

# RF TEST REPORT



Report No.: 15050047-FCC-R2

Supersede Report No.: N/A

Applicant	Collage Investments LLC.	
Product Name	Mobile Phone	
Model No.	LK500	
Serial No.	N/A	
Test Standard	FCC Part 15.247: 2014, ANSI C63.10: 2013	
Test Date	October 13 to November 02, 2015	
Issue Date	November 03, 2015	
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"/>
<i>Winnie Zhang</i>	<i>David Huang</i>	
Winnie Zhang Test Engineer	David Huang Checked By	
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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
15050047-FCC-R2	NONE	Original	November 03, 2015

## 2. Customer information

Applicant Name	Collage Investments LLC.
Applicant Add	11437 NW 34 STREET Doral Florida United States 33178
Manufacturer	Collage Investments LLC.
Manufacturer Add	11437 NW 34 STREET Doral Florida United States 33178

## 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	Radiated Emission Program-To Shenzhen v2.0

## 4. Equipment under Test (EUT) Information

Description of EUT:	Mobile Phone
Main Model:	LK500
Serial Model:	N/A
Date EUT received:	October 12, 2015
Test Date(s):	October 13 to November 02, 2015
Equipment Category :	DSS
Antenna Gain:	GSM850:0.8dBi PCS1900:1.5dBi UMTS-FDD Band II : 1.5dBi Bluetooth:1.5dBi
Type of Modulation:	GSM / GPRS: GMSK Bluetooth: GFSK, $\pi$ /4DQPSK, 8DPSK UMTS-FDD: QPSK, 16QAM
RF Operating Frequency (ies):	GSM850 TX: 824.2 ~ 848.8 MHz; RX: 869.2 ~ 893.8 MHz PCS1900 TX: 1850.2 ~ 1909.8 MHz; RX: 1930.2 ~ 1989.8 MHz Bluetooth: 2402-2480 MHz UMTS-FDD Band II TX:1852.4 ~ 1907.6 MHz; RX: 1932.4 ~ 1987.6 MHz
Max. Output Power:	1.970dBm
Number of Channels:	GSM 850: 124CH PCS1900: 299CH UMTS-FDD Band II : 277CH Bluetooth: 79CH
Port:	Earphone Port, USB Port
Input Power:	Adapter:

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Model:LK500

Input: AC 100-240V; 50/60Hz;0.15A

Output: DC5.0V;500mA

Battery:

Model:LK500

Spec:DC3.7V,800mAh,2.96Wh

Limited charger voltage:4.2V

Trade Name : LIKUID

GPRS Multi-slot class 8/10/12

FCC ID: GAO- LK500

## 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	Compliance
§15.207(a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Radiated Emissions	Compliance

### Measurement Uncertainty

Emissions		
Test Item	Description	Uncertainty
Band Edge and Radiated Spurious Emissions	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 PIFA antenna for Bluetooth, the gain is 1.5dBi.

A permanently attached PIFA antenna for GSM and UMTS, the gain is 0.8dBi for GSM850, 1.5dBi for PCS1900, 1.5dBi for UMTS-FDD Band II.


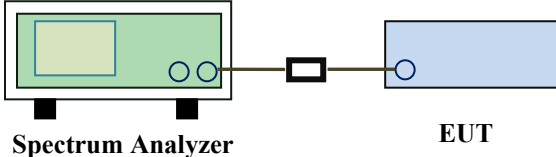
**The antenna meets up with the ANTENNA REQUIREMENT.**

**Result:** Compliance.

## 6.2 Channel Separation

Temperature	25°C
Relative Humidity	53%
Atmospheric Pressure	1020mbar
Test date :	October 20, 2015
Tested By :	Winnie Zhang

### 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	 <p style="text-align: center;">Spectrum Analyzer                      EUT</p>		
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) ≥ 1% of the span</li> <li>- Video (or Average) Bandwidth (VBW) ≥ 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

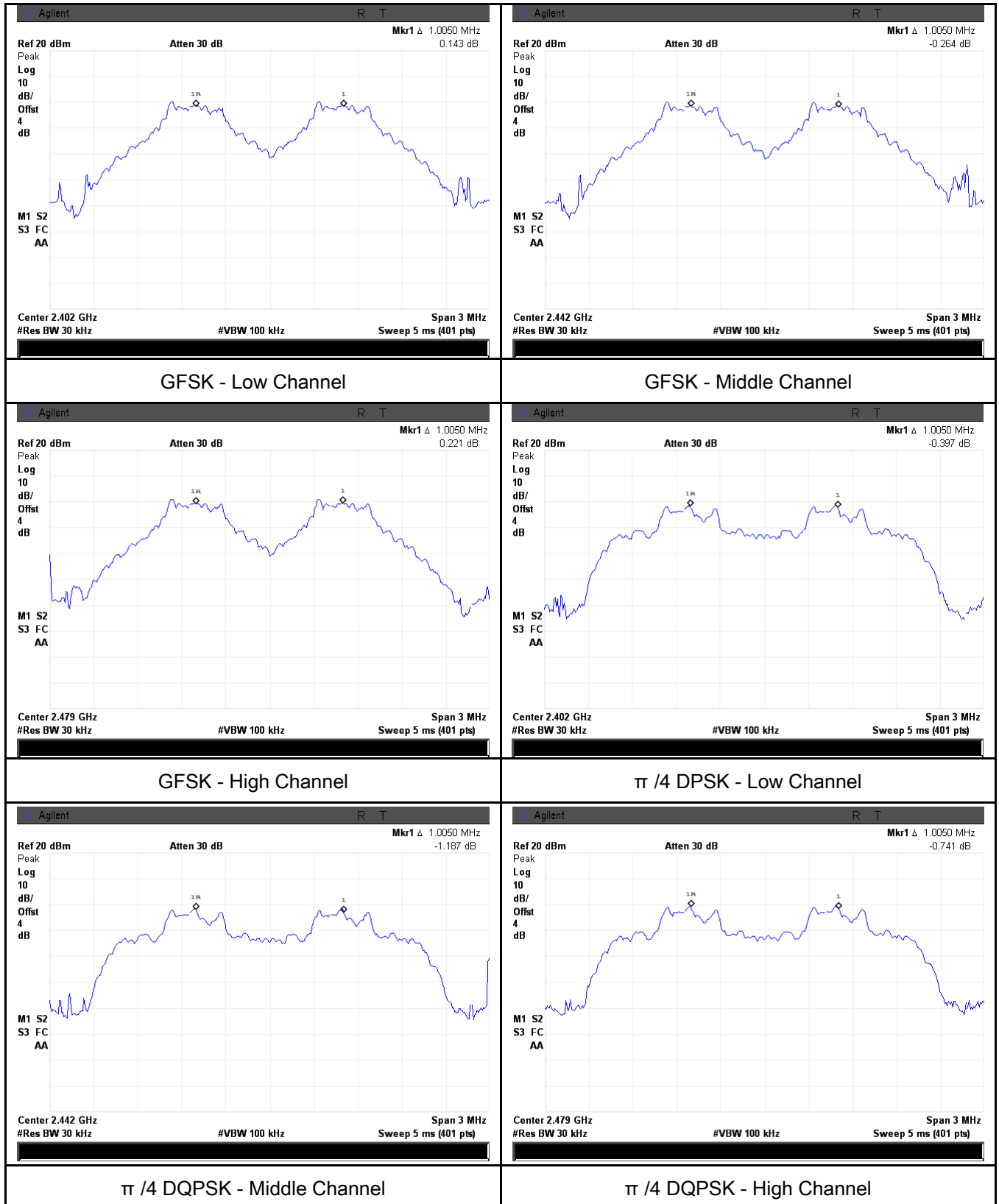
Test Data ☒ Yes ☐ N/A  
 Test Plot ☒ Yes (See below) ☐ N/A

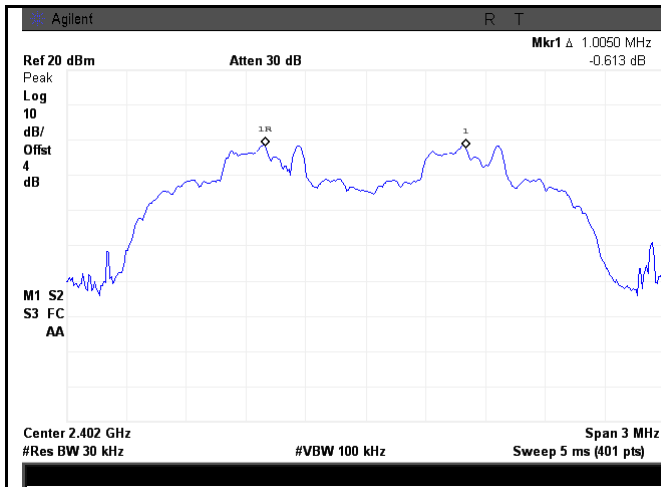
### Channel Separation measurement result

Type/ Modulation	CH	CH Freq (MHz)	CH Separation (MHz)	Limit (MHz)	Result
CH Separation GFSK	Low Channel	2402	1.005	0.980	Pass
	Adjacency Channel	2403			
	Mid Channel	2440	1.005	0.949	Pass
	Adjacency Channel	2441			
	High Channel	2480	1.005	0.952	Pass
	Adjacency Channel	2479			
CH Separation $\pi/4$ DQPSK	Low Channel	2402	1.005	0.794	Pass
	Adjacency Channel	2403			
	Mid Channel	2440	1.005	0.793	Pass
	Adjacency Channel	2441			
	High Channel	2480	1.005	0.793	Pass
	Adjacency Channel	2479			
CH Separation 8DPSK	Low Channel	2402	1.005	0.806	Pass
	Adjacency Channel	2403			
	Mid Channel	2440	1.005	0.803	Pass
	Adjacency Channel	2441			
	High Channel	2480	1.005	0.799	Pass
	Adjacency Channel	2479			

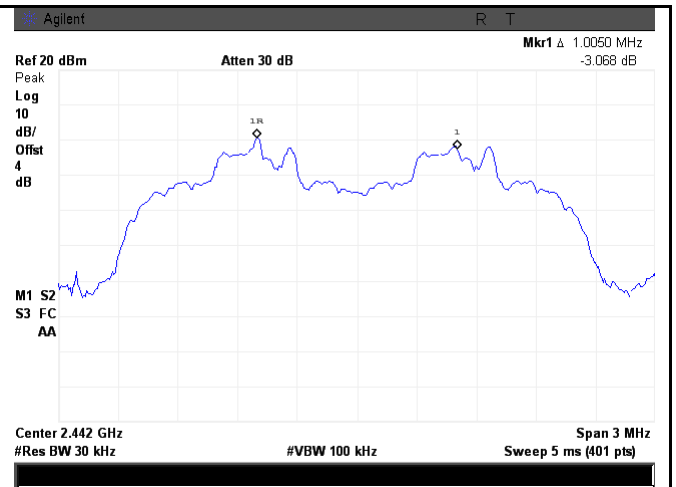
## Test Plots

### Channel Separation measurement result

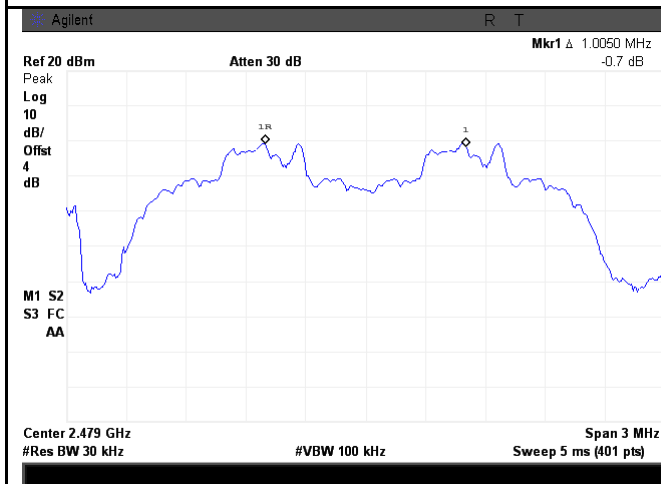




8DPSK - Low Channel



8DPSK - Middle Channel

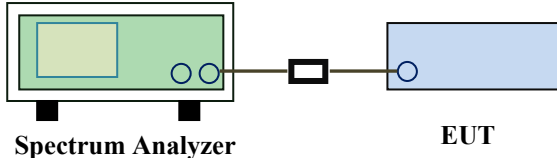


8DPSK - High Channel

### 6.3 20dB Bandwidth

Temperature	25°C
Relative Humidity	53%
Atmospheric Pressure	1020mbar
Test date :	October 20, 2015
Tested By :	Winnie Zhang

#### 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;">Spectrum Analyzer                      EUT</p>		
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>		

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	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

