



# RF TEST REPORT



Report No.: 18070747-FCC-R1

Supersede Report No.: N/A

Applicant	Circus World Displays Limited	
Product Name	Powered Bookshelf Speaker	
Model No.	Ai60	
Serial No.	N/A	
Test Standard	FCC Part 15.247, ANSI C63.10: 2013	
Test Date	July 19 to 26, 2018	
Issue Date	July 27, 2018	
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"/>		
		
Aaron 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**

Zone A, Floor 1, Building 2 Wan Ye Long Technology Park

South Side of Zhoushi Road, Bao' an District, Shenzhen, Guangdong China 518108

Phone: +86 0755 2601 4629801 Email: [China@siemic.com.cn](mailto:China@siemic.com.cn)

## 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
18070747-FCC-R1	NONE	Original	July 27, 2018

## 2. Customer information

Applicant Name	Circus World Displays Limited
Applicant Add	4080 Montrose Rd Niagara Falls Canada L2H 1J9
Manufacturer	Circus World Displays Limited
Manufacturer Add	4080 Montrose Rd Niagara Falls Canada L2H 1J9

## 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_EMG(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:	Powered Bookshelf Speaker
Main Model:	Ai60
Serial Model:	N/A
Date EUT received:	July 18, 2018
Test Date(s):	July 19 to 26, 2018
Equipment Category :	DSS
Antenna Gain:	Bluetooth/BLE: 0dBi
Antenna Type:	PCB antenna
Type of Modulation:	Bluetooth: GFSK, $\pi/4$ DQPSK, 8DPSK BLE: GFSK
RF Operating Frequency (ies):	Bluetooth& BLE: 2402-2480 MHz
Max. Output Power:	2.263dBm
Number of Channels:	Bluetooth: 79CH BLE: 40CH
Port:	Please refer to the user' s manual
Input Power:	Adapter: Model: DQS751-240300-3 INPUT: AC 100-240V~50/60Hz, 2.0A Max OUTPUT: DC 24V, 3.0A
Trade Name :	Fluance

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FCC ID:

SMHAI60

## 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	Compliance
§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/BLE, the gain is 0dBi for Bluetooth/BLE.


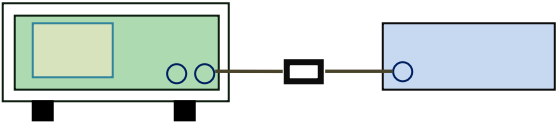
**The antenna meets up with the ANTENNA REQUIREMENT.**

**Result:** Compliance.

## 6.2 Channel Separation

Temperature	26°C
Relative Humidity	55%
Atmospheric Pressure	1017mbar
Test date :	July 18, 2018
Tested By :	Aaron 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	
Test Setup			
Test Procedure	<p>The test follows FCC Public Notice DA 00-705 Measurement Guidelines. Use the following spectrum analyzer settings:</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 ☒ Yes ☐ N/A

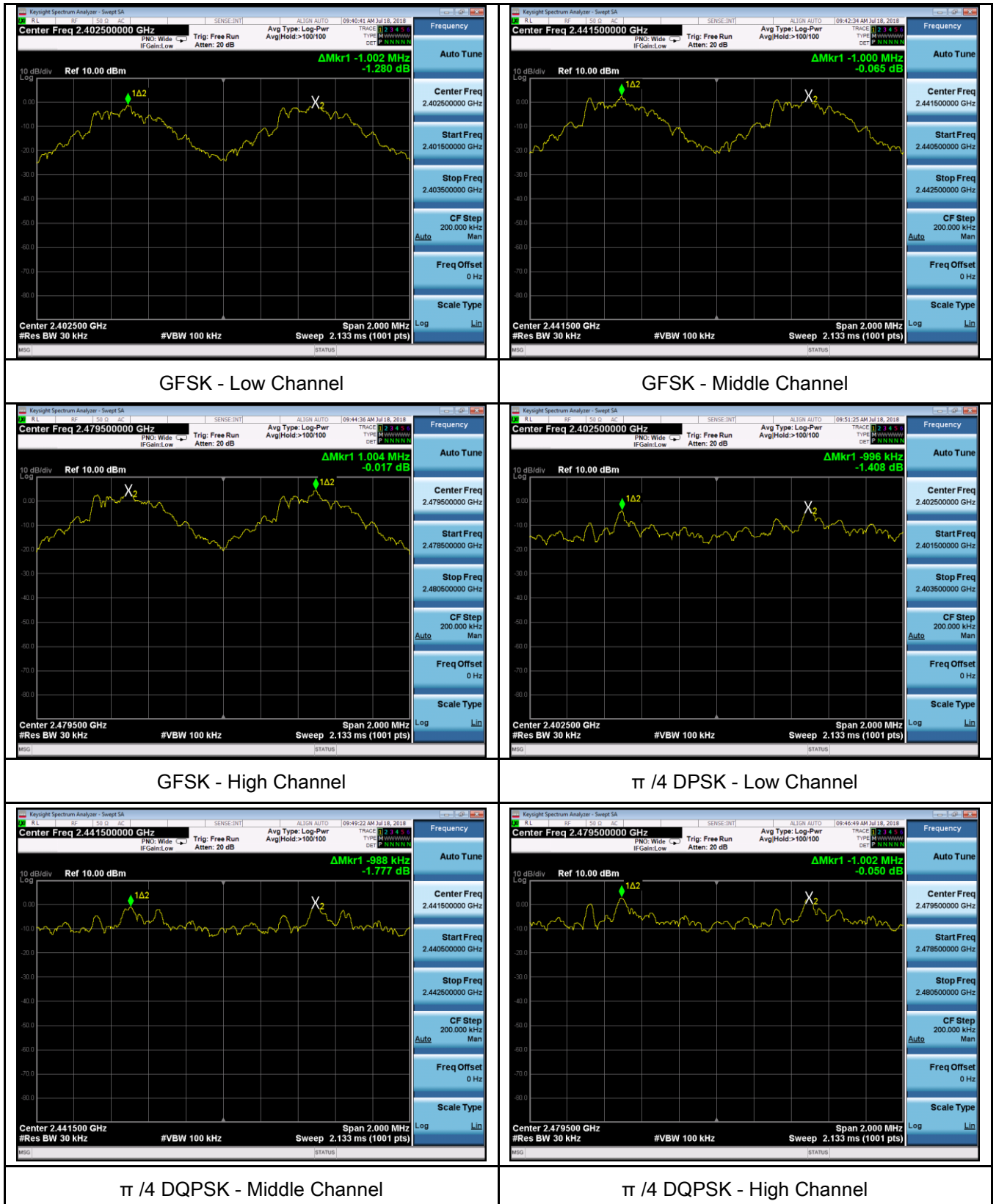
Test Plot ☒ Yes (See below) ☐ N/A

### 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	1.000	0.861	Pass
	Adjacency Channel	2441			
	High Channel	2480	1.004	0.887	Pass
	Adjacency Channel	2479			
CH Separation $\pi/4$ DQPSK	Low Channel	2402	0.996	0.810	Pass
	Adjacency Channel	2403			
	Mid Channel	2440	0.988	0.811	Pass
	Adjacency Channel	2441			
	High Channel	2480	1.002	0.810	Pass
	Adjacency Channel	2479			
CH Separation 8DPSK	Low Channel	2402	0.998	0.804	Pass
	Adjacency Channel	2403			
	Mid Channel	2440	1.006	0.804	Pass
	Adjacency Channel	2441			
	High Channel	2480	0.998	0.805	Pass
	Adjacency Channel	2479			

## Test Plots

### Channel Separation measurement result

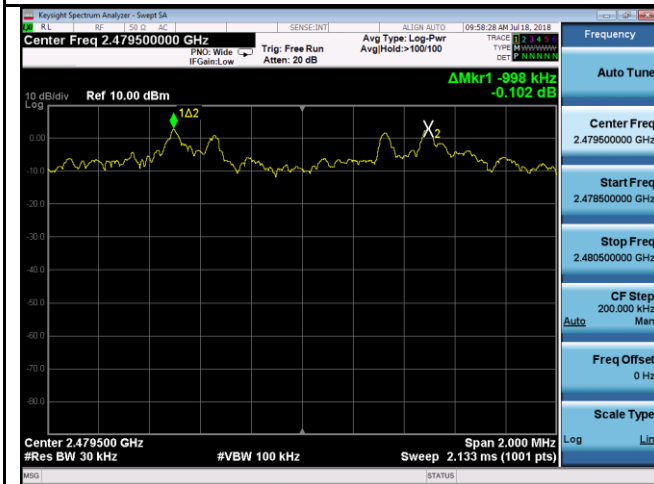




8DPSK - Low Channel



8DPSK - Middle Channel


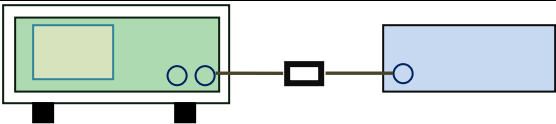


8DPSK - High Channel

### 6.3 20dB Bandwidth

Temperature	26°C
Relative Humidity	55%
Atmospheric Pressure	1017mbar
Test date :	July 18, 2018
Tested By :	Aaron 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.	
Test Setup			
Test Procedure	<p>The test follows FCC Public Notice DA 00-705 Measurement Guidelines. Use the following spectrum analyzer settings:</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

