1.005	0.801	Pass
	Adjacency Channel	2403			
	Mid Channel	2440			
	Adjacency Channel	2441	0.993	0.814	Pass
	High Channel	2480			
	Adjacency Channel	2479			
CH Separation 8DPSK	Low Channel	2402	1.005	0.805	Pass
	Adjacency Channel	2403			
	Mid Channel	2440			
	Adjacency Channel	2441	0.996	0.806	Pass
	High Channel	2480			
	Adjacency Channel	2479			

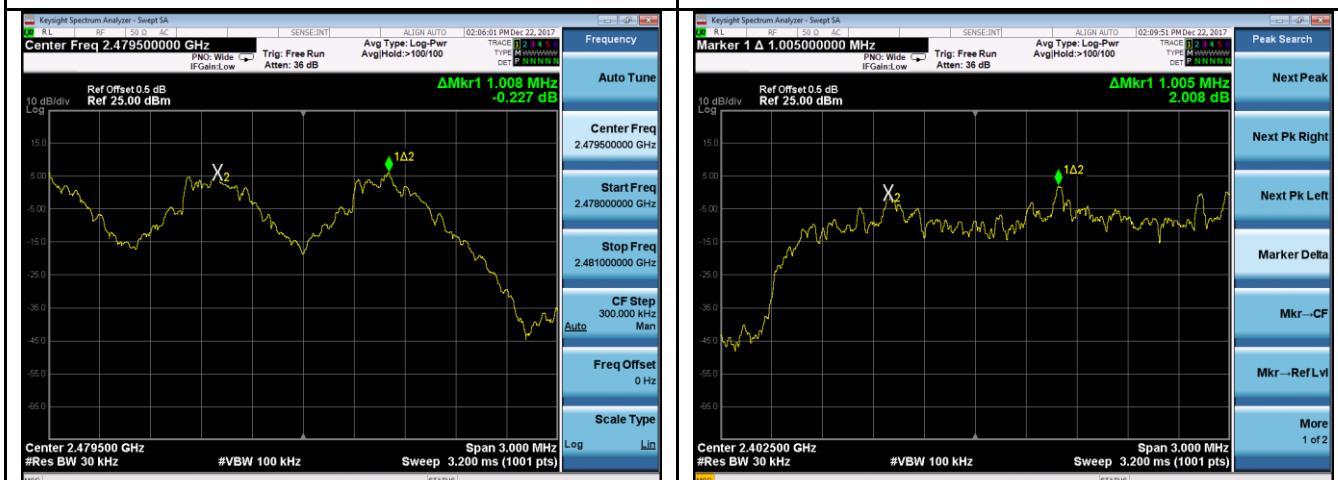
## Test Plots

### Channel Separation measurement result



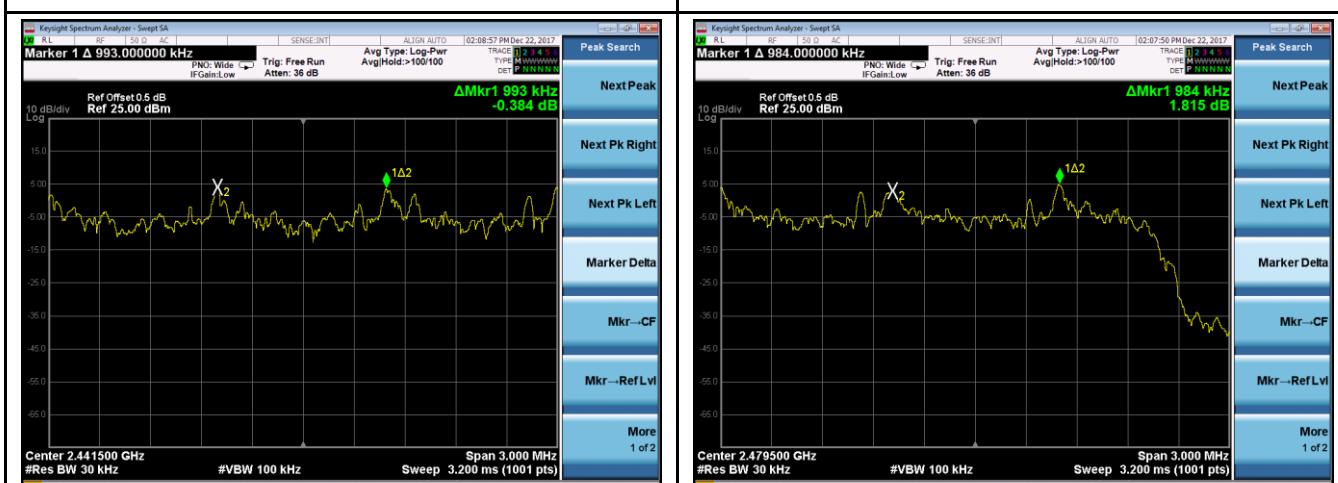
GFSK - Low Channel

GFSK - Middle Channel



GFSK - High Channel

π /4 DPSK - Low Channel



π /4 DQPSK - Middle Channel

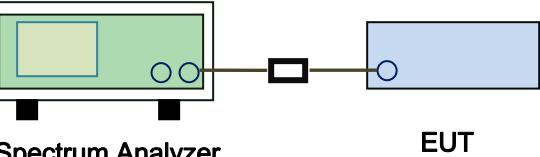
π /4 DQPSK - High Channel



### 6.3 20dB Bandwidth

Temperature	27°C
Relative Humidity	55%
Atmospheric Pressure	1023mbar
Test date :	December 22, 2017
Tested By :	Aarron Liang

## Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(a) (1)	a)	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.	<input checked="" type="checkbox"/>
Test Setup			
Test Procedure		<p>The test follows FCC Public Notice DA 00-705 Measurement Guidelines.</p> <p><u>Use the following spectrum analyzer settings:</u></p> <ul style="list-style-type: none"> <li>- Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel</li> <li>- RBW <math>\geq</math> 1% of the 20 dB bandwidth</li> <li>- VBW <math>\geq</math> RBW</li> <li>- Sweep = auto</li> <li>- Detector function = peak</li> <li>- Trace = max hold.</li> <li>- The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference</li> </ul>	

	marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).
Remark	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Test Data  Yes  N/A

Test Plot  Yes (See below)  N/A

#### Measurement result

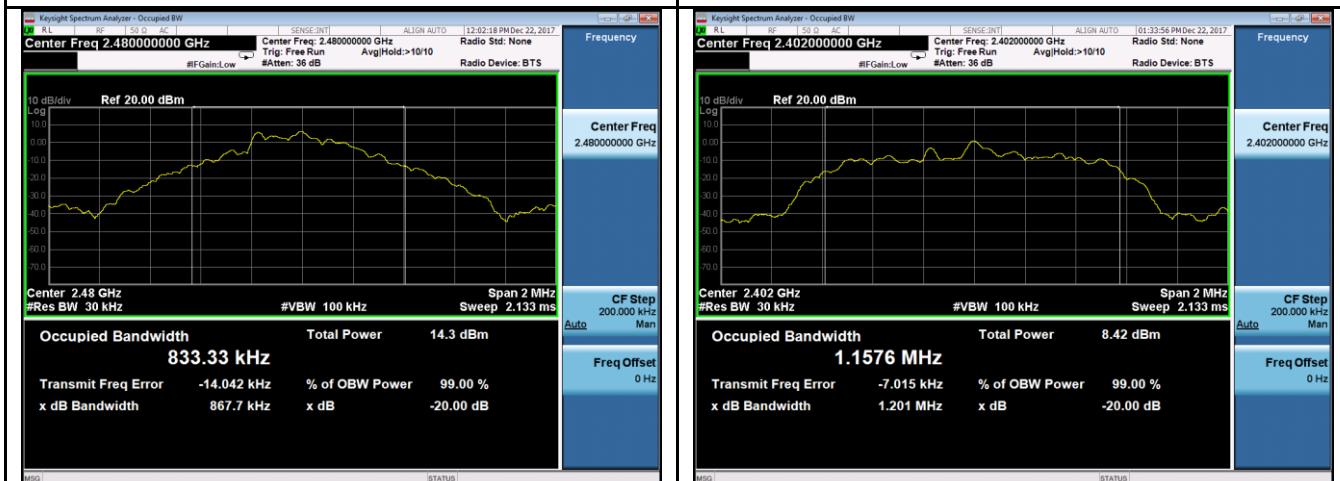
Modulation	CH	CH Frequency (MHz)	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
GFSK	Low	2402	0.911	0.8393
	Mid	2441	0.871	0.8356
	High	2480	0.868	0.8333
$\pi/4$ DQPSK	Low	2402	1.201	1.1576
	Mid	2441	1.221	1.1609
	High	2480	1.221	1.1635
8-DPSK	Low	2402	1.208	1.1451
	Mid	2441	1.209	1.1406
	High	2480	1.210	1.1452

