

# RF TEST REPORT



Report No.: 17070432-FCC-R

Supersede Report No.: N/A

Applicant	SHENZHEN HANGSHENG ELECTRONICS CO.,LTD	
Product Name	E-Canter Navigation	
Model No.	HS-N1196	
Serial No.	N/A	
Test Standard	FCC Part 15.247: 2016, ANSI C63.10: 2013	
Test Date	June 10 to July 05, 2017	
Issue Date	July 11, 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"/>		
Loren Luo 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
17070432-FCC-R	NONE	Original	July 06, 2017
17070432-FCC-R	V1	Updated the test summary	July 11, 2017

## 2. Customer information

Applicant Name	SHENZHEN HANGSHENG ELECTRONICS CO.,LTD
Applicant Add	Hangsheng Industrial Park, Fuyuan Yi Road,Heping Village, Fuyong Town,Baoan District,Shenzhen ,China
Manufacturer	SHENZHEN HANGSHENG ELECTRONICS CO.,LTD
Manufacturer Add	Hangsheng Industrial Park, Fuyuan Yi Road,Heping Village, Fuyong Town,Baoan District,Shenzhen ,China

## 3. Test site information

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.	718246
IC Test Site No.	4842E-1
Test Software of Radiated Emission	Radiated Emission Program-To Shenzhen v2.0
Test Software of Conducted Emission	EZ-EMC(ver.lcp-03A1)

## 4. Equipment under Test (EUT) Information

Description of EUT:	E-Canter Navigation
Main Model:	HS-N1196
Serial Model:	N/A
Date EUT received:	June 09, 2017
Test Date(s):	June 10 to July 05, 2017
Equipment Category :	DSS
Antenna Gain:	Bluetooth: 3dBi GPS: 18dBi
Antenna Type:	BT: Chip antenna GPS: Patch antenna
Type of Modulation:	Bluetooth: GFSK, π /4DQPSK, 8DPSK GPS:BPSK
RF Operating Frequency (ies):	Bluetooth: 2402-2480 MHz GPS: 1575.42 MHz
Max. Output Power:	4.519dBm
Number of Channels:	Bluetooth: 79CH GPS:1CH
Port:	The radio antenna Connector, GPS antenna Connector, Power supply and sound signal Connector (Note: USB Connector, HDMI data Connector, 3g/CAM Connector and TPMS/astern rear view are not used)
Input Power:	DC Input:12V 10A USB Output:5V 500mA

Trade Name :

**HSAE**

FCC ID:

Y9TN1196

## 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 2 antennas:

A permanently attached Chip antenna for Bluetooth, the gain is 3dBi for Bluetooth.

A permanently attached Patch antenna for GPS, the gain is 18dBi for GPS.

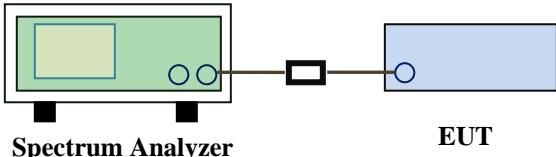
**The antenna meets up with the ANTENNA REQUIREMENT.**

**Result:** Compliance.

## 6.2 Channel Separation

Temperature	25 °C
Relative Humidity	55%
Atmospheric Pressure	1017mbar
Test date :	June 23, 2017
Tested By :	Loren Luo

### 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	 <p style="text-align: center;"><b>Spectrum Analyzer</b>                                   <b>EUT</b></p>		
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  Yes  N/A

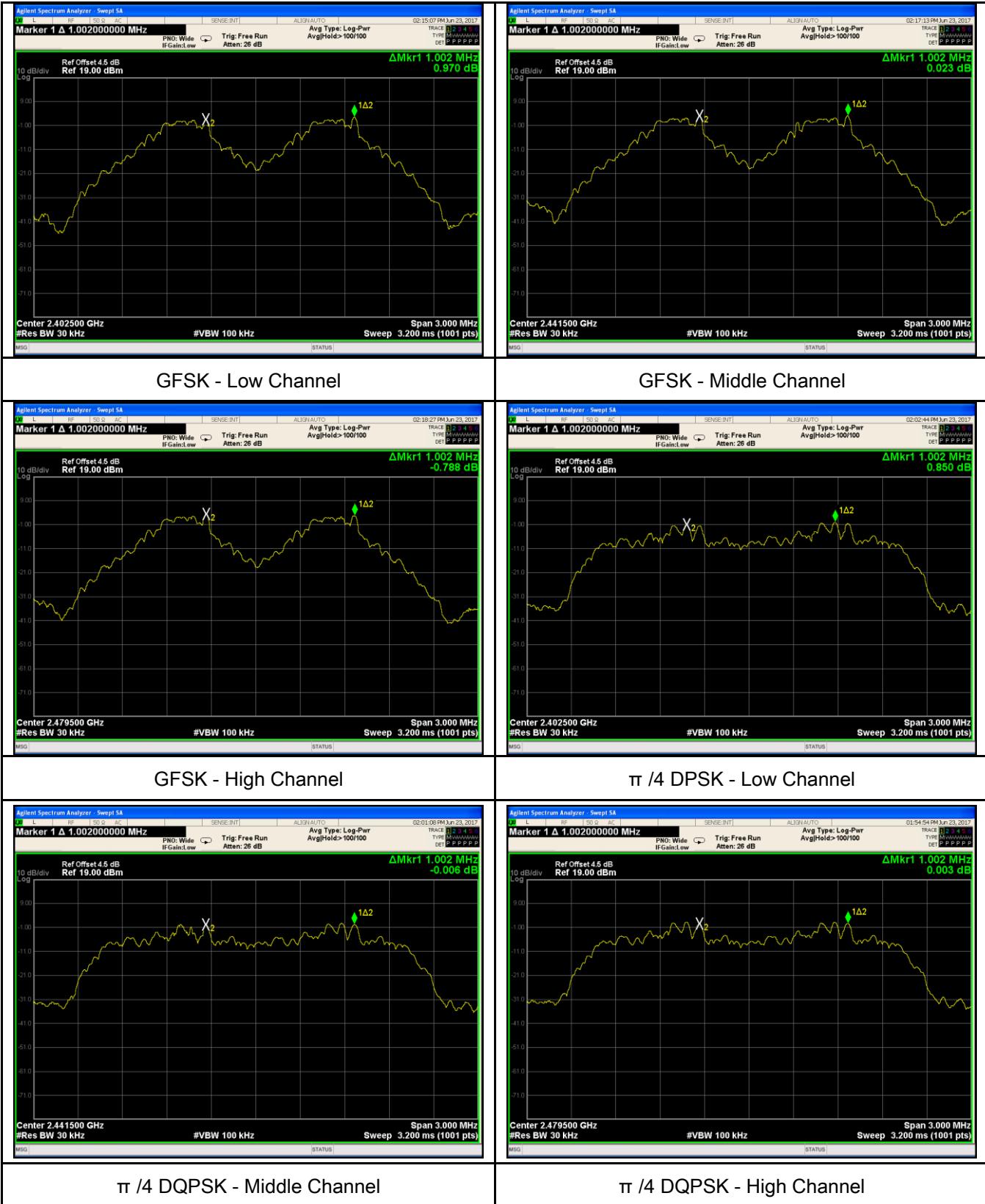
Test Plot  Yes (See below)  N/A

### Channel Separation measurement result

Type/ Modulation	CH	CH Frequency (MHz)	CH Separation (MHz)	Limit (MHz)	Result
CH Separation GFSK	Low Channel	2402	1.002	0.630	Pass
	Adjacency Channel	2403			
	Mid Channel	2440			
	Adjacency Channel	2441	1.002	0.630	Pass
	High Channel	2480			
	Adjacency Channel	2479			
CH Separation $\pi/4$ DQPSK	Low Channel	2402	1.002	0.874	Pass
	Adjacency Channel	2403			
	Mid Channel	2440			
	Adjacency Channel	2441	1.002	0.867	Pass
	High Channel	2480			
	Adjacency Channel	2479			
CH Separation 8DPSK	Low Channel	2402	1.002	0.866	Pass
	Adjacency Channel	2403			
	Mid Channel	2440			
	Adjacency Channel	2441	1.002	0.861	Pass
	High Channel	2480			
	Adjacency Channel	2479			

## Test Plots

### Channel Separation measurement result





8DPSK - Low Channel

8DPSK - Middle Channel

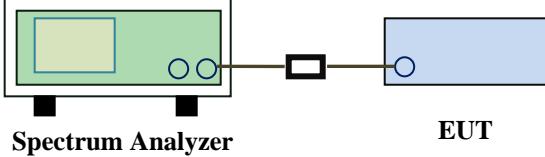


8DPSK - High Channel

### 6.3 20dB Bandwidth

Temperature	25 °C
Relative Humidity	55%
Atmospheric Pressure	1017mbar
Test date :	June 23, 2017
Tested By :	Loren Luo

#### 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	 <p style="text-align: center;"><b>Spectrum Analyzer</b>                            <b>EUT</b></p>		
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	0.9449	0.8498
	Mid	2441	0.9455	0.8591
	High	2480	0.9555	0.8813
$\pi/4$ DQPSK	Low	2402	1.311	1.1698
	Mid	2441	1.301	1.1692
	High	2480	1.316	1.1838
8-DPSK	Low	2402	1.299	1.1856
	Mid	2441	1.291	1.1909
	High	2480	1.292	1.1941

## Test Plots

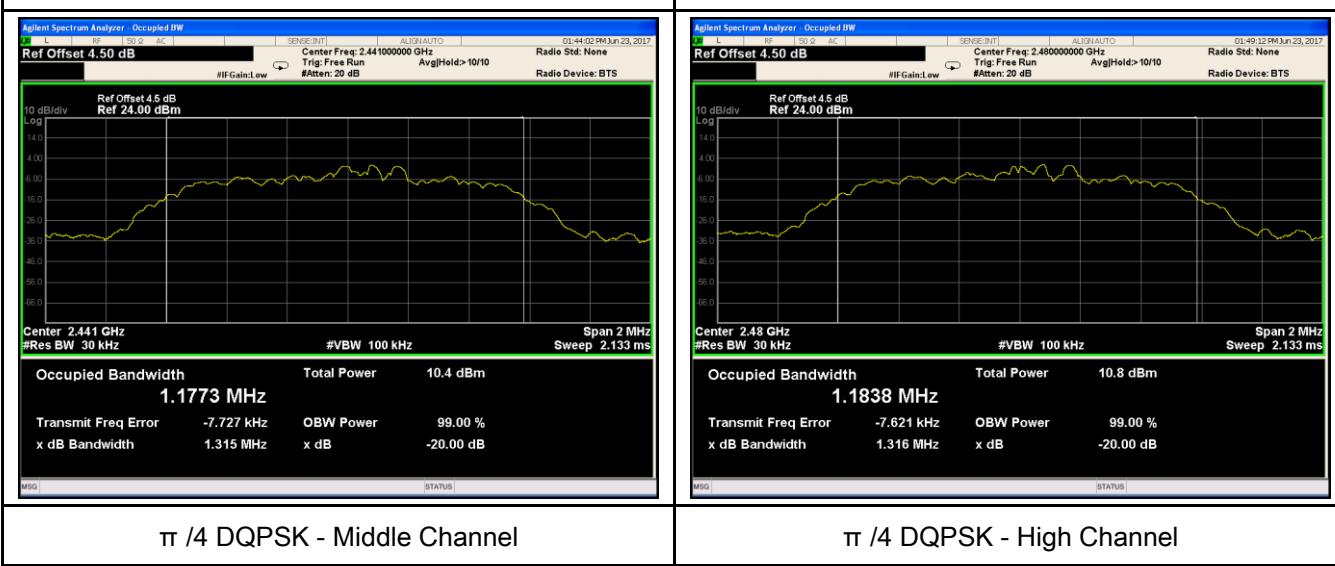
### 20dB Bandwidth measurement result



GFSK - Low Channel



GFSK - High Channel

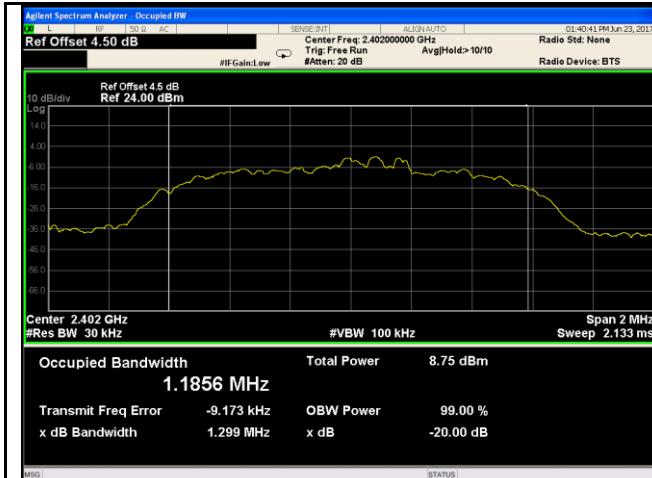


π /4 DQPSK - Middle Channel

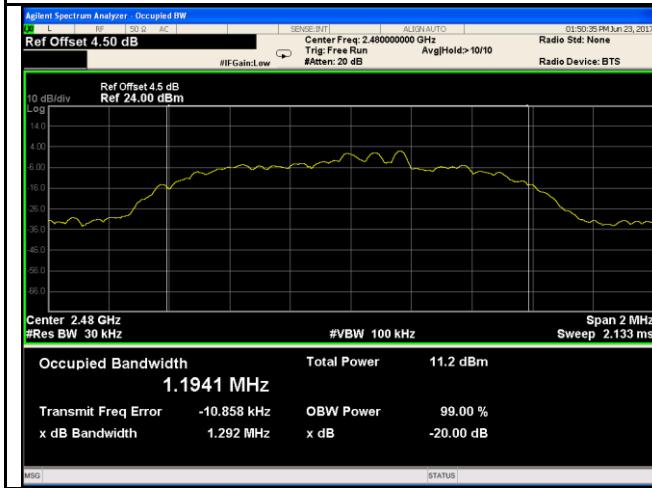
GFSK - Middle Channel

π /4 DPSK - Low Channel

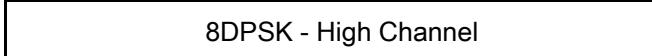
π /4 DQPSK - High Channel



### 8DPSK - Low Channel



### 8DPSK - Middle Channel

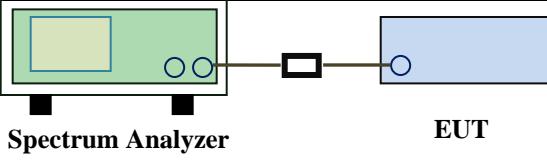


### 8DPSK - High Channel

## 6.4 Peak Output Power

Temperature	25 °C
Relative Humidity	55%
Atmospheric Pressure	1017mbar
Test date :	June 23, 2017
Tested By :	Loren Luo