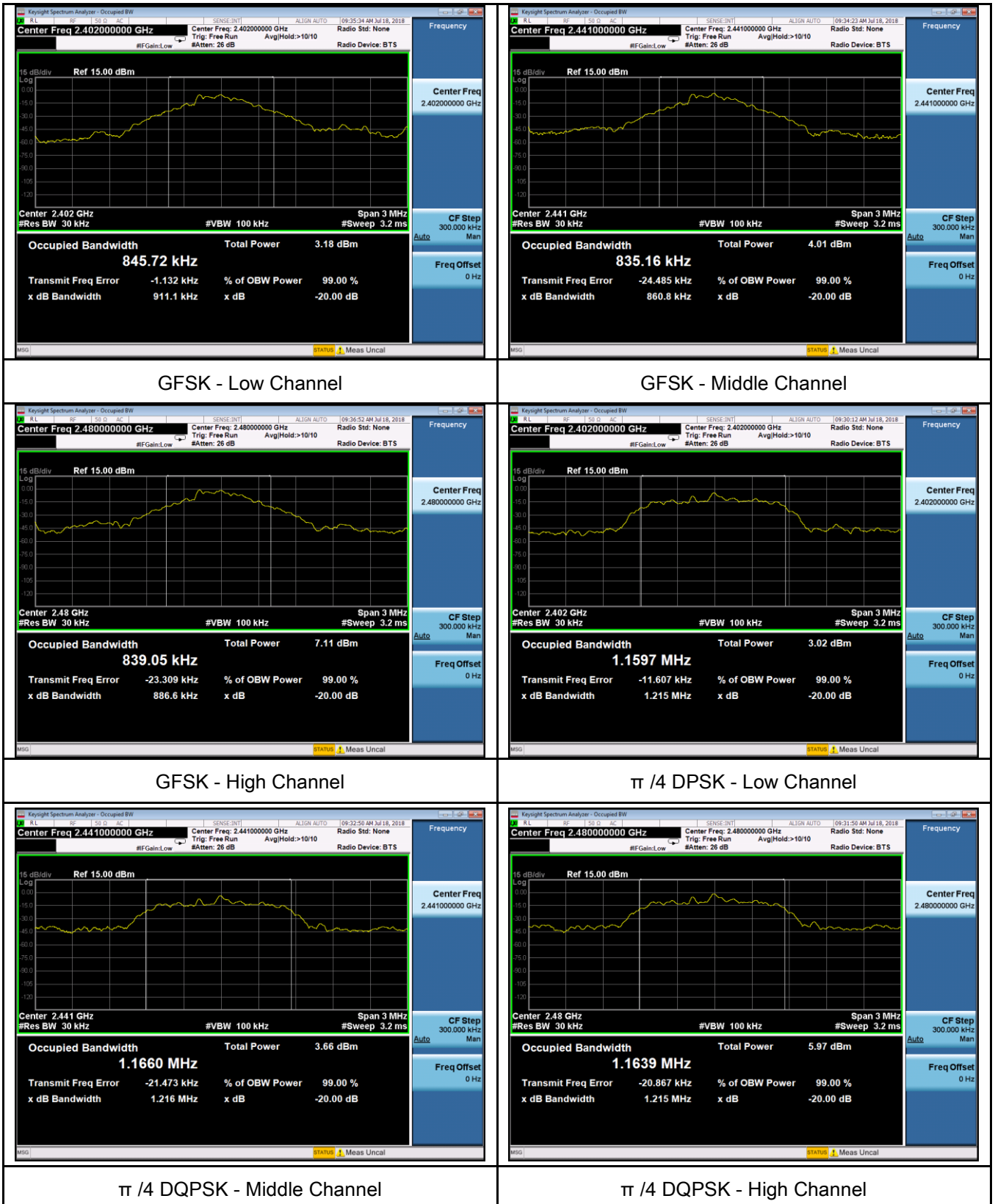
Test Plot ☒ Yes (See below) ☐ N/A

#### Measurement result

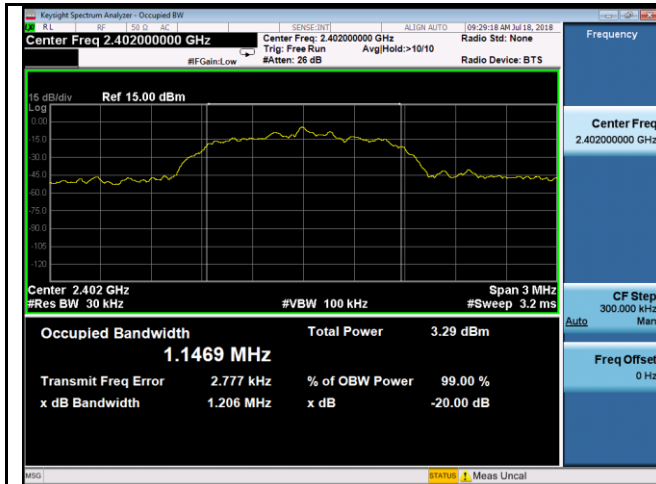
Modulation	CH	CH Frequency (MHz)	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
GFSK	Low	2402	0.9111	0.8457
	Mid	2441	0.8608	0.8352
	High	2480	0.8866	0.8391
$\pi/4$ DQPSK	Low	2402	1.215	1.1597
	Mid	2441	1.216	1.1660
	High	2480	1.215	1.1639
8-DPSK	Low	2402	1.206	1.1469
	Mid	2441	1.206	1.1466
	High	2480	1.207	1.1454

## Test Plots

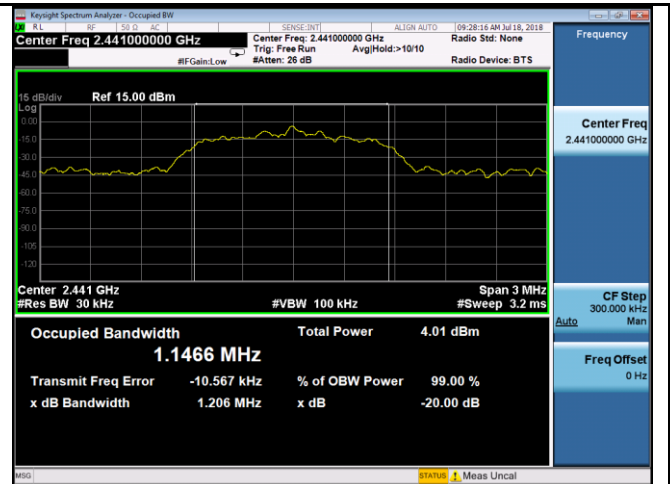
### 20dB Bandwidth measurement result



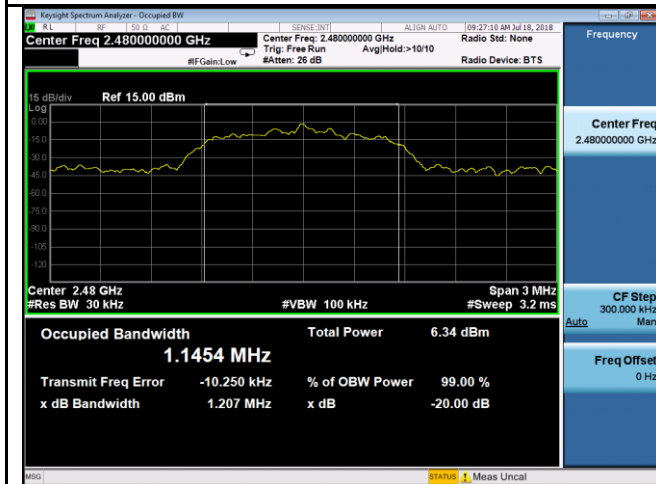




8DPSK - Low Channel



8DPSK - Middle Channel



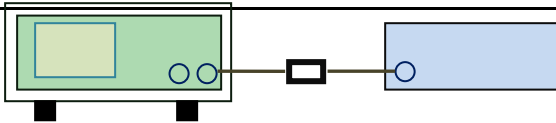
8DPSK - High Channel

## 6.4 Peak Output Power

Temperature	26°C
Relative Humidity	55%
Atmospheric Pressure	1017mbar
Test date :	July 18, 2018
Tested By :	Aaron 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	
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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 <math>&gt;</math> 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>
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	<p>- 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.</p>
Remark	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Test Data ☒ Yes ☐ N/A

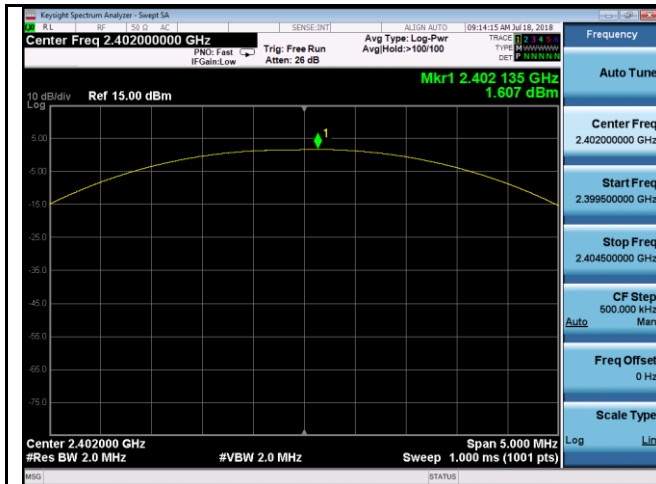
Test Plot ☒ Yes (See below) ☐ N/A

#### Peak Output Power measurement result

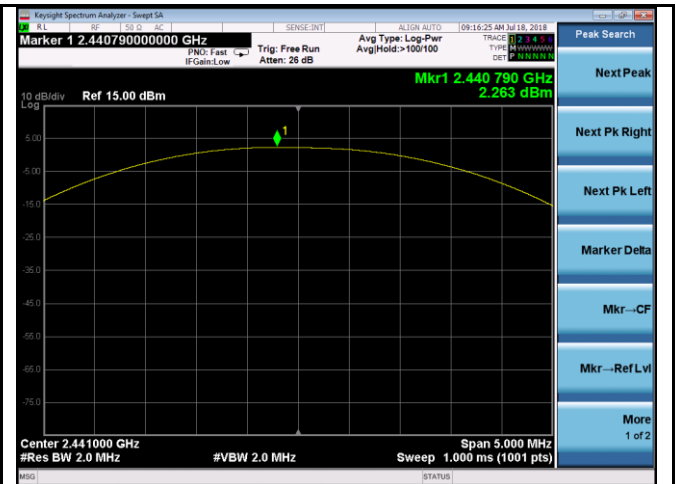
Type	Modulation	CH	Frequency (MHz)	Conducted Power (dBm)	Limit (mW)	Result
Output power	GFSK	Low	2402	1.607	1000	Pass
		Mid	2441	2.263	1000	Pass
		High	2480	1.851	1000	Pass
	$\pi/4$ DQPSK	Low	2402	0.769	125	Pass
		Mid	2441	1.903	125	Pass
		High	2480	1.985	125	Pass
	8-DPSK	Low	2402	1.023	125	Pass
		Mid	2441	1.754	125	Pass
		High	2480	1.795	125	Pass