## Test Plots

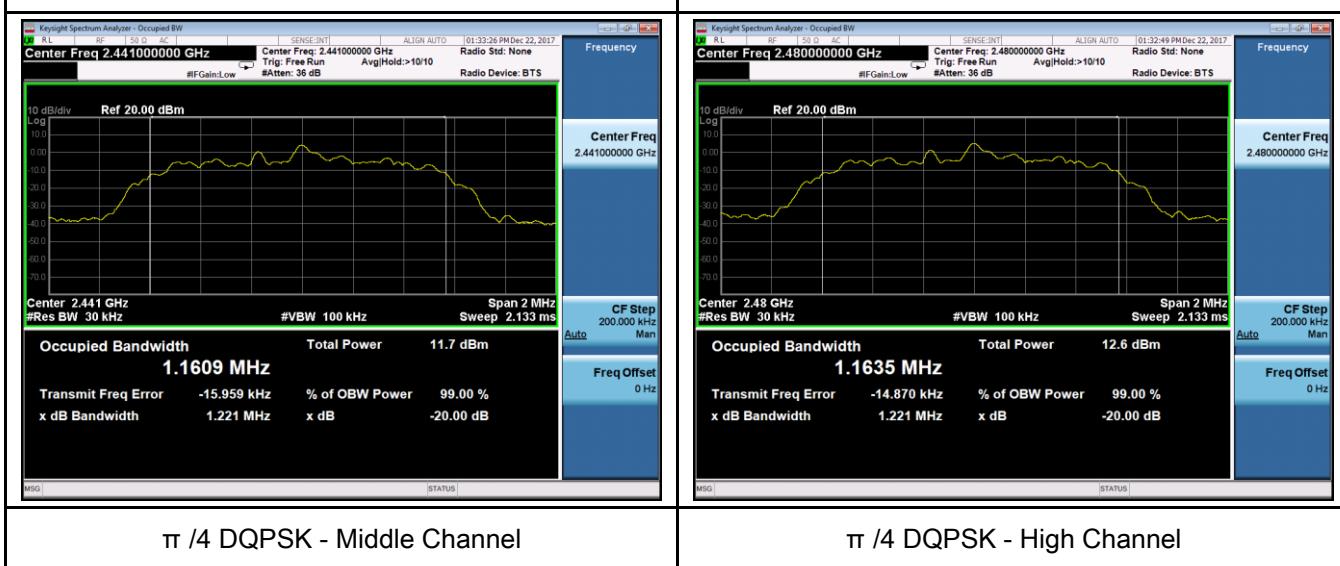
### 20dB Bandwidth measurement result



### GFSK - Low Channel



### GFSK - Middle Channel

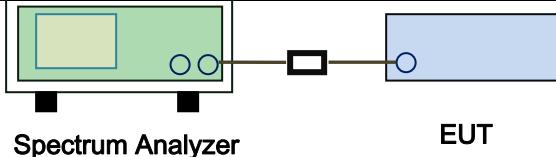




## 6.4 Peak Output Power

Temperature	26°C
Relative Humidity	56%
Atmospheric Pressure	1022mbar
Test date :	December 26&27, 2017
Tested By :	Aarron Liang

### Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(b) (3)	a)	FHSS in 2400-2483.5MHz with $\geq$ 75 channels: $\leq$ 1 Watt	<input checked="" type="checkbox"/>
	b)	FHSS in 5725-5850MHz: $\leq$ 1 Watt	<input type="checkbox"/>
	c)	For all other FHSS in the 2400-2483.5MHz band: $\leq$ 0.125 Watt.	<input checked="" type="checkbox"/>
	d)	FHSS in 902-928MHz with $\geq$ 50 channels: $\leq$ 1 Watt	<input type="checkbox"/>
	e)	FHSS in 902-928MHz with $\geq$ 25 & $<$ 50 channels: $\leq$ 0.25 Watt	<input type="checkbox"/>
	f)	DTS in 902-928MHz, 2400-2483.5MHz: $\leq$ 1 Watt	<input type="checkbox"/>
Test Setup			
Test Procedure		<p>The test follows FCC Public Notice DA 00-705 Measurement Guidelines.</p> <p><u>Use the following spectrum analyzer settings:</u></p> <ul style="list-style-type: none"> <li>- Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel</li> <li>- RBW &gt; the 20 dB bandwidth of the emission being measured</li> <li>- VBW <math>\geq</math> RBW</li> <li>- Sweep = auto</li> <li>- Detector function = peak</li> <li>- Trace = max hold</li> <li>- Allow the trace to stabilize.</li> </ul>	

	<ul style="list-style-type: none"> <li>- Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power (see the note above regarding external attenuation and cable loss). The limit is specified in one of the subparagraphs of this Section. Submit this plot. A peak responding power meter may be used instead of a spectrum analyzer.</li> </ul>
Remark	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Test Data  Yes  N/A

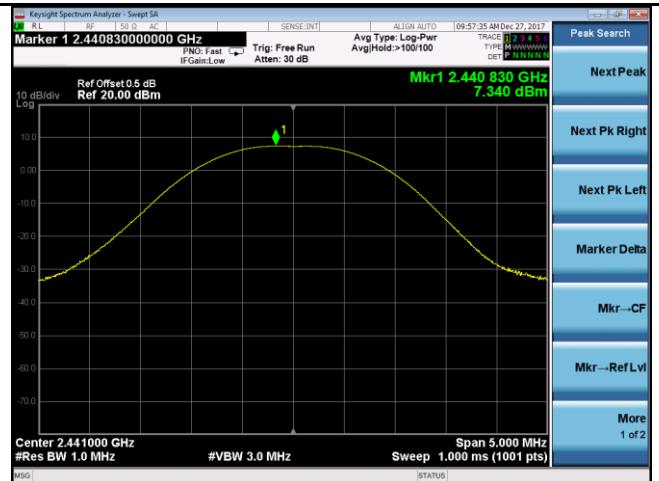
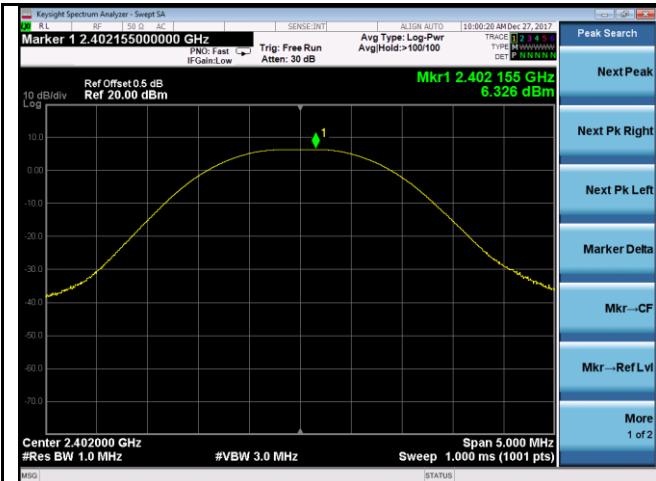
Test Plot  Yes (See below)  N/A

#### Peak Output Power measurement result

Type	Modulation	CH	Frequency (MHz)	Conducted Power (dBm)	Limit (mW)	Result
Output power	GFSK	Low	2402	6.326	1000	Pass
		Mid	2441	7.340	1000	Pass
		High	2480	7.811	1000	Pass
	$\pi/4$ DQPSK	Low	2402	5.857	125	Pass
		Mid	2441	6.159	125	Pass
		High	2480	6.516	125	Pass
	8-DPSK	Low	2402	5.384	125	Pass
		Mid	2441	6.543	125	Pass
		High	2480	6.287	125	Pass

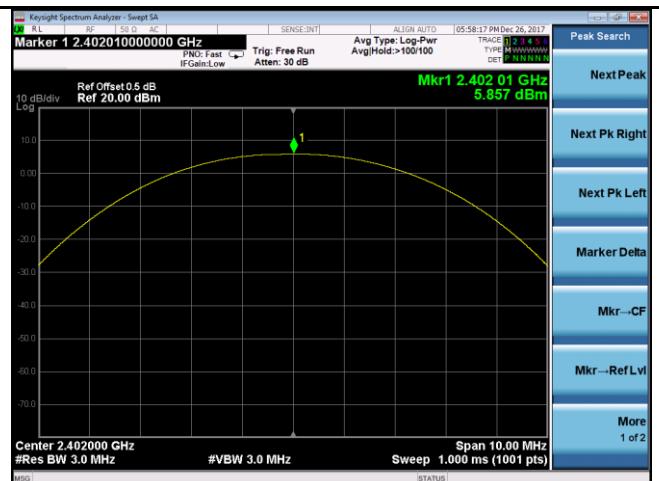
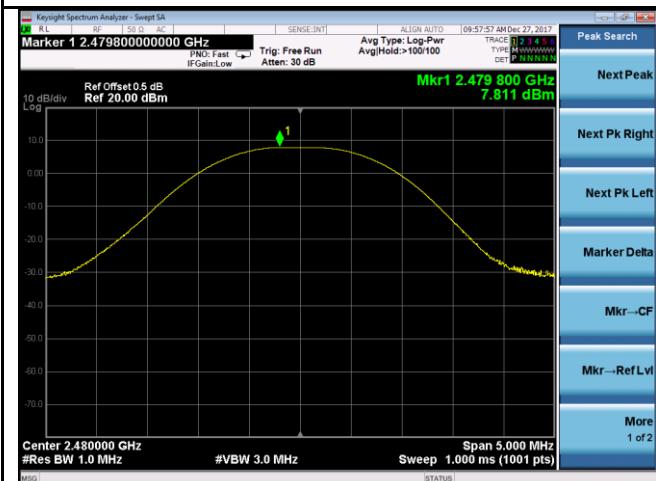
## Test Plots