### 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		 <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>- 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

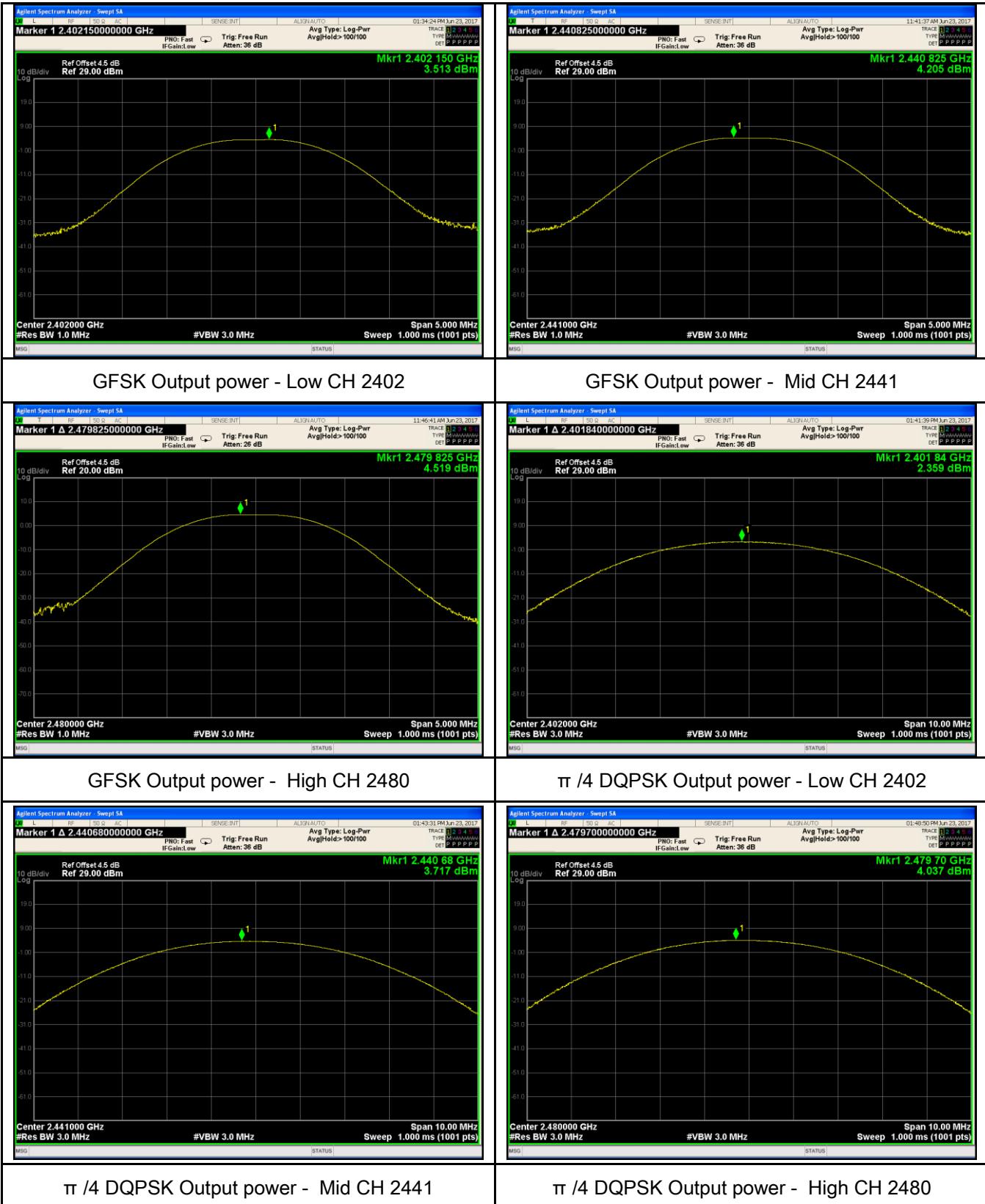
Test Plot  Yes (See below)  N/A

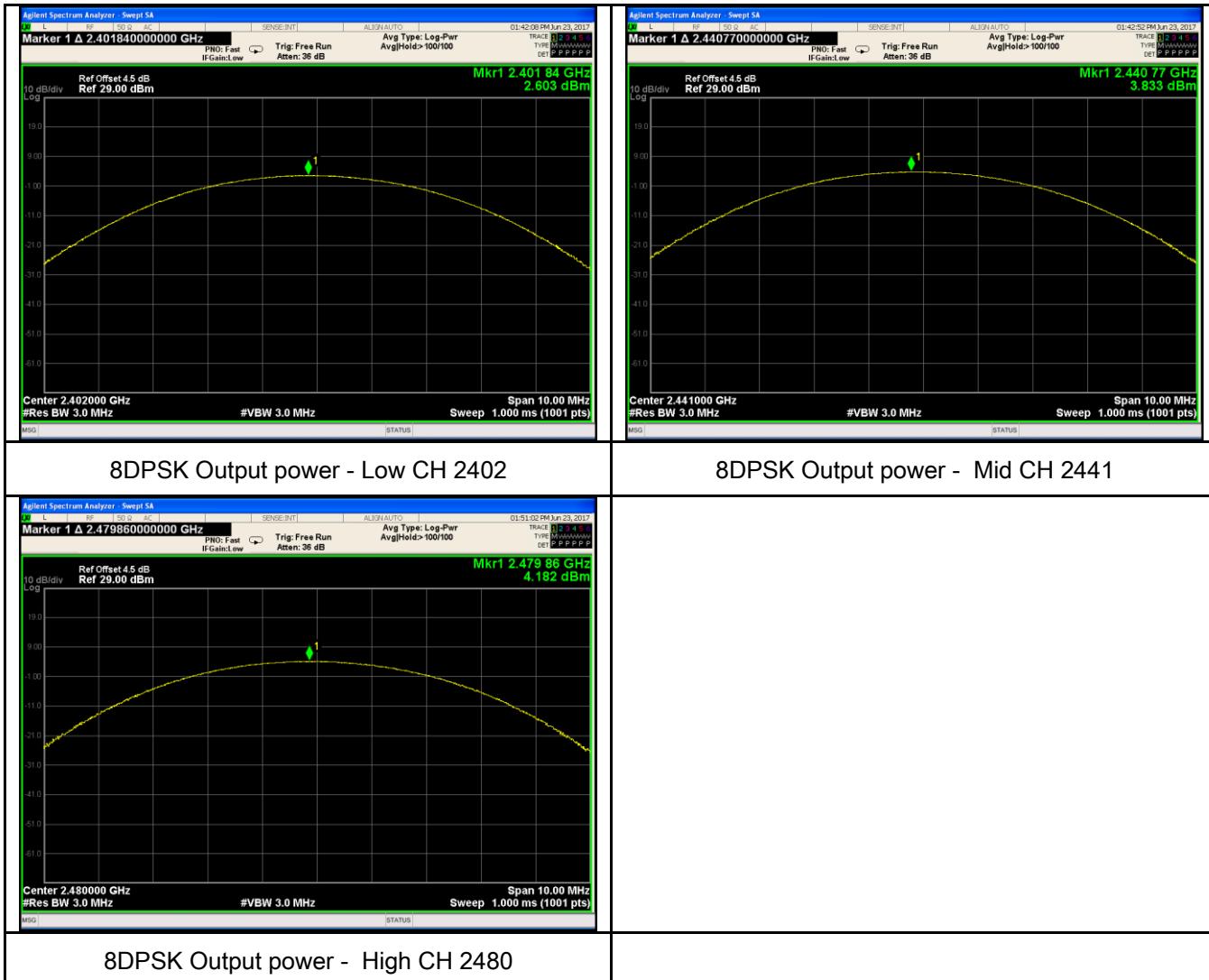
#### Peak Output Power measurement result

Type	Modulation	CH	Frequency (MHz)	Conducted Power (dBm)	Limit (mW)	Result
Output power	GFSK	Low	2402	3.513	1000	Pass
		Mid	2441	4.205	1000	Pass
		High	2480	<b>4.519</b>	1000	Pass
	$\pi/4$ DQPSK	Low	2402	2.359	125	Pass
		Mid	2441	3.717	125	Pass
		High	2480	4.037	125	Pass
	8-DPSK	Low	2402	2.603	125	Pass
		Mid	2441	3.833	125	Pass
		High	2480	4.182	125	Pass

## Test Plots

### Output Power measurement result

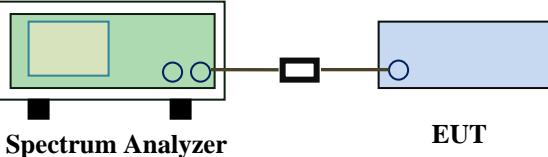




## 6.5 Number of Hopping Channel

Temperature	25 °C
Relative Humidity	55%
Atmospheric Pressure	1017mbar
Test date :	June 23, 2017
Tested By :	Loren Luo

### Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(a) (1)(iii)	a)	FHSS in 2400-2483.5MHz ≥ 15 channels	<input checked="" type="checkbox"/>
Test Setup	 <p style="text-align: center;">Spectrum Analyzer                                  EUT</p>		
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 ≥ 1% of the span</li> <li>- VBW ≥ 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

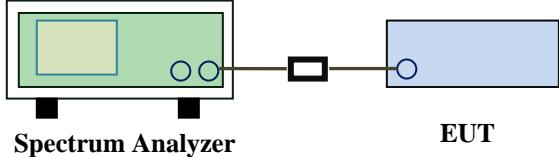
#### Number of Hopping Channels measurement result



## 6.6 Time of Occupancy (Dwell Time)

Temperature	25 °C
Relative Humidity	55%
Atmospheric Pressure	1017mbar
Test date :	June 23, 2017
Tested By :	Loren Luo

### Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(a) (1)(iii)	a)	Dwell Time < 0.4s	<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</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 <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>		
Remark			
Result	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	