## Test Plots

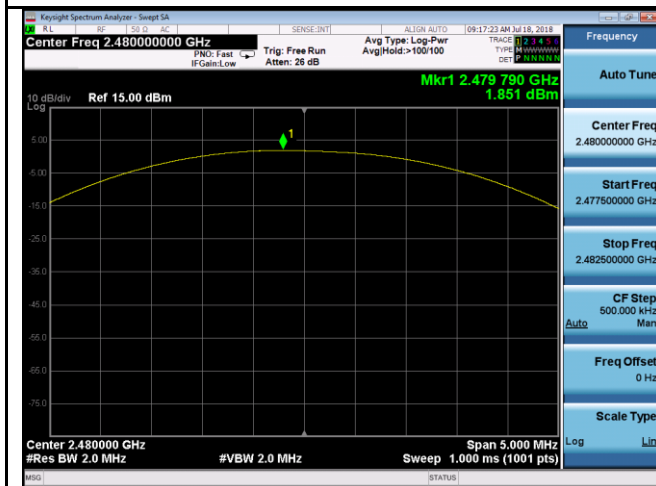
### Output Power measurement result



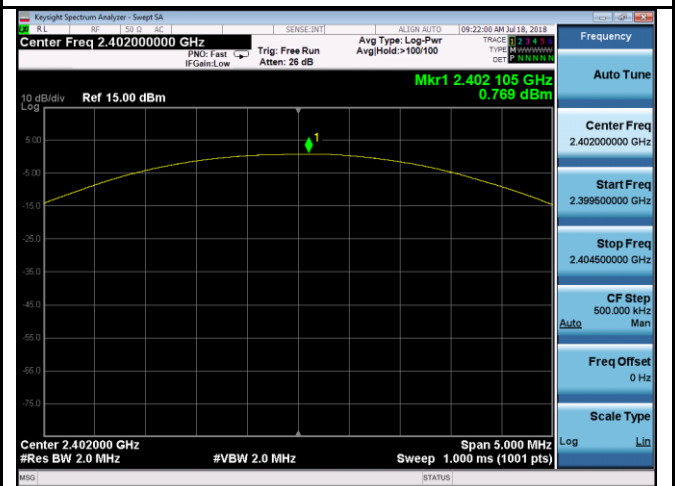
GFSK Output power - Low CH 2402



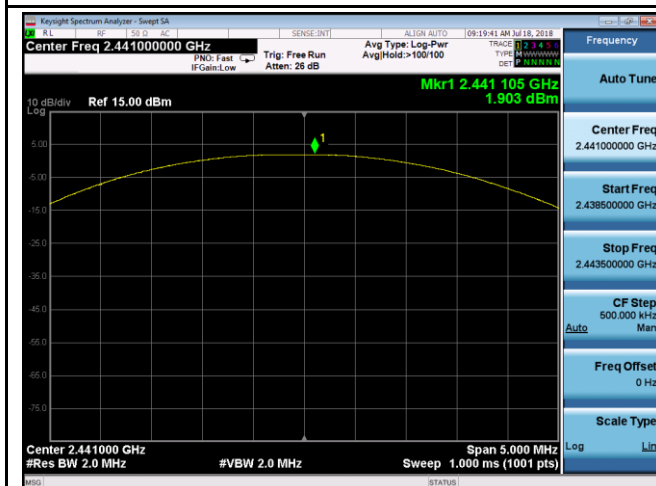
GFSK Output power - Mid CH 2441



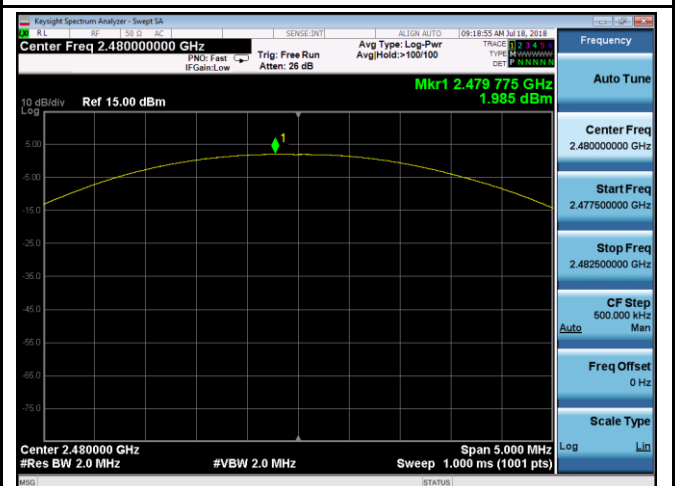
GFSK Output power - High CH 2480



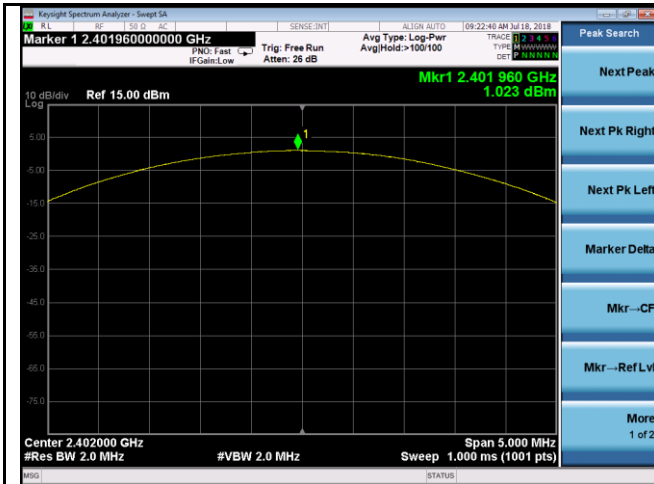
$\pi/4$  DQPSK Output power - Low CH 2402



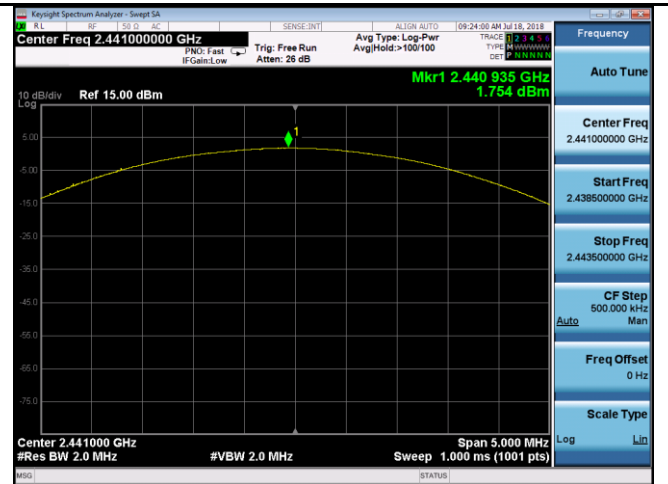
$\pi/4$  DQPSK Output power - Mid CH 2441



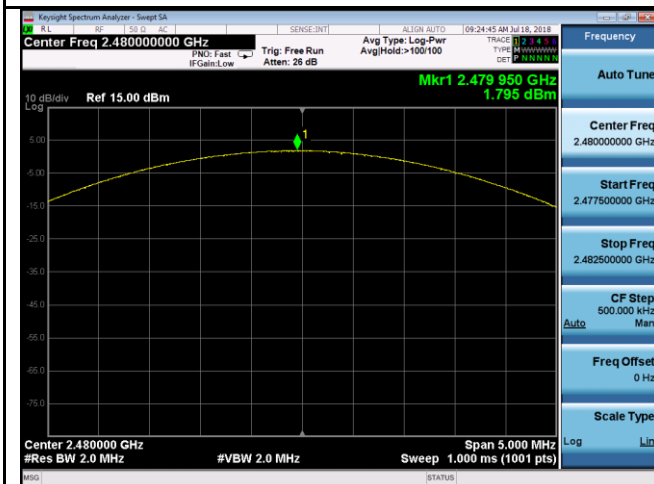
$\pi/4$  DQPSK Output power - High CH 2480



8DPSK Output power - Low CH 2402



8DPSK Output power - Mid CH 2441

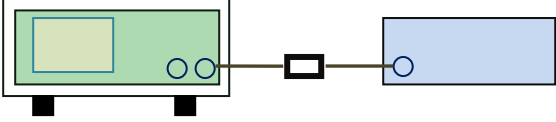


8DPSK Output power - High CH 2480

## 6.5 Number of Hopping Channel

Temperature	26°C
Relative Humidity	55%
Atmospheric Pressure	1017mbar
Test date :	July 18, 2018
Tested By :	Aaron 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			
Test Procedure	<p>The test follows FCC Public Notice DA 00-705 Measurement Guidelines.  <u>Use the following spectrum analyzer settings:</u>            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 ☒ Yes ☐ N/A  
 Test Plot ☒ Yes (See below) ☐ N/A

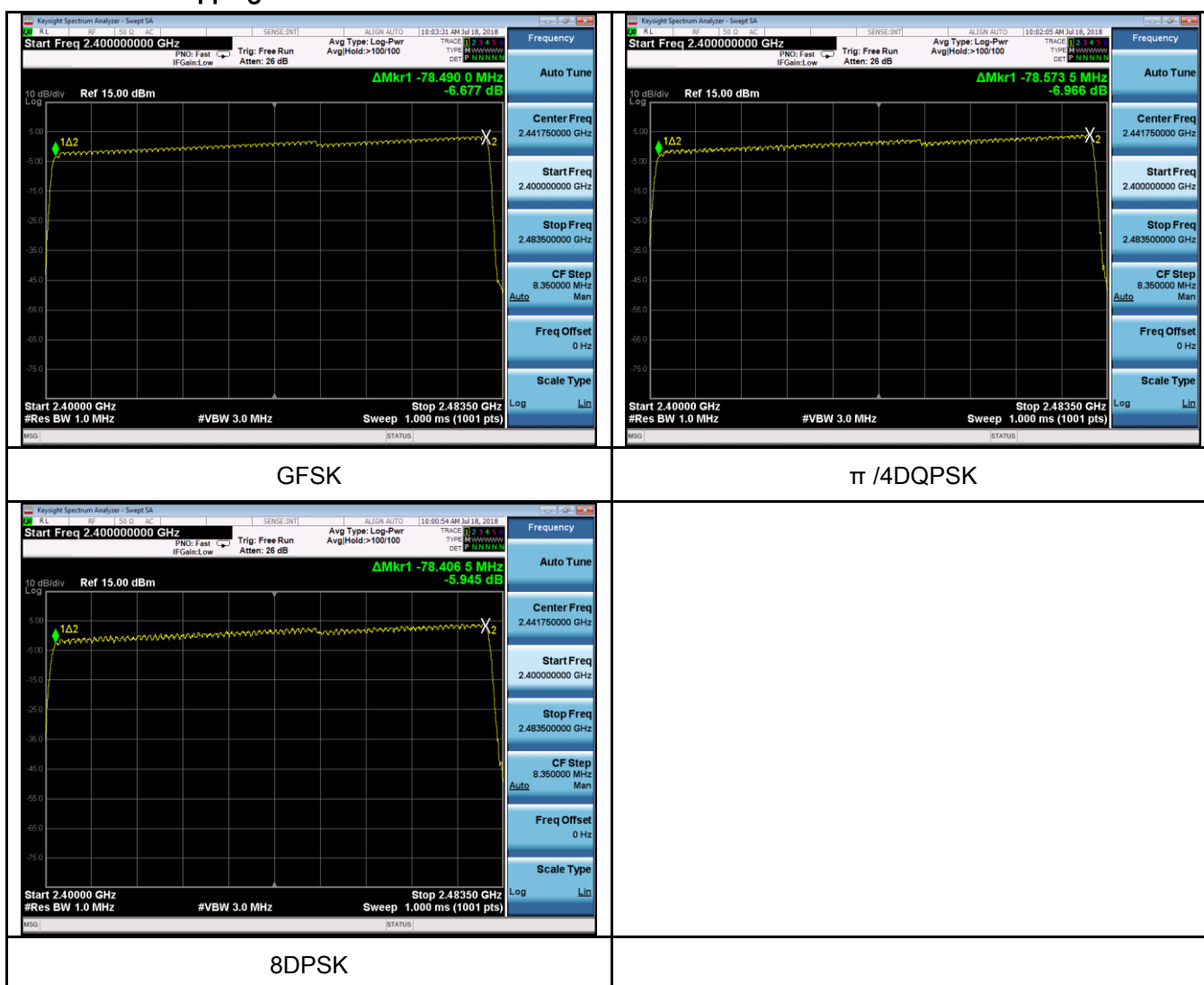
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### Number of Hopping Channel measurement result

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

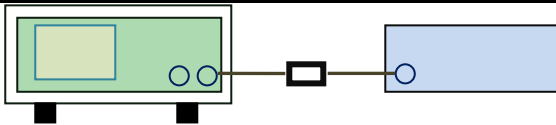
### Number of Hopping Channels measurement result



## 6.6 Time of Occupancy (Dwell Time)

Temperature	26°C
Relative Humidity	55%
Atmospheric Pressure	1017mbar
Test date :	July 18, 2018
Tested By :	Aaron Liang

### Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(a) (1)(iii)	a)	Dwell Time < 0.4s	<input checked="" type="checkbox"/>
Test Setup			
Test Procedure	<p>The test follows FCC Public Notice DA 00-705 Measurement Guidelines.  <u>Use the following spectrum analyzer</u></p> <ul style="list-style-type: none"> <li>- Span = zero span, centered on a hopping channel</li> <li>- RBW = 1 MHz</li> <li>- VBW ≥ 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>		
Remark			
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail		