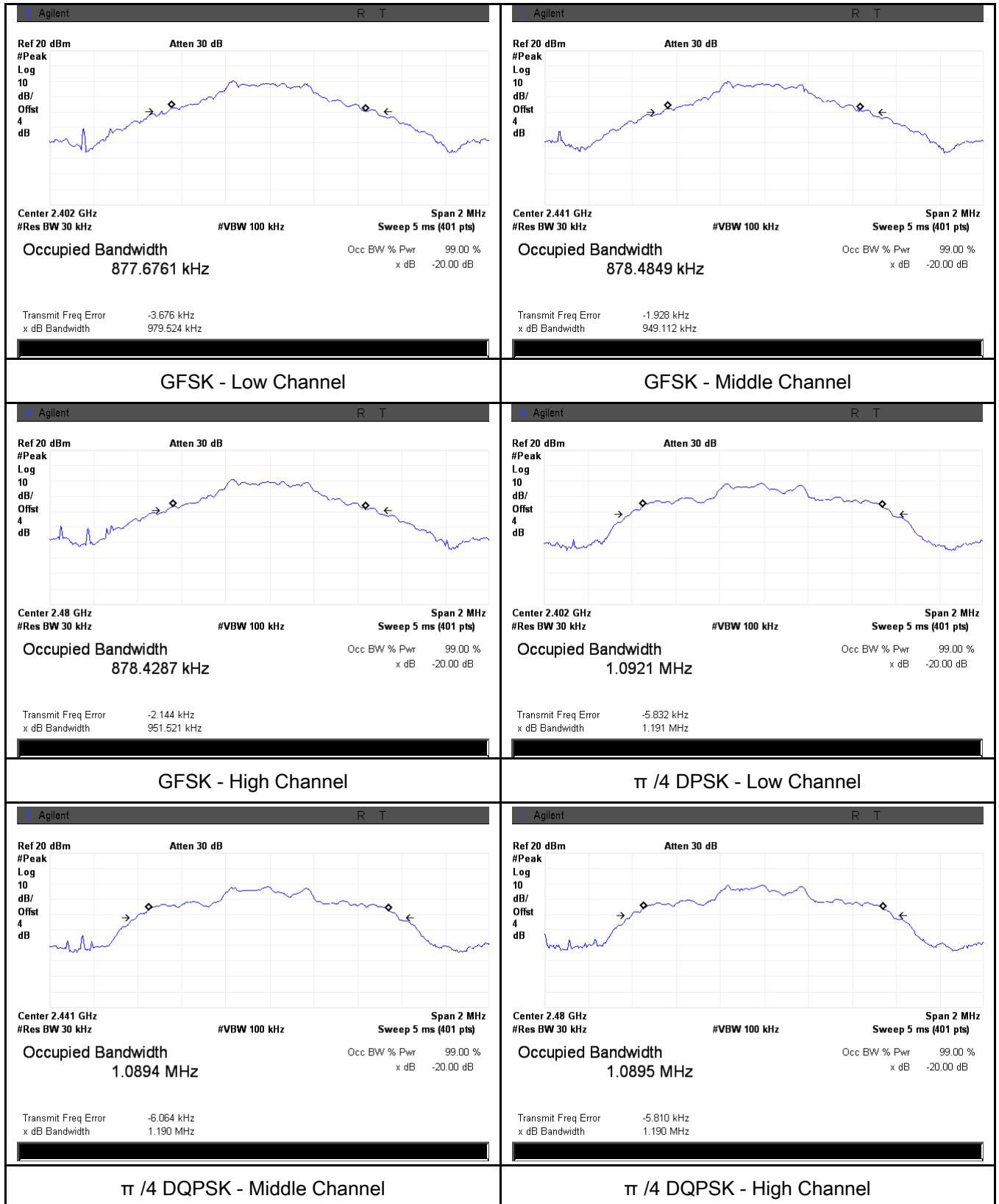
Test Plot ☒ Yes (See below) ☐ N/A

#### Measurement result

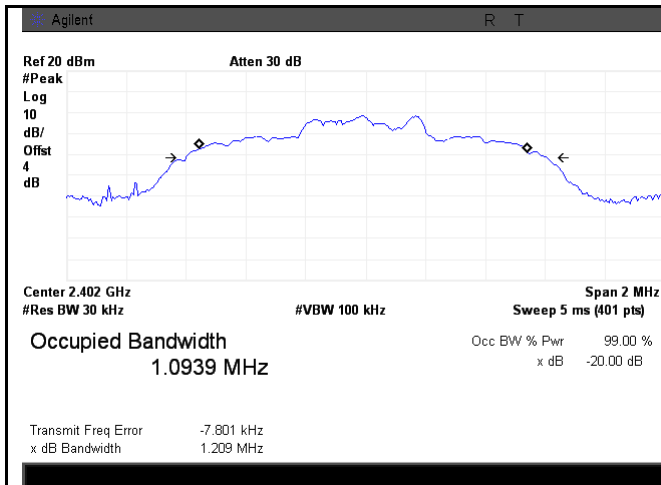
Modulation	CH	CH Freq (MHz)	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
GFSK	Low	2402	0.9795	0.8777
	Mid	2441	0.9491	0.8785
	High	2480	0.9515	0.8784
$\pi/4$ DQPSK	Low	2402	1.1910	1.0921
	Mid	2441	1.1900	1.0894
	High	2480	1.1900	1.0895
8-DPSK	Low	2402	1.2090	1.0939
	Mid	2441	1.2050	1.0876
	High	2480	1.1990	1.0866

## Test Plots

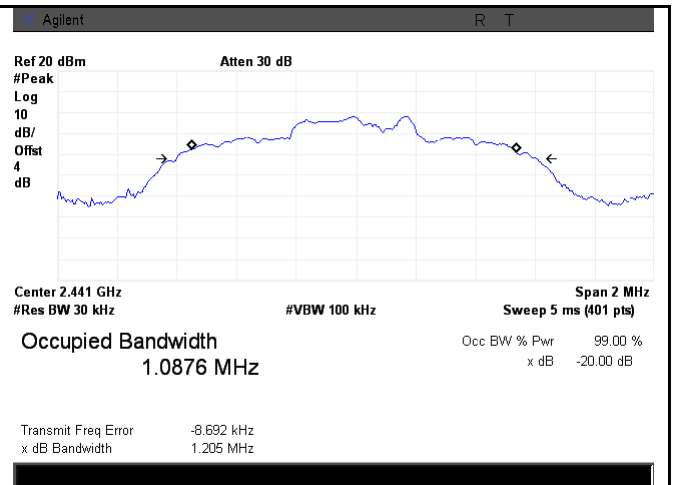
### 20dB Bandwidth measurement result



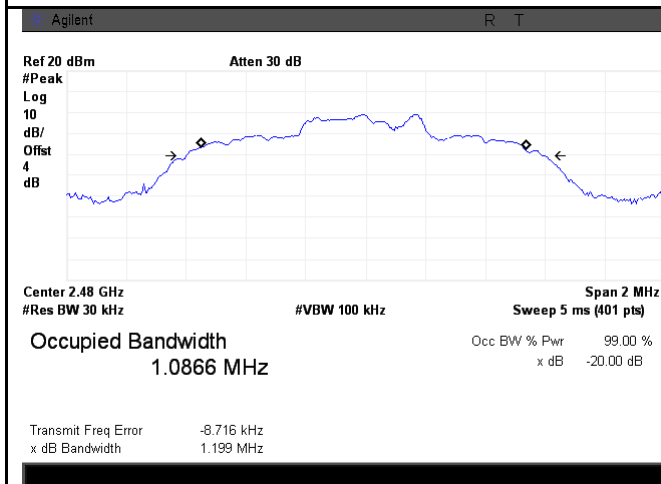




8DPSK - Low Channel



8DPSK - Middle Channel



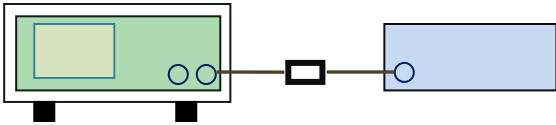
8DPSK - High Channel

## 6.4 Peak Output Power

Temperature	25°C
Relative Humidity	53%
Atmospheric Pressure	1020mbar
Test date :	October 20, 2015
Tested By :	Winnie Zhang

### Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(b) (2)	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)	DSSS in 902-928MHz, 2400-2483.5MHz, 5725-5850MHz: $\leq 1$ Watt	<input type="checkbox"/>

Test Setup	 <p style="text-align: center;">Spectrum Analyzer                      EUT</p>
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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 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> </ul>
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	<ul style="list-style-type: none"> <li>- Allow the trace to stabilize.</li> <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

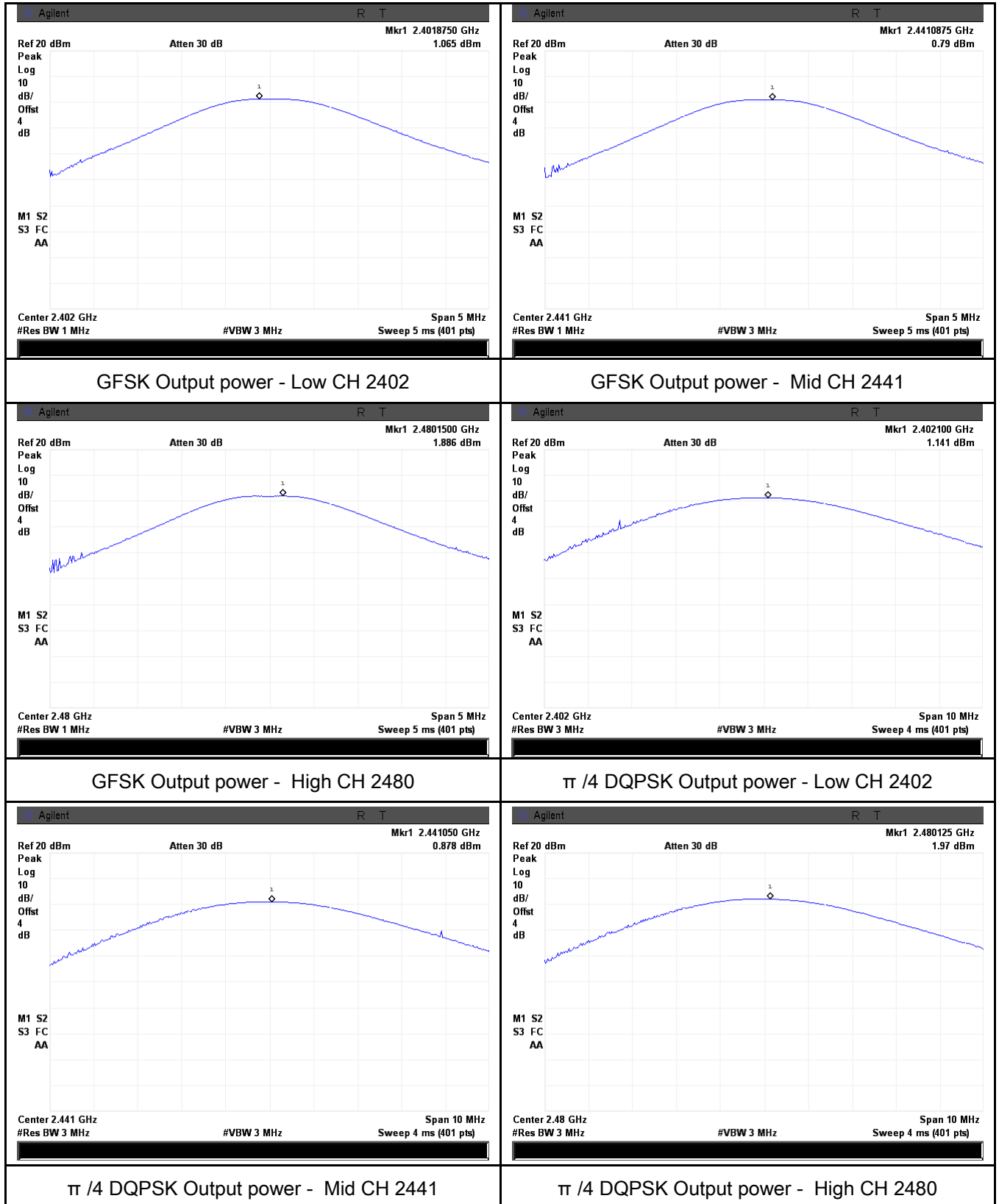
Test Data ☒ Yes ☐ N/A  
 Test Plot ☒ Yes (See below) ☐ N/A

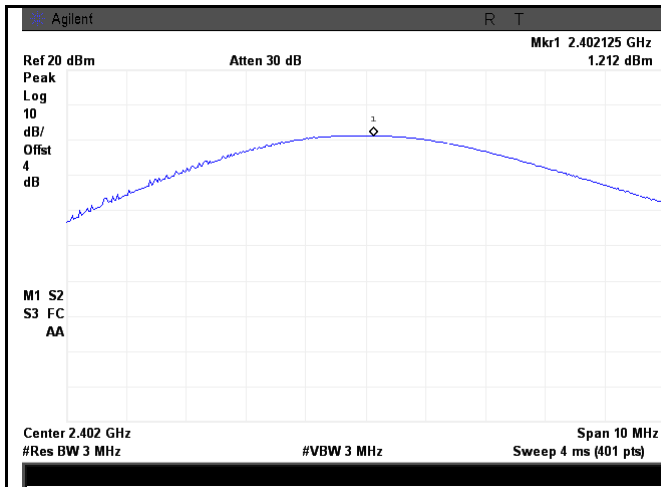
**Peak Output Power measurement result**

Type	Modulation	CH	Freq (MHz)	Conducted Power (dBm)	Limit (mW)	Result
Output power	GFSK	Low	2402	1.065	1000	Pass
		Mid	2441	0.790	1000	Pass
		High	2480	1.886	1000	Pass
	$\pi/4$ DQPSK	Low	2402	1.141	125	Pass
		Mid	2441	0.878	125	Pass
		High	2480	<b>1.970</b>	125	Pass
	8-DPSK	Low	2402	1.212	125	Pass
		Mid	2441	0.946	125	Pass
		High	2480	1.945	125	Pass

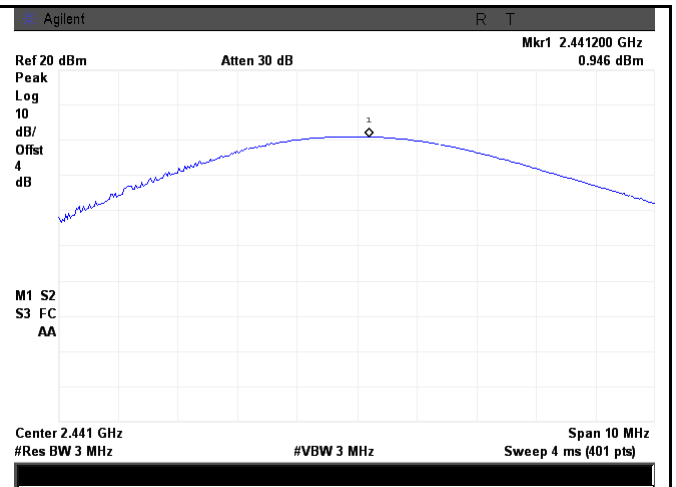
## Test Plots

### Output Power measurement result

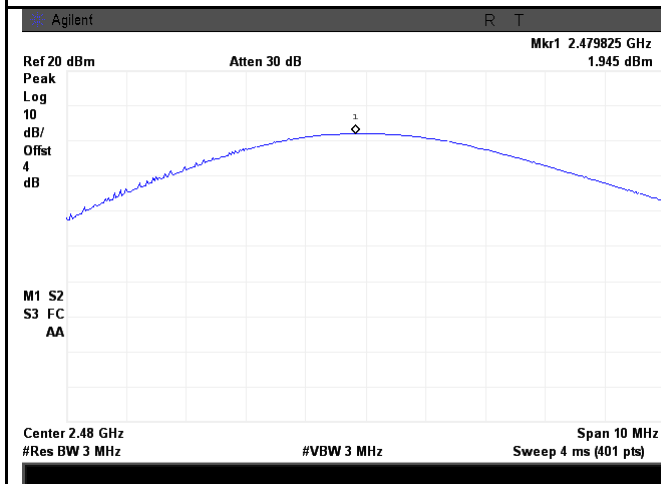




8DPSK Output power - Low CH 2402



8DPSK Output power - Mid CH 2441

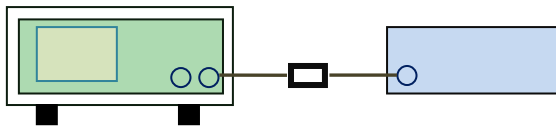


8DPSK Output power - High CH 2480

## 6.5 Number of Hopping Channel

Temperature	25°C
Relative Humidity	53%
Atmospheric Pressure	1020mbar
Test date :	October 20, 2015
Tested By :	Winnie Zhang