### Output Power measurement result



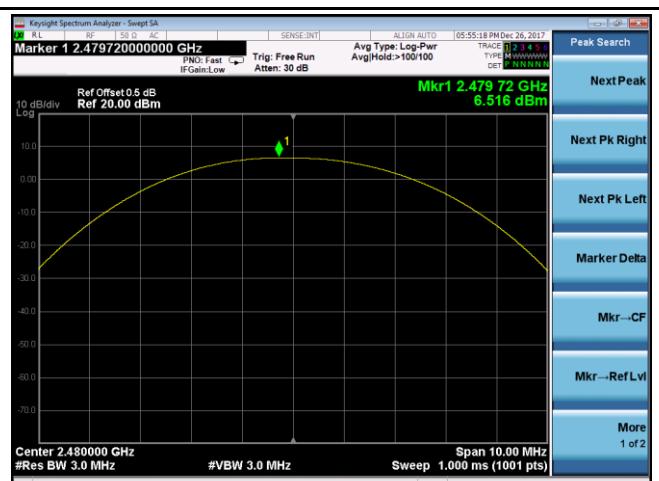
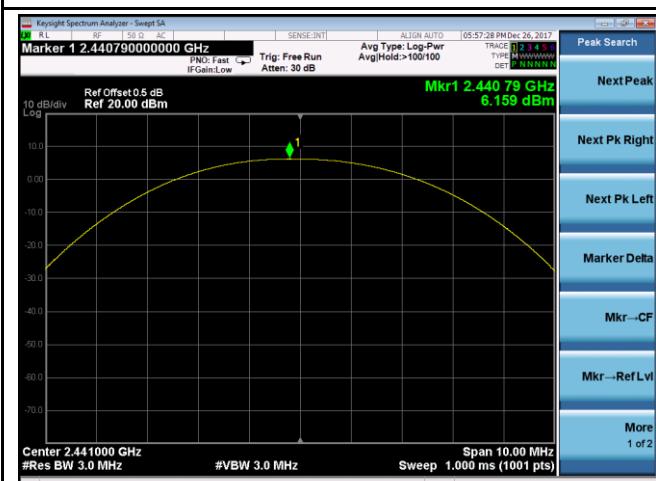
GFSK Output power - Low CH 2402

GFSK Output power - Mid CH 2441



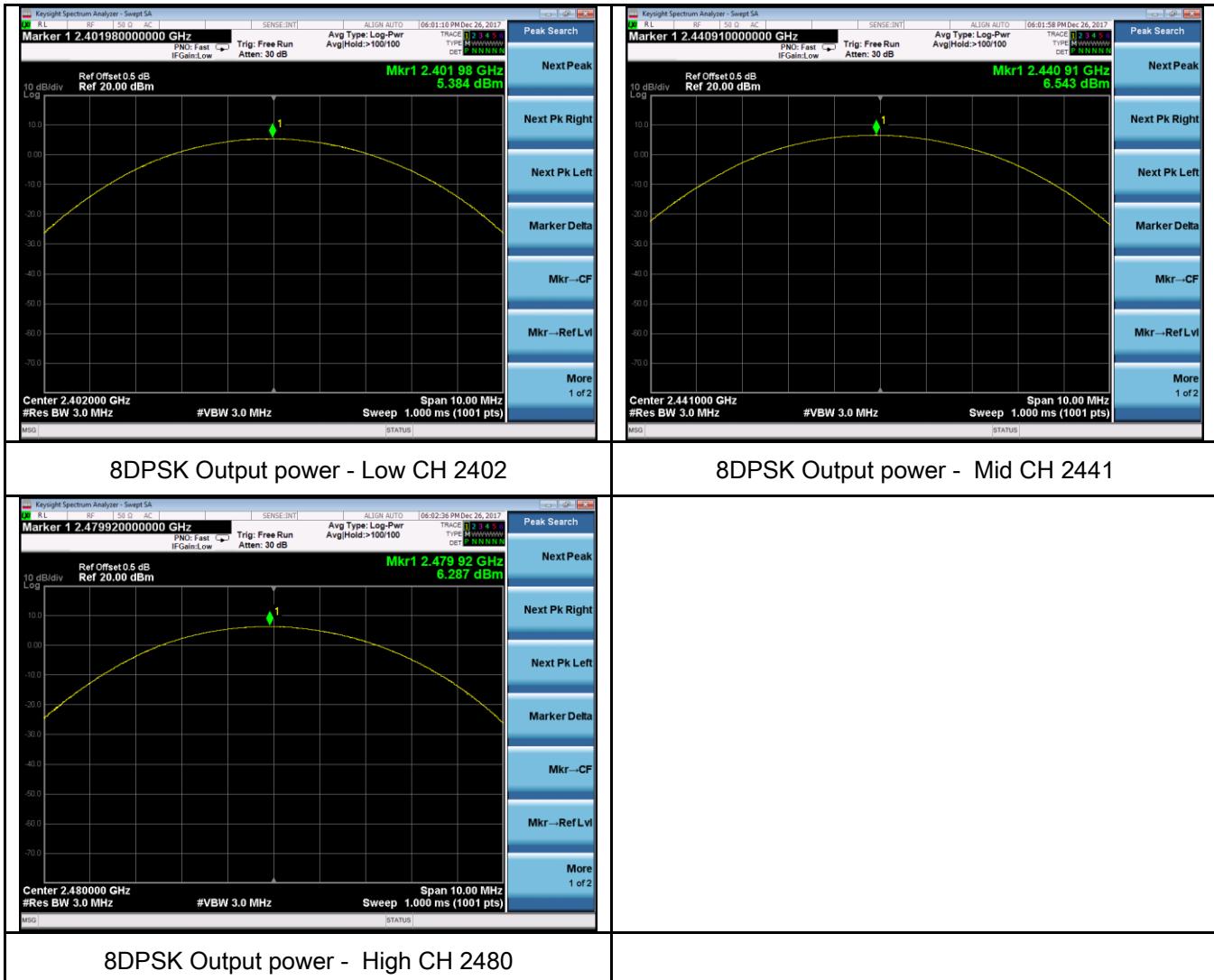
GFSK Output power - High CH 2480

$\pi/4$  DQPSK Output power - Low CH 2402



$\pi/4$  DQPSK Output power - Mid CH 2441

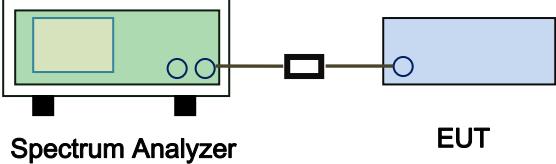
$\pi/4$  DQPSK Output power - High CH 2480



## 6.5 Number of Hopping Channel

Temperature	27°C
Relative Humidity	55%
Atmospheric Pressure	1023mbar
Test date :	December 22, 2017
Tested By :	Aarron Liang