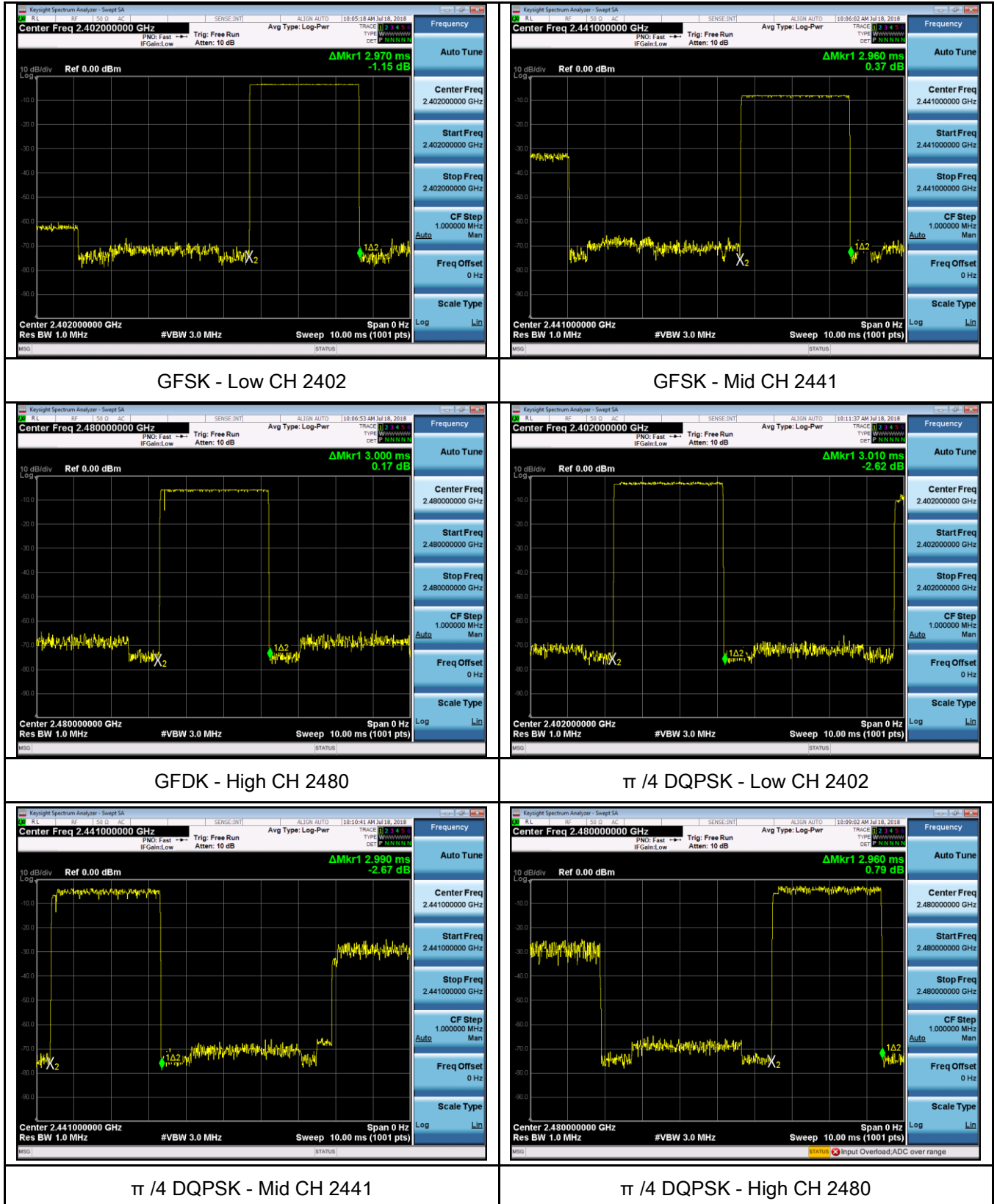
Test Data    ☒ Yes      ☐ N/A  
 Test Plot    ☒ Yes (See below)      ☐ N/A

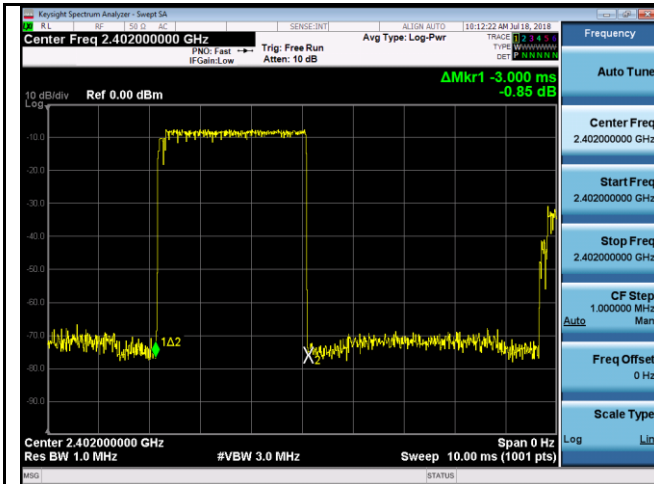


Type	Modulation	CH	Pulse Width (ms)	Dwell Time (ms)	Limit (ms)	Result
Dwell Time	GFSK	Low	2.97	316.800	400	Pass
		Mid	2.96	315.733	400	Pass
		High	3.00	320.000	400	Pass
	$\pi$ /4 DQPSK	Low	3.01	321.067	400	Pass
		Mid	2.99	318.933	400	Pass
		High	2.96	315.733	400	Pass
	8-DPSK	Low	3.00	320.000	400	Pass
		Mid	2.97	316.800	400	Pass
		High	2.98	317.867	400	Pass
Note: Dwell time=Pulse Time (ms) $\times$ (1600 $\div$ 6 $\div$ 79) $\times$ 31.6						

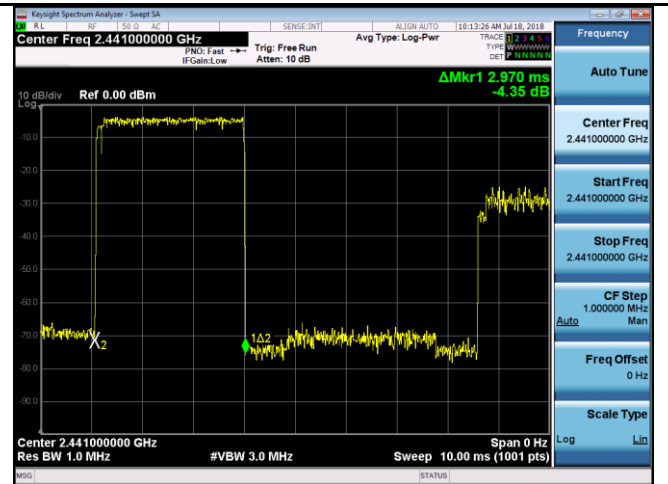
## Test Plots

### Dwell Time measurement result

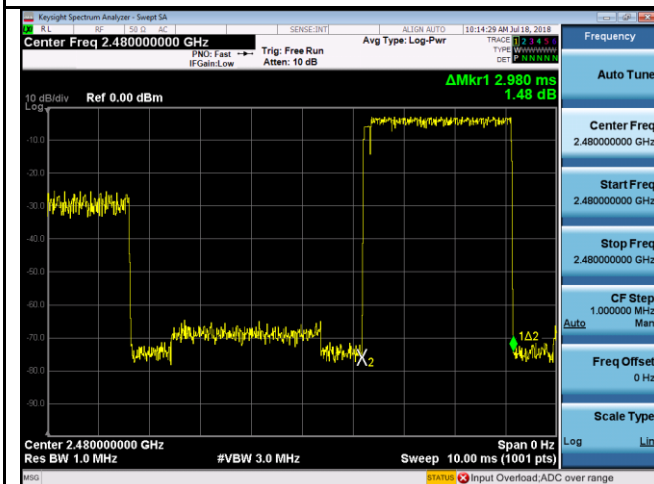




8DPSK - Low CH 2402



8DPSK - Mid CH 2441



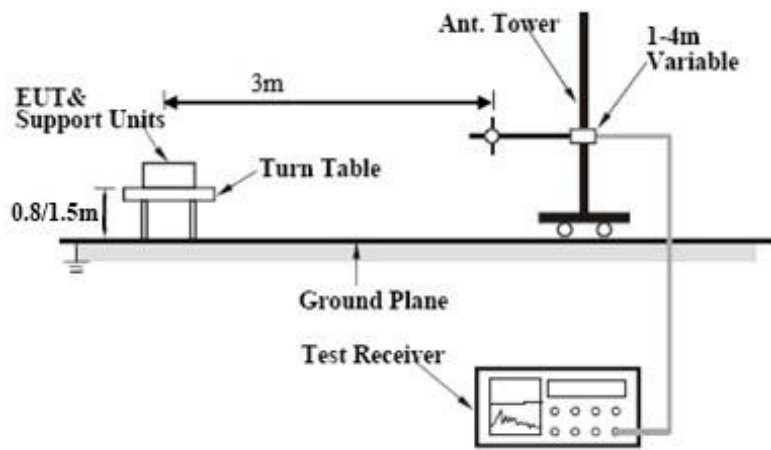
8DPSK - High CH 2480

## 6.7 Band Edge & Restricted Band

Temperature	26°C
Relative Humidity	55%
Atmospheric Pressure	1017mbar
Test date :	July 18, 2018
Tested By :	Aaron 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	
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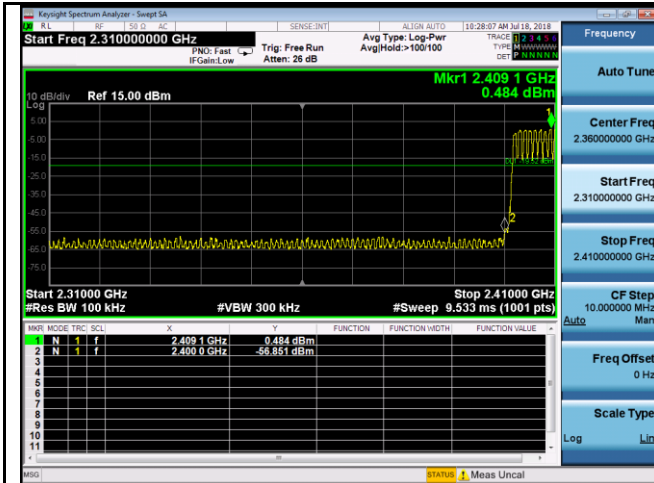
Test Procedure	<p>The test follows FCC Public Notice DA 00-705 Measurement Guidelines. Radiated Method Only</p> <ul style="list-style-type: none"> <li>1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.</li> <li>2. Position 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>
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	<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-Right Side

8DPSK-Right Side

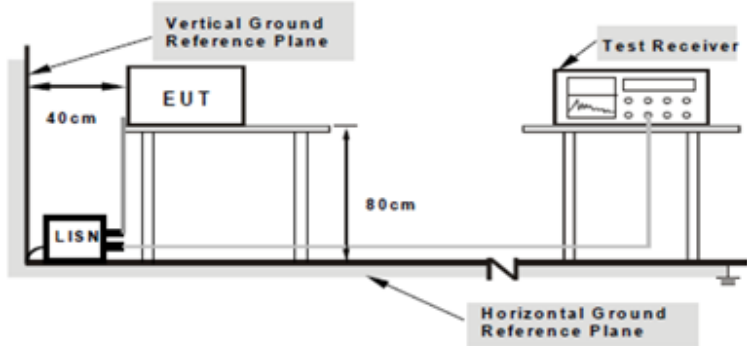


## 6.8 AC Power Line Conducted Emissions

Temperature	26°C
Relative Humidity	55%
Atmospheric Pressure	1017mbar
Test date :	July 18, 2018
Tested By :	Aaron Liang