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

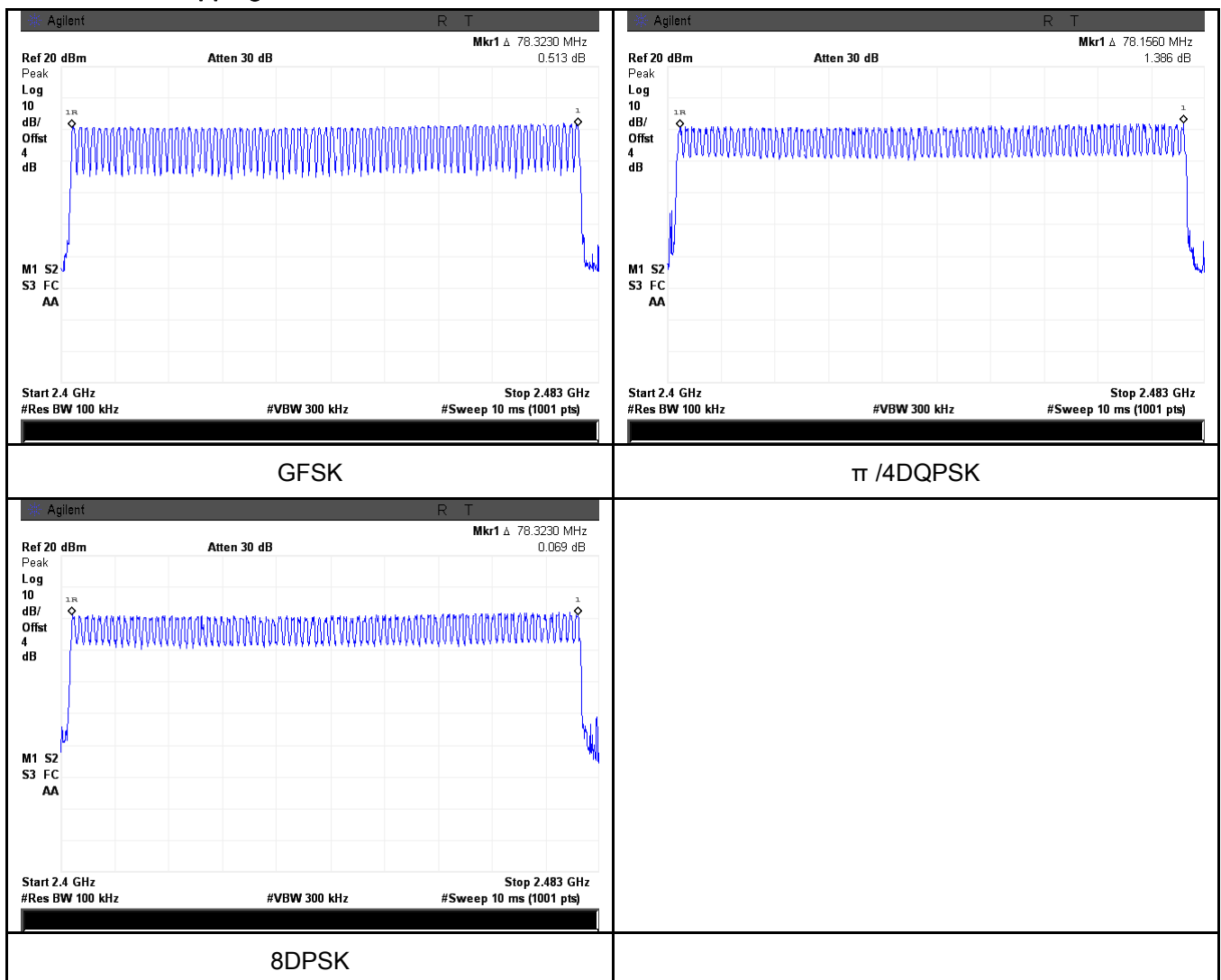
Test Plot    ☒ Yes (See below)                      ☐ N/A

### 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

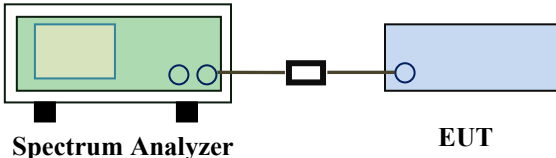
#### Number of Hopping Channels measurement result



## 6.6 Time of Occupancy (Dwell Time)

Temperature	25°C
Relative Humidity	53%
Atmospheric Pressure	1020mbar
Test date :	October 20, 2015
Tested By :	Winnie Zhang

### 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>		
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

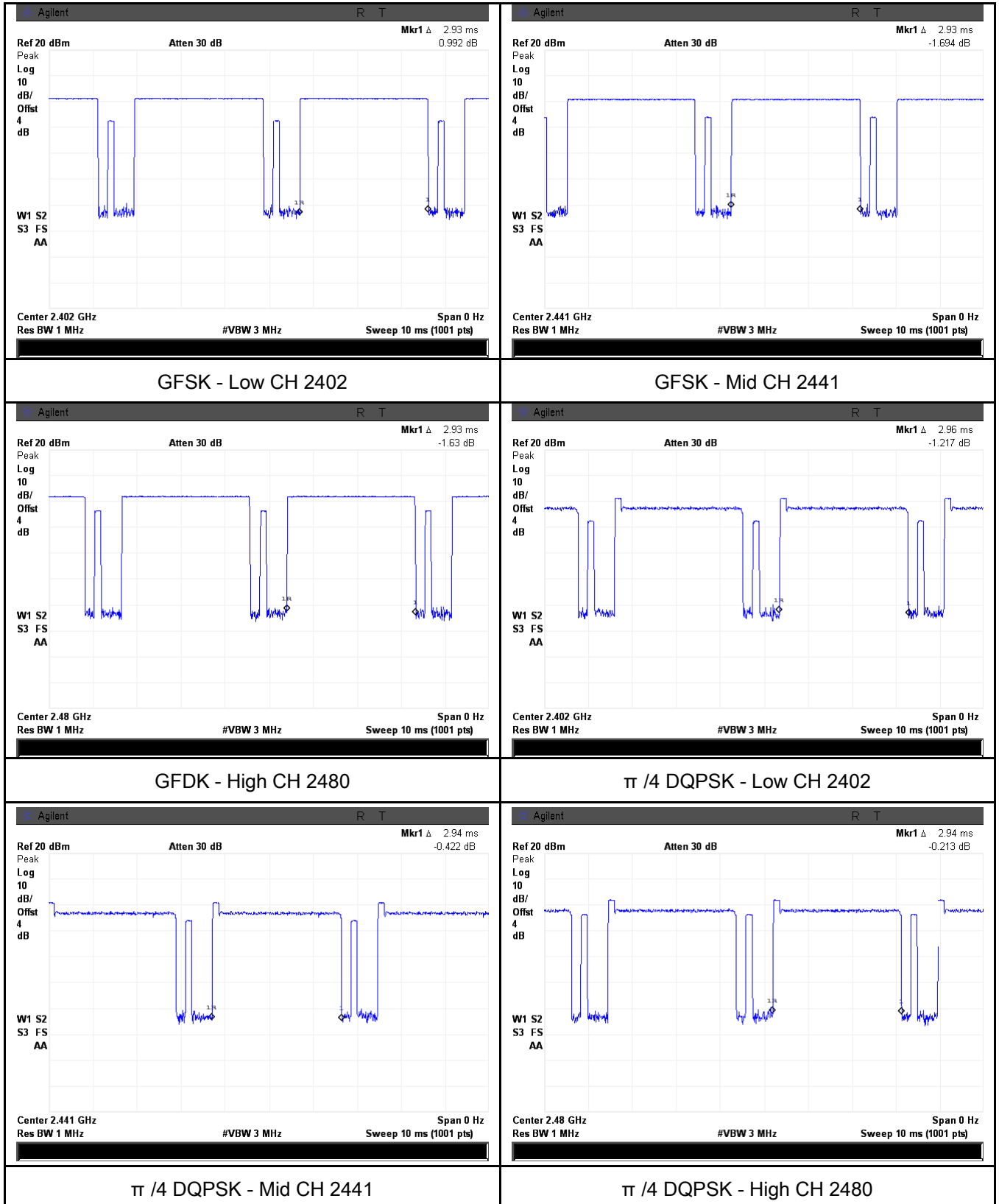
Test Plot    ☒ Yes (See below)                      ☐ N/A

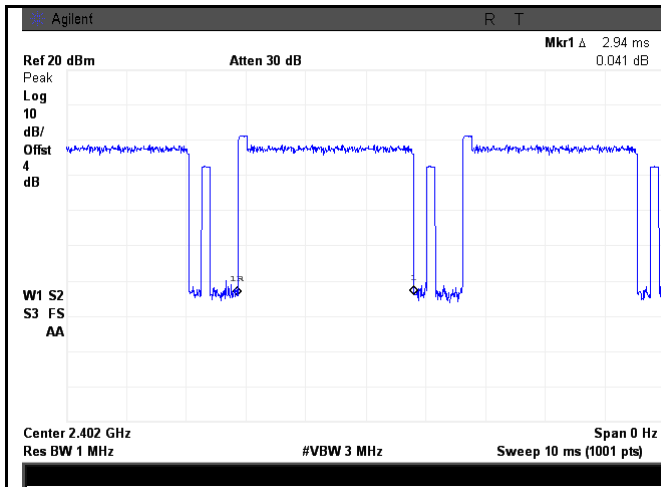


Type	Modulation	CH	Pulse Width (ms)	Dwell Time (ms)	Limit (ms)	Result
Dwell Time	GFSK	Low	2.93	312.533	400	Pass
		Mid	2.93	312.533	400	Pass
		High	2.93	312.533	400	Pass
	$\pi/4$ DQPSK	Low	2.96	315.733	400	Pass
		Mid	2.94	313.600	400	Pass
		High	2.94	313.600	400	Pass
	8-DPSK	Low	2.94	313.600	400	Pass
		Mid	2.93	312.533	400	Pass
		High	2.94	313.600	400	Pass
Note: Dwell time=Pulse Time (ms) $\times$ (1600 $\div$ 6 $\div$ 79) $\times$ 31.6						

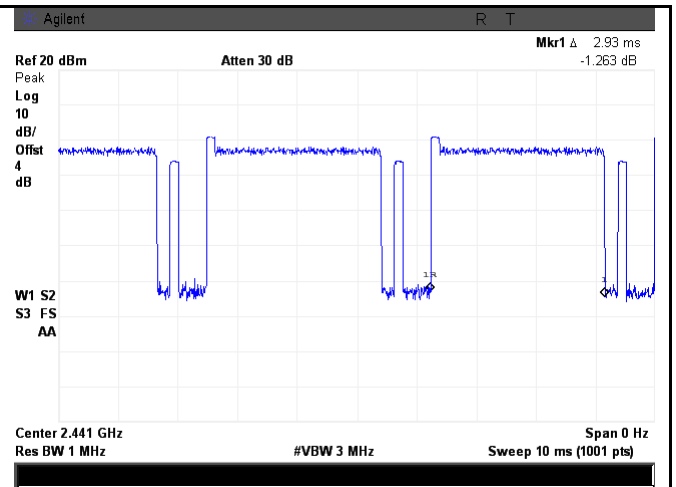
## Test Plots

### Dwell Time measurement result

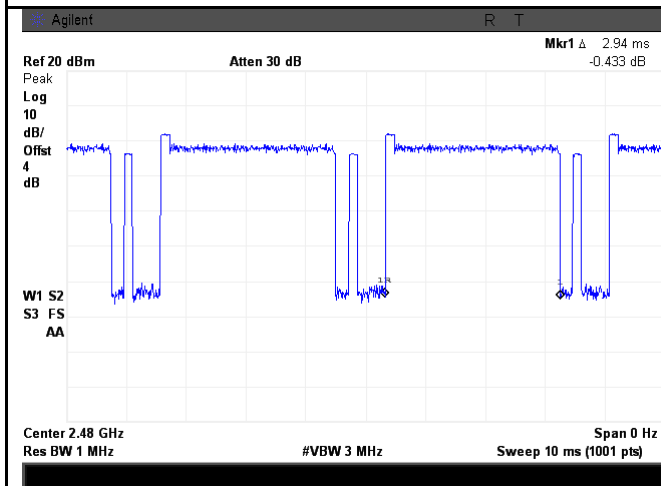




8DPSK - Low CH 2402



8DPSK - Mid CH 2441

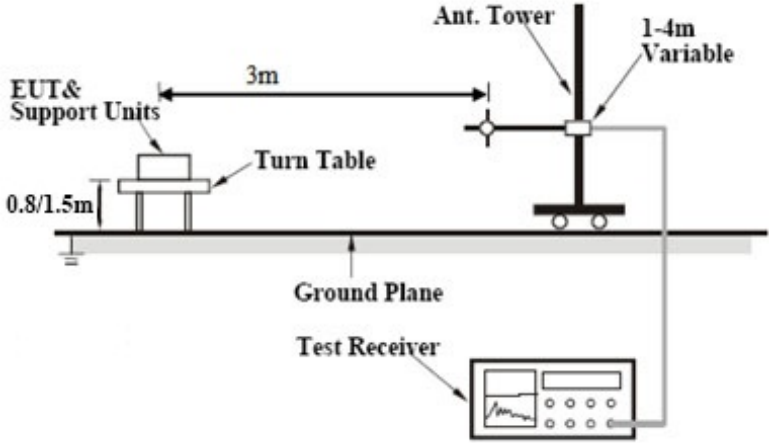


8DPSK - High CH 2480

## 6.7 Band Edge

Temperature	23°C
Relative Humidity	54%
Atmospheric Pressure	1030mbar
Test date :	October 30, 2015
Tested By :	Winnie Zhang