### Requirement(s):

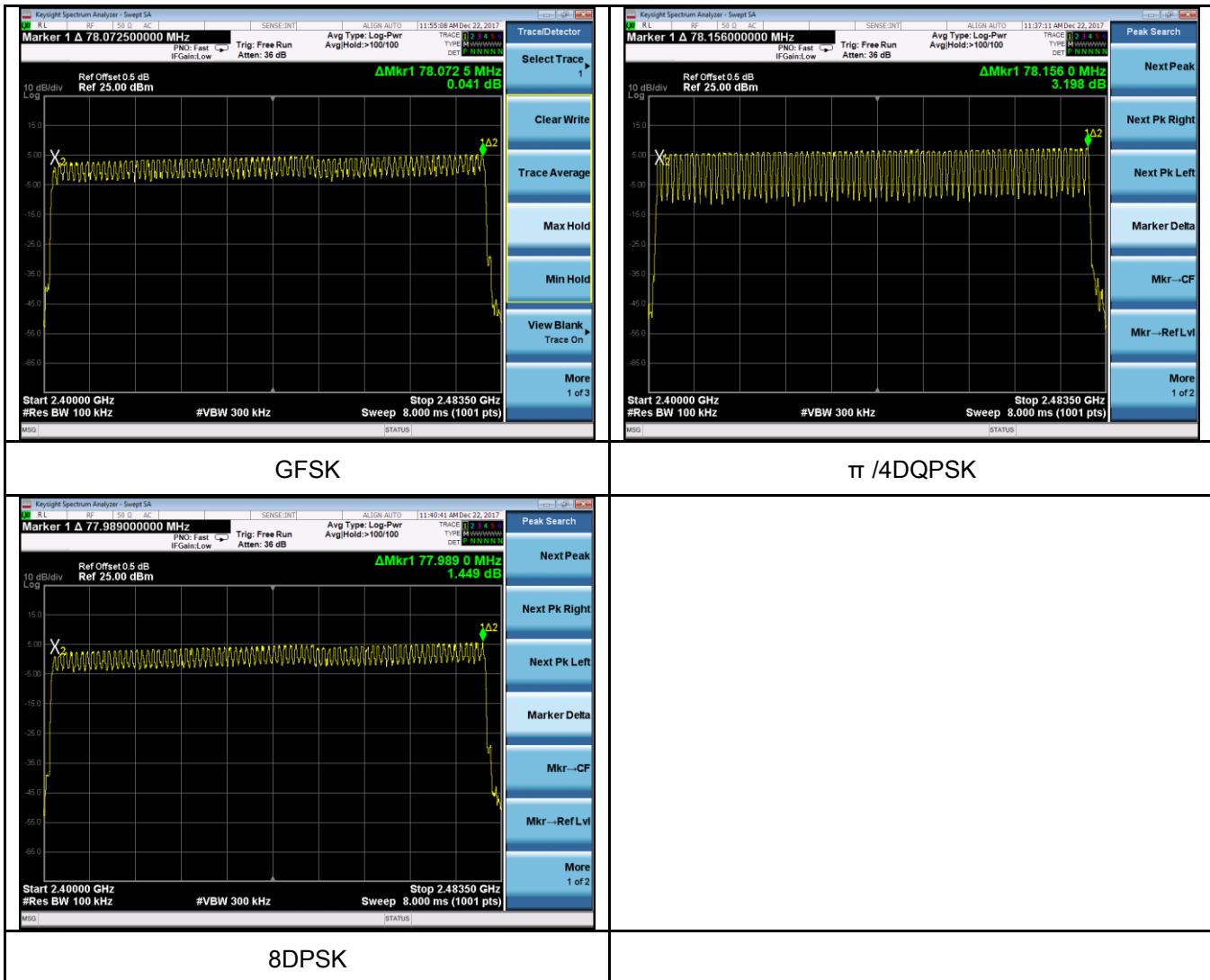
Spec	Item	Requirement	Applicable	
§15.247(a) (1)(iii)	a)	FHSS in 2400-2483.5MHz $\geq$ 15 channels	<input checked="" type="checkbox"/>	
Test Setup	 <b>Spectrum Analyzer</b> <b>EUT</b>			
Test Procedure	<p>The test follows FCC Public Notice DA 00-705 Measurement Guidelines.</p> <p><u>Use the following spectrum analyzer settings:</u></p> <p>The EUT must have its hopping function enabled.</p> <ul style="list-style-type: none"> <li>- Span = the frequency band of operation</li> <li>- RBW <math>\geq</math> 1% of the span</li> <li>- VBW <math>\geq</math> RBW</li> <li>- Sweep = auto</li> <li>- Detector function = peak</li> <li>- Trace = max hold</li> <li>- Allow trace to fully stabilize.</li> <li>- It may prove necessary to break the span up to sections, in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).</li> </ul>			
Remark				
Result	<input checked="" type="checkbox"/>	Pass	<input type="checkbox"/>	Fail
Test Data	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	N/A
Test Plot	<input checked="" type="checkbox"/>	Yes (See below)	<input type="checkbox"/>	N/A

### Number of Hopping Channel measurement result

Type	Modulation	Frequency Range	Number of Hopping Channel	Limit
Number of Hopping Channel	GFSK	2400-2483.5	79	15
	$\pi/4$ DQPSK	2400-2483.5	79	15
	8-DPSK	2400-2483.5	79	15

### Test Plots

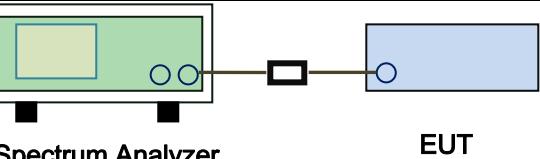
#### Number of Hopping Channels measurement result



## 6.6 Time of Occupancy (Dwell Time)

Temperature	27°C
Relative Humidity	55%
Atmospheric Pressure	1023mbar
Test date :	December 22, 2017
Tested By :	Aarron Liang

### Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(a) (1)(iii)	a)	Dwell Time < 0.4s	<input checked="" type="checkbox"/>
Test Setup		 <p style="text-align: center;">Spectrum Analyzer      EUT</p>	
The test follows FCC Public Notice DA 00-705 Measurement Guidelines.			
<u>Use the following spectrum analyzer</u> <ul style="list-style-type: none"> <li>- Span = zero span, centered on a hopping channel</li> <li>- RBW = 1 MHz</li> <li>- VBW <math>\geq</math> RBW</li> <li>- Sweep = as necessary to capture the entire dwell time per hopping channel</li> <li>- Detector function = peak</li> <li>- Trace = max hold</li> <li>- use the marker-delta function to determine the dwell time</li> </ul>			
Test Procedure			
Remark			
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail		