Test Data  Yes  N/A

Test Plot  Yes (See below)  N/A

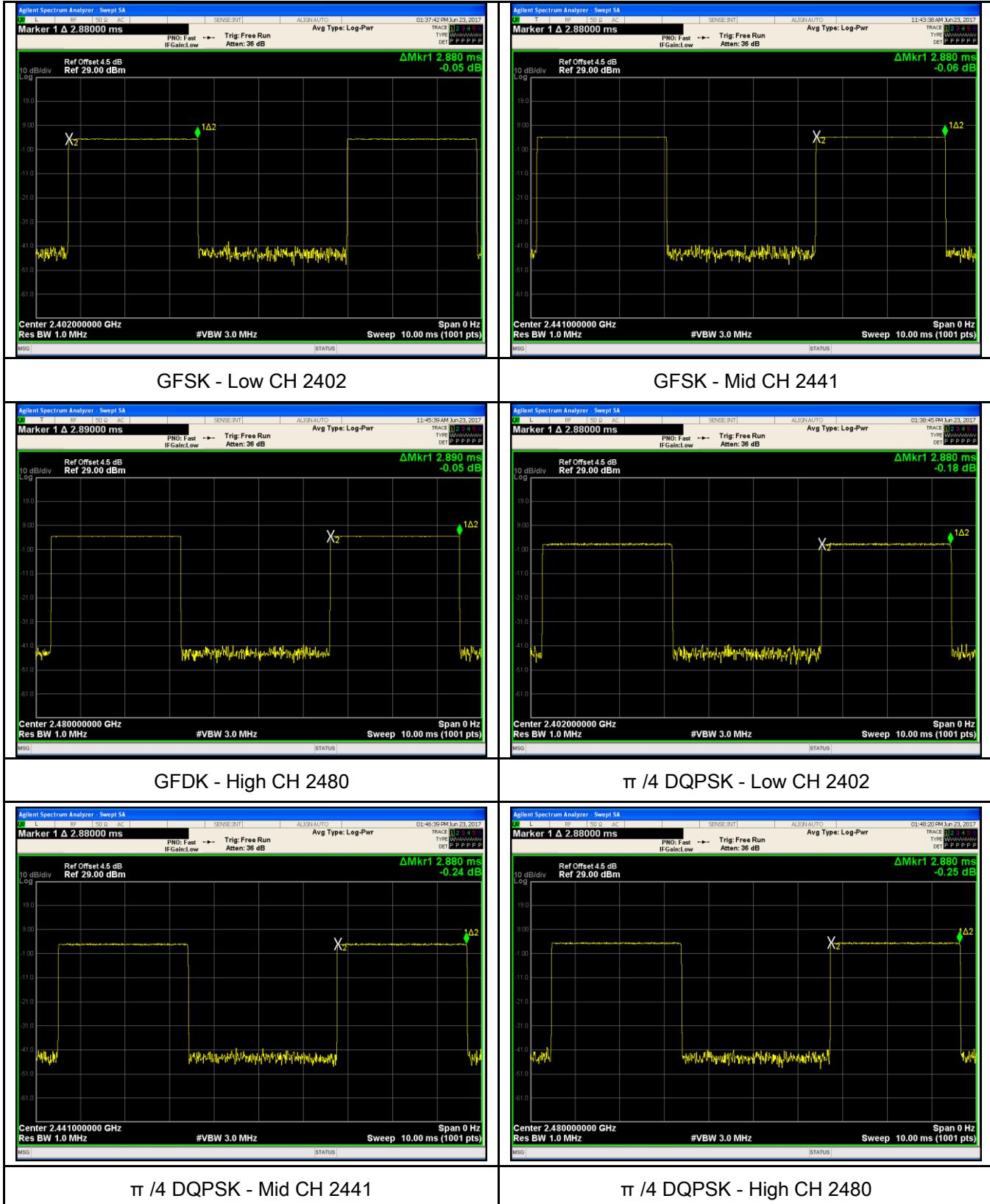
### Dwell Time measurement result

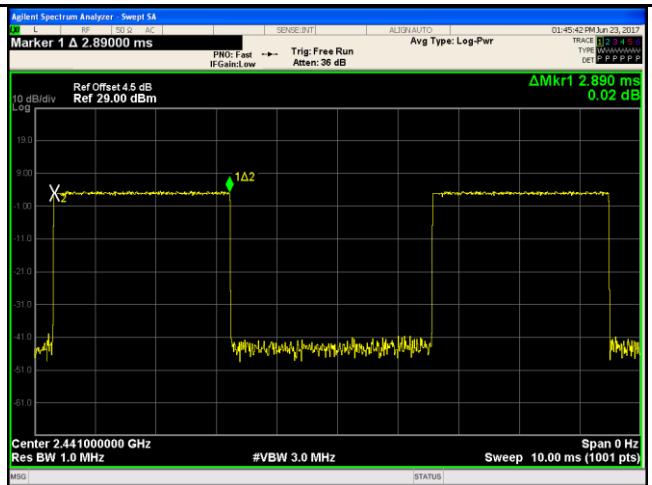
Type	Modulation	CH	Pulse Width (ms)	Dwell Time (ms)	Limit (ms)	Result
Dwell Time	GFSK	Low	2.880	307.200	400	Pass
		Mid	2.880	307.200	400	Pass
		High	2.890	308.267	400	Pass
	$\pi/4$ DQPSK	Low	2.880	307.200	400	Pass
		Mid	2.880	307.200	400	Pass
		High	2.880	307.200	400	Pass
	8-DPSK	Low	2.890	308.267	400	Pass
		Mid	2.890	308.267	400	Pass
		High	2.890	308.267	400	Pass

Note: Dwell time=Pulse Time (ms) × (1600 ÷ 6 ÷ 79) ×31.6

## Test Plots

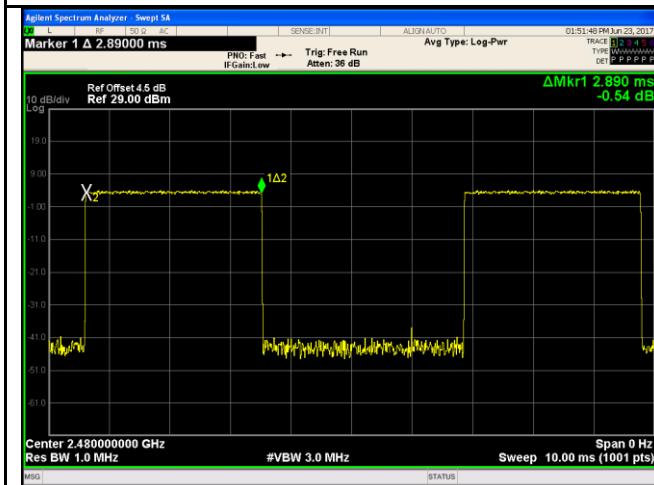
### Dwell Time measurement result





8DPSK - Low CH 2402

8DPSK - Mid CH 2441

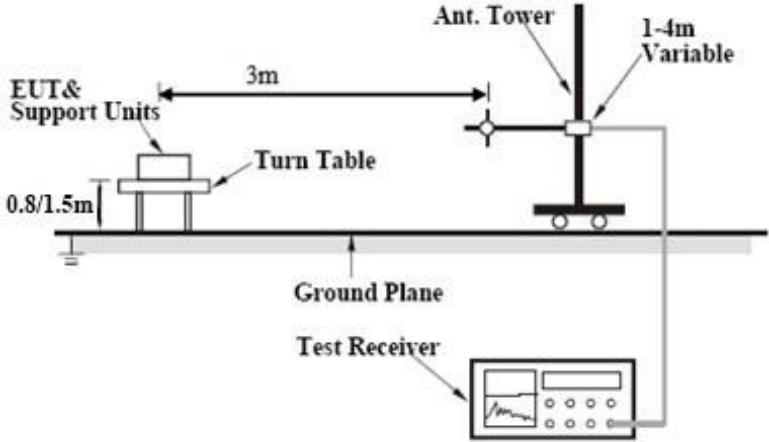


8DPSK - High CH 2480

## 6.7 Band Edge & Restricted Band

Temperature	25 °C
Relative Humidity	57%
Atmospheric Pressure	1023mbar
Test date :	June 27, 2017
Tested By :	Loren Luo

### 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 assembly sits 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 via a horizontal bar. The distance between the EUT and the Ant. Tower is 3m. 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>		

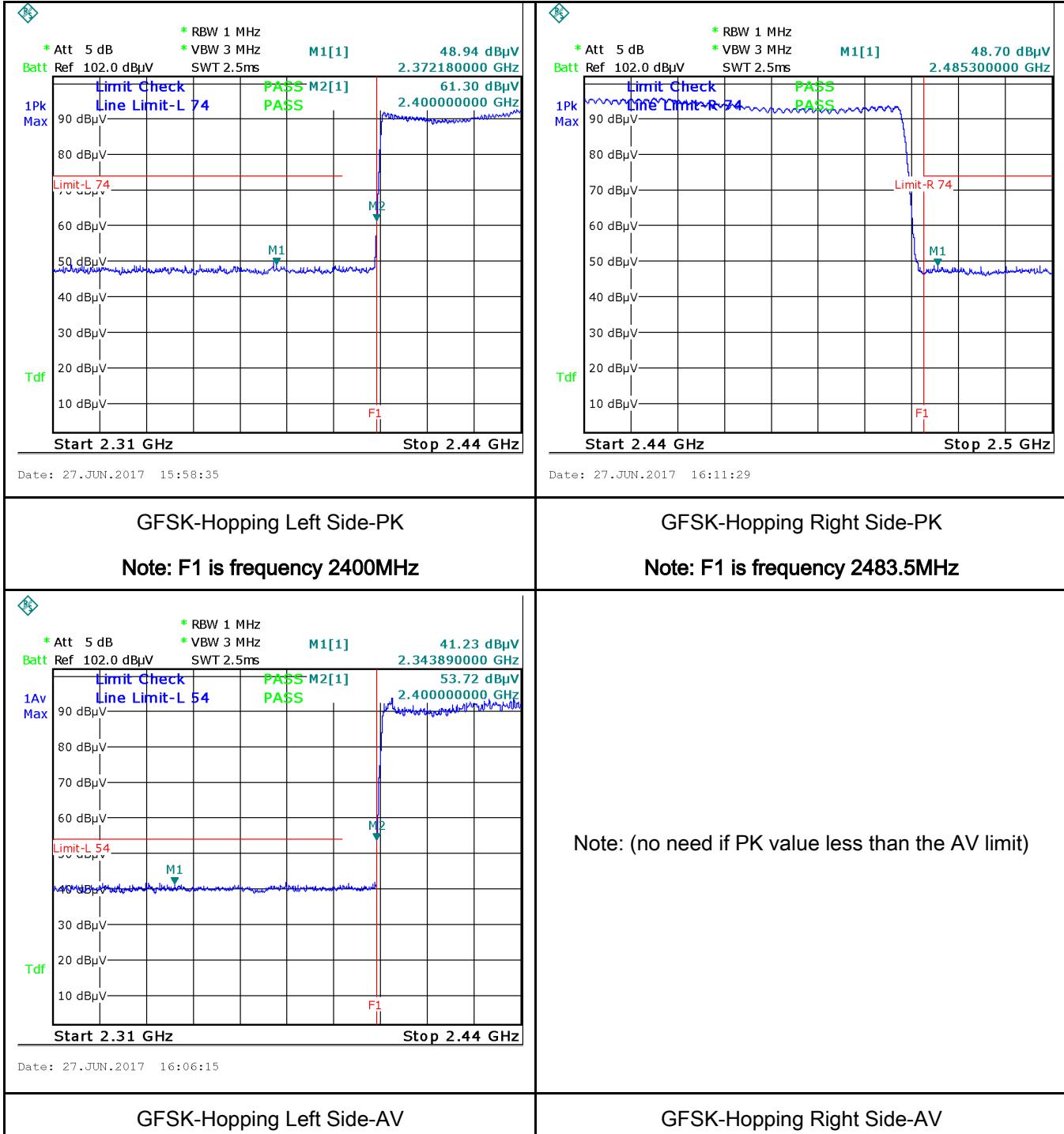
	<p>and make sure the instrument is operated in its linear range.</p> <ul style="list-style-type: none"> <li>- 3. First, set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, check the emission of EUT, if pass then set Spectrum Analyzer as below:</li> <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> <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

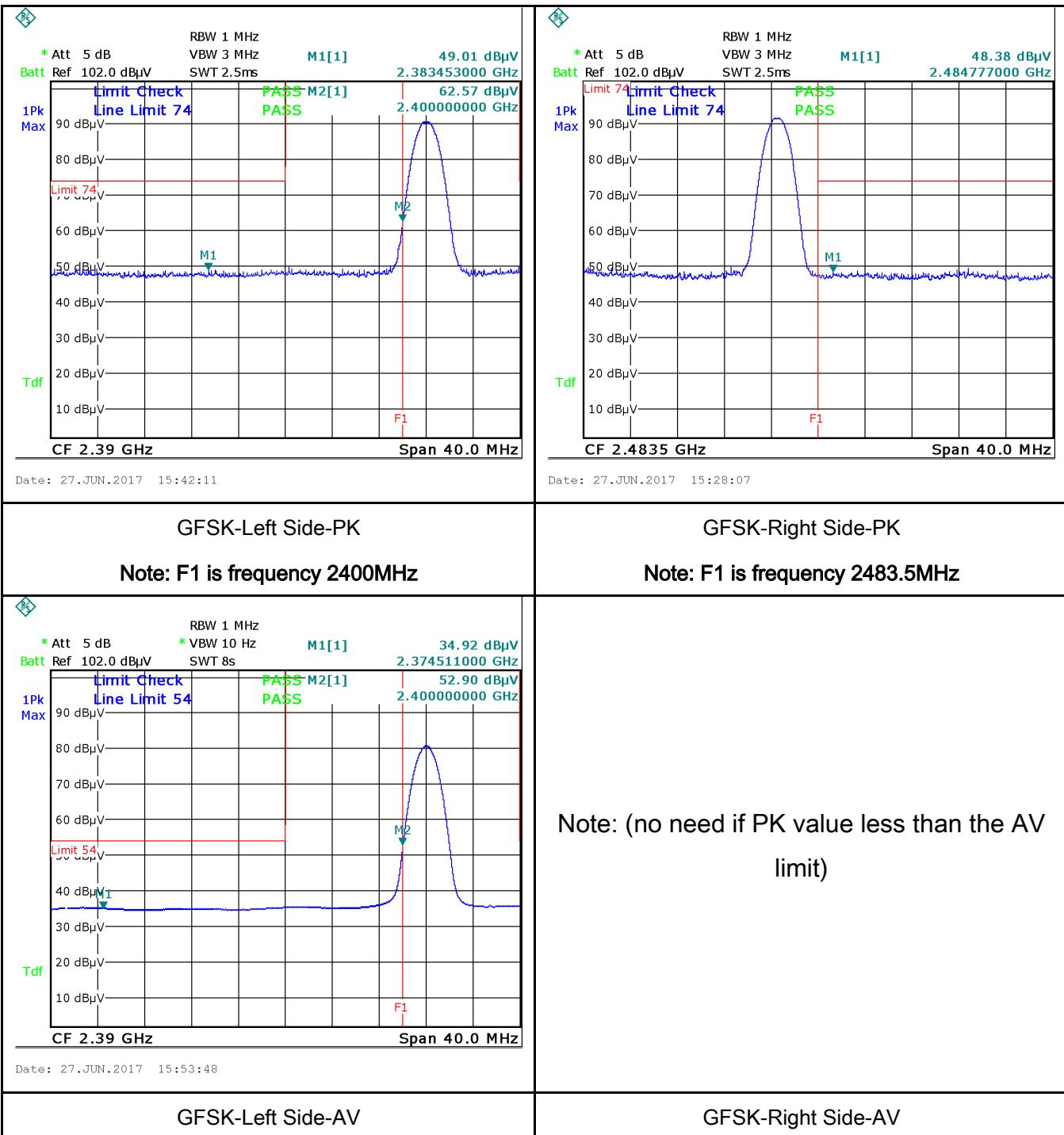
Test Data  Yes  N/A

Test Plot  Yes (See below)  N/A

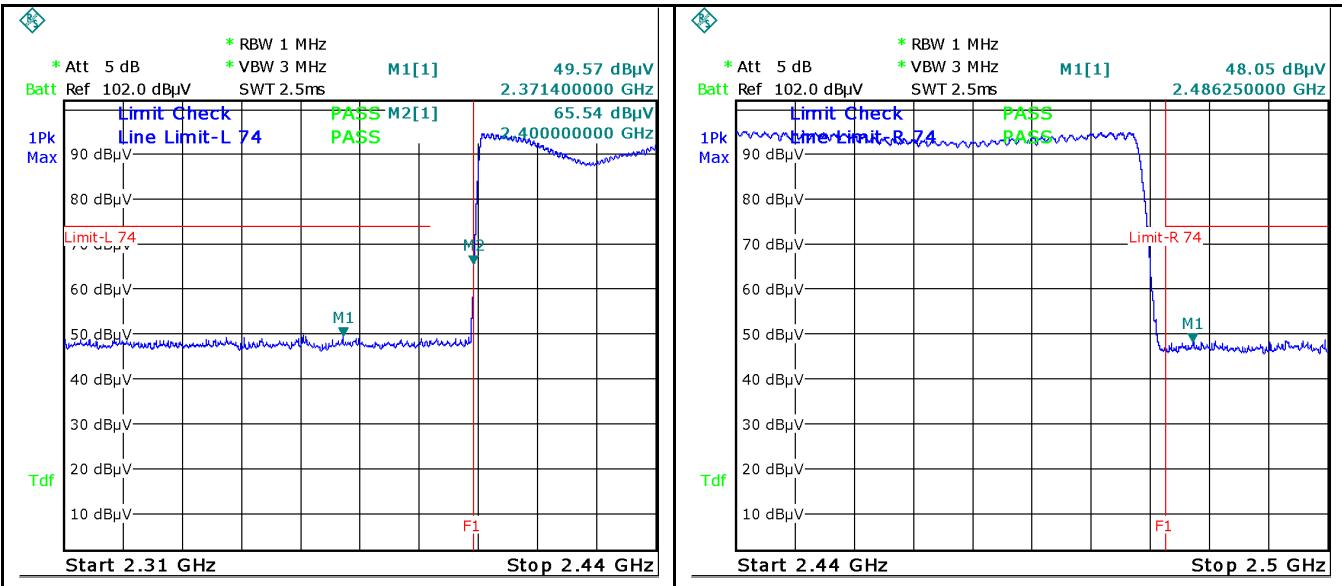
## Test Plots

### GFSK Mode:





$\pi/4$  DQPSK Mode:



Date: 27.JUN.2017 15:59:28

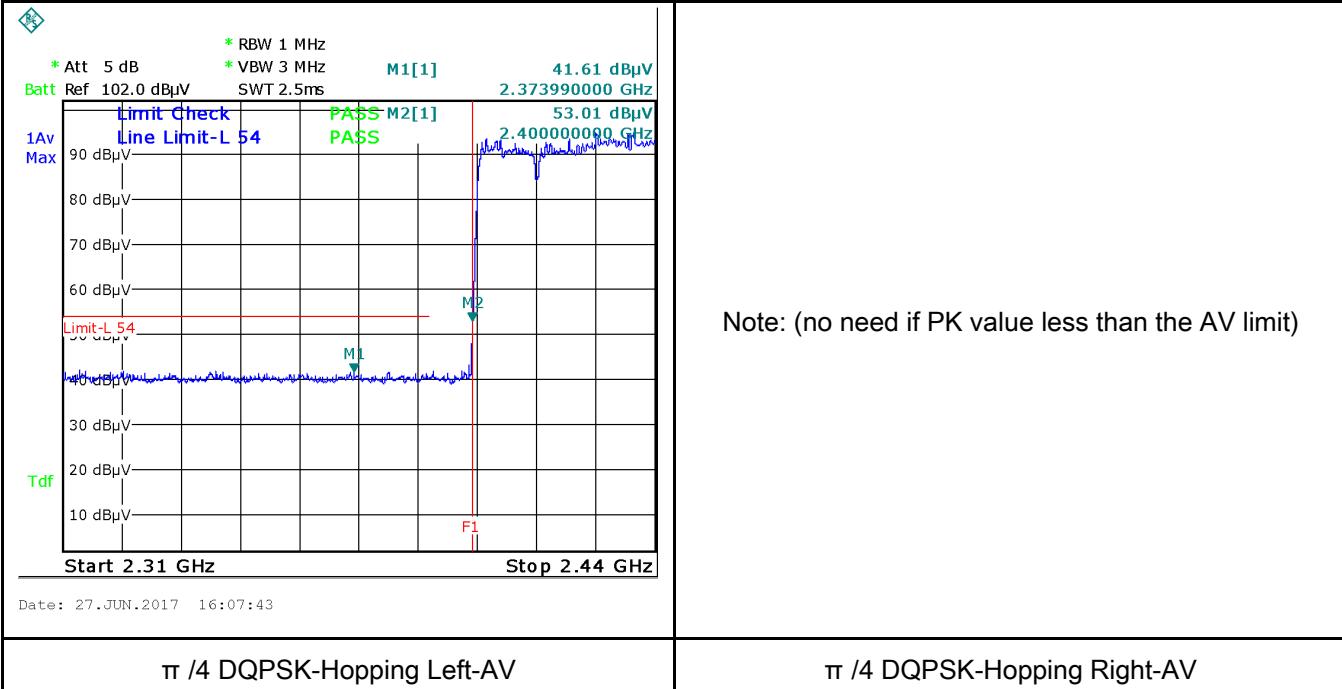
Date: 27.JUN.2017 16:11:51

$\pi/4$  DQPSK-Hopping Left Side-PK

Note: F1 is frequency 2400MHz

$\pi/4$  DQPSK-Hopping Right Side-PK

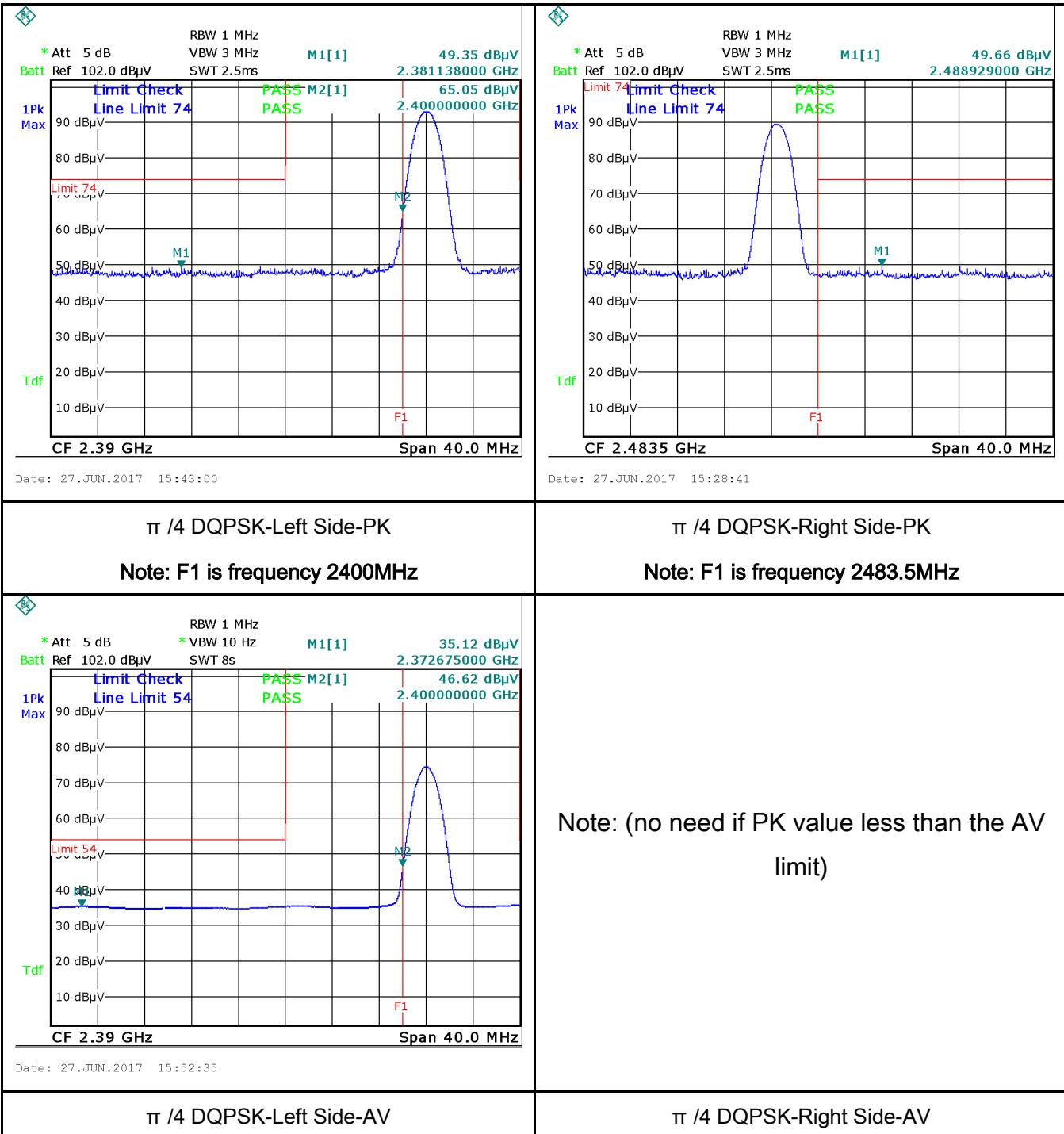
Note: F1 is frequency 2483.5MHz



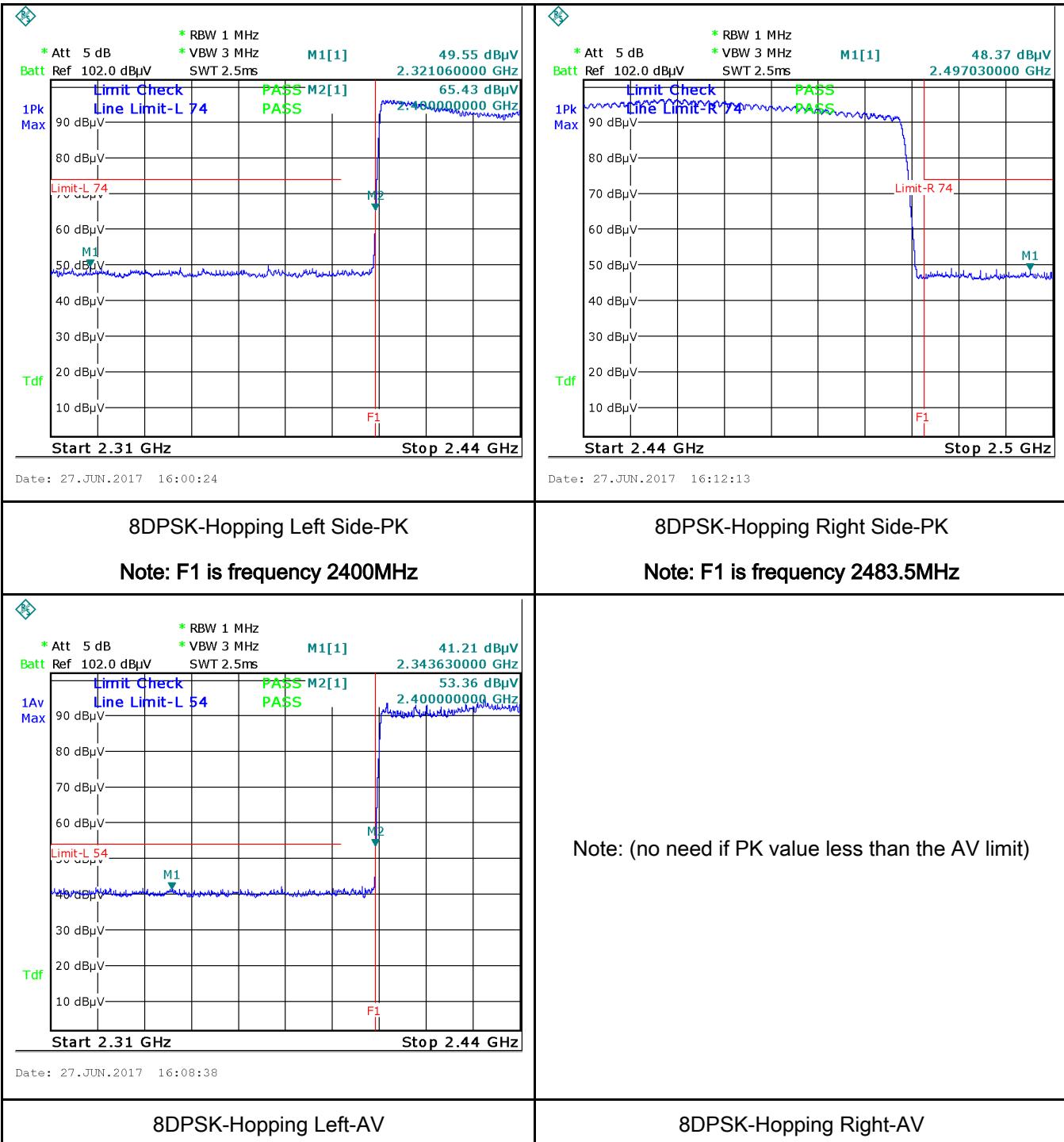
Date: 27.JUN.2017 16:07:43

$\pi/4$  DQPSK-Hopping Left-AV

$\pi/4$  DQPSK-Hopping Right-AV



### 8-DPSK Mode:

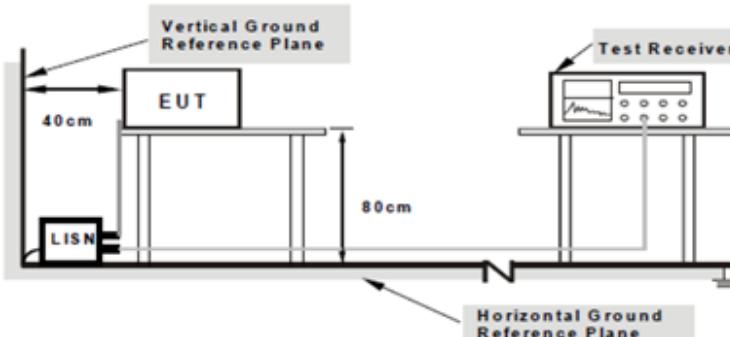




## 6.8 AC Power Line Conducted Emissions

Temperature	23 °C
Relative Humidity	55%
Atmospheric Pressure	1022mbar
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 type="checkbox"/> Pass <input checked="" type="checkbox"/> Fail <input checked="" type="checkbox"/> N/A