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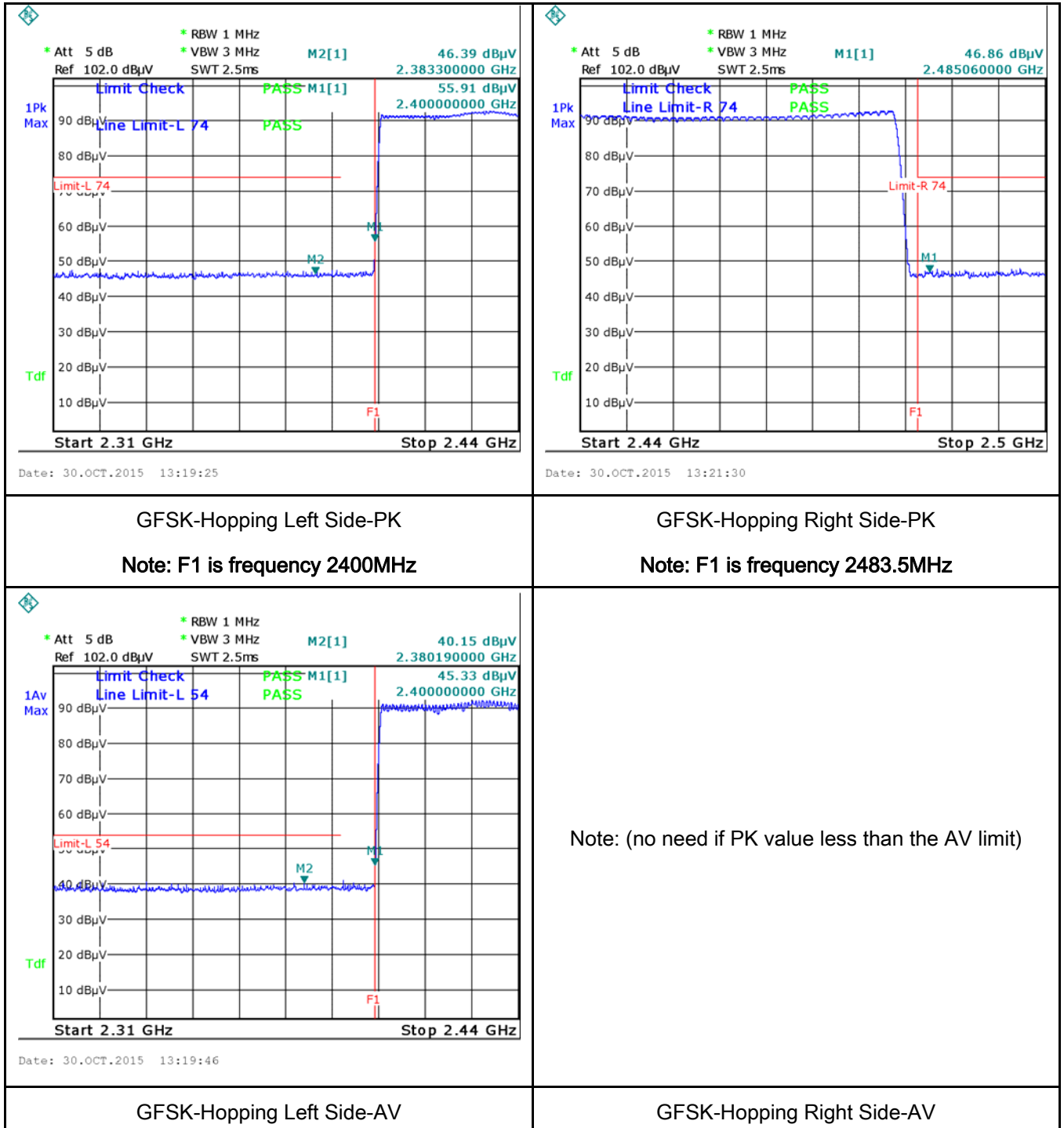
	<p>and make sure the instrument is operated in its linear range.</p> <ul style="list-style-type: none"> <li>- 3. First, set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, check the emission of EUT, if pass then set Spectrum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

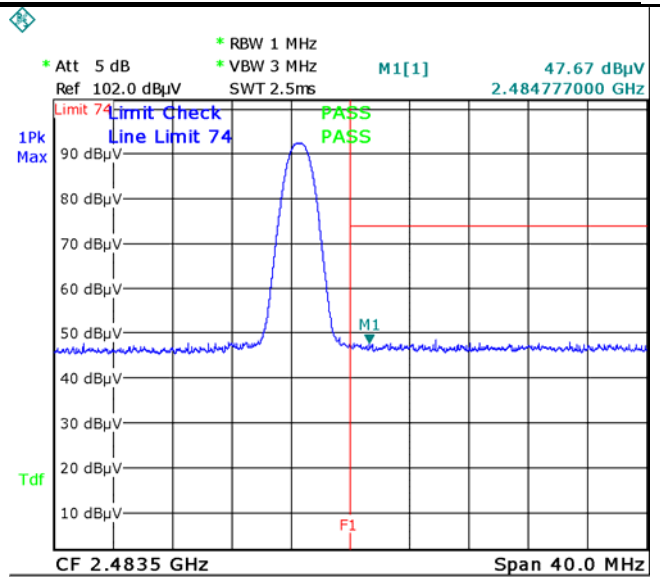
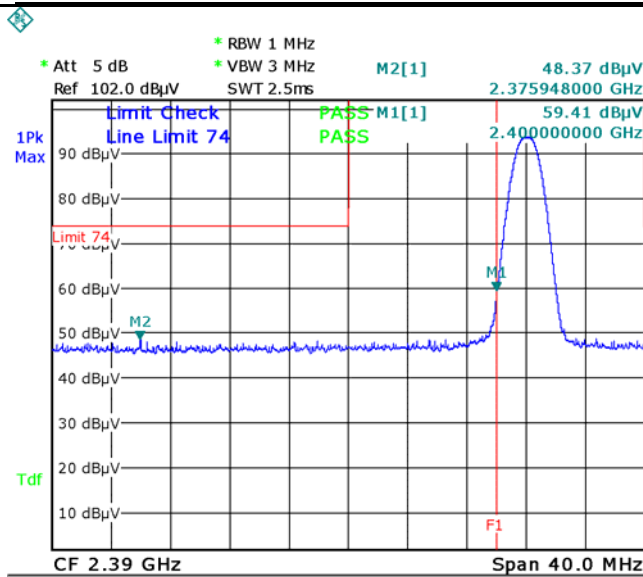
Test Data ☐ Yes ☒ N/A

Test Plot ☒ Yes (See below) ☐ N/A

## Test Plots

### GFSK Mode:



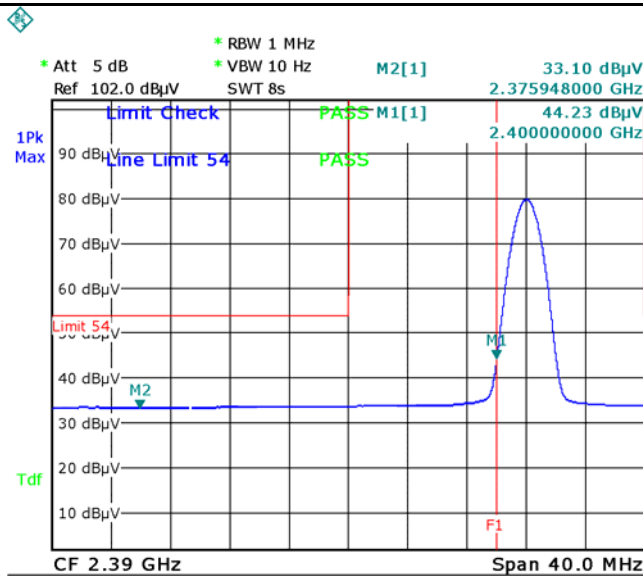


GFSK-Left Side-PK

Note: F1 is frequency 2400MHz

GFSK-Right Side-PK

Note: F1 is frequency 2483.5MHz

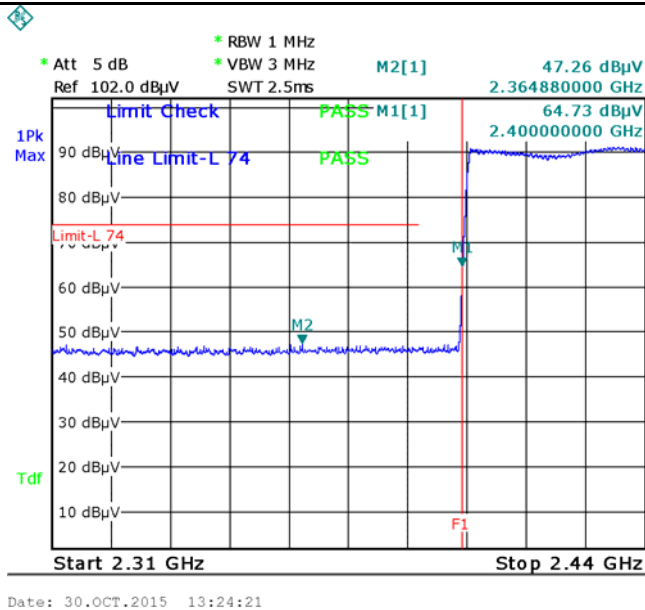


Note: (no need if PK value less than the AV limit)

GFSK-Left Side-AV

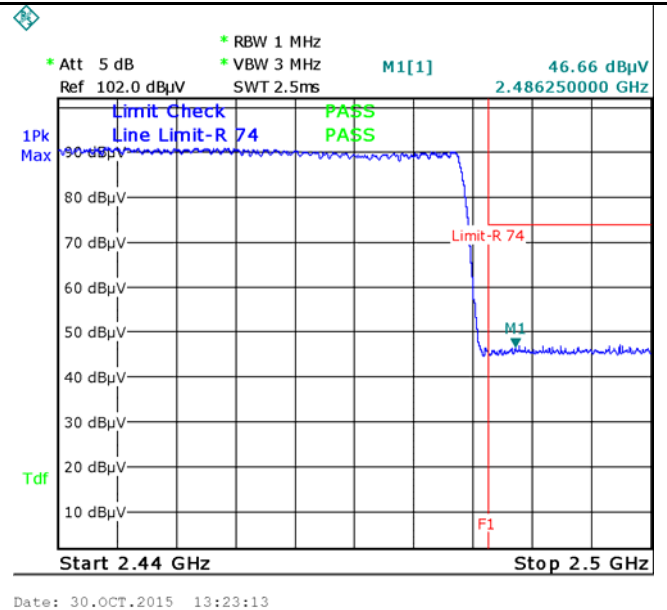
GFSK-Right Side-AV

$\pi/4$  DQPSK Mode:



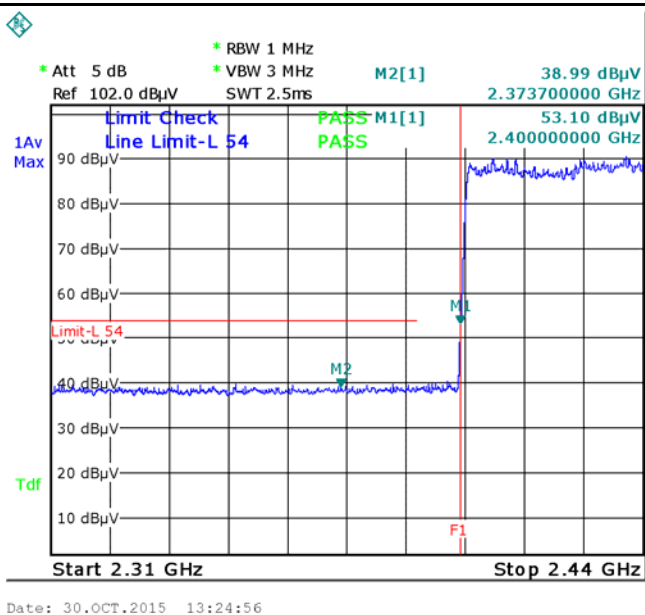
$\pi/4$  DQPSK-Hopping Left Side-PK

Note: F1 is frequency 2400MHz



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

Note: F1 is frequency 2483.5MHz

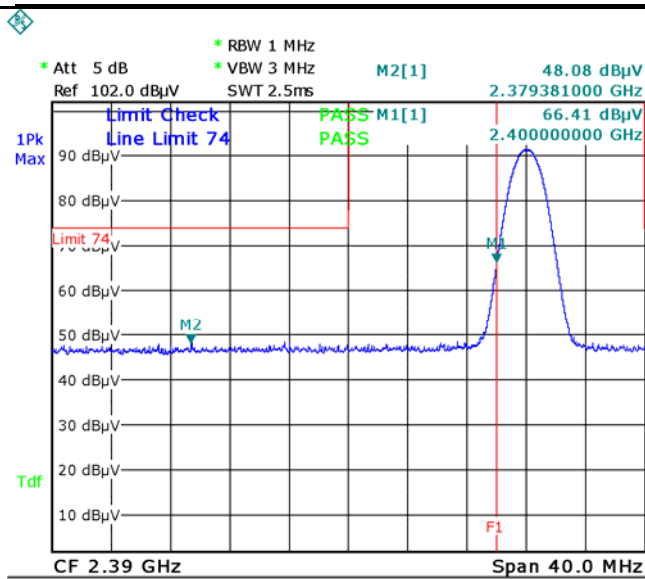


$\pi/4$  DQPSK-Hopping Left-AV

Note: (no need if PK value less than the AV limit)