Test Data  Yes

N/A

**Test Plot**  Yes (See below)

N/A

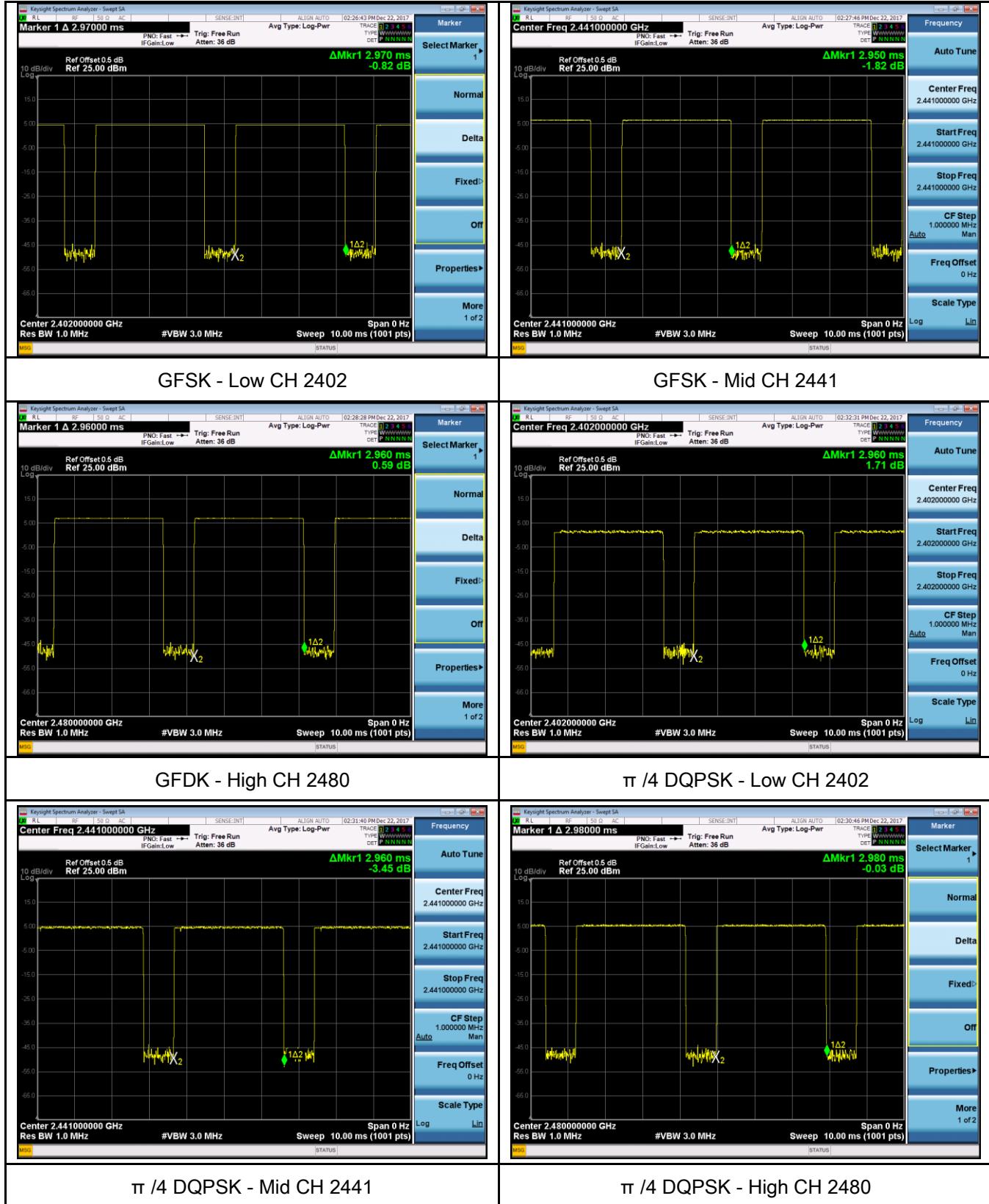
Dwell Time measurement result

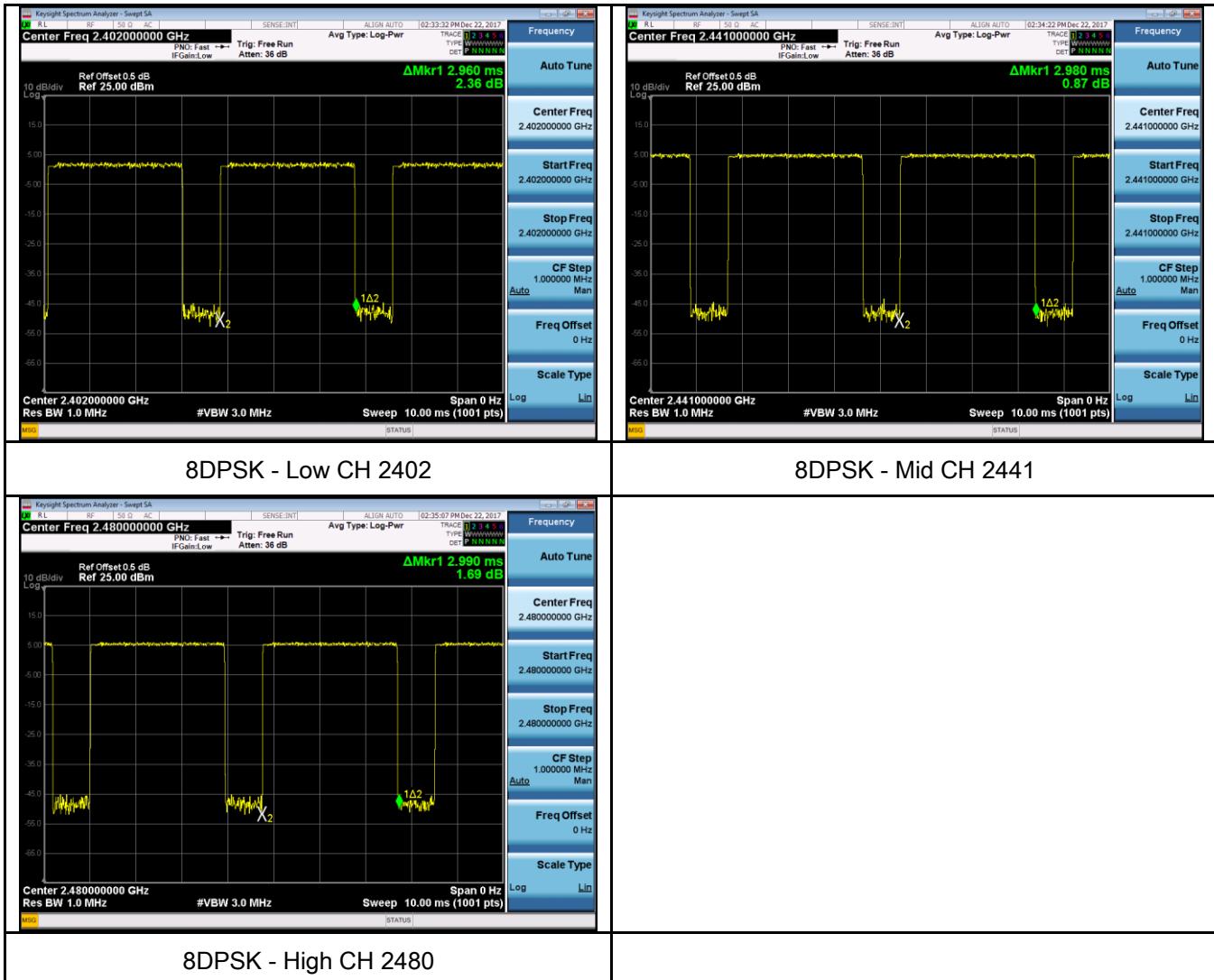
Type	Modulation	CH	Pulse Width (ms)	Dwell Time (ms)	Limit (ms)	Result
Dwell Time	GFSK	Low	2.97	316.800	400	Pass
		Mid	2.95	314.667	400	Pass
		High	2.96	315.733	400	Pass
	$\pi/4$ DQPSK	Low	2.96	315.733	400	Pass
		Mid	2.96	315.733	400	Pass
		High	2.98	317.867	400	Pass
	8-DPSK	Low	2.96	315.733	400	Pass
		Mid	2.98	317.867	400	Pass
		High	2.99	318.933	400	Pass

Note: Dwell time=Pulse Time (ms)  $\times (1600 \div 6 \div 79) \times 31.6$

## Test Plots

### Dwell Time measurement result

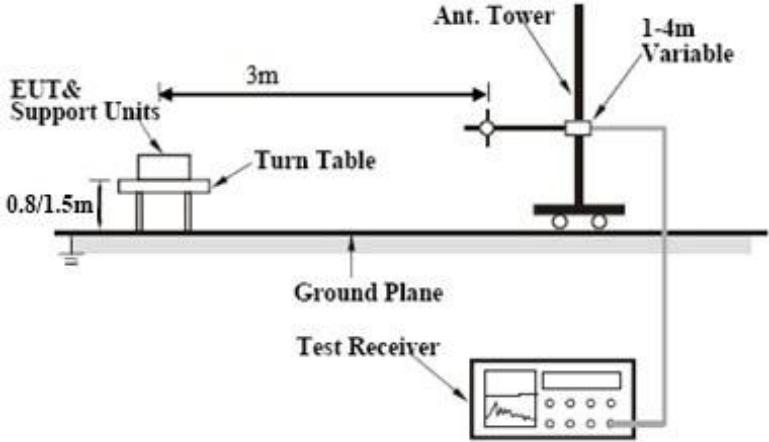




## 6.7 Band Edge & Restricted Band

Temperature	25°C
Relative Humidity	57%
Atmospheric Pressure	1015mbar
Test date :	December 07, 2017
Tested By :	Aarron Liang

### Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(a) (1)(iii)	a)	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.□	<input checked="" type="checkbox"/>
Test Setup	 <p>The diagram illustrates the test setup. An EUT &amp; Support Units are mounted on a Turn Table, which is positioned 0.8/1.5m above a Ground Plane. A vertical Ant. Tower is connected to the turn table, and its height is adjustable from 1-4m. A Test Receiver is connected to the Ant. Tower to measure the signal.</p>		
Test Procedure	<p>The test follows FCC Public Notice DA 00-705 Measurement Guidelines. Radiated Method Only</p> <ul style="list-style-type: none"> <li>- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.</li> <li>- 2. Position the EUT without connection to measurement instrument. Put it on the Rotated table and turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range,</li> </ul>		