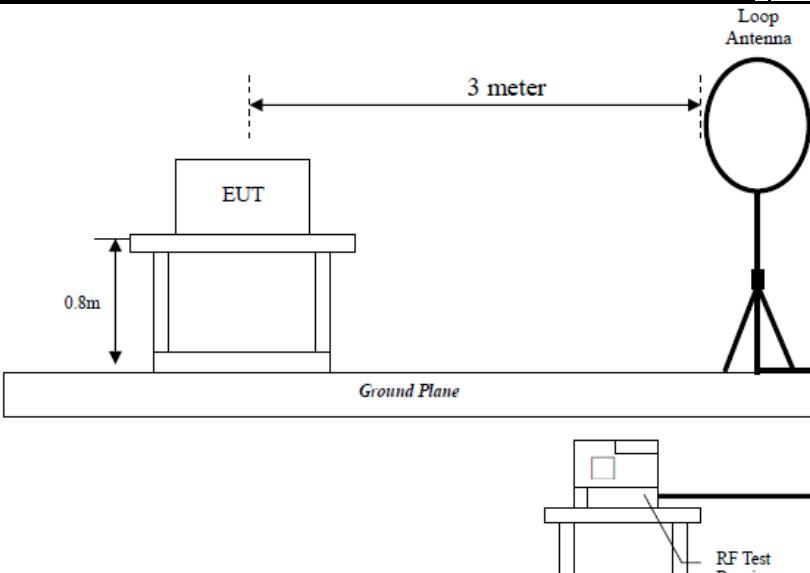
Test Data  Yes  N/A

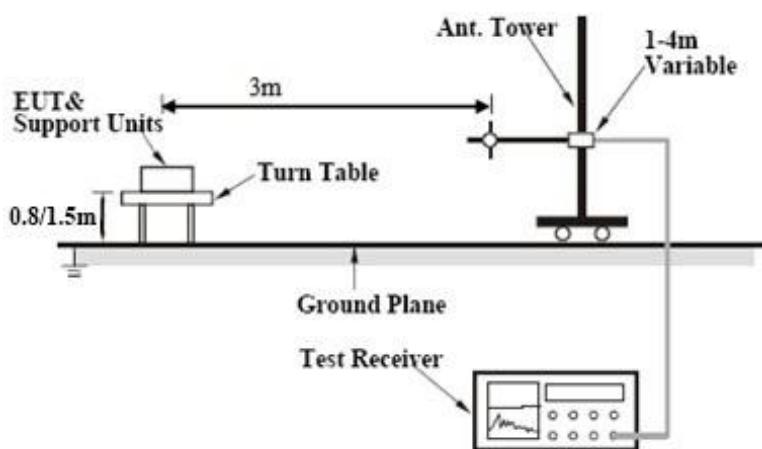
Test Plot  Yes (See below)  N/A

## 6.9 Radiated Emissions & Restricted Band

Temperature	25 °C
Relative Humidity	57%
Atmospheric Pressure	1014mbar
Test date :	June 20, 2017
Tested By :	Loren Luo

### 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. An EUT (Equipment Under Test) is placed on a stand 0.8m above a ground plane. A loop antenna is positioned 3 meters away from the EUT. The RF Test Receiver is connected to the loop antenna to measure the signal.</p>																	



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: <ul 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> </ul> </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  Yes

N/A

Test Plot  Yes (See below)  N/A

## Test Result:

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

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:

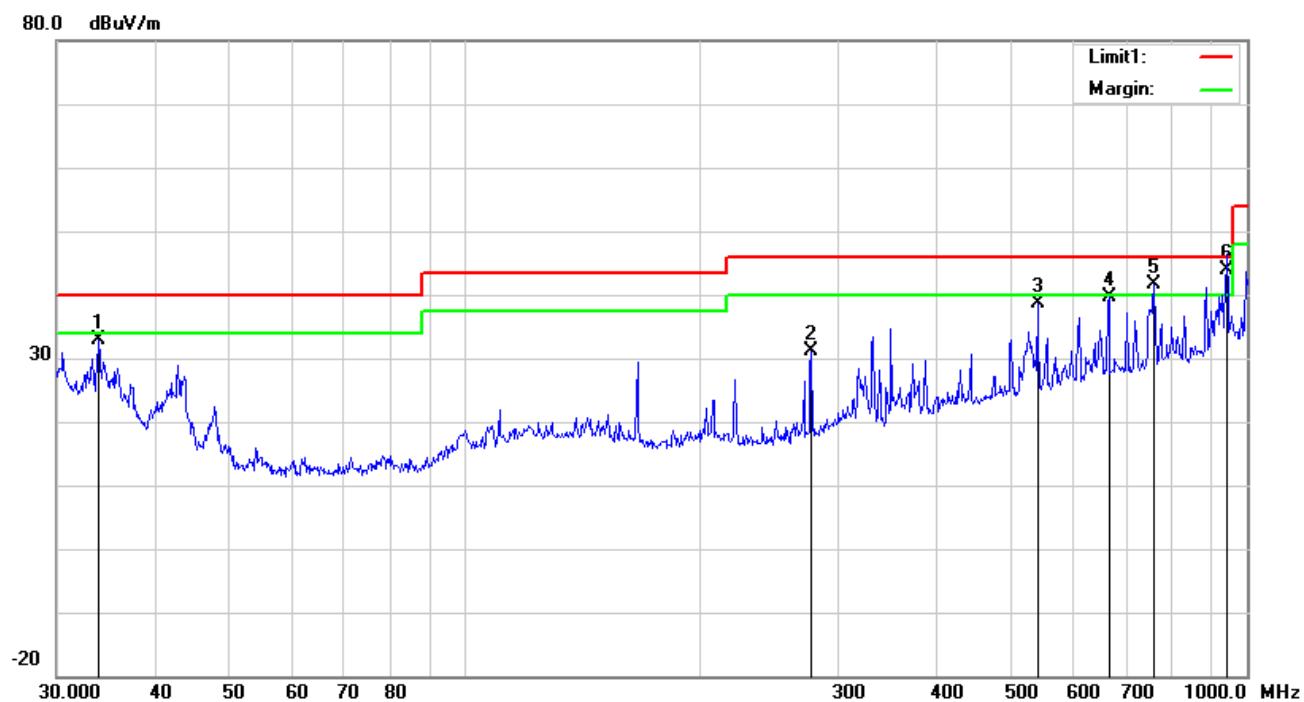
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

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

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

**Test Mode:** Bluetooth Mode

**30MHz -1GHz**



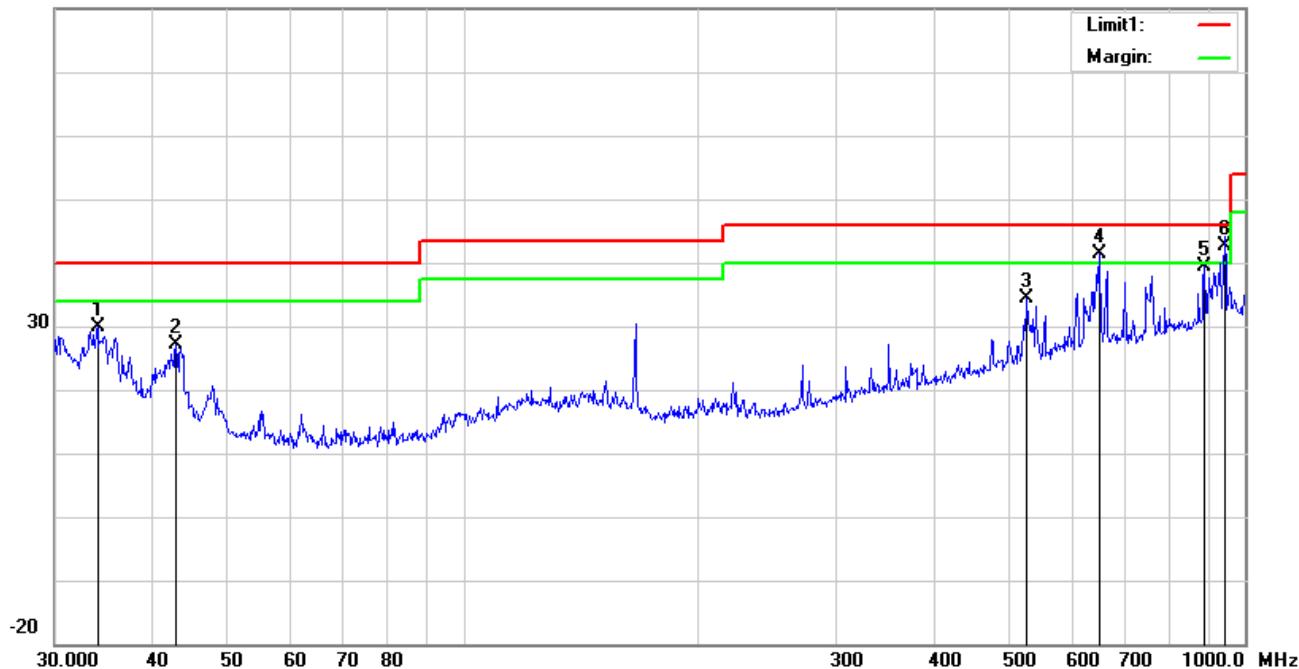
#### Test Data

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	33.9174	35.96	peak	18.38	22.26	0.73	32.81	40.00	-7.19	100	294
2	H	277.0935	39.19	peak	12.59	22.29	1.75	31.24	46.00	-14.76	100	156
3	H	539.4775	39.67	peak	18.25	21.72	2.47	38.67	46.00	-7.33	100	128
4	H	665.8035	38.63	QP	19.82	21.44	2.60	39.61	46.00	-6.39	100	119
5	H	760.7036	38.96	QP	20.93	21.23	2.89	41.55	46.00	-4.45	100	137
6	H	942.1305	38.94	QP	22.71	20.80	3.15	44.00	46.00	-2.00	100	151

### 30MHz -1GHz

80.0 dB<sub>uV/m</sub>



### Test Data

Vertical Polarity Plot @3m

No.	P/L	Frequency (MHz)	Reading (dB <sub>uV/m</sub> )	Detect or	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dB <sub>uV/m</sub> )	Limit (dB <sub>uV/m</sub> )	Margin (dB)	Height (cm)	Degr ee
1	V	34.0365	33.16	peak	18.29	22.26	0.73	29.92	40.00	-10.08	100	53
2	V	42.8998	36.68	peak	11.99	22.29	0.77	27.15	40.00	-12.85	200	217
3	V	526.3967	35.52	peak	18.07	21.75	2.45	34.29	46.00	-11.71	100	242
4	V	651.9417	40.65	QP	19.67	21.47	2.63	41.48	46.00	-4.52	100	145
5	V	887.6099	34.99	peak	22.36	20.91	3.02	39.46	46.00	-6.54	100	299
6	V	942.1305	37.59	QP	22.71	20.80	3.15	42.65	46.00	-3.35	100	154

## Above 1GHz

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

Low Channel: GFSK Mode (Worst Case) (2402 MHz)

Frequency (MHz)	S.A. Reading (dB $\mu$ V)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
4804	39.68	AV	V	33.67	6.86	32.66	47.55	54	-6.45
4804	38.74	AV	H	33.67	6.86	32.66	46.61	54	-7.39
4804	48.56	PK	V	33.67	6.86	32.66	56.43	74	-17.57
4804	46.23	PK	H	33.67	6.86	32.66	54.1	74	-19.9
17803	24.59	AV	V	45.03	11.21	32.38	48.45	54	-5.55
17803	23.17	AV	H	45.03	11.21	32.38	47.03	54	-6.97
17803	41.67	PK	V	45.03	11.21	32.38	65.53	74	-8.47
17803	39.52	PK	H	45.03	11.21	32.38	63.38	74	-10.62

Middle Channel: GFSK Mode (Worst Case) (2441 MHz)

Frequency (MHz)	S.A. Reading (dB $\mu$ V)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
4882	38.79	AV	V	33.71	6.95	32.74	46.71	54	-7.29
4882	37.61	AV	H	33.71	6.95	32.74	45.53	54	-8.47
4882	50.23	PK	V	33.71	6.95	32.74	58.15	74	-15.85
4882	48.91	PK	H	33.71	6.95	32.74	56.83	74	-17.17
17819	25.16	AV	V	45.15	11.18	32.41	49.08	54	-4.92
17819	23.58	AV	H	45.15	11.18	32.41	47.5	54	-6.5
17819	41.59	PK	V	45.15	11.18	32.41	65.51	74	-8.49
17819	40.27	PK	H	45.15	11.18	32.41	64.19	74	-9.81

#### High Channel: GFSK Mode (Worst Case) (2480 MHz)

Frequency (MHz)	S.A. Reading (dB $\mu$ V)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre- Amp. Gain (dB)	Cord. Amp. (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
4960	39.44	AV	V	33.9	6.76	32.74	47.36	54	-6.64
4960	36.29	AV	H	33.9	6.76	32.74	44.21	54	-9.79
4960	49.61	PK	V	33.9	6.76	32.74	57.53	74	-16.47
4960	45.27	PK	H	33.9	6.76	32.74	53.19	74	-20.81
17824	24.15	AV	V	45.22	11.35	32.38	48.34	54	-5.66
17824	23.17	AV	H	45.22	11.35	32.38	47.36	54	-6.64
17824	42.51	PK	V	45.22	11.35	32.38	66.7	74	-7.3
17824	40.29	PK	H	45.22	11.35	32.38	64.48	74	-9.52