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

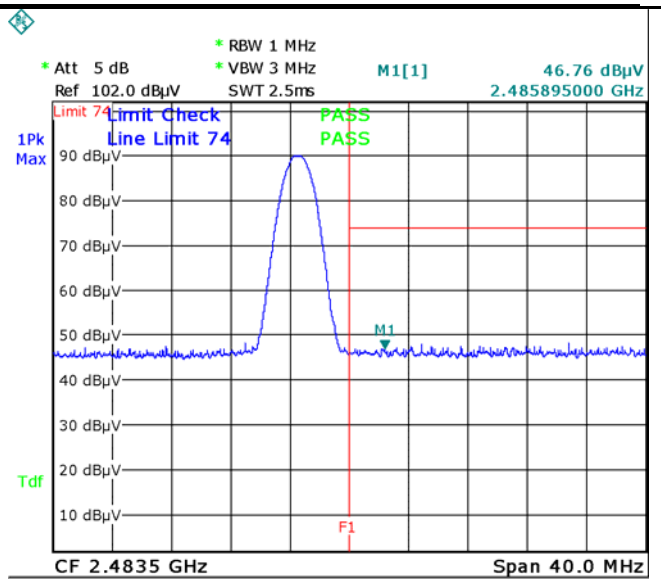




Date: 30.OCT.2015 13:01:28

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

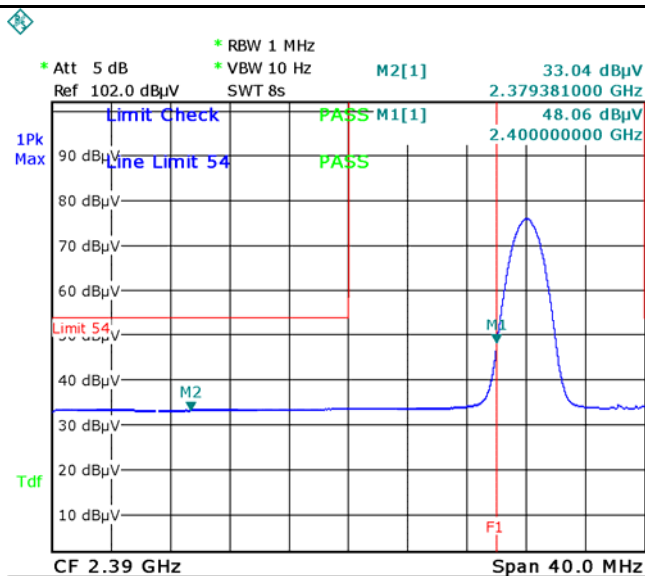
Note: F1 is frequency 2400MHz



Date: 30.OCT.2015 13:13:46

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

Note: F1 is frequency 2483.5MHz



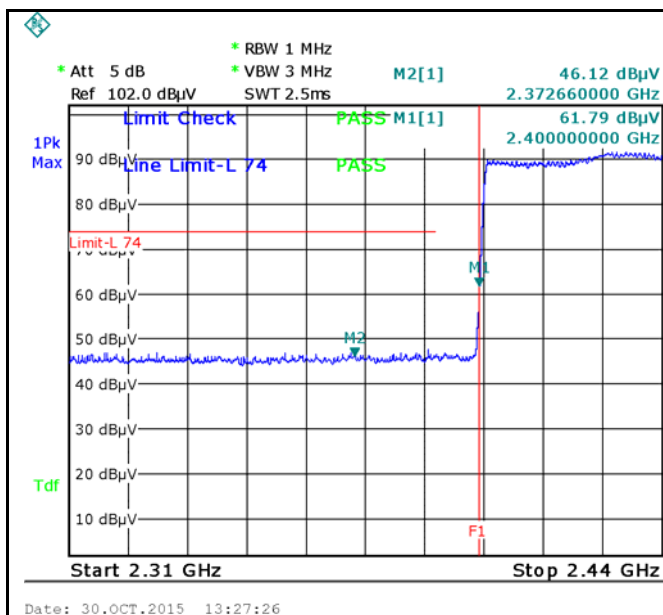
Date: 30.OCT.2015 13:02:14

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

Note: (no need if PK value less than the AV limit)

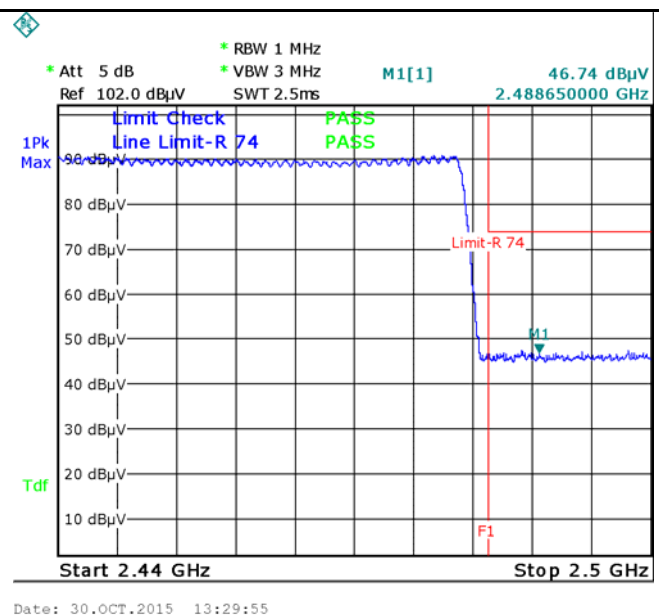
$\pi/4$  DQPSK-Right Side-AV

## 8-DPSK Mode:



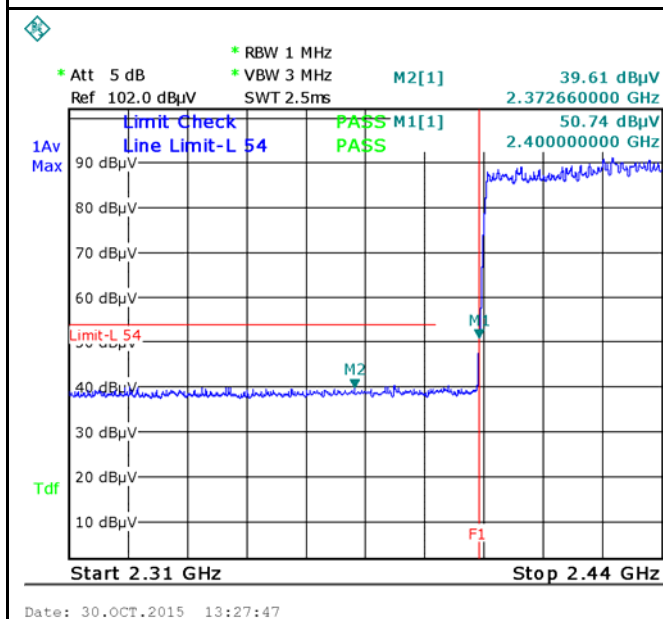
### 8DPSK-Hopping Left Side-PK

Note: F1 is frequency 2400MHz



### 8DPSK-Hopping Right Side-PK

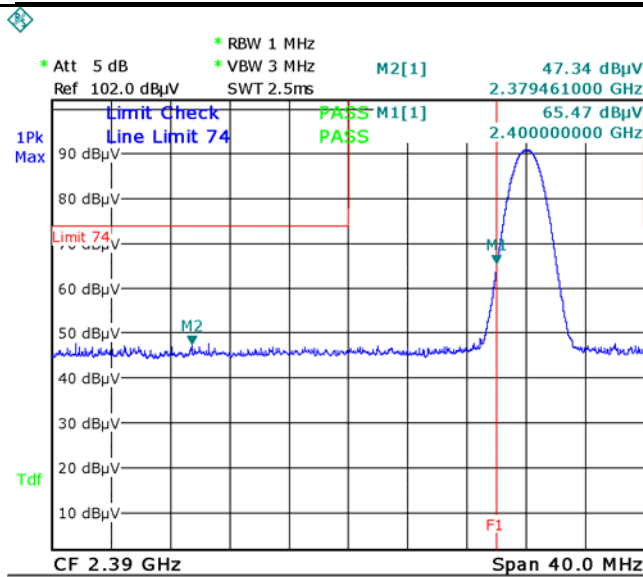
Note: F1 is frequency 2483.5MHz



### 8DPSK-Hopping Left-AV

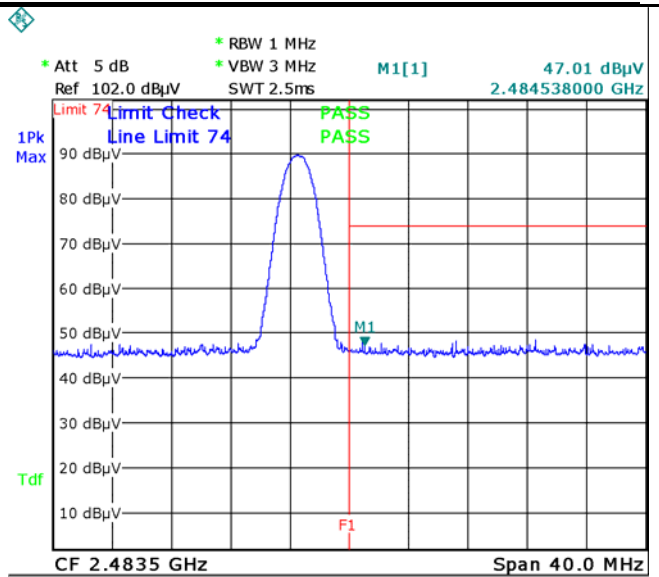
Note: (no need if PK value less than the AV limit)

### 8DPSK-Hopping Right-AV



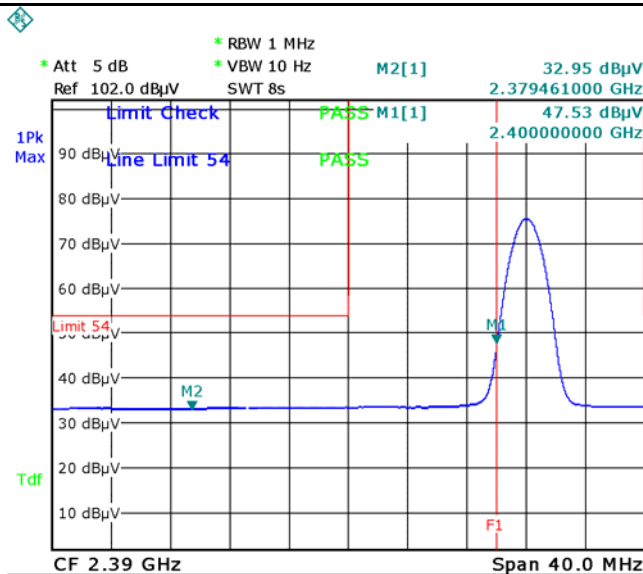
8DPSK-Left Side-PK

Note: F1 is frequency 2400MHz



8DPSK-Right Side-PK

Note: F1 is frequency 2483.5MHz



8DPSK-Left Side-AV

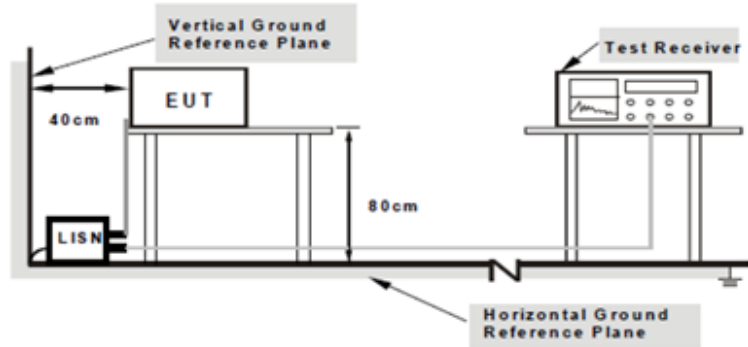
Note: (no need if PK value less than the AV limit)

8DPSK-Right Side-AV

## 6.8 AC Power Line Conducted Emissions

Temperature	24°C
Relative Humidity	56%
Atmospheric Pressure	1023mbar
Test date :	October 23, 2015
Tested By :	Winnie Zhang

### 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	<div></div>																
		1. 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.															
		2. The power supply for the EUT was fed through a 50W/50mH EUT LISN, connected to filtered mains.															
Procedure		3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss															

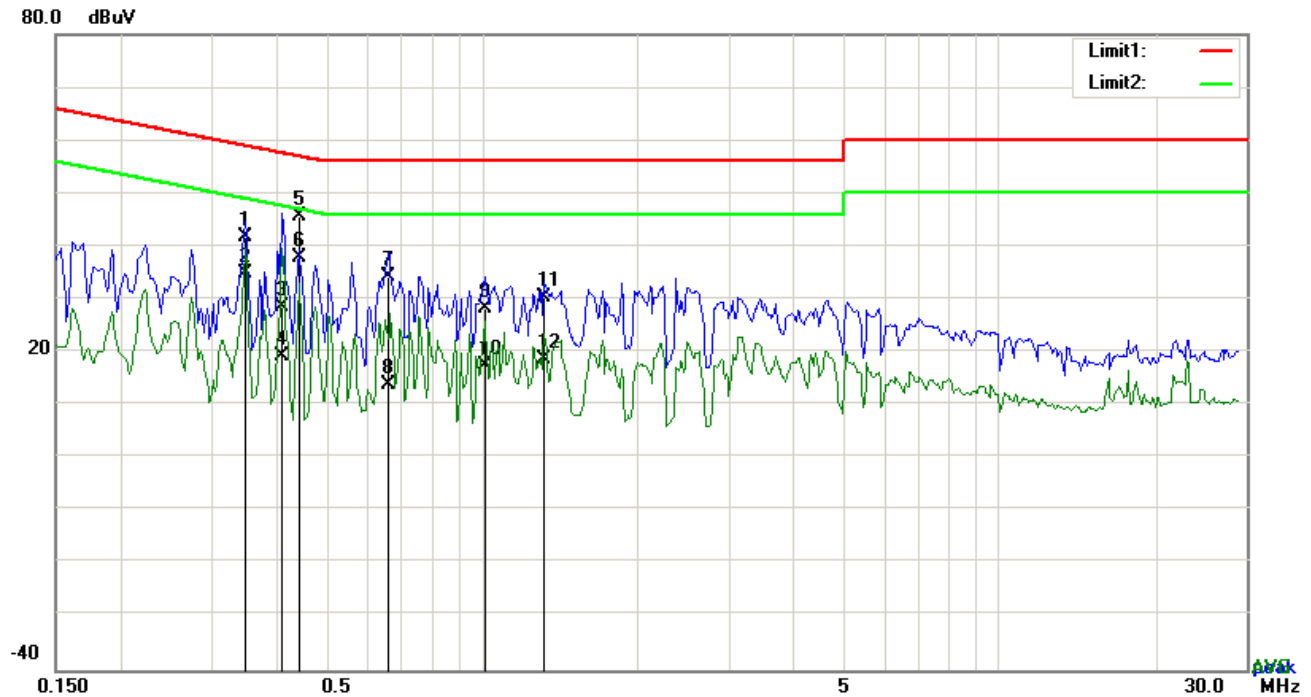
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	<p>coaxial cable.</p> <ol style="list-style-type: none"> <li>4. All other supporting equipment were powered separately from another main supply.</li> <li>5. The EUT was switched on and allowed to warm up to its normal operating condition.</li> <li>6. 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