### Requirement(s):

Spec	Item	Requirement	Applicable														
47CFR§15.207, RSS210 (A8.1)	a)	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.	<div><input checked="" type="checkbox"/></div>														
		<table><tr><th rowspan="2">Frequency ranges (MHz)</th><th colspan="2">Limit (dBµV)</th></tr><tr><th>QP</th><th>Average</th></tr><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></table>		Frequency ranges (MHz)	Limit (dBµV)		QP	Average	0.15 ~ 0.5	66 – 56	56 – 46	0.5 ~ 5	56	46	5 ~ 30	60	50
		Frequency ranges (MHz)			Limit (dBµV)												
				QP	Average												
		0.15 ~ 0.5		66 – 56	56 – 46												
		0.5 ~ 5		56	46												
5 ~ 30	60	50															

Test Setup	 <p>The diagram illustrates the test setup for AC Power Line Conducted Emissions. It shows a test receiver connected to a LISN (Line Impedance Stabilization Network), which is connected to the EUT (Equipment Under Test). The EUT is placed on a table, and the LISN is connected to the power line. The test receiver is also connected to the power line. The setup is positioned relative to a vertical ground reference plane and a horizontal ground reference plane. Dimensions are indicated: 40 cm for the distance from the vertical ground reference plane to the EUT, and 80 cm for the distance from the horizontal ground reference plane to the EUT and the LISN.</p> <p>Note: 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>
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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>
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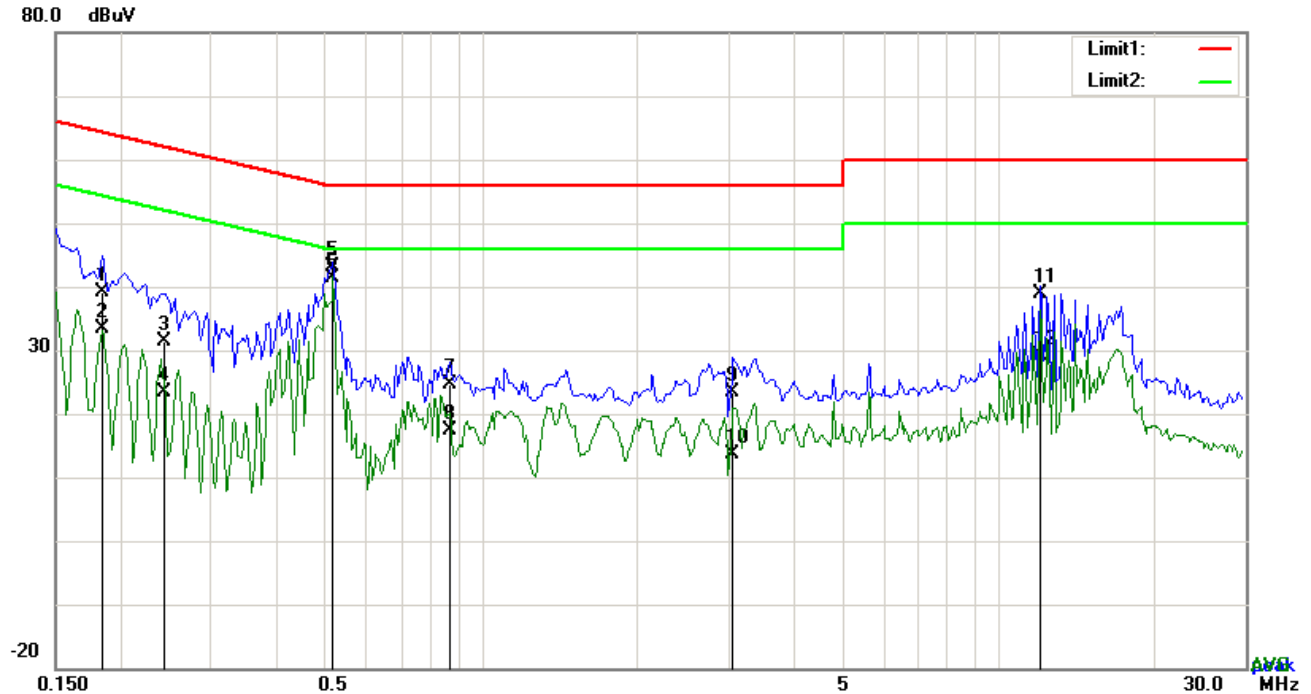
Test Report	18070747-FCC-R1
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	<p>coaxial cable.</p> <ol style="list-style-type: none"> <li>4. All other supporting equipment were powered separately from another main supply.</li> <li>5. The EUT was switched on and allowed to warm up to its normal operating 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

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

**Test Mode:** Bluetooth Mode

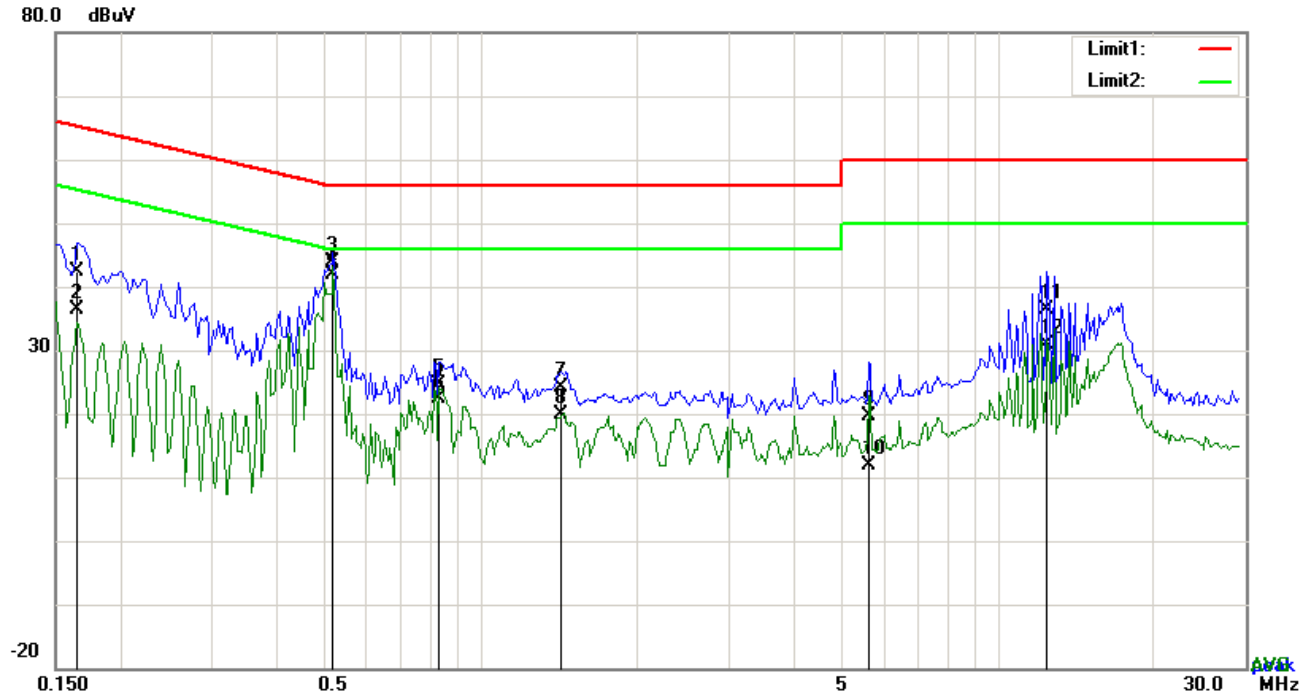


### Test Data

#### Phase Line Plot at 120Vac, 60Hz

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB)	(dBuV)	(dBuV)	(dB)
1	L1	0.1851	29.10	QP	10.03	39.13	64.25	-25.12
2	L1	0.1851	23.27	AVG	10.03	33.30	54.25	-20.95
3	L1	0.2436	21.34	QP	10.03	31.37	61.97	-30.60
4	L1	0.2436	13.33	AVG	10.03	23.36	51.97	-28.61
5	L1	0.5166	33.04	QP	10.03	43.07	56.00	-12.93
6	L1	0.5166	31.36	AVG	10.03	41.39	46.00	-4.61
7	L1	0.8676	14.67	QP	10.03	24.70	56.00	-31.30
8	L1	0.8676	7.26	AVG	10.03	17.29	46.00	-28.71
9	L1	3.0663	13.42	QP	10.06	23.48	56.00	-32.52
10	L1	3.0663	3.49	AVG	10.06	13.55	46.00	-32.45
11	L1	12.0324	28.75	QP	10.18	38.93	60.00	-21.07
12	L1	12.0324	18.99	AVG	10.18	29.17	50.00	-20.83

**Test Mode:** Bluetooth Mode

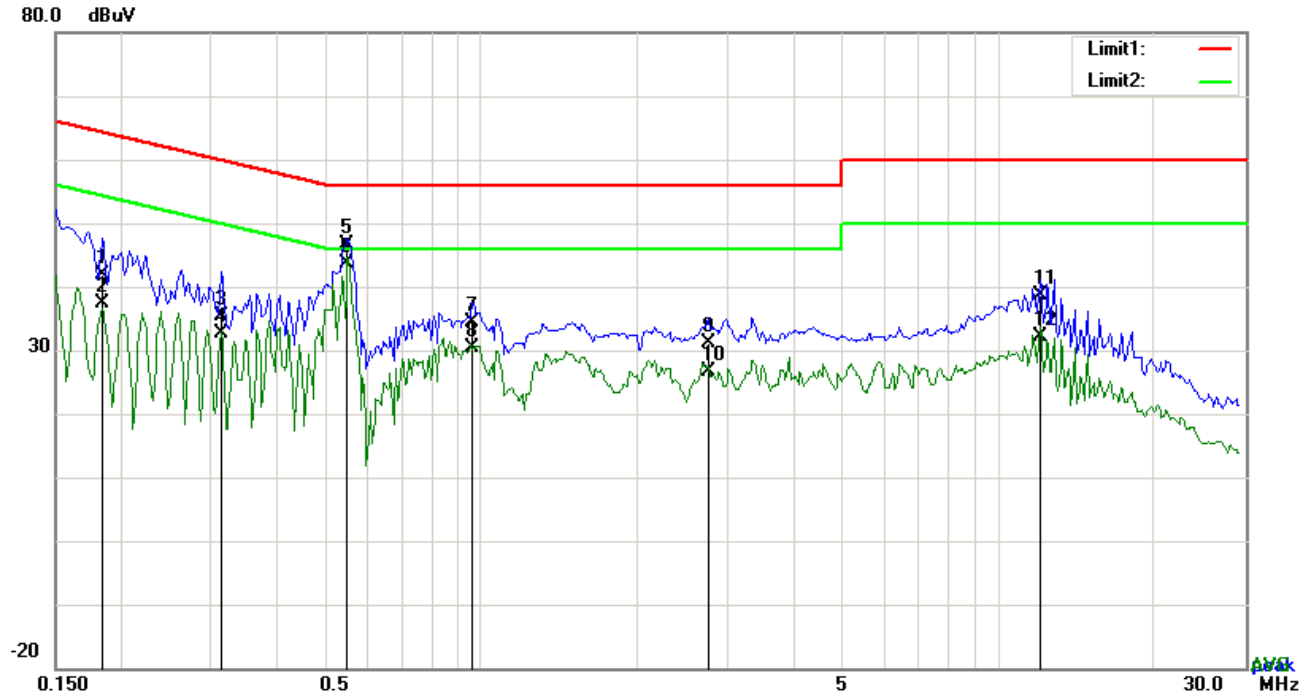


**Test Data**

**Phase Neutral Plot at 120Vac, 60Hz**

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB)	(dBuV)	(dBuV)	(dB)
1	N	0.1656	32.36	QP	10.02	42.38	65.18	-22.80
2	N	0.1656	26.45	AVG	10.02	36.47	55.18	-18.71
3	N	0.5166	33.74	QP	10.02	43.76	56.00	-12.24
4	N	0.5166	31.91	AVG	10.02	41.93	46.00	-4.07
5	N	0.8286	14.72	QP	10.03	24.75	56.00	-31.25
6	N	0.8286	12.37	AVG	10.03	22.40	46.00	-23.60
7	N	1.4214	14.06	QP	10.03	24.09	56.00	-31.91
8	N	1.4214	9.84	AVG	10.03	19.87	46.00	-26.13
9	N	5.6208	9.56	QP	10.08	19.64	60.00	-40.36
10	N	5.6208	1.70	AVG	10.08	11.78	50.00	-38.22
11	N	12.4341	26.28	QP	10.17	36.45	60.00	-23.55
12	N	12.4341	20.59	AVG	10.17	30.76	50.00	-19.24