**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.

## Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Due	In use
<b>AC Line Conducted</b>					
EMI test receiver	ESCS30	8471241027	09/16/2016	09/15/2017	<input checked="" type="checkbox"/>
Line Impedance	LI-125A	191106	09/24/2016	09/23/2017	<input checked="" type="checkbox"/>
Line Impedance	LI-125A	191107	09/24/2016	09/23/2017	<input checked="" type="checkbox"/>
ISN	ISN T800	34373	09/24/2016	09/23/2017	<input type="checkbox"/>
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/23/2016	09/22/2017	<input checked="" type="checkbox"/>
Transient Limiter	LIT-153	531118	08/31/2016	08/30/2017	<input checked="" type="checkbox"/>
<b>RF conducted test</b>					
Agilent ESA-E SERIES	E4407B	MY45108319	09/16/2016	09/15/2017	<input checked="" type="checkbox"/>
Power Splitter	1#	1#	08/31/2016	08/30/2017	<input checked="" type="checkbox"/>
DC Power Supply	E3640A	MY40004013	09/16/2016	09/15/2017	<input checked="" type="checkbox"/>
<b>Radiated Emissions</b>					
EMI test receiver	ESL6	100262	09/16/2016	09/15/2017	<input checked="" type="checkbox"/>
Positioning Controller	UC3000	MF780208282	11/18/2016	11/17/2017	<input checked="" type="checkbox"/>
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	08/31/2016	08/30/2017	<input checked="" type="checkbox"/>
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/23/2017	03/22/2018	<input checked="" type="checkbox"/>
Active Antenna (9kHz-30MHz)	AL-130	121031	10/13/2016	10/12/2017	<input checked="" type="checkbox"/>
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/20/2016	09/19/2017	<input checked="" type="checkbox"/>
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/23/2016	09/22/2017	<input checked="" type="checkbox"/>
Universal Radio Communication Tester	CMU200	121393	09/24/2016	09/23/2017	<input checked="" type="checkbox"/>

## Annex B. EUT And Test Setup Photographs

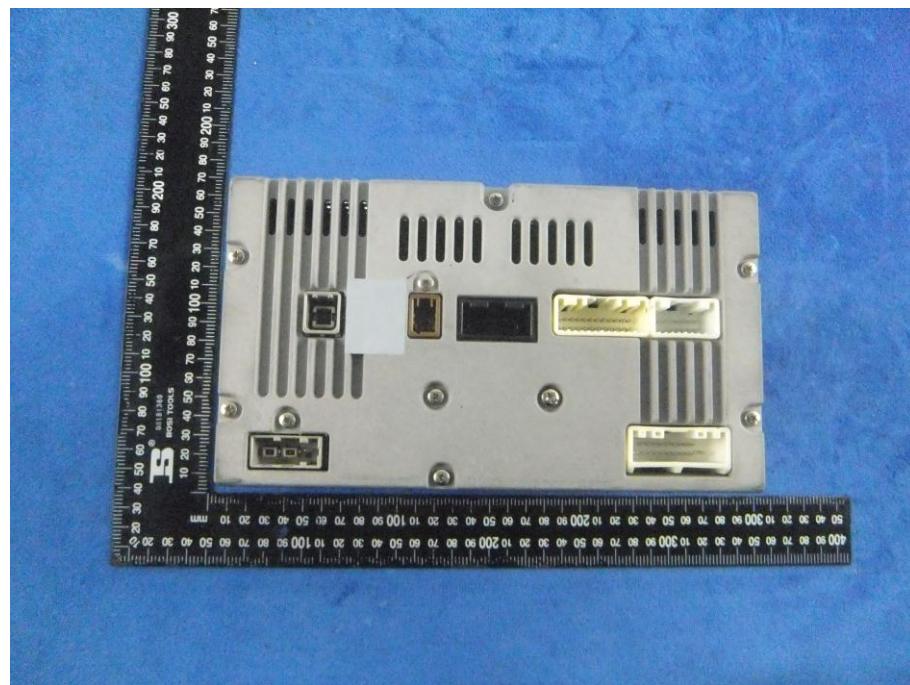
### Annex B.i. Photograph: EUT External Photo