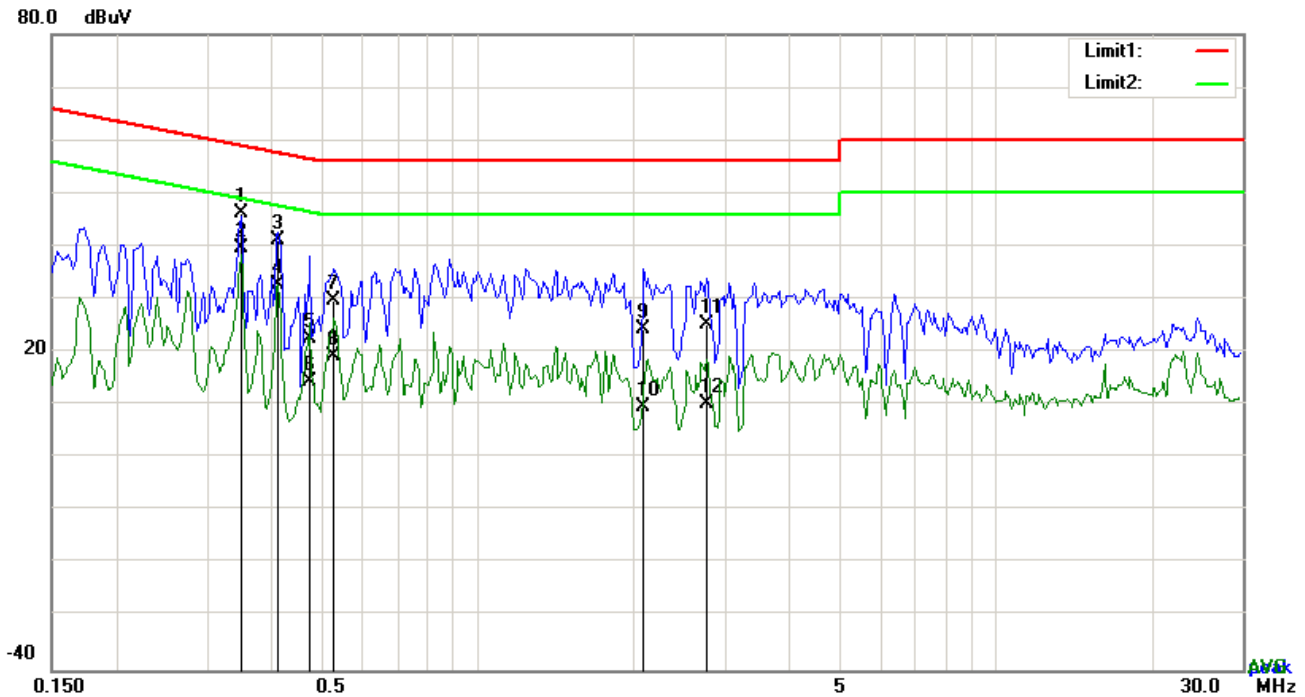


**Test Data**

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

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB}	(dBuV)	(dBuV)	(dB)
1	L1	0.3489	31.60	QP	10.03	41.63	58.99	-17.36
2	L1	0.3489	24.70	AVG	10.03	34.73	48.99	-14.26
3	L1	0.4113	18.51	QP	10.03	28.54	57.62	-29.08
4	L1	0.4113	9.13	AVG	10.03	19.16	47.62	-28.46
5	L1	0.4425	35.74	QP	10.03	45.77	57.01	-11.24
6	L1	0.4425	27.76	AVG	10.03	37.79	47.01	-9.22
7	L1	0.6609	24.14	QP	10.03	34.17	56.00	-21.83
8	L1	0.6609	3.92	AVG	10.03	13.95	46.00	-32.05
9	L1	1.0119	18.37	QP	10.03	28.40	56.00	-27.60
10	L1	1.0119	7.46	AVG	10.03	17.49	46.00	-28.51
11	L1	1.3200	20.18	QP	10.03	30.21	56.00	-25.79
12	L1	1.3200	8.74	AVG	10.03	18.77	46.00	-27.23

**Test Mode:** Bluetooth Mode

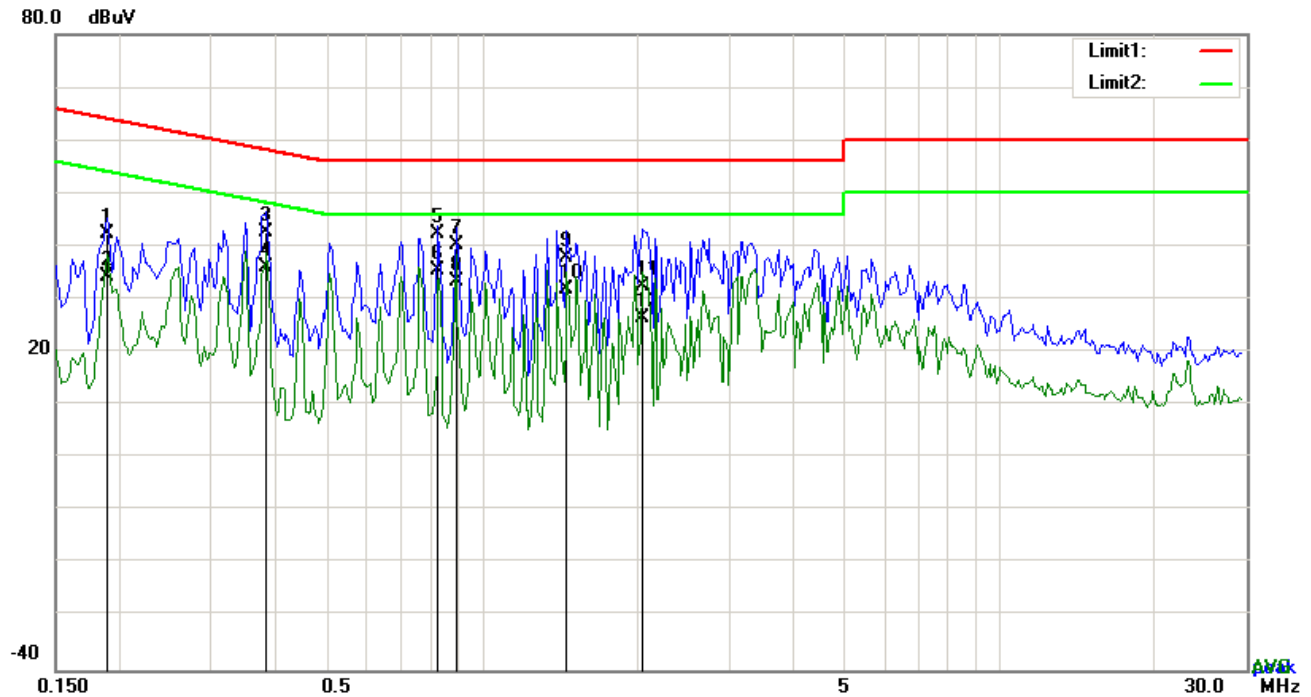


**Test Data**

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

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB)	(dBuV)	(dBuV)	(dB)
1	N	0.3489	36.30	QP	10.02	46.32	58.99	-12.67
2	N	0.3489	29.54	AVG	10.02	39.56	48.99	-9.43
3	N	0.4113	31.13	QP	10.02	41.15	57.62	-16.47
4	N	0.4113	22.76	AVG	10.02	32.78	47.62	-14.84
5	N	0.4737	12.59	QP	10.02	22.61	56.45	-33.84
6	N	0.4737	4.37	AVG	10.02	14.39	46.45	-32.06
7	N	0.5283	19.58	QP	10.02	29.60	56.00	-26.40
8	N	0.5283	9.15	AVG	10.02	19.17	46.00	-26.83
9	N	2.0922	14.27	QP	10.04	24.31	56.00	-31.69
10	N	2.0922	-0.24	AVG	10.04	9.80	46.00	-36.20
11	N	2.7747	15.24	QP	10.05	25.29	56.00	-30.71
12	N	2.7747	0.33	AVG	10.05	10.38	46.00	-35.62

**Test Mode:** Bluetooth Mode



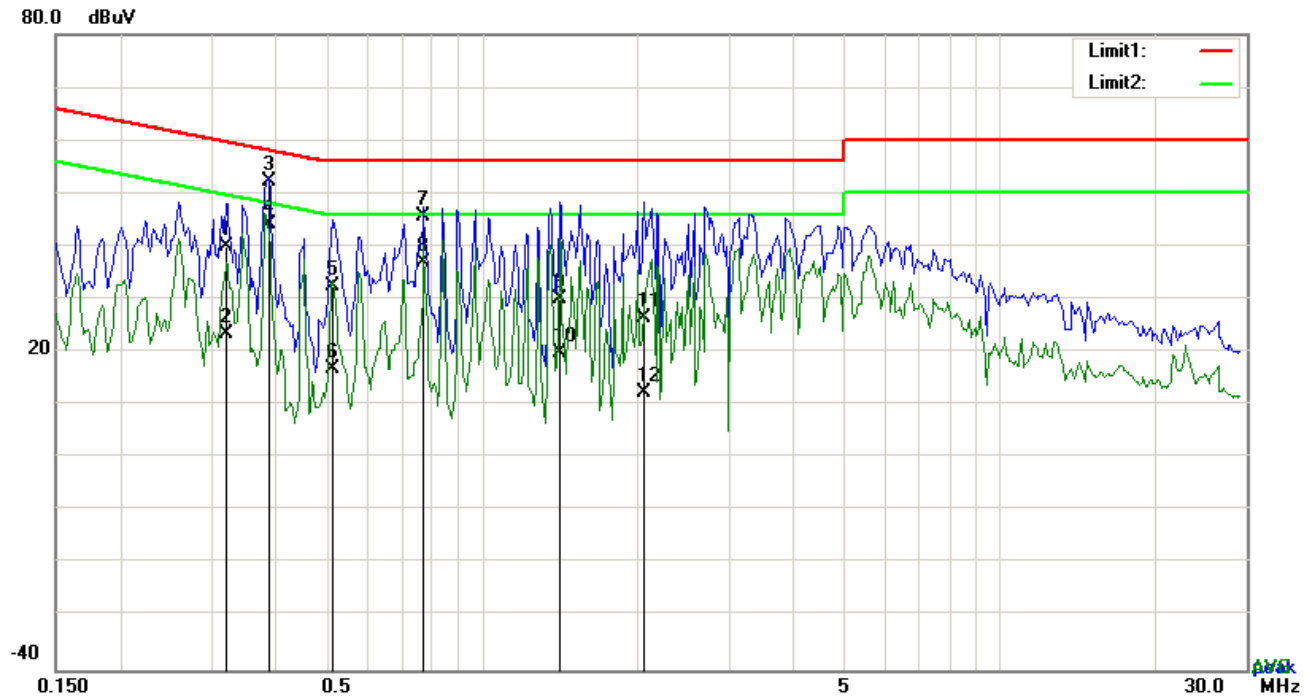
**Test Data**

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

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB}	(dBuV)	(dBuV)	(dB)
1	L1	0.1890	32.39	QP	10.03	42.42	64.08	-21.66
2	L1	0.1890	24.14	AVG	10.03	34.17	54.08	-19.91
3	L1	0.3840	32.56	QP	10.03	42.59	58.19	-15.60
4	L1	0.3840	25.99	AVG	10.03	36.02	48.19	-12.17
5	L1	0.8247	32.24	QP	10.03	42.27	56.00	-13.73
6	L1	0.8247	25.31	AVG	10.03	35.34	46.00	-10.66
7	L1	0.8910	30.24	QP	10.03	40.27	56.00	-15.73
8	L1	0.8910	23.27	AVG	10.03	33.30	46.00	-12.70
9	L1	1.4604	27.89	QP	10.04	37.93	56.00	-18.07
10	L1	1.4604	21.74	AVG	10.04	31.78	46.00	-14.22
11	L1	2.0337	22.32	QP	10.04	32.36	56.00	-23.64
12	L1	2.0337	16.39	AVG	10.04	26.43	46.00	-19.57



**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	0.3216	29.93	QP	10.02	39.95	59.67	-19.72
2	N	0.3216	13.44	AVG	10.02	23.46	49.67	-26.21
3	N	0.3879	42.36	QP	10.02	52.38	58.11	-5.73
4	N	0.3879	34.16	AVG	10.02	44.18	48.11	-3.93
5	N	0.5166	22.39	QP	10.02	32.41	56.00	-23.59
6	N	0.5166	6.93	AVG	10.02	16.95	46.00	-29.05
7	N	0.7740	35.48	QP	10.03	45.51	56.00	-10.49
8	N	0.7740	26.99	AVG	10.03	37.02	46.00	-8.98
9	N	1.4175	20.17	QP	10.03	30.20	56.00	-25.80
10	N	1.4175	9.72	AVG	10.03	19.75	46.00	-26.25
11	N	2.0610	16.36	QP	10.04	26.40	56.00	-29.60
12	N	2.0610	2.41	AVG	10.04	12.45	46.00	-33.55

## 6.9 Radiated Emissions

Temperature	23°C
Relative Humidity	59%
Atmospheric Pressure	1026mbar
Test date :	October 26, 2015
Tested By :	Winnie Zhang

### 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												
		<table><tr><th>Frequency range (MHz)</th><th>Field Strength (µV/m)</th></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)	30 – 88	100	88 – 216	150	216 960	200	Above 960	500	
		Frequency range (MHz)		Field Strength (µV/m)										
		30 – 88		100										
		88 – 216		150										
		216 960		200										
Above 960	500													

Test Setup	
------------	--

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> </ol> </li> </ol>
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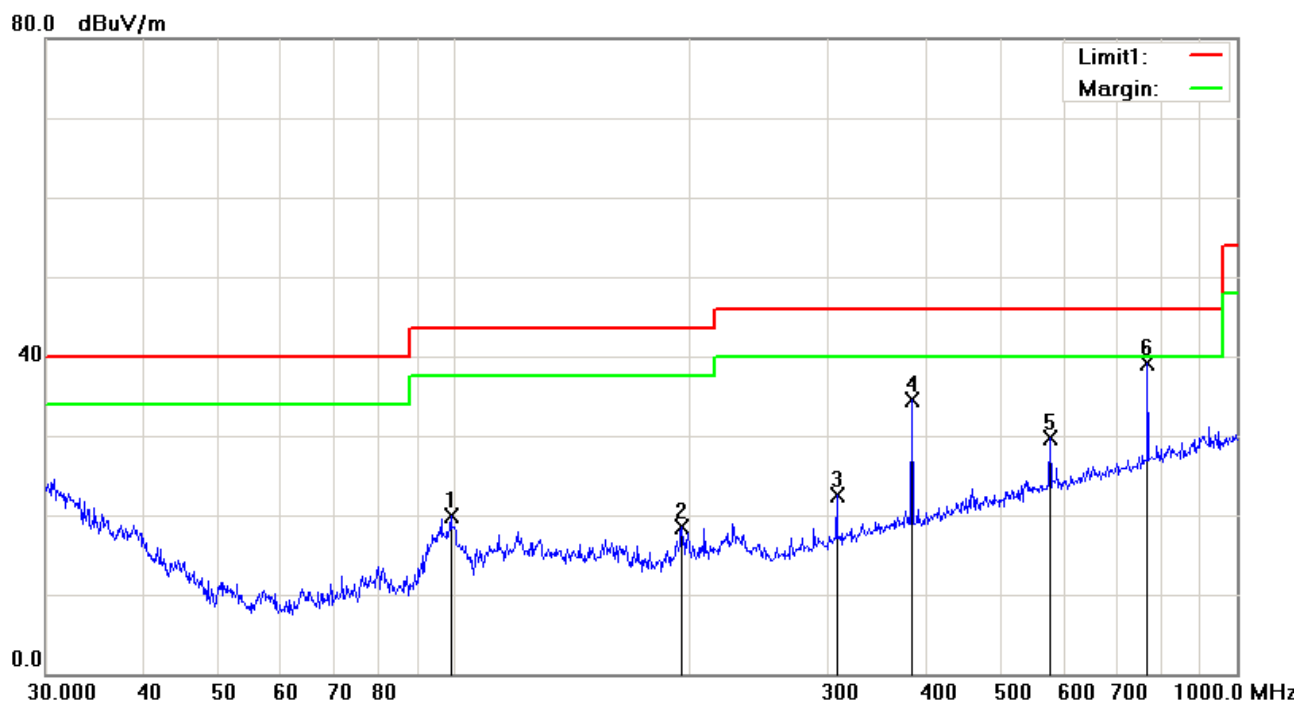
	<p>b. The EUT was then rotated to the direction that gave the maximum emission.</p> <p>c. Finally, the antenna height was adjusted to the height that gave the maximum emission.</p> <p>3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasiy Peak detection at frequency below 1GHz.</p> <p>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.</p> <p>5. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.</p>
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