**Test Mode:** Bluetooth Mode

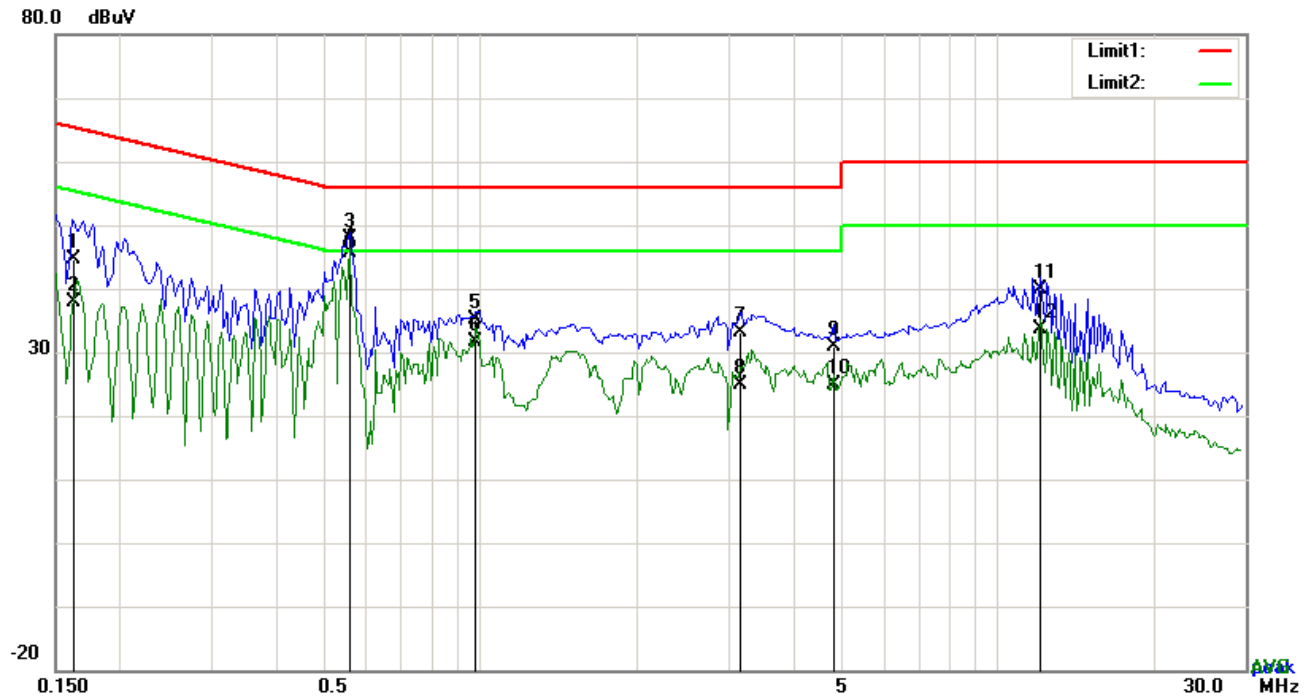


### Test Data

#### Phase Line Plot at 240Vac, 60Hz

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB)	(dBuV)	(dBuV)	(dB)
1	L1	0.1851	31.79	QP	10.03	41.82	64.25	-22.43
2	L1	0.1851	27.43	AVG	10.03	37.46	54.25	-16.79
3	L1	0.3138	25.45	QP	10.03	35.48	59.87	-24.39
4	L1	0.3138	22.72	AVG	10.03	32.75	49.87	-17.12
5	L1	0.5517	36.71	QP	10.03	46.74	56.00	-9.26
6	L1	0.5517	33.65	AVG	10.03	43.68	46.00	-2.32
7	L1	0.9612	24.35	QP	10.03	34.38	56.00	-21.62
8	L1	0.9612	20.46	AVG	10.03	30.49	46.00	-15.51
9	L1	2.7474	21.19	QP	10.05	31.24	56.00	-24.76
10	L1	2.7474	16.69	AVG	10.05	26.74	46.00	-19.26
11	L1	12.0285	28.33	QP	10.18	38.51	60.00	-21.49
12	L1	12.0285	22.01	AVG	10.18	32.19	50.00	-17.81

**Test Mode:** Bluetooth Mode



**Test Data**

### Phase Neutral Plot at 240Vac, 60Hz

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB)	(dBuV)	(dBuV)	(dB)
1	N	0.1624	34.68	QP	10.02	44.70	65.34	-20.64
2	N	0.1624	27.97	AVG	10.02	37.99	55.34	-17.35
3	N	0.5556	37.89	QP	10.02	47.91	56.00	-8.09
4	N	0.5556	35.52	AVG	10.02	45.54	46.00	-0.46
5	N	0.9768	25.20	QP	10.03	35.23	56.00	-20.77
6	N	0.9768	21.63	AVG	10.03	31.66	46.00	-14.34
7	N	3.1677	23.12	QP	10.05	33.17	56.00	-22.83
8	N	3.1677	14.95	AVG	10.05	25.00	46.00	-21.00
9	N	4.8096	20.90	QP	10.07	30.97	56.00	-25.03
10	N	4.8096	14.70	AVG	10.07	24.77	46.00	-21.23
11	N	12.0285	29.67	QP	10.16	39.83	60.00	-20.17
12	N	12.0285	23.43	AVG	10.16	33.59	50.00	-16.41

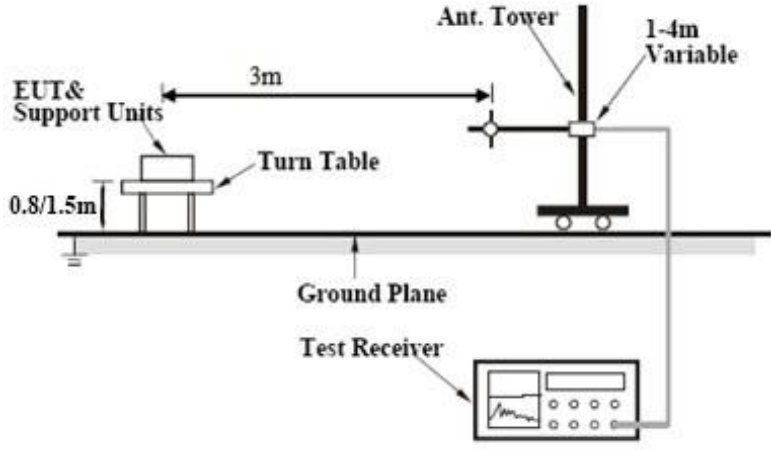
## 6.9 Radiated Emissions & Restricted Band

Temperature	26°C
Relative Humidity	55%
Atmospheric Pressure	1017mbar
Test date :	July 18, 2018
Tested By :	Aaron Liang

### Requirement(s):

Spec	Item	Requirement	Applicable																
47CFR§15.205, §15.209, §15.247(d)	a)	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	<div><input checked="" type="checkbox"/></div>																
		<table><tr><th>Frequency range (MHz)</th><th>Field Strength (µV/m)</th></tr><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></table>		Frequency range (MHz)	Field Strength (µV/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
		Frequency range (MHz)		Field Strength (µV/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. It shows an Equipment Under Test (EUT) placed on a stand that is 0.8 meters high. A Loop Antenna is positioned 3 meters away from the EUT. An RF Test Receiver is connected to the Loop Antenna. The entire setup is on a Ground Plane.</p>
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Procedure	<ol style="list-style-type: none"> <li>The EUT was switched on and allowed to warm up to its normal operating condition.</li> <li>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>Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.</li> <li>The EUT was then rotated to the direction that gave the maximum emission.</li> <li>Finally, the antenna height was adjusted to the height that gave the maximum emission.</li> </ol> </li> <li>The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasiy Peak detection at frequency below 1GHz.</li> <li>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>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 ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A



## Test Result:

Test Mode:	Transmitting Mode
------------	-------------------

Frequency range: 9KHz - 30MHz

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

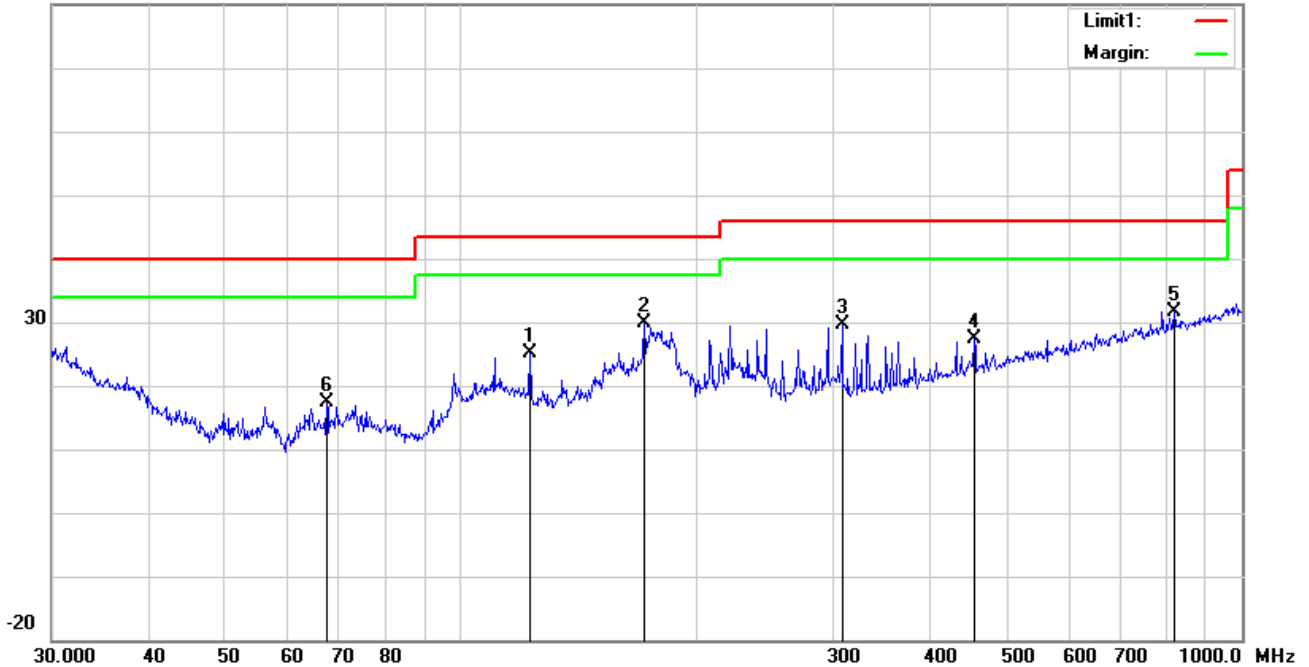
Distance extrapolation factor =  $40 \log (\text{specific distance}/\text{test distance})$ (dB);