Package Front View



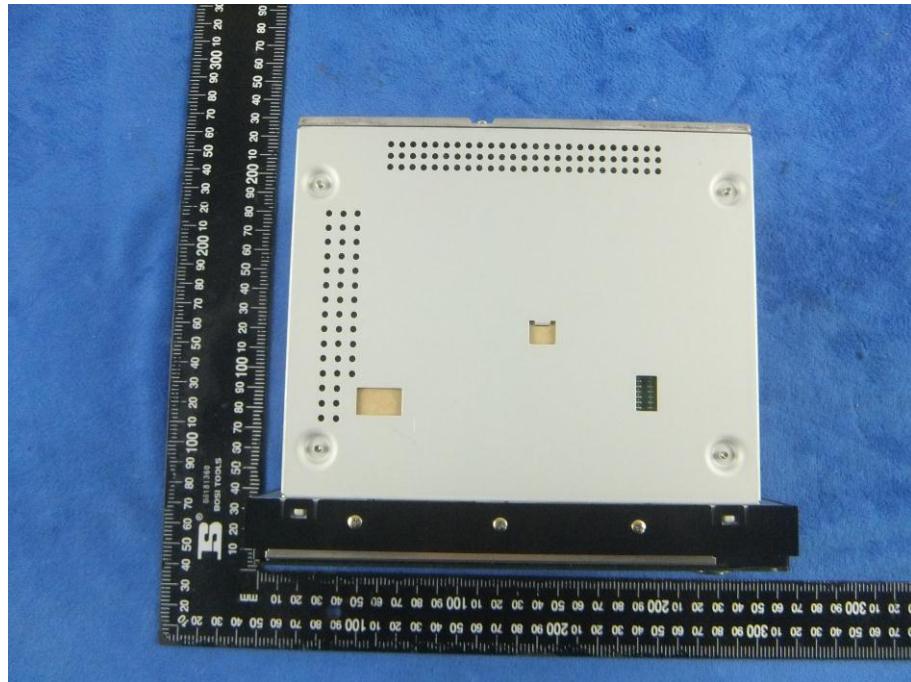
EUT - Front View



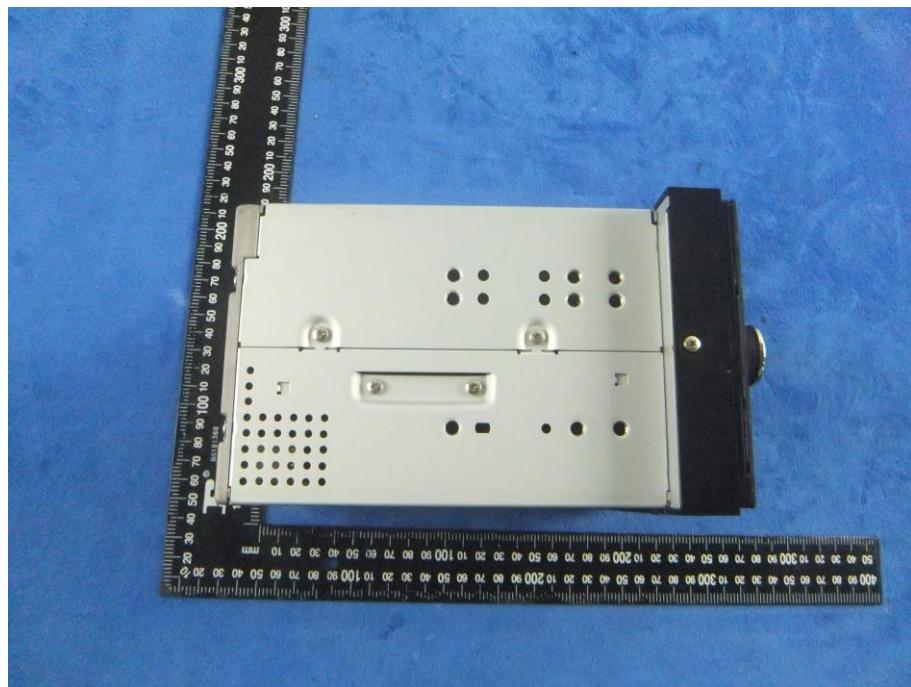
EUT – Rear View



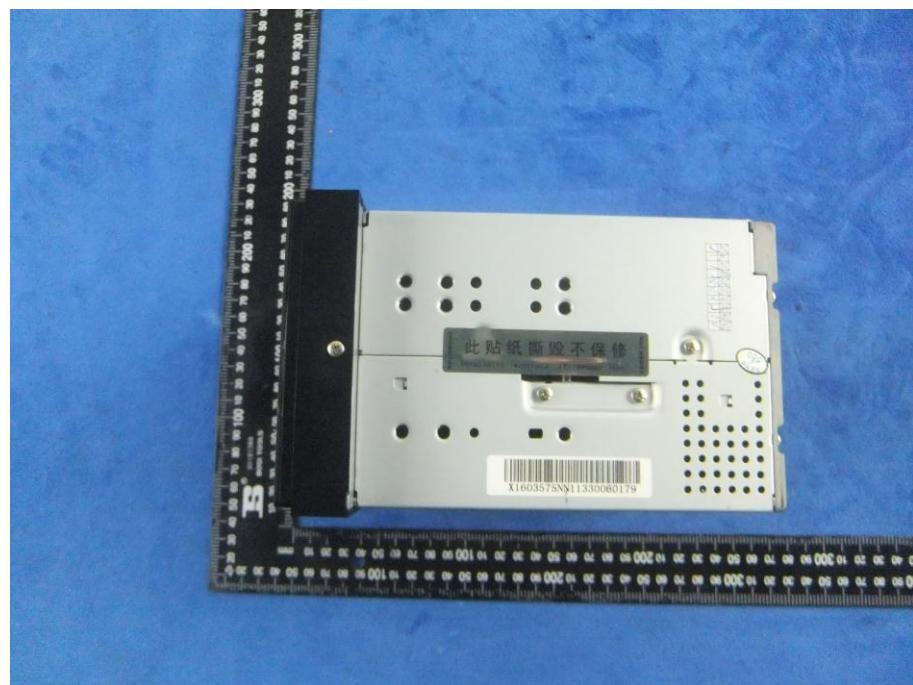
EUT - Top View



EUT - Bottom View

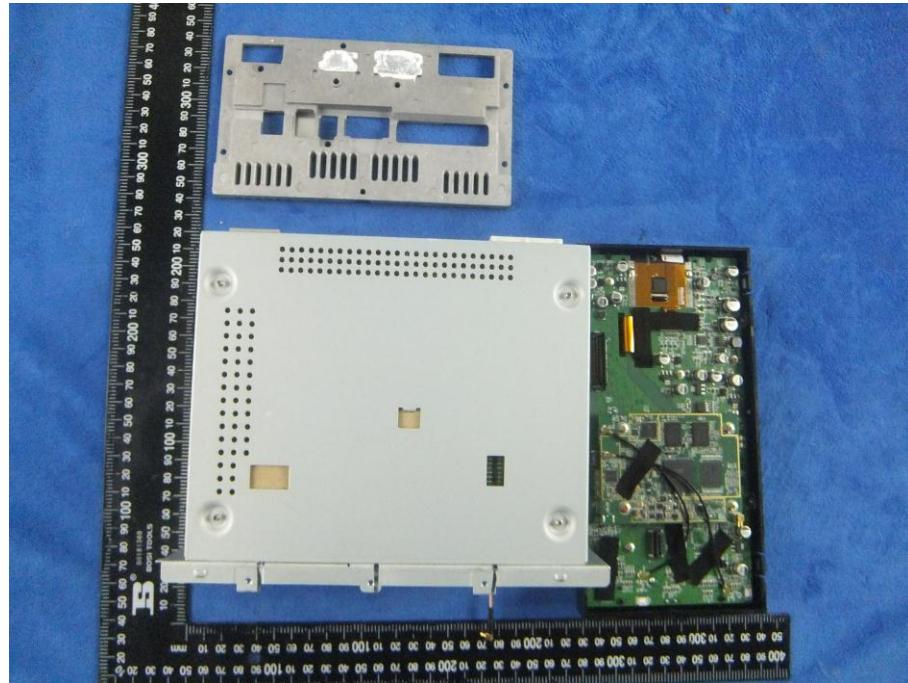


EUT - Left View

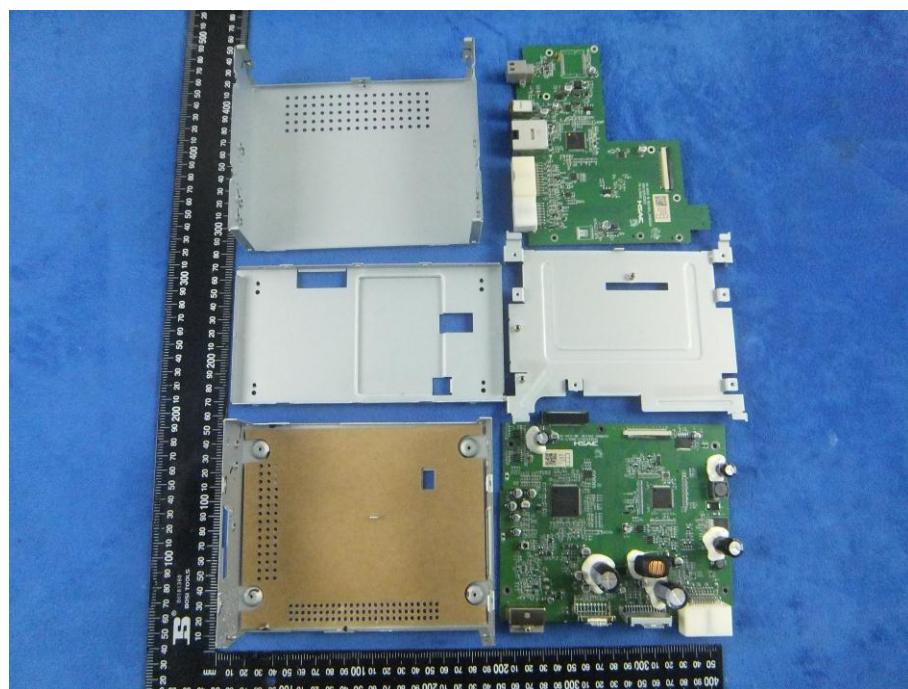


EUT - Left View

Annex B.ii. Photograph: EUT Internal Photo



Cover Off - Top View 1



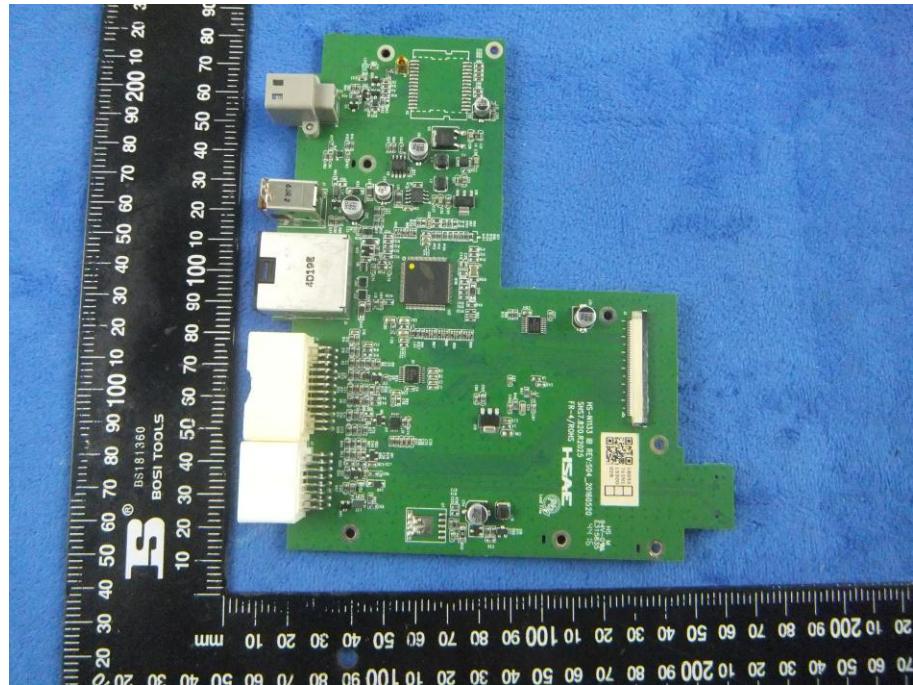
Cover Off - Top View 2



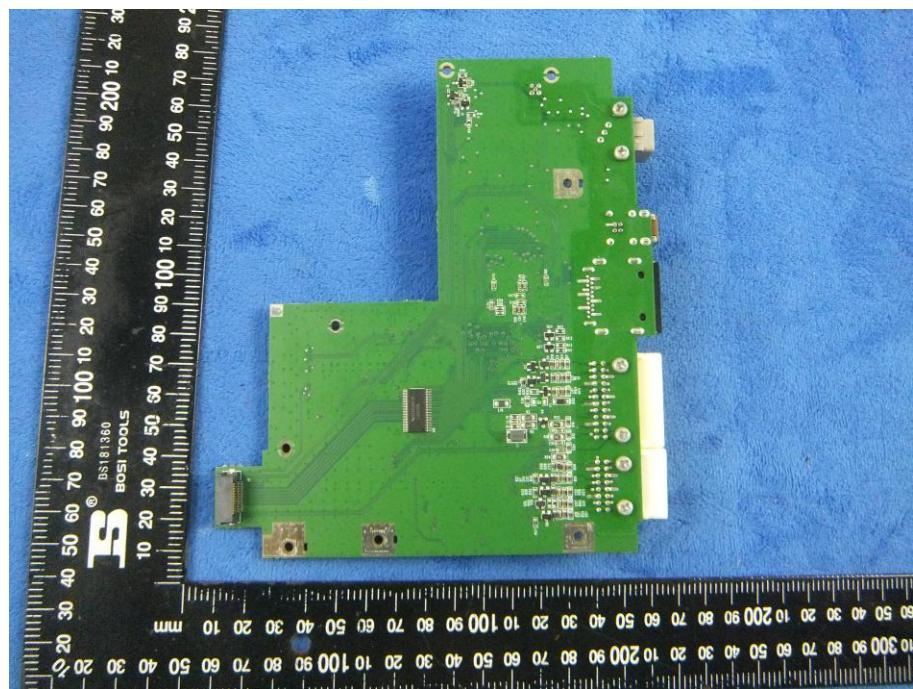
Mainborad - Front View



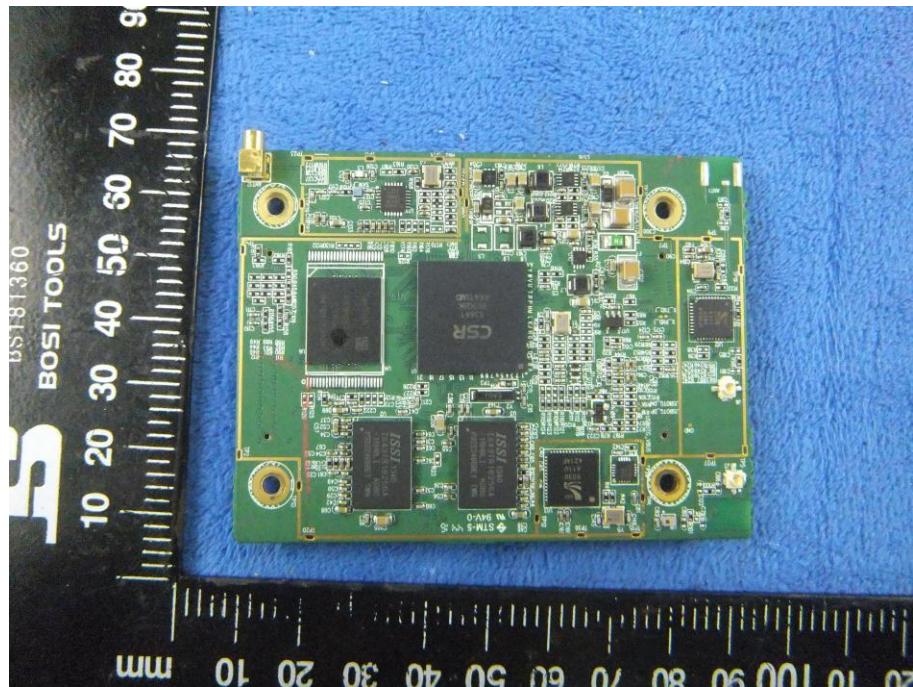
Mainborad - Rear View



PCB borad 1 - Front View



PCB borad 1 - Rear View



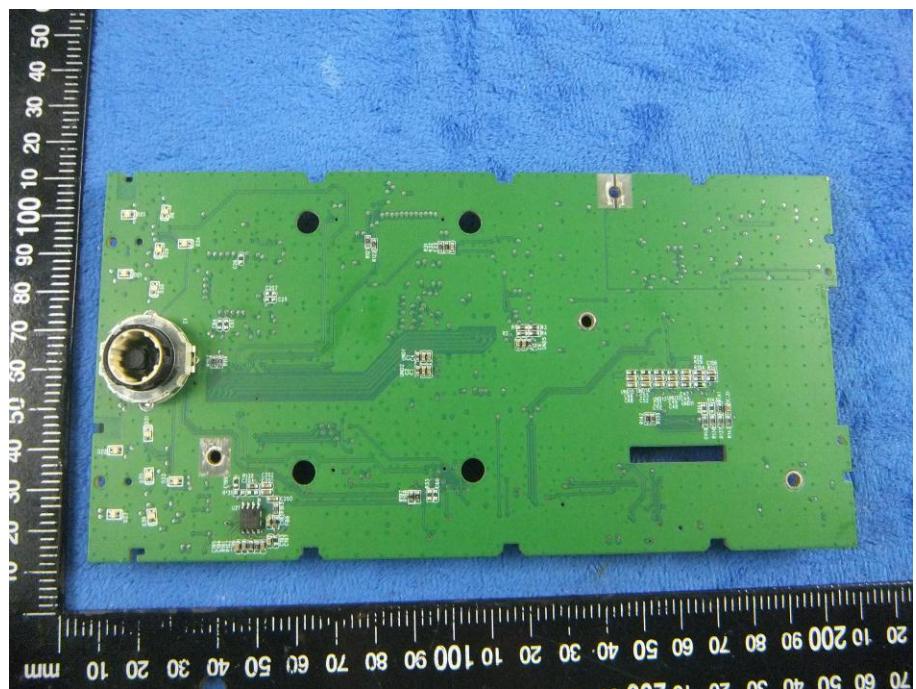
PCB borad 2 - Front View



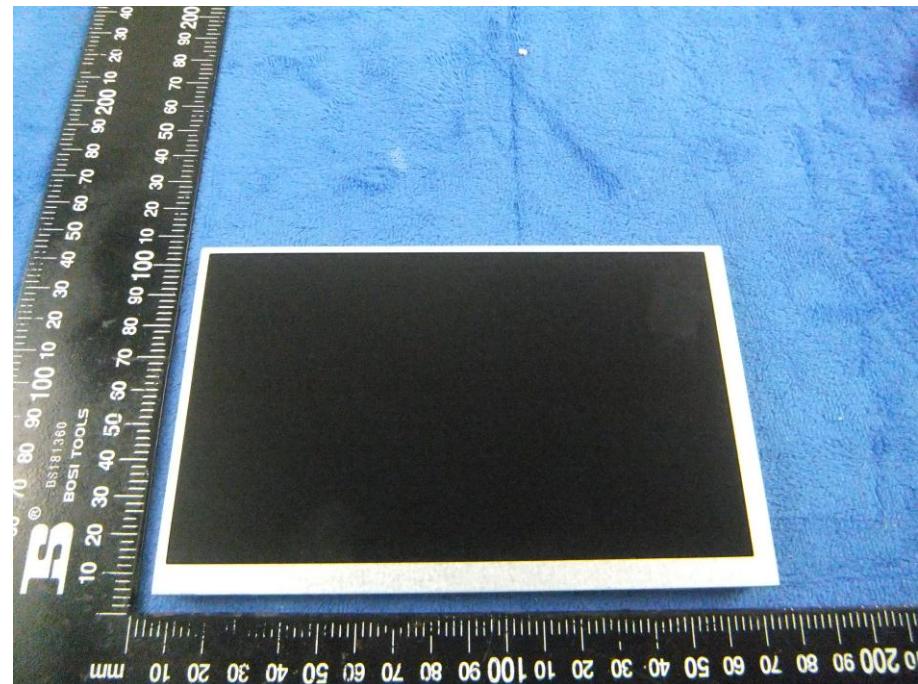
PCB borad 2 - Rear View



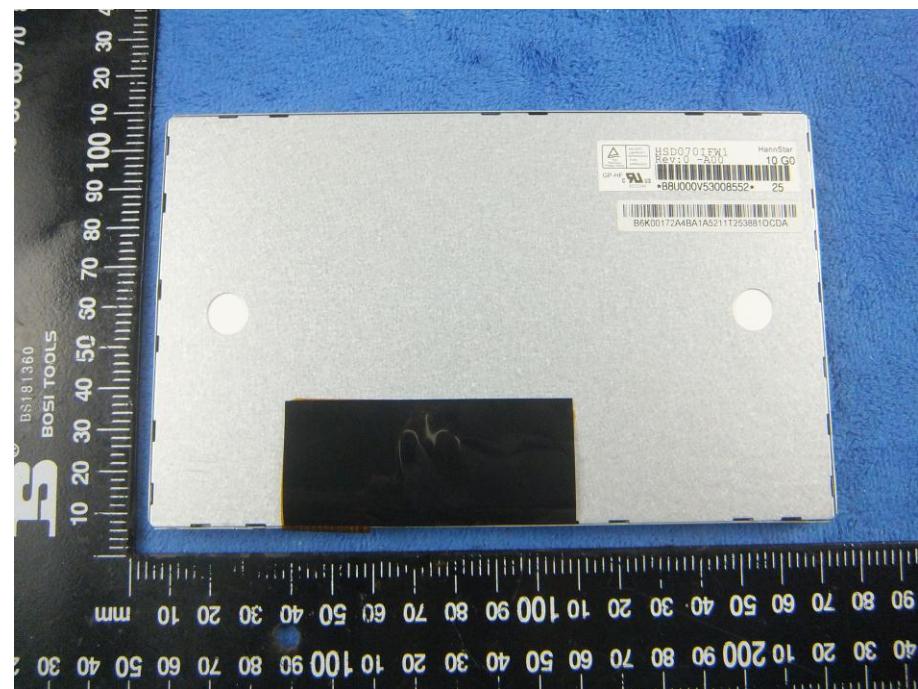
PCB borad 3 - Front View



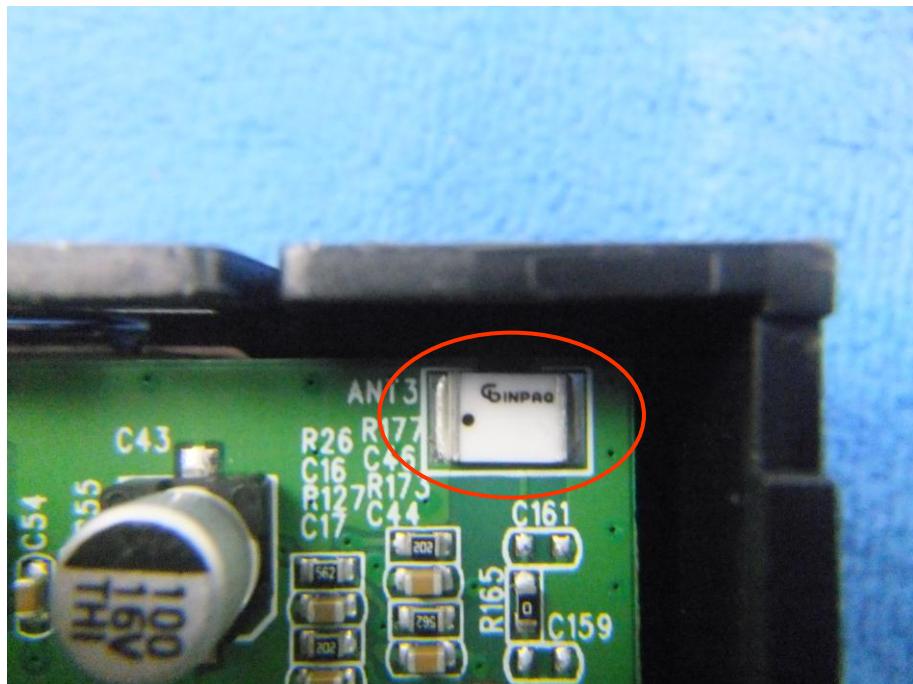
PCB borad 3 - Rear View



LCD – Front View



LCD – Rear View