### Below 1GHz

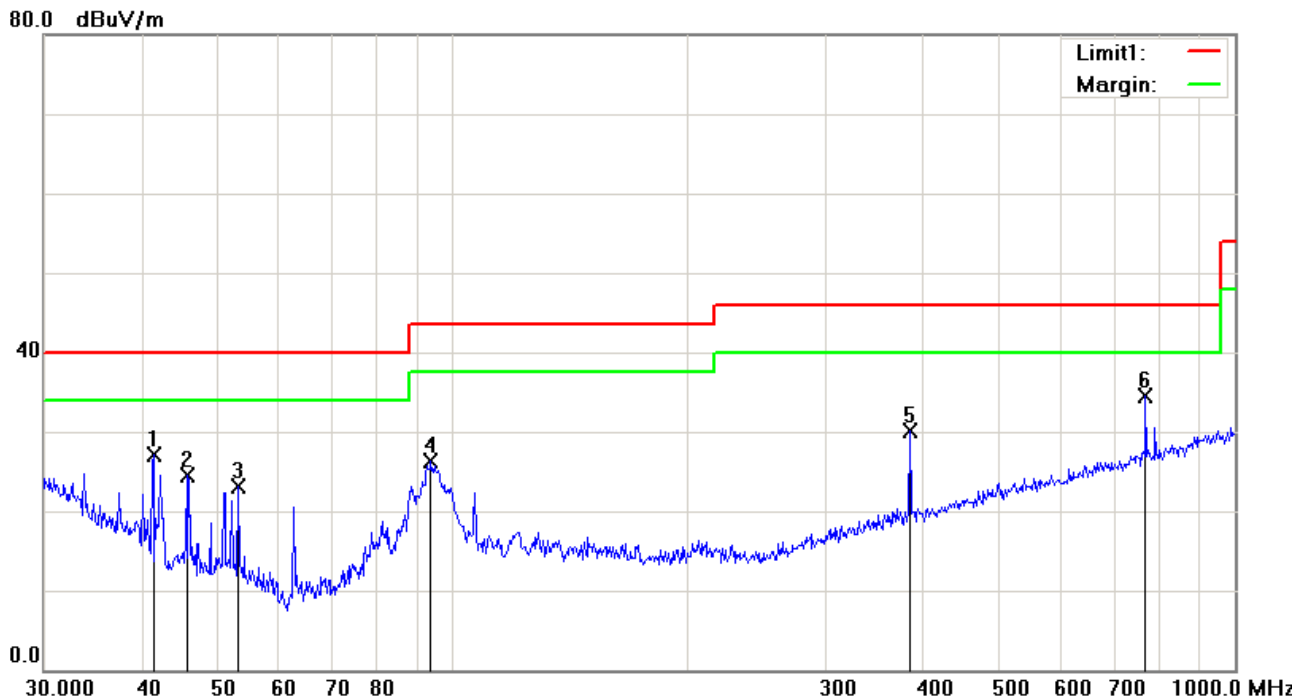


### Test Data

#### Horizontal Polarity Plot @3m

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin	Height	Degree
		(MHz)	(dBuV/m)		(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	( )
1	H	98.8326	30.98	peak	-11.11	19.87	43.50	-23.63	100	195
2	H	195.1365	27.42	peak	-8.98	18.44	43.50	-25.06	100	116
3	H	307.8313	29.13	peak	-6.68	22.45	46.00	-23.55	100	360
4	H	383.9318	39.09	peak	-4.67	34.42	46.00	-11.58	100	56
5	H	576.6443	30.08	peak	-0.37	29.71	46.00	-16.29	100	356
6	H	768.7482	36.38	peak	2.70	39.08	46.00	-6.92	100	0

### Below 1GHz



### Test Data

#### Vertical Polarity Plot @3m

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin	Height	Degree
		(MHz)	(dBuV/m)		(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	( )
1	V	41.4215	35.64	peak	-8.54	27.10	40.00	-12.90	100	203
2	V	45.6948	35.79	peak	-11.25	24.54	40.00	-15.46	100	214
3	V	53.1313	36.72	peak	-13.54	23.18	40.00	-16.82	100	214
4	V	93.7685	38.75	peak	-12.44	26.31	43.50	-17.19	100	188
5	V	383.9318	34.76	peak	-4.67	30.09	46.00	-15.91	100	300
6	V	768.7482	31.73	peak	2.70	34.43	46.00	-11.57	100	342

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

Mode: GFSK (Worst Case)

Low Channel (2402 MHz)

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4804	38.96	AV	V	33.83	6.86	31.72	47.93	54	-6.07
4804	38.52	AV	H	33.83	6.86	31.72	47.49	54	-6.51
4804	47.65	PK	V	33.83	6.86	31.72	56.62	74	-17.38
4804	46.93	PK	H	33.83	6.86	31.72	55.9	74	-18.10

Middle Channel (2441 MHz)

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4882	38.91	AV	V	33.86	6.82	31.82	47.77	54	-6.23
4882	38.57	AV	H	33.86	6.82	31.82	47.43	54	-6.57
4882	47.63	PK	V	33.86	6.82	31.82	56.49	74	-17.51
4882	46.88	PK	H	33.86	6.82	31.82	55.74	74	-18.26

High Channel (2480 MHz)

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4960	38.86	AV	V	33.9	6.76	31.92	47.6	54	-6.4
4960	38.51	AV	H	33.9	6.76	31.92	47.25	54	-6.75
4960	47.59	PK	V	33.9	6.76	31.92	56.33	74	-17.67
4960	46.73	PK	H	33.9	6.76	31.92	55.47	74	-18.53

## Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Due	In use
<b>AC Line Conducted</b>					
EMI test receiver	ESCS30	8471241027	09/17/2015	09/16/2016	<input checked="" type="checkbox"/>
Line Impedance	LI-125A	191106	09/25/2015	09/24/2016	<input checked="" type="checkbox"/>
Line Impedance	LI-125A	191107	09/25/2015	09/24/2016	<input checked="" type="checkbox"/>
LISN	ISN T800	34373	09/25/2015	09/24/2016	<input checked="" type="checkbox"/>
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/24/2015	09/23/2016	<input checked="" type="checkbox"/>
Transient Limiter	LIT-153	531118	09/01/2015	08/31/2016	<input checked="" type="checkbox"/>
<b>RF conducted test</b>					
Agilent ESA-E SERIES	E4407B	MY45108319	09/17/2015	09/16/2016	<input checked="" type="checkbox"/>
Power Splitter	1#	1#	09/01/2015	08/31/2016	<input checked="" type="checkbox"/>
DC Power Supply	E3640A	MY40004013	09/17/2015	09/16/2016	<input checked="" type="checkbox"/>
<b>Radiated Emissions</b>					
EMI test receiver	ESL6	100262	09/17/2015	09/16/2016	<input checked="" type="checkbox"/>
Positioning Controller	UC3000	MF780208282	11/20/2014	11/19/2015	<input checked="" type="checkbox"/>
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	09/01/2015	08/31/2016	<input checked="" type="checkbox"/>
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/25/2015	03/24/2016	<input checked="" type="checkbox"/>
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/21/2015	09/20/2016	<input checked="" type="checkbox"/>
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/24/2015	09/23/2016	<input checked="" type="checkbox"/>
Universal Radio Communication Tester	CMU200	121393	09/25/2015	09/23/2016	<input checked="" type="checkbox"/>



## Annex B. EUT And Test Setup Photographs

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







EUT - Top View



EUT - Bottom View



EUT - Left View



EUT - Right View



**Annex B.ii. Photograph: EUT Internal Photo**



Cover Off - Top View 1



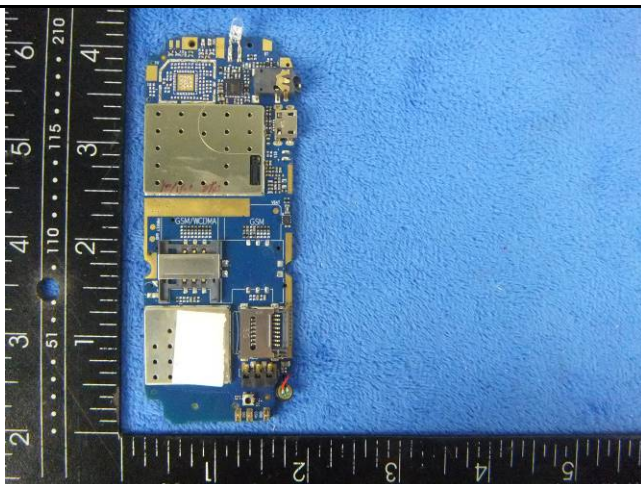
Cover Off - Top View 2



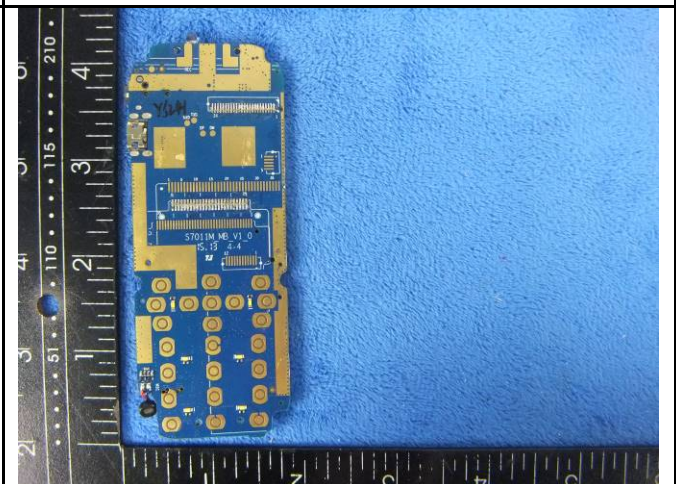
Battery - Top View



Battery - Bottom View

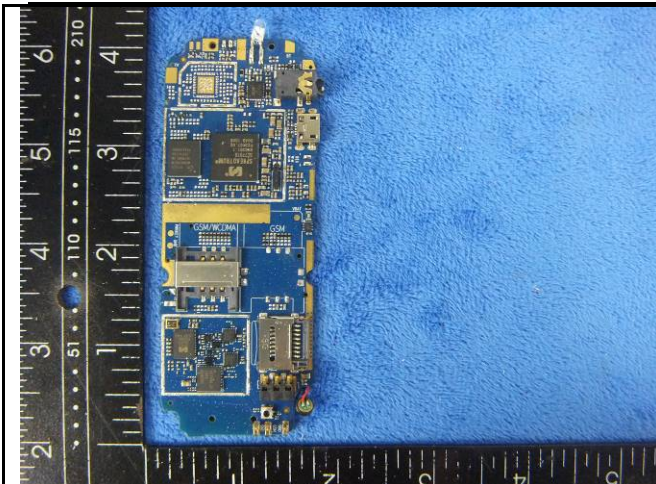


Mainboard With Shielding - Front View

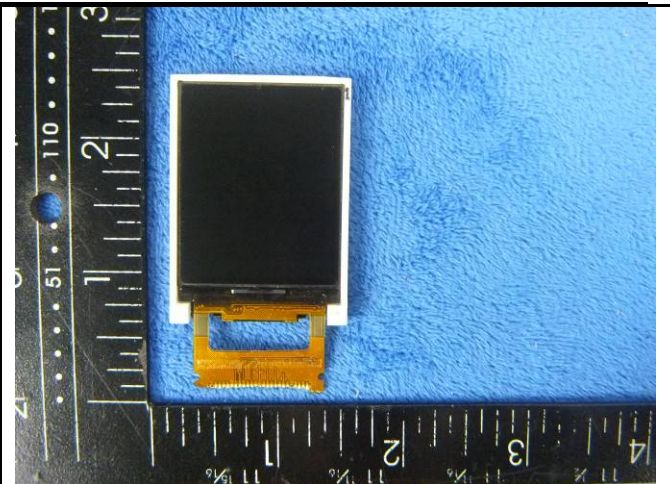


Mainboard With Shielding - Rear View

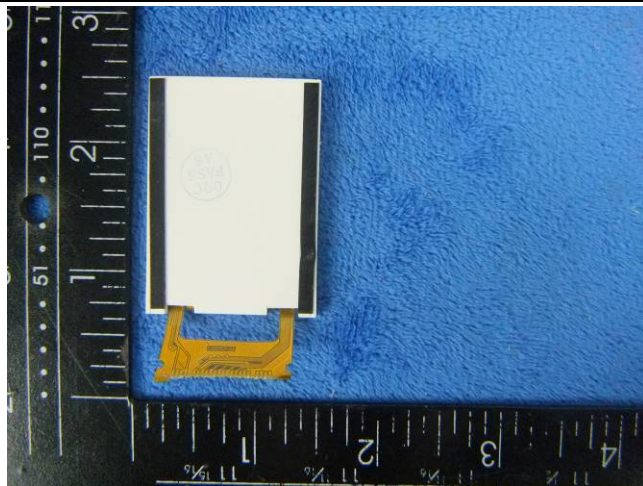




Mainboard Without Shielding - Front View



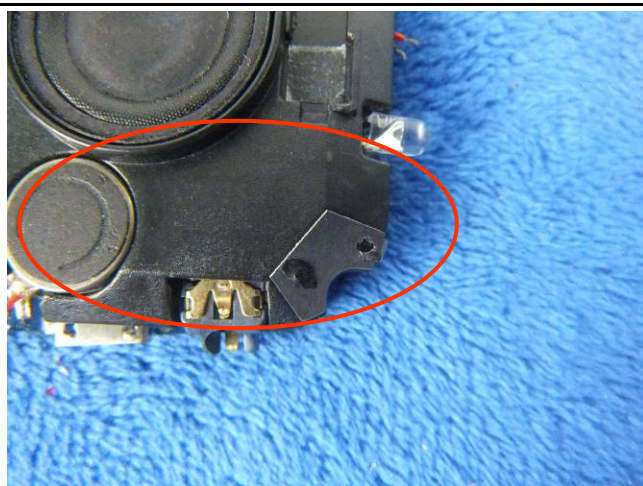
LCD - Front View



LCD - Rear View



GSM/PCS/UMTS-FDD Antenna View



BT Antenna View

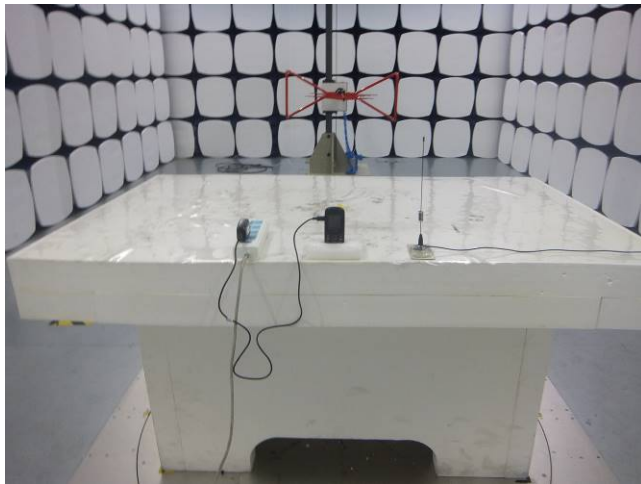
**Annex B.iii. Photograph: Test Setup Photo**