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

**Test Mode:** Bluetooth Mode

**30MHz -1GHz**

80.0 dBuV/m



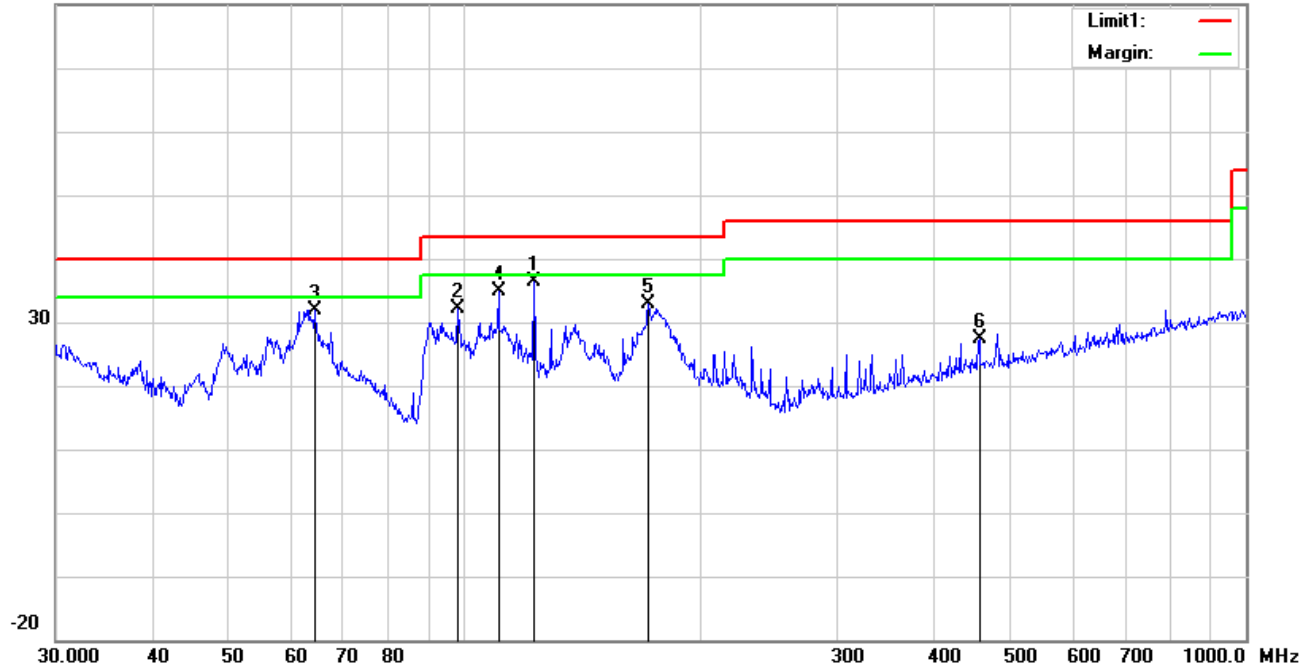
**Test Data**

**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	122.8340	32.58	peak	13.72	22.37	1.17	25.10	43.50	-18.40	100	210
2	H	171.9946	39.06	peak	11.64	22.26	1.36	29.80	43.50	-13.70	100	254
3	H	307.8313	36.23	peak	13.76	22.27	1.83	29.55	46.00	-16.45	100	354
4	H	454.3100	30.24	peak	16.79	21.90	2.15	27.28	46.00	-18.72	200	275
5	H	818.8341	28.30	peak	21.61	21.10	2.93	31.74	46.00	-14.26	100	345
6	H	67.4382	31.29	peak	7.67	22.39	0.93	17.50	40.00	-22.50	100	165

### 30MHz -1GHz

80.0 dBuV/m



#### Test Data

#### Vertical Polarity Plot @3m

N o.	P/ L	Frequency (MHz)	Reading (dBuV/m)	Detect or	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degr ee (°)
1	V	122.8340	43.76	peak	13.72	22.37	1.17	36.28	43.50	-7.22	100	139
2	V	98.1419	43.52	peak	9.95	22.32	1.07	32.22	43.50	-11.28	200	126
3	V	64.4331	45.89	peak	7.52	22.40	0.87	31.88	40.00	-8.12	100	212
4	V	110.5687	43.77	peak	12.25	22.34	1.17	34.85	43.50	-8.65	100	353
5	V	171.9946	42.04	peak	11.64	22.26	1.36	32.78	43.50	-10.72	100	265
6	V	455.9058	30.27	peak	16.82	21.90	2.16	27.35	46.00	-18.65	100	10

## Above 1GHz

<b>Test Mode:</b>	<b>Transmitting Mode</b>
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Frequency	Meter Reading	Antenna Factor	Cable loss	Preamp factor	Emission Level	Limits	Margin	Detector	Polarity
(MHz)	(dBμV)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(PK/AV)	(H/V)
Low Channel:GFSK Mode(Worst Case)-2402MHz									
2398	35.98	28.72	3.36	26.32	41.74	74	-32.26	peak	Vertical
4809	30.85	32.94	3.98	27.49	40.28	54	-13.72	Average	Vertical
4809	39.05	32.94	3.98	27.49	48.48	74	-25.52	peak	Vertical
7210	30.14	25.28	5.51	27.94	32.99	54	-21.01	Average	Vertical
7210	41.68	25.28	5.51	27.94	44.53	74	-29.47	peak	Vertical
2398	37.84	28.72	3.36	26.32	43.60	74	-30.40	peak	Horizontal
4809	32.26	32.94	3.98	27.49	41.69	54	-12.31	Average	Horizontal
4809	42.09	32.94	3.98	27.49	51.52	74	-22.48	peak	Horizontal
7210	32.01	25.28	5.51	27.94	34.86	54	-19.14	Average	Horizontal
7210	41.28	25.28	5.51	27.94	44.13	74	-29.87	peak	Horizontal
Middle Channel:GFSK Mode(Worst Case)-2441MHz									
4888	32.04	32.11	4.04	27.53	40.66	54	-13.34	Average	Vertical
4888	37.09	32.11	4.04	27.53	45.71	74	-28.29	peak	Vertical
7336	31.36	24.33	5.58	27.96	33.31	54	-20.69	Average	Vertical
7336	40.34	24.33	5.58	27.96	42.29	74	-31.71	peak	Vertical
4888	31.57	32.11	4.04	27.53	40.19	54	-13.81	Average	Horizontal
4888	41.38	32.11	4.04	27.53	50.00	74	-24.00	peak	Horizontal
7336	34.05	24.33	5.58	27.96	36.00	54	-18.00	Average	Horizontal
7336	41.39	24.33	5.58	27.96	43.34	74	-30.66	peak	Horizontal
High Channel:GFSK Mode(Worst Case)-2480MHz									
2483.9	39.36	28.79	3.48	26.34	45.29	74	-28.71	peak	Vertical
4958.1	32.25	31.32	4.12	27.58	40.11	54	-13.89	Average	Vertical
4958.1	40.01	31.32	4.12	27.58	47.87	74	-26.13	peak	Vertical
7433.9	30.58	24.38	5.68	27.99	32.65	54	-21.35	Average	Vertical
7433.9	42.39	24.38	5.68	27.99	44.46	74	-29.54	peak	Vertical
2483.9	39.99	28.79	3.48	26.34	45.92	74	-28.08	peak	Horizontal
4958.1	30.25	31.32	4.12	27.58	38.11	54	-15.89	Average	Horizontal
4958.1	39.89	31.32	4.12	27.58	47.75	74	-26.25	peak	Horizontal
7433.9	33.28	24.38	5.68	27.99	35.35	54	-18.65	Average	Horizontal
7433.9	42.64	24.38	5.68	27.99	44.71	74	-29.29	peak	Horizontal

NOTE:1.Absolute Level= ReadingLevel+antenna Factor+cable loss-preamp factor.  
2.EUT Pre-scan X/Y/Z orientation, only the worst case is presented in the report (Z orientation)