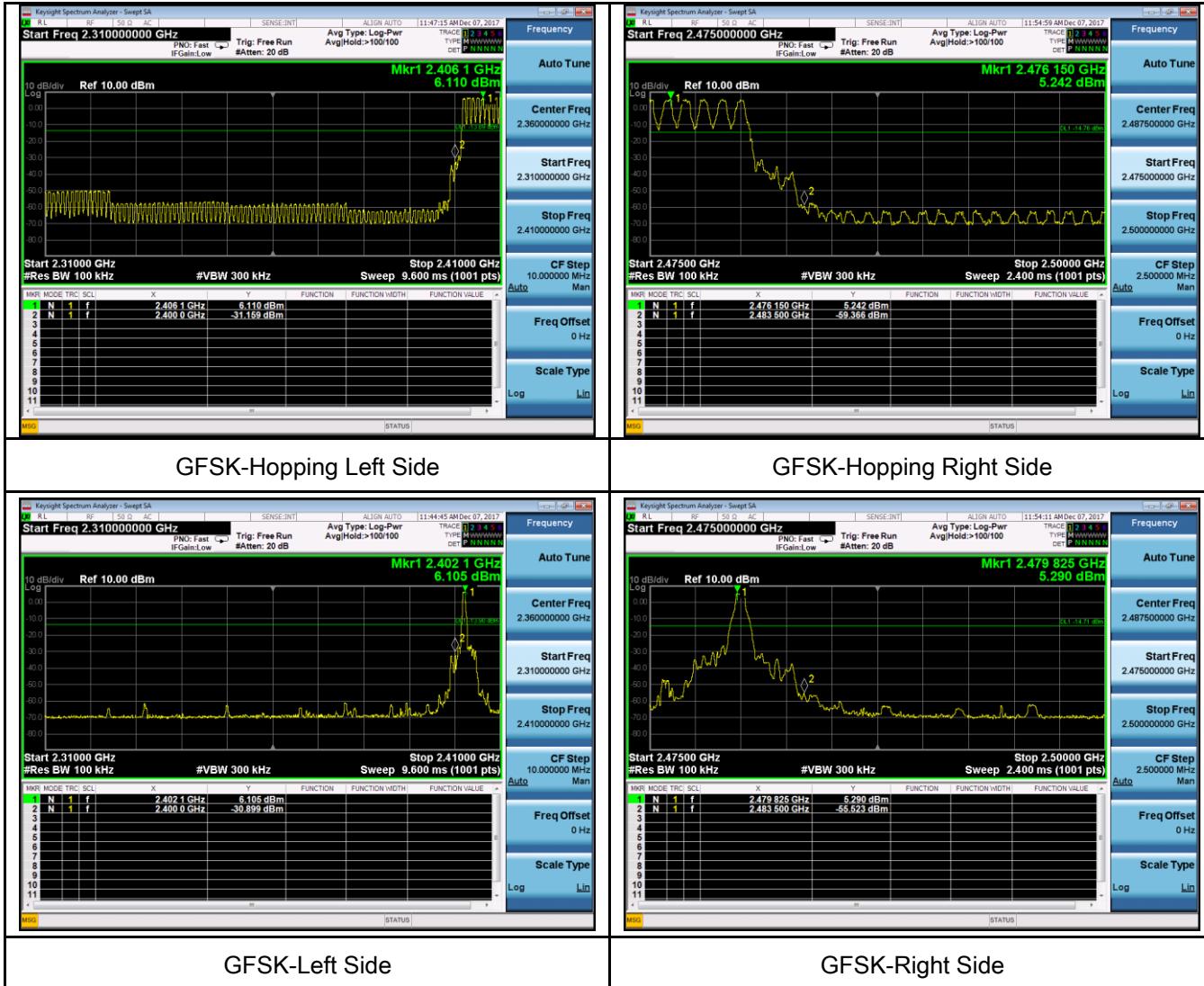
	<p>and make sure the instrument is operated in its linear range.</p> <ul style="list-style-type: none"> <li>- 3. First, set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, check the emission of EUT, if pass then set Spectrum Analyzer as below:           <ul style="list-style-type: none"> <li>a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasiy Peak detection at frequency below 1GHz.</li> <li>b. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak measurement at frequency above 1GHz.</li> <li>c. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz with Peak detection for Average Measurement as below at frequency above 1GHz.</li> </ul> </li> <li>- 4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.</li> <li>- 5. Repeat above procedures until all measured frequencies were complete.</li> </ul>
Remark	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Test Data     Yes       N/A

Test Plot     Yes (See below)       N/A

## Test Plots

### GFSK Mode:

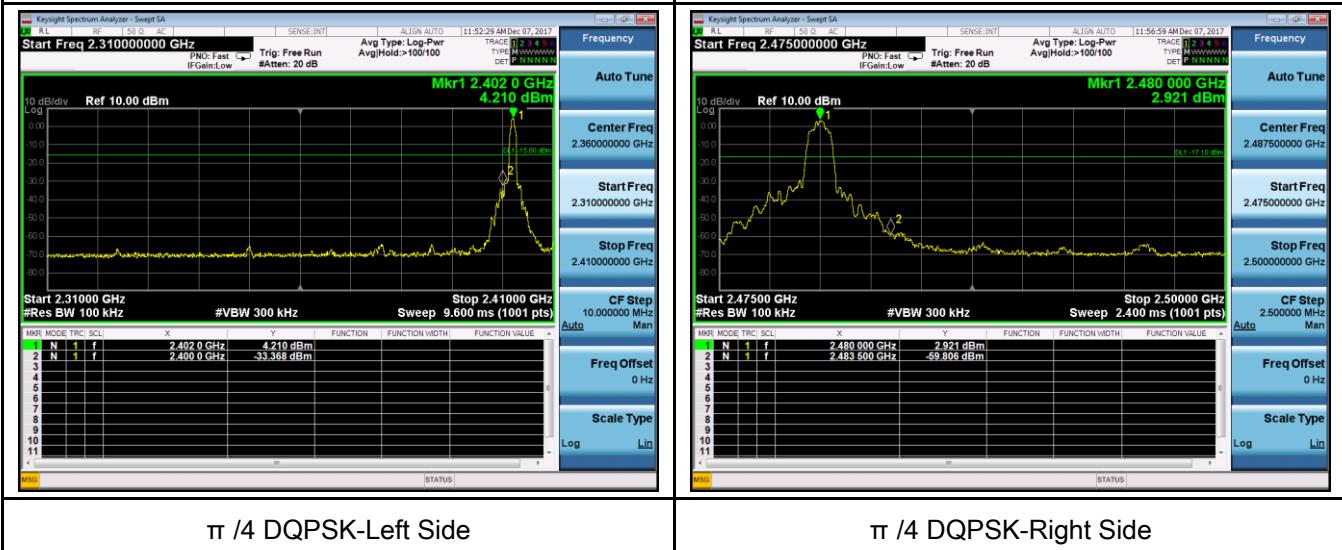


### $\pi/4$ DQPSK Mode:



$\pi/4$  DQPSK-Hopping Left Side

$\pi/4$  DQPSK-Hopping Right Side



$\pi/4$  DQPSK-Left Side

$\pi/4$  DQPSK-Right Side

## 8-DPSK Mode:



8DPSK-Hopping Left Side

8DPSK-Hopping Right Side



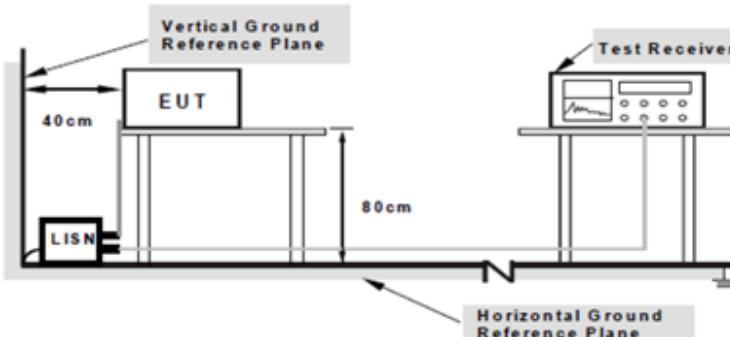
8DPSK-Left Side

8DPSK-Right Side

## 6.8 AC Power Line Conducted Emissions

Temperature	--
Relative Humidity	--
Atmospheric Pressure	--
Test date :	--
Tested By :	--

### Requirement(s):

Spec	Item	Requirement	Applicable														
47CFR§15.207, RSS210 (A8.1)	a)	<p>For Low-power radio-frequency devices that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 [mu]H/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequencies ranges.</p> <table border="1"> <thead> <tr> <th rowspan="2">Frequency ranges (MHz)</th> <th colspan="2">Limit (dB<math>\mu</math>V)</th> </tr> <tr> <th>QP</th> <th>Average</th> </tr> </thead> <tbody> <tr> <td>0.15 ~ 0.5</td> <td>66 – 56</td> <td>56 – 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 ranges (MHz)	Limit (dB $\mu$ V)		QP	Average	0.15 ~ 0.5	66 – 56	56 – 46	0.5 ~ 5	56	46	5 ~ 30	60	50	<input type="checkbox"/>
Frequency ranges (MHz)	Limit (dB $\mu$ V)																
	QP	Average															
0.15 ~ 0.5	66 – 56	56 – 46															
0.5 ~ 5	56	46															
5 ~ 30	60	50															
Test Setup	 <p><b>Note:</b> 1. Support units were connected to second LISN. 2. Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.</p>																
Procedure	<ol style="list-style-type: none"> <li>The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.</li> <li>The power supply for the EUT was fed through a 50W/50mH EUT LISN, connected to filtered mains.</li> <li>The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss</li> </ol>																

	<p>coaxial cable.</p> <ol style="list-style-type: none"> <li>4. All other supporting equipment were powered separately from another main supply.</li> <li>5. The EUT was switched on and allowed to warm up to its normal operating condition.</li> <li>6. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.</li> <li>7. High peaks, relative to the limit line, The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 kHz.</li> <li>8. Step 7 was then repeated for the LIVE line (for AC mains) or DC line (for DC power).</li> </ol>
Remark	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail <input checked="" type="checkbox"/> N/A

