
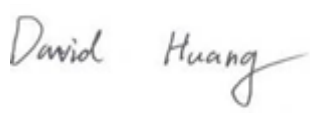



# RF TEST REPORT



Report No.: 17070938-FCC-R

Supersede Report No.: N/A

Applicant	HONWA(HK) CORPORATION LIMITED	
Product Name	BLUETOOTH EARPHONE	
Model No.	MBH542	
Serial No.	N/A	
Test Standard	FCC Part 15.247: 2016, ANSI C63.10: 2013	
Test Date	September 23 to October 12, 2017	
Issue Date	October 13, 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**

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

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

## Laboratories Introduction

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



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

### Accreditations for Conformity Assessment

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

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## 1. Report Revision History

Report No.	Report Version	Description	Issue Date
17070938-FCC-R	NONE	Original	October 13, 2017

## 2. Customer information

Applicant Name	HONWA(HK) CORPORATION LIMITED
Applicant Add	MAOGUANG INDUSTRIAL GURAO TOWN CHAOYANG DISTRICT SHANTOU
Manufacturer	HONWA(HK) CORPORATION LIMITED
Manufacturer Add	MAOGUANG INDUSTRIAL GURAO TOWN CHAOYANG DISTRICT SHANTOU

## 3. Test site information

Test Lab A:

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

Test Lab B:

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

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

#### 4. Equipment under Test (EUT) Information

Description of EUT:	BLUETOOTH EARPHONE
Main Model:	MBH542
Serial Model:	N/A
Date EUT received:	September 22, 2017
Test Date(s):	September 23 to October 12, 2017
Equipment Category :	DSS
Antenna Gain:	-9dBi
Antenna Type:	PCB Antenna
Type of Modulation:	GFSK, $\pi$ /4DQPSK
RF Operating Frequency (ies):	2402-2480 MHz
Max. Output Power:	-4.828dBm
Number of Channels:	79CH
Port:	USB Port, AUX IN Port
Input Power:	Battery: Spec: 3.7V, 450mAh USB: DC 5.0V
Trade Name :	MAGNAVOX
FCC ID:	2AIXC-HW-MBH542

## 5. Test Summary

The product was tested in accordance with the following specifications.

All testing has been performed according to below product classification:

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

### Measurement Uncertainty

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

## 6. Measurements, Examination And Derived Results

### 6.1 Antenna Requirement

#### **Applicable Standard**

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

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

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

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

#### **Antenna Connector Construction**

The EUT has 1 antenna:

A permanently attached PCB antenna for Bluetooth, the gain is -9dBi for Bluetooth.

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


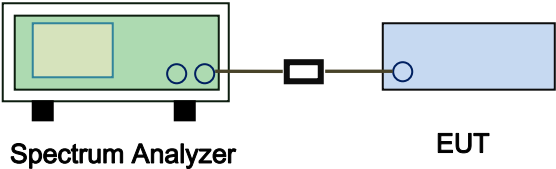
**Result:** Compliance.



## 6.2 Channel Separation

Temperature	23°C
Relative Humidity	54%
Atmospheric Pressure	1020mbar
Test date :	September 28, 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	
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

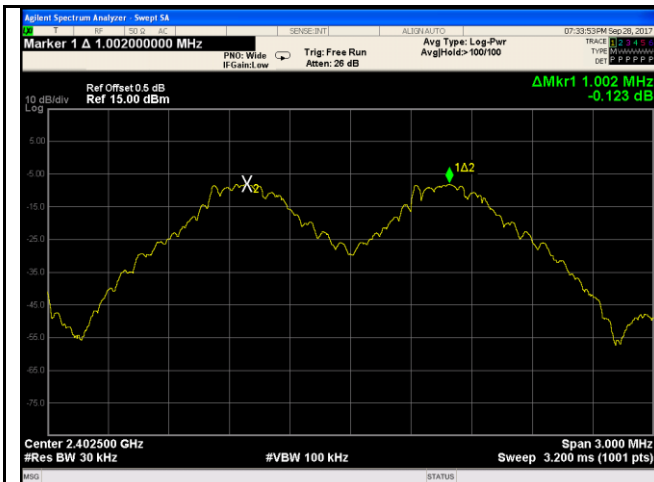
Test Plot ☒ Yes (See below) ☐ N/A

### Channel Separation measurement result

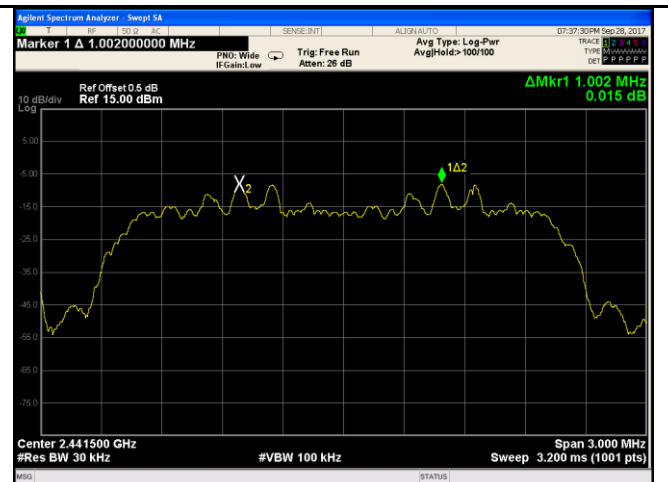
Type/ Modulation	CH	CH Frequency (MHz)	CH Separation (MHz)	Limit (MHz)	Result
CH Separation GFSK	Low Channel	2402	1.002	0.953	Pass
	Adjacency Channel	2403			
	Mid Channel	2440	1.002	0.951	Pass
	Adjacency Channel	2441			
	High Channel	2480	1.002	0.955	Pass
	Adjacency Channel	2479			
CH Separation $\pi$ / 4 DQPSK	Low Channel	2402	1.002	0.854	Pass
	Adjacency Channel	2403			
	Mid Channel	2440	1.002	0.854	Pass
	Adjacency Channel	2441			
	High Channel	2480	1.002	0.855	Pass
	Adjacency Channel	2479			

## Test Plots