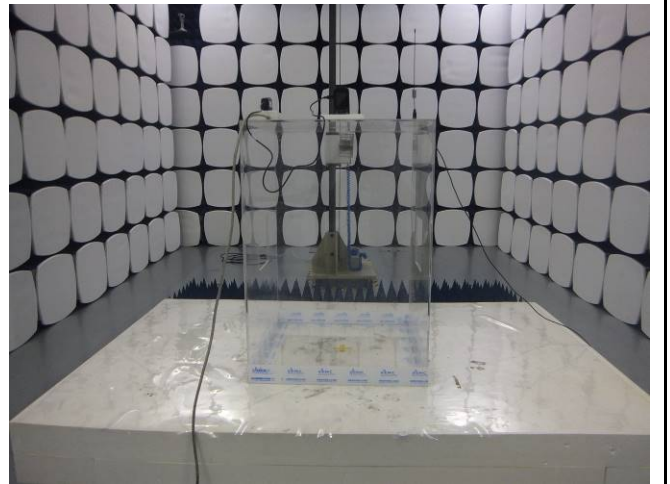
Conducted Emissions Test Setup Front View



Conducted Emissions Test Setup Side View



Radiated Spurious Emissions Test Setup Below 1GHz

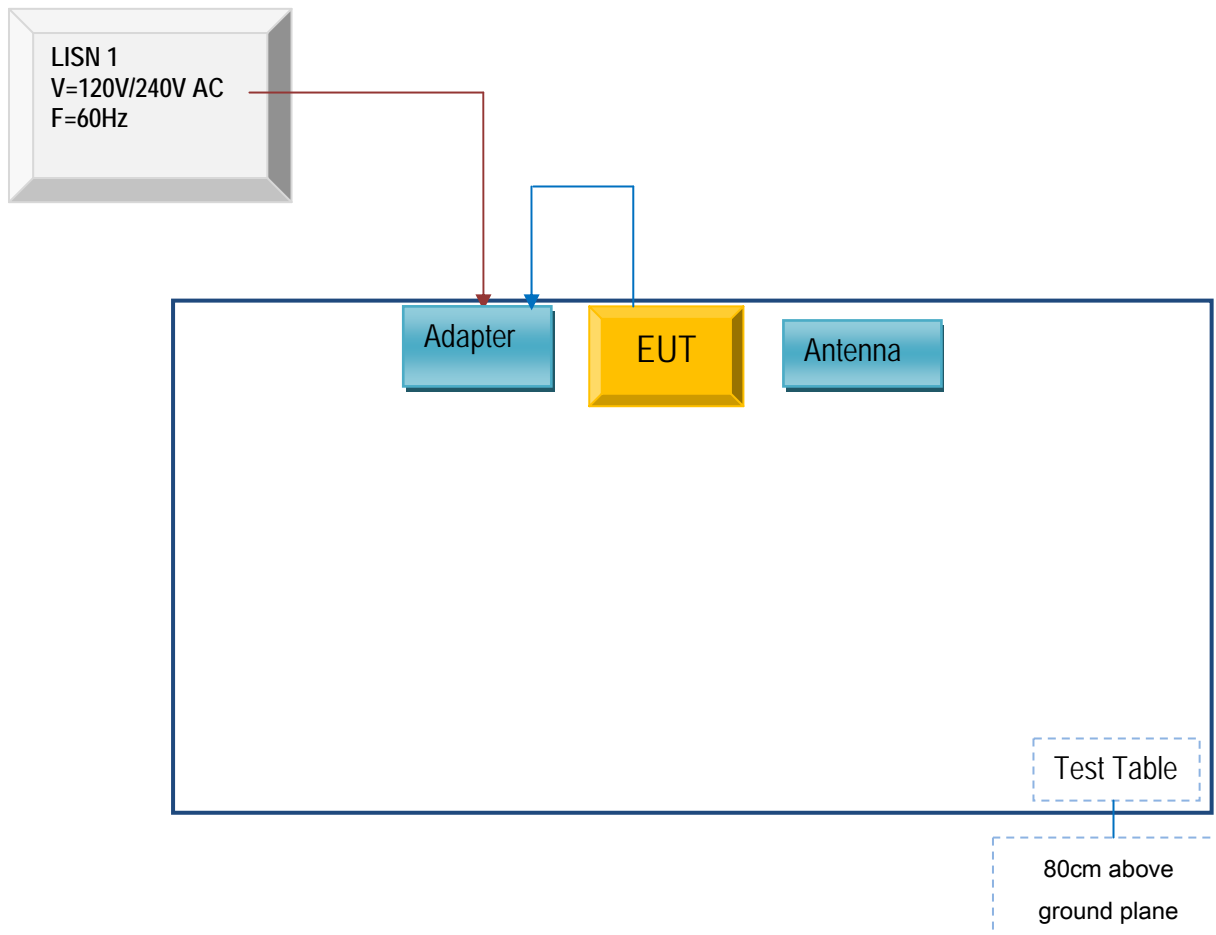


Radiated Spurious Emissions Test Setup Above  
1GHz

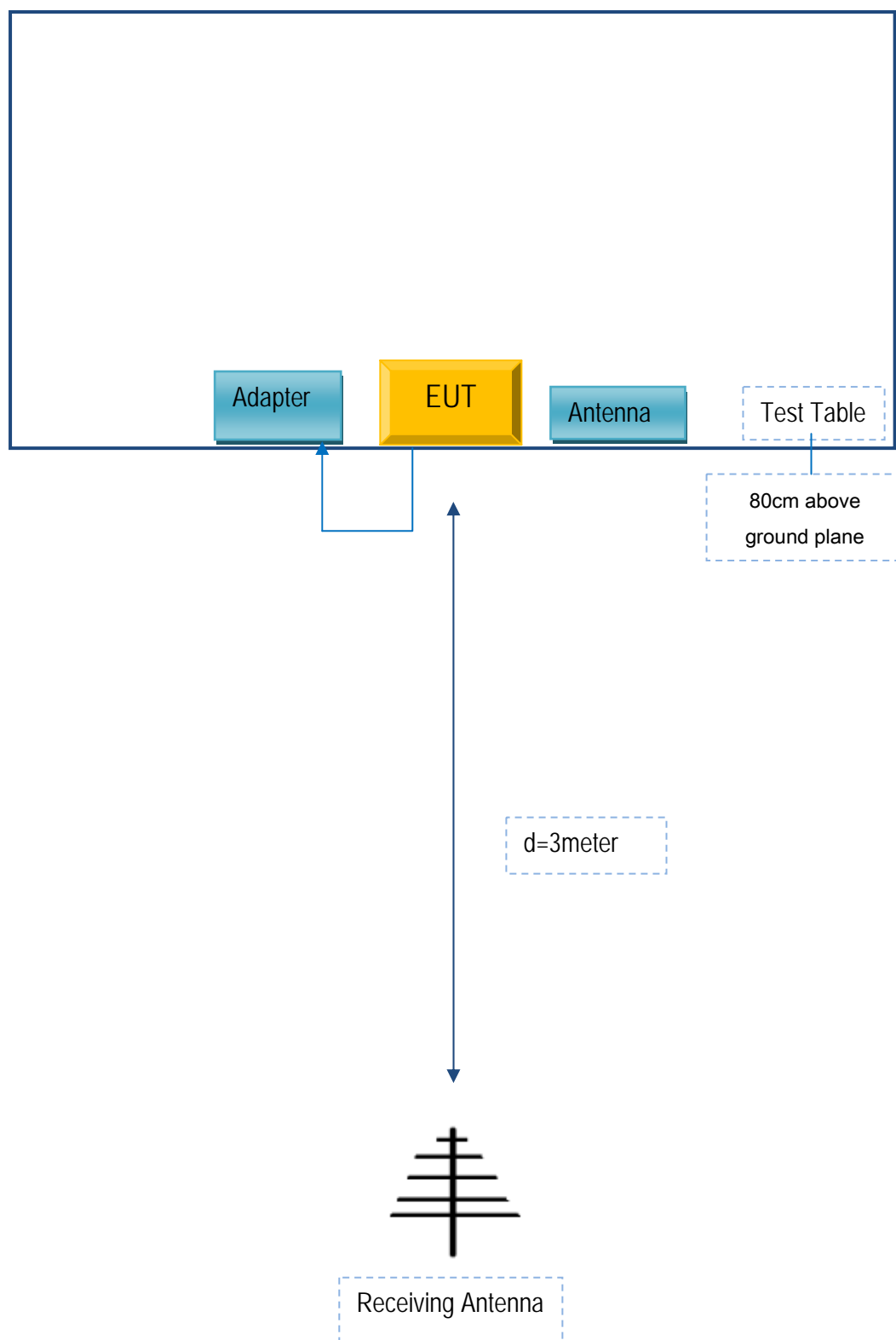
## Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

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

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

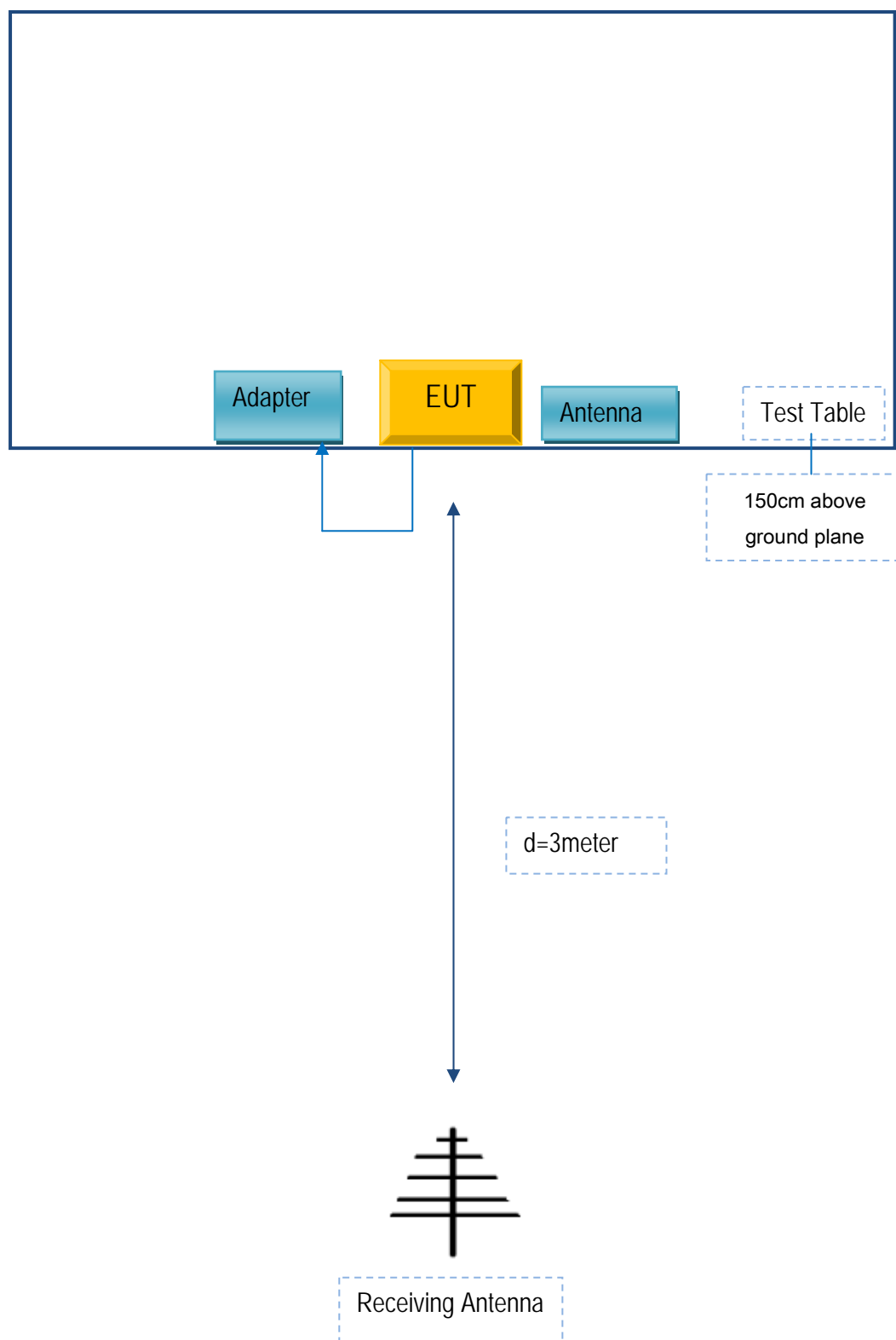


**Block Configuration Diagram for Radiated Emissions ( Below 1GHz ) .**





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



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

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

Manufacturer	Equipment Description	Model	Calibration Date	Calibration Due Date
ROHDE&SCHWARZ	BLUETOOTH TESTER	CBT 32	N/A	N/A



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

Please see attachment

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## Annex E. DECLARATION OF SIMILARITY

N/A