Test Data  Yes  N/A

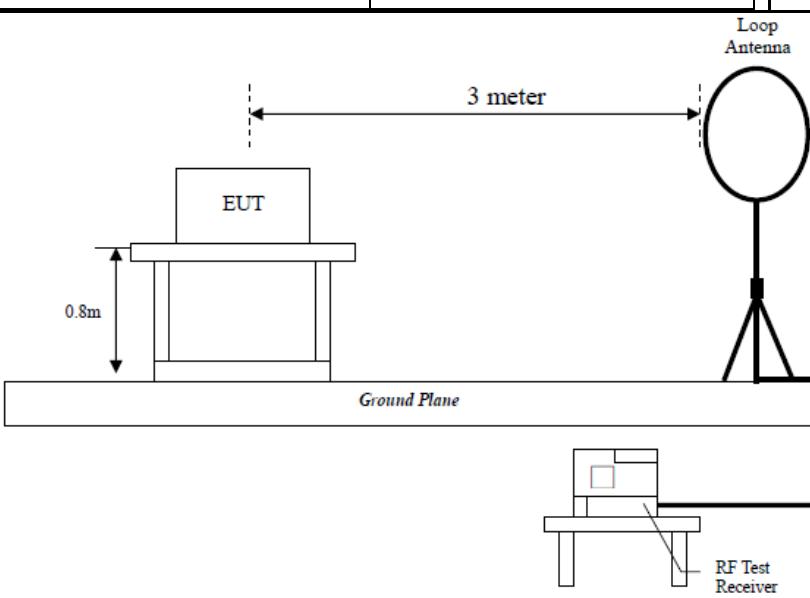
Test Plot  Yes (See below)  N/A

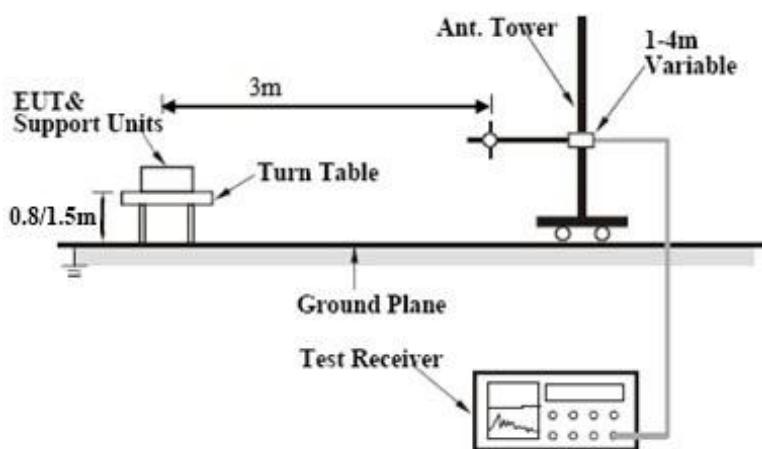
## 6.9 Radiated Emissions & Restricted Band

Temperature	25°C
Relative Humidity	57%
Atmospheric Pressure	1015mbar
Test date :	December 07, 2017
Tested By :	Aarron Liang

### Requirement(s):

Spec	Item	Requirement	Applicable																
47CFR§15. 205, §15.209, §15.247(d)	a)	<p>Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges</p> <table border="1"> <thead> <tr> <th>Frequency range (MHz)</th> <th>Field Strength (<math>\mu</math>V/m)</th> </tr> </thead> <tbody> <tr> <td>0.009~0.490</td> <td>2400/F(KHz)</td> </tr> <tr> <td>0.490~1.705</td> <td>24000/F(KHz)</td> </tr> <tr> <td>1.705~30.0</td> <td>30</td> </tr> <tr> <td>30 – 88</td> <td>100</td> </tr> <tr> <td>88 – 216</td> <td>150</td> </tr> <tr> <td>216~960</td> <td>200</td> </tr> <tr> <td>Above 960</td> <td>500</td> </tr> </tbody> </table>	Frequency range (MHz)	Field Strength ( $\mu$ V/m)	0.009~0.490	2400/F(KHz)	0.490~1.705	24000/F(KHz)	1.705~30.0	30	30 – 88	100	88 – 216	150	216~960	200	Above 960	500	<input checked="" type="checkbox"/>
Frequency range (MHz)	Field Strength ( $\mu$ V/m)																		
0.009~0.490	2400/F(KHz)																		
0.490~1.705	24000/F(KHz)																		
1.705~30.0	30																		
30 – 88	100																		
88 – 216	150																		
216~960	200																		
Above 960	500																		

Test Setup	 <p>The diagram illustrates the test setup for radiated emissions. A 'Loop Antenna' is positioned 3 meters horizontally from the 'EUT' (Equipment Under Test). The EUT is placed on a 'Ground Plane' and is 0.8m above it. An 'RF Test Receiver' is connected to the Loop Antenna via a cable, with a small inset showing a close-up of the connection point.</p>
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Procedure	<ol style="list-style-type: none"> <li>1. The EUT was switched on and allowed to warm up to its normal operating condition.</li> <li>2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:           <ol style="list-style-type: none"> <li>a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.</li> <li>b. The EUT was then rotated to the direction that gave the maximum emission.</li> <li>c. Finally, the antenna height was adjusted to the height that gave the maximum emission.</li> </ol> </li> <li>3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasiy Peak detection at frequency below 1GHz.</li> <li>4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak measurement at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz with Peak detection for Average Measurement as below at frequency above 1GHz.</li> <li>5. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.</li> </ol>
Remark	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Test Data	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> N/A
Test Plot	<input checked="" type="checkbox"/> Yes (See below) <input type="checkbox"/> N/A

Yes       N/A  
 Yes (See below)       N/A

## Test Result:

Test Mode:	Transmitting Mode
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Frequency range: 9KHz - 30MHz

Freq. (MHz)	Detection value	Factor (dB/m)	Reading (dBuV/m)	Result (dBuV/m)	Limit@3m (dBuV/m)	Margin (dB)
--	--	--	--	--	--	>20
--	--	--	--	--	--	>20

Note:

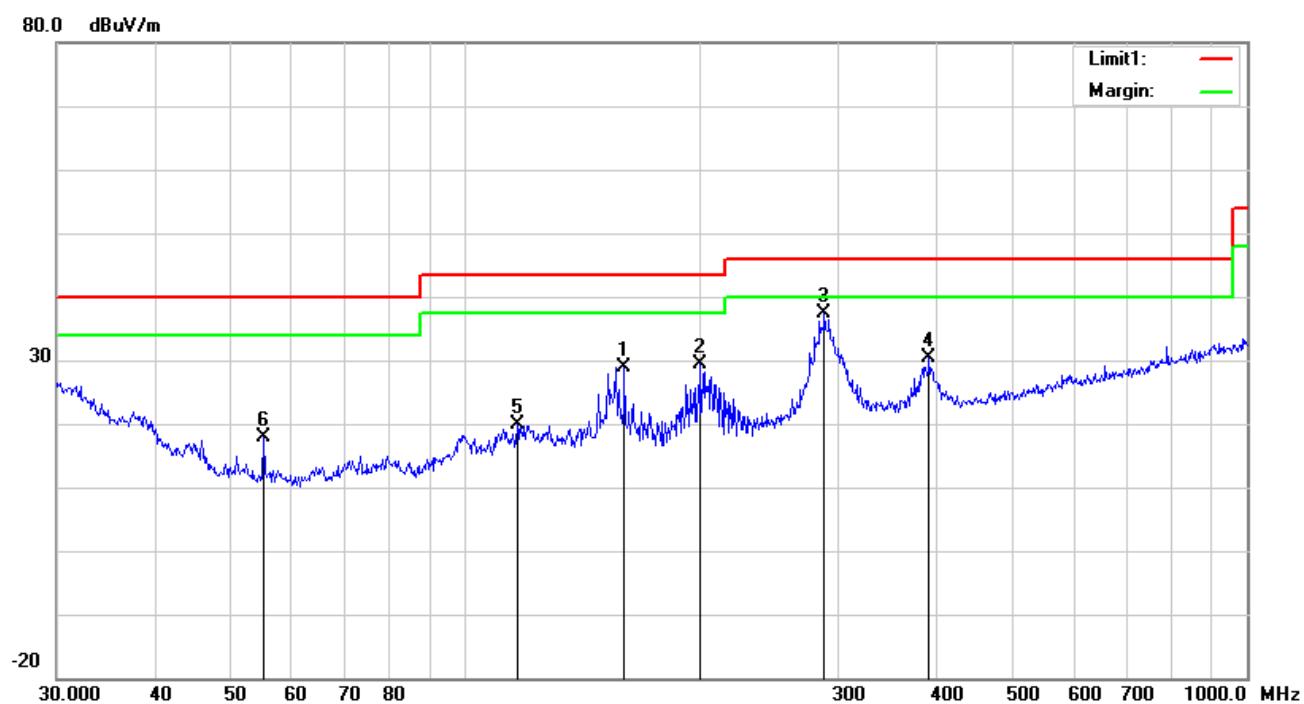
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =  $40 \log \left( \frac{\text{specific distance}}{\text{test distance}} \right) \text{dB}$ ;

Limit line = specific limits(dBuv) + distance extrapolation factor.