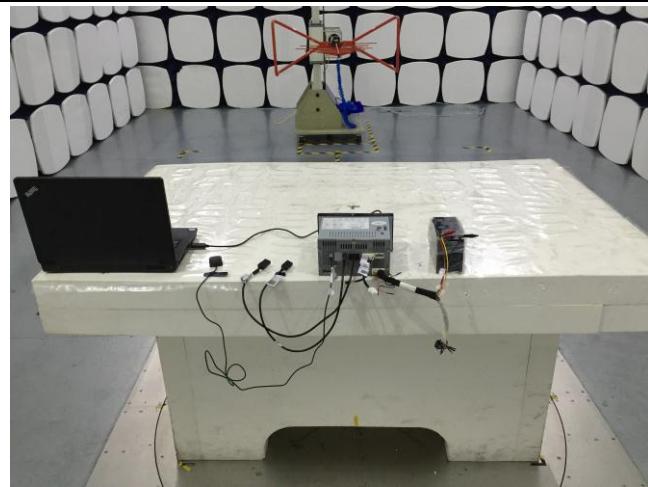


BT - Antenna View

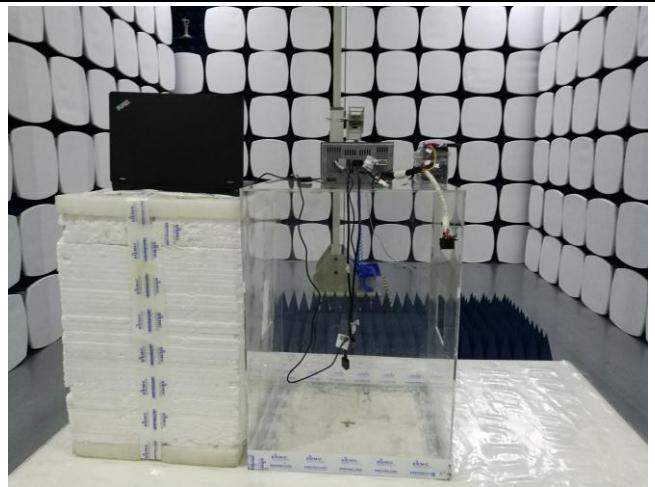


GPS - Antenna View

Annex B.iii. Photograph: Test Setup Photo



Radiated Spurious Emissions Test Setup Below 1GHz

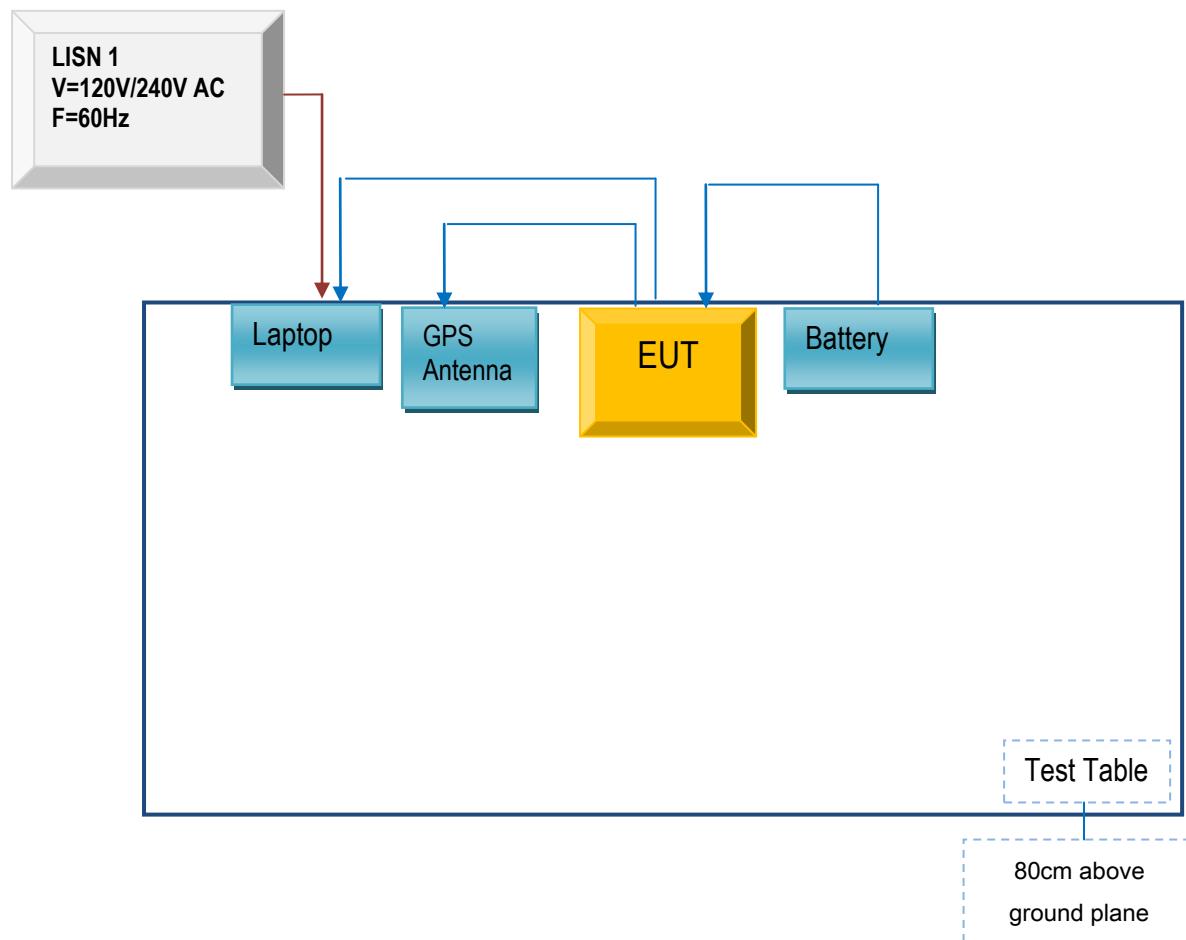


Radiated Spurious Emissions Test Setup Above  
1GHz

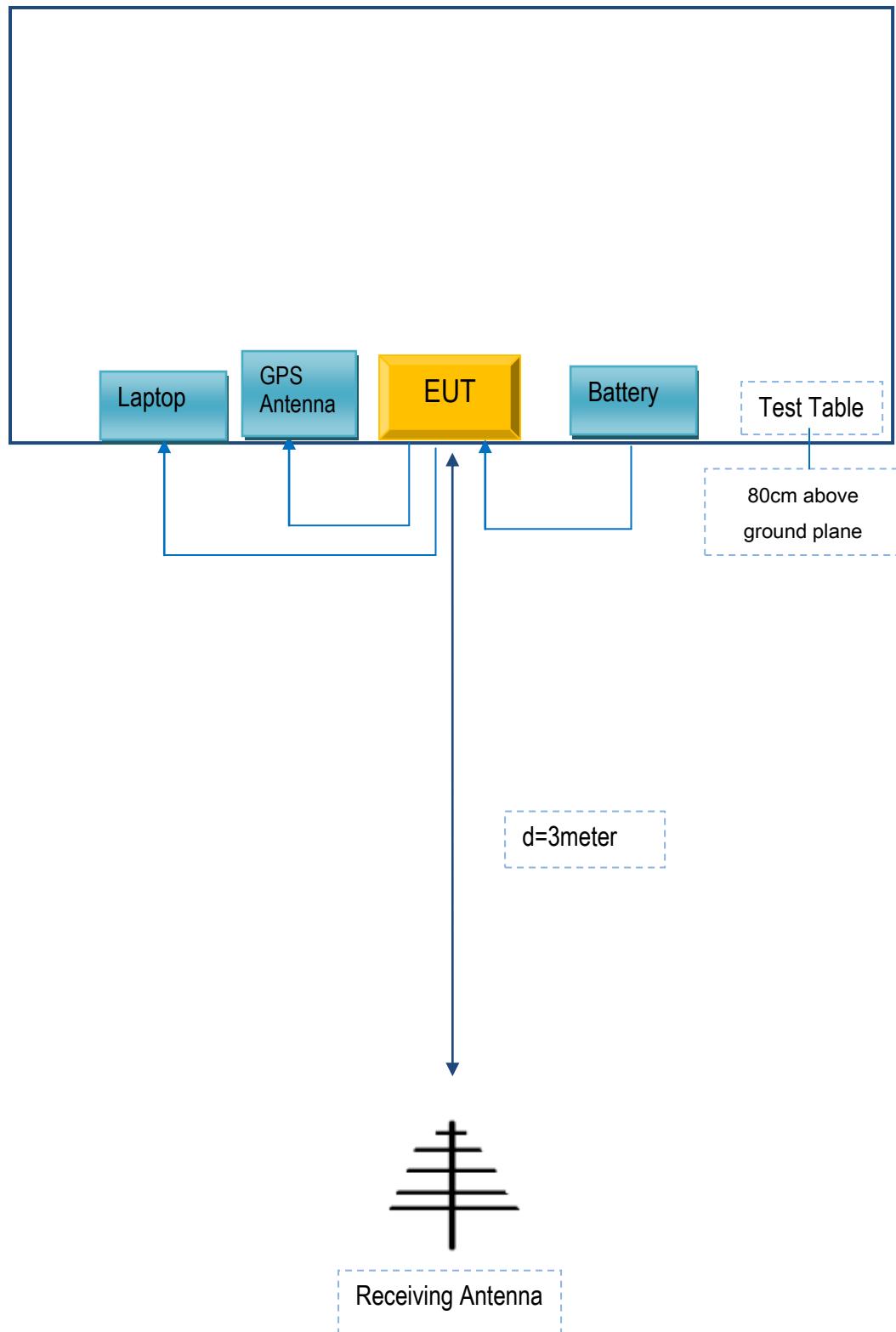
## Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

### Annex C.ii. TEST SET UP BLOCK

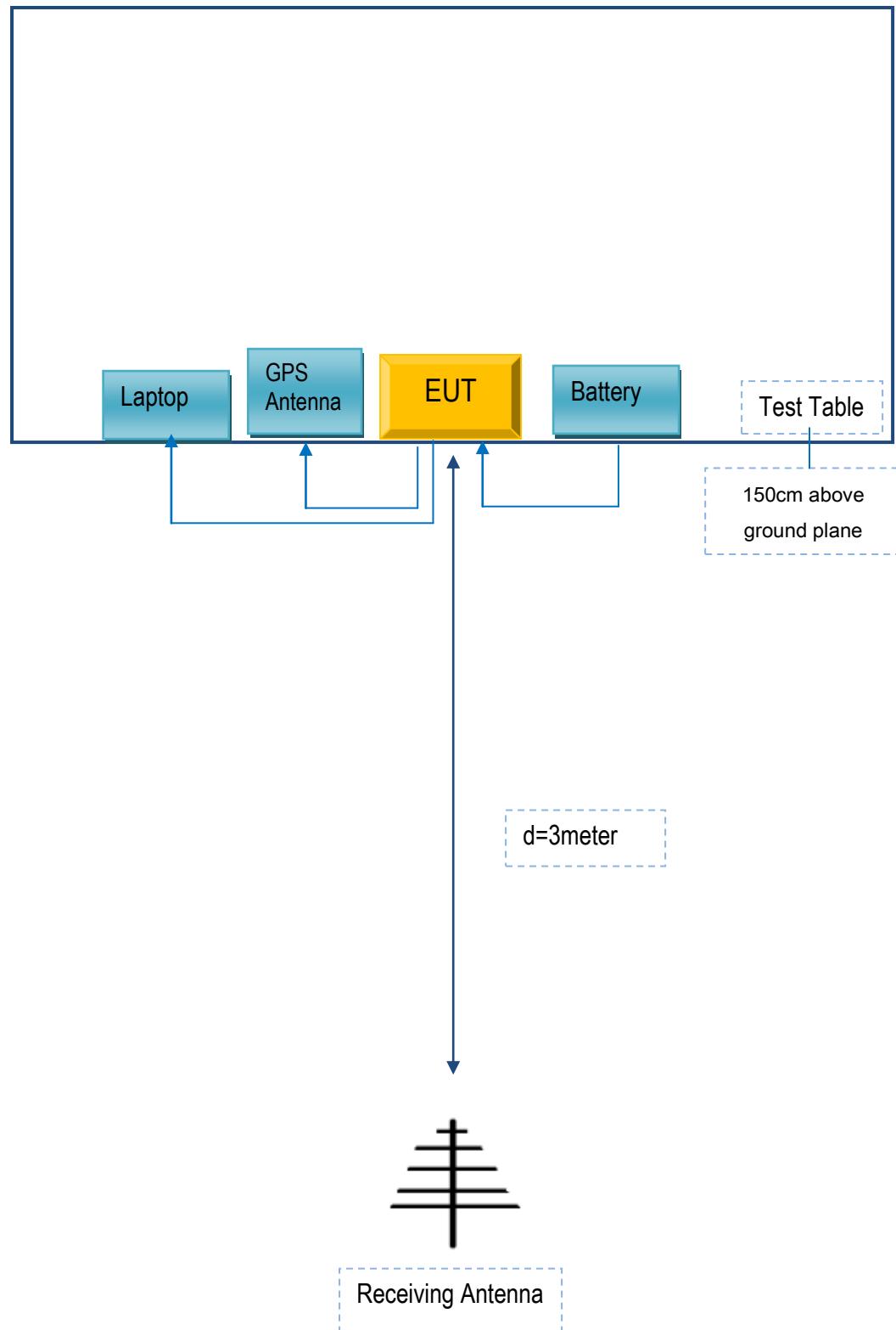
Block Configuration Diagram for AC Line Conducted Emissions



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



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



## Annex C. 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
Gaoke Ant Co.,LTD	GPS Antenna	GT5	N/A

### Supporting Cable:

Cable type	Shield Type	Ferrite Core	Length	Serial No
USB Cable	Un-shielding	No	0.5m	N/A

## Annex D. User Manual / Block Diagram / Schematics / Partlist

Please see the attachment

## Annex E. DECLARATION OF SIMILARITY

N/A