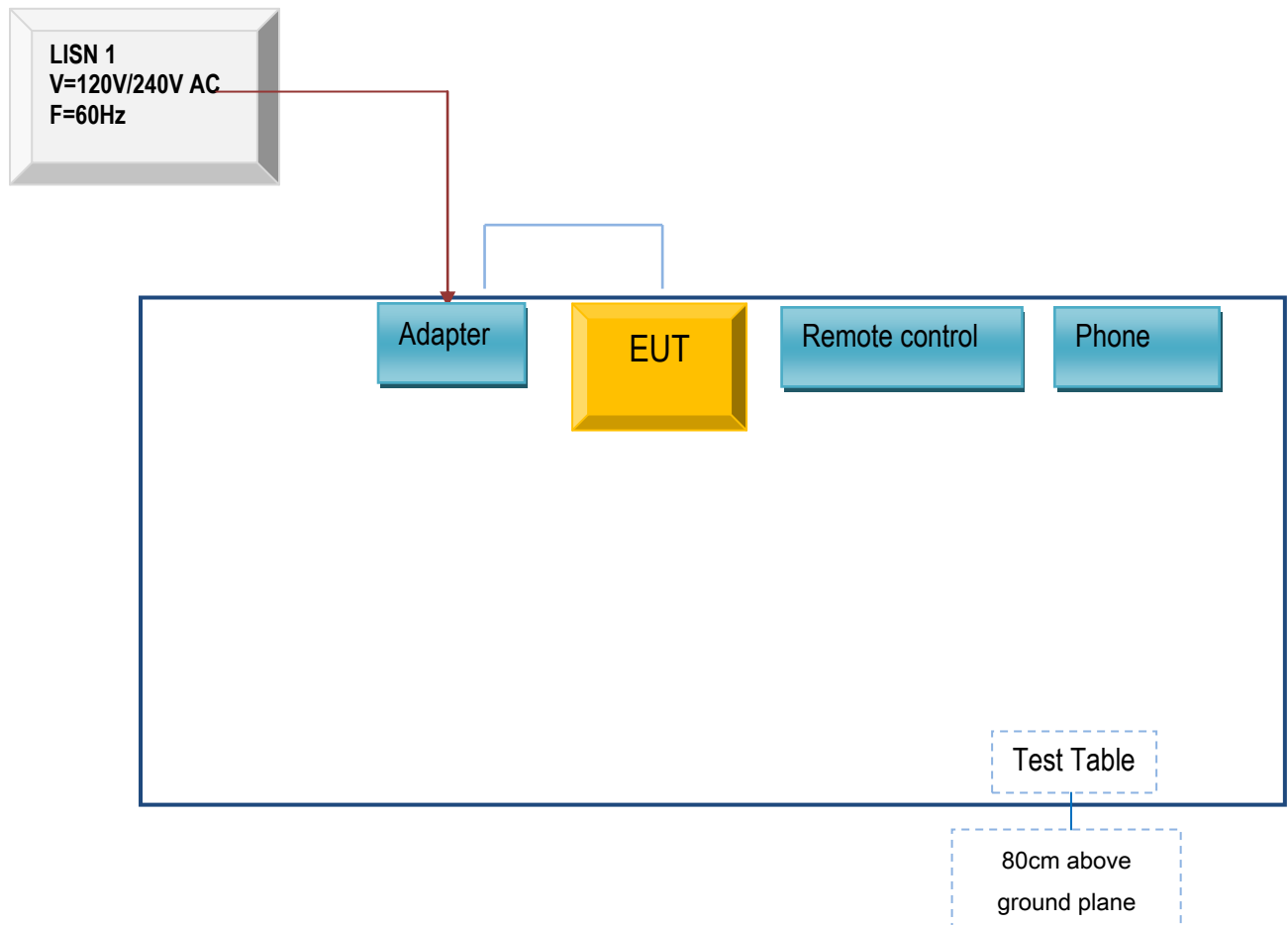
## Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Due	In use
<b>AC Line Conducted</b>					
EMI test receiver	ESCS30	8471241027	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
Line Impedance	LI-125A	191106	09/23/2017	09/22/2018	<input checked="" type="checkbox"/>
Line Impedance	LI-125A	191107	09/23/2017	09/22/2018	<input checked="" type="checkbox"/>
ISN	ISN T800	34373	09/23/2017	09/22/2018	<input type="checkbox"/>
Transient Limiter	LIT-153	531118	08/30/2017	08/29/2018	<input type="checkbox"/>
<b>RF conducted test</b>					
Agilent ESA-E SERIES	E4407B	MY45108319	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
Power Splitter	1#	1#	08/30/2017	08/29/2018	<input checked="" type="checkbox"/>
DC Power Supply	E3640A	MY40004013	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
<b>Radiated Emissions</b>					
EMI test receiver	ESL6	100262	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
Positioning Controller	UC3000	MF780208282	11/17/2017	11/16/2018	<input checked="" type="checkbox"/>
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	08/30/2017	08/29/2018	<input checked="" type="checkbox"/>
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/22/2018	03/21/2019	<input checked="" type="checkbox"/>
Horn Antenna	BBHA9170	3145226D1	09/27/2017	09/26/2018	<input checked="" type="checkbox"/>
Active Antenna (9kHz-30MHz)	AL-130	121031	10/12/2017	10/11/2018	<input checked="" type="checkbox"/>
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/19/2017	09/18/2018	<input checked="" type="checkbox"/>
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/22/2017	09/21/2018	<input checked="" type="checkbox"/>
Universal Radio Communication Tester	CMU200	121393	09/23/2017	09/22/2018	<input checked="" type="checkbox"/>

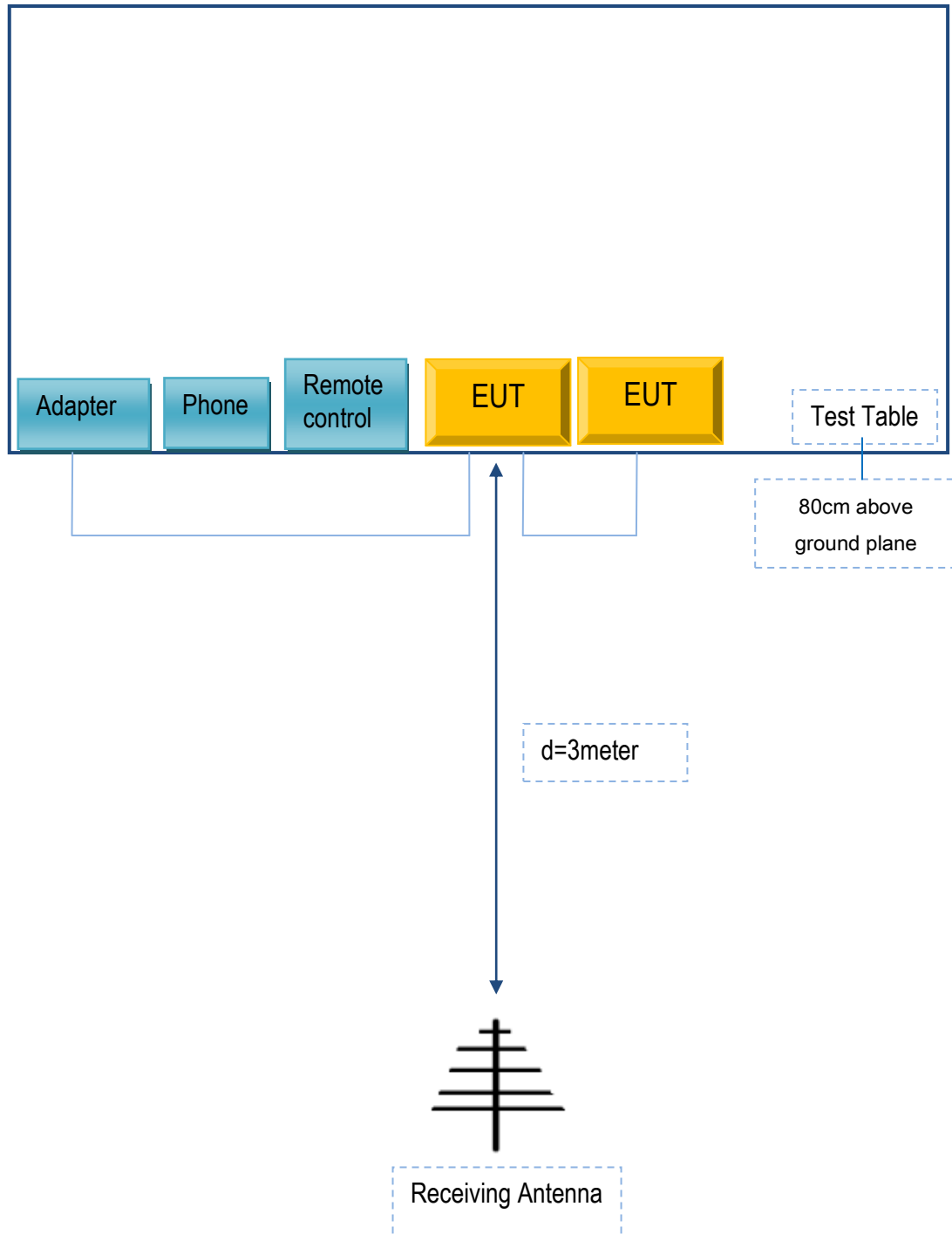
## Annex B. TEST SETUP AND SUPPORTING EQUIPMENT

### Annex B.i. TEST SET UP BLOCK

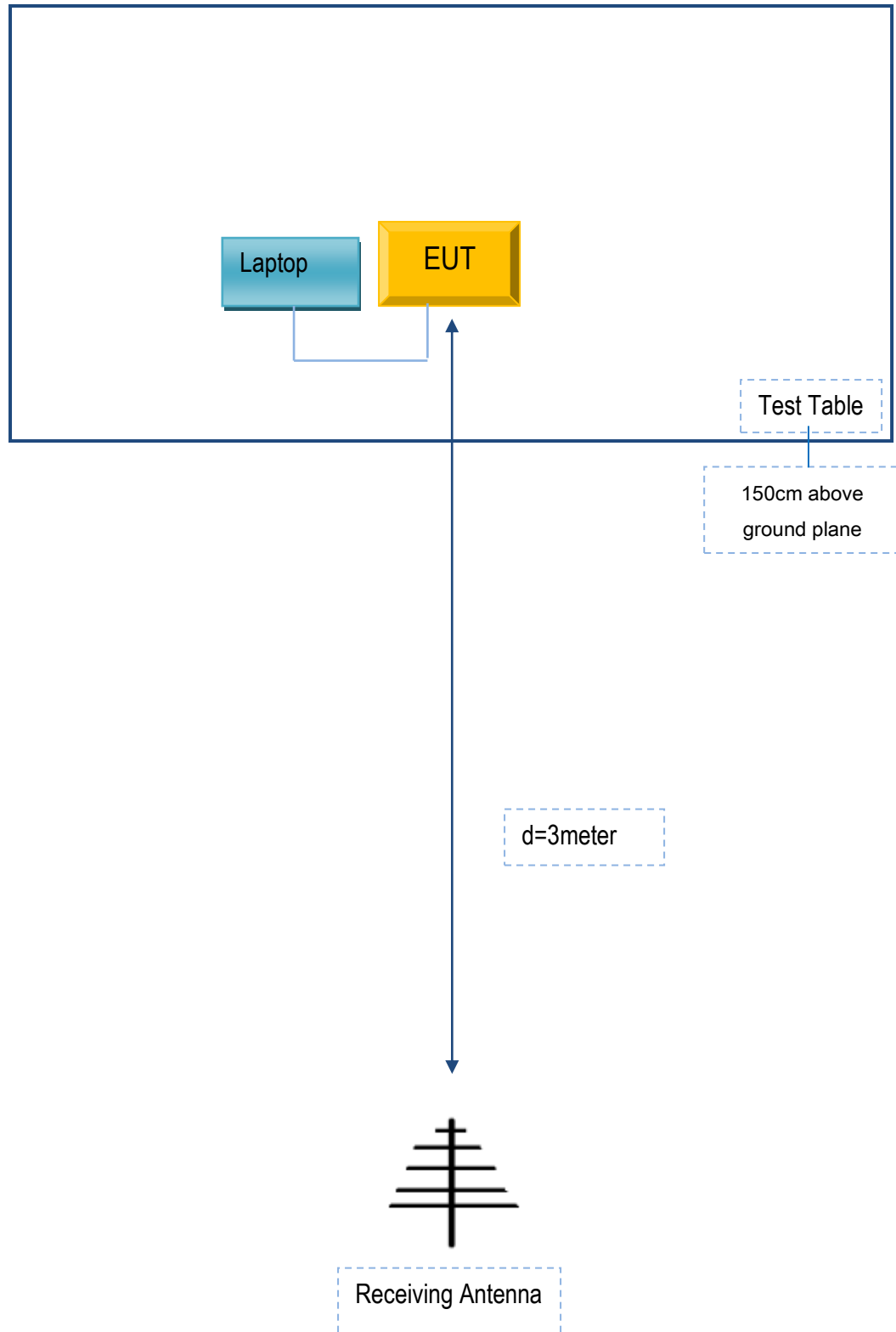
#### Block Configuration Diagram for AC Line Conducted Emissions



**Block Configuration Diagram for Radiated Emissions ( Below 1GHz ) .**



**Block Configuration Diagram for Radiated Emissions ( Above 1GHz ) .**





## **Annex B. ii. SUPPORTING EQUIPMENT DESCRIPTION**

The following is a description of supporting equipment and details of cables used with the EUT.

### **Supporting Equipment:**

Manufacturer	Equipment Description	Model	Serial No
Lenovo	Laptop	E40	LR-1EHRX
Huawei	Phone	Honor 9	N/A
Circus World Displays Limited	Remote control	Ai60	N/A

### **Supporting Cable:**

Cable type	Shield Type	Ferrite Core	Length	Serial No
Power Line	Un-shielding	No	0.8m	N/A

**Annex C. User Manual / Block Diagram / Schematics / Partlist/  
DECLARATION OF SIMILARITY**

Please see the attachment