**Test Mode:** Bluetooth Mode

**30MHz -1GHz**

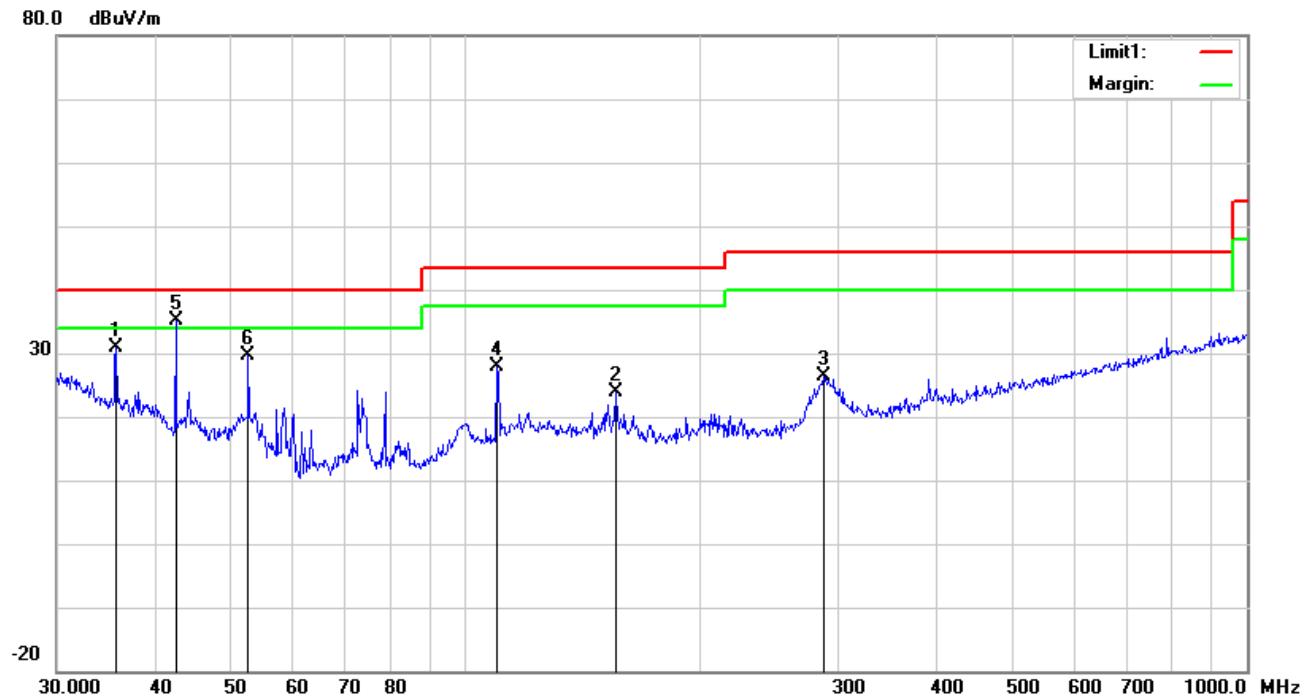


### Test Data

Horizontal Polarity Plot @3m

No.	P/L	Frequency	Reading	Detect or	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degr ee
		(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	( )
1	H	159.7844	37.23	peak	12.60	22.27	1.39	28.95	43.50	-14.55	100	289
2	H	199.9856	38.08	peak	12.10	22.38	1.54	29.34	43.50	-14.16	100	164
3	H	287.9904	44.74	peak	13.07	22.29	1.77	37.29	46.00	-8.71	100	244
4	H	392.0951	34.85	peak	15.53	22.03	2.01	30.36	46.00	-15.64	100	295
5	H	116.5401	27.88	peak	13.29	22.35	1.16	19.98	43.50	-23.52	100	161
6	H	55.2207	31.55	peak	7.83	22.40	0.78	17.76	40.00	-22.24	100	171

### 30MHz -1GHz



#### Test Data

Vertical Polarity Plot @3m

No.	P/L	Frequency	Reading	Detect or	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degr ee
		(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	( )
1	V	35.7491	35.37	peak	17.00	22.25	0.76	30.88	40.00	-9.12	100	255
2	V	155.9101	32.11	peak	12.60	22.30	1.37	23.78	43.50	-19.72	200	150
3	V	286.9823	33.94	peak	13.03	22.29	1.77	26.45	46.00	-19.55	100	26
4	V	109.7960	36.84	peak	12.11	22.34	1.17	27.78	43.50	-15.72	100	78
5	V	42.6000	44.58	QP	12.18	22.29	0.77	35.24	40.00	-4.76	100	140
6	V	52.7600	43.14	peak	8.10	22.39	0.79	29.64	40.00	-10.36	100	111

## Above 1GHz

Test Mode:	Transmitting Mode
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### Low Channel: GFSK Mode (Worst Case) (2402 MHz)

Frequency (MHz)	Meter Reading (dB $\mu$ V)	Antenna Factor (dB)	Cable loss (dB)	Preamp factor (dB)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector (PK/AV)	Polarity (H/V)
Low Channel:GFSK Mode(Worst Case)-2402MHz									
2390	38.54	28.72	3.36	26.32	44.30	74	-29.70	peak	Vertical
4804	29.52	32.94	3.98	27.49	38.95	54	-15.05	Average	Vertical
4804	40.16	32.94	3.98	27.49	49.59	74	-24.41	peak	Vertical
7206	30.27	25.28	5.51	27.94	33.12	54	-20.88	Average	Vertical
7206	41.28	25.28	5.51	27.94	44.13	74	-29.87	peak	Vertical
2390	39.42	28.72	3.36	26.32	45.18	74	-28.82	peak	Horizontal
4804	29.85	32.94	3.98	27.49	39.28	54	-14.72	Average	Horizontal
4804	40.57	32.94	3.98	27.49	50.00	74	-24.00	peak	Horizontal
7206	30.35	25.28	5.51	27.94	33.20	54	-20.80	Average	Horizontal
7206	41.24	25.28	5.51	27.94	44.09	74	-29.91	peak	Horizontal
Middle Channel:GFSK Mode(Worst Case)-2441MHz									
4882	30.52	32.11	4.04	27.53	39.14	54	-14.86	Average	Vertical
4882	40.23	32.11	4.04	27.53	48.85	74	-25.15	peak	Vertical
7323	31.17	24.33	5.58	27.96	33.12	54	-20.88	Average	Vertical
7323	41.05	24.33	5.58	27.96	43.00	74	-31.00	peak	Vertical
4882	30.56	32.11	4.04	27.53	39.18	54	-14.82	Average	Horizontal
4882	42.28	32.11	4.04	27.53	50.90	74	-23.10	peak	Horizontal
7323	31.13	24.33	5.58	27.96	33.08	54	-20.92	Average	Horizontal
7323	42.19	24.33	5.58	27.96	44.14	74	-29.86	peak	Horizontal
High Channel:GFSK Mode(Worst Case)-2480MHz									
2483.5	39.17	28.79	3.48	26.34	45.10	74	-28.90	peak	Vertical
4960	30.17	31.32	4.12	27.58	38.03	54	-15.97	Average	Vertical
4960	40.75	31.32	4.12	27.58	48.61	74	-25.39	peak	Vertical
7440	30.56	24.38	5.68	27.99	32.63	54	-21.37	Average	Vertical
7440	41.26	24.38	5.68	27.99	43.33	74	-30.67	peak	Vertical
2483.5	39.17	28.79	3.48	26.34	45.10	74	-28.90	peak	Horizontal
4960	29.13	31.32	4.12	27.58	36.99	54	-17.01	Average	Horizontal
4960	40.12	31.32	4.12	27.58	47.98	74	-26.02	peak	Horizontal
7440	31.36	24.38	5.68	27.99	33.43	54	-20.57	Average	Horizontal

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**Note:**

- 1, The testing has been conformed to  $10 \times 2480\text{MHz} = 24,800\text{MHz}$
- 2, All other emissions more than 30 dB below the limit
- 3, X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.
- 4, The radiated spurious test above 18GHz is subcontracted to SIEMIC (Nanjing-China) Laboratories. and found 30dB below the limit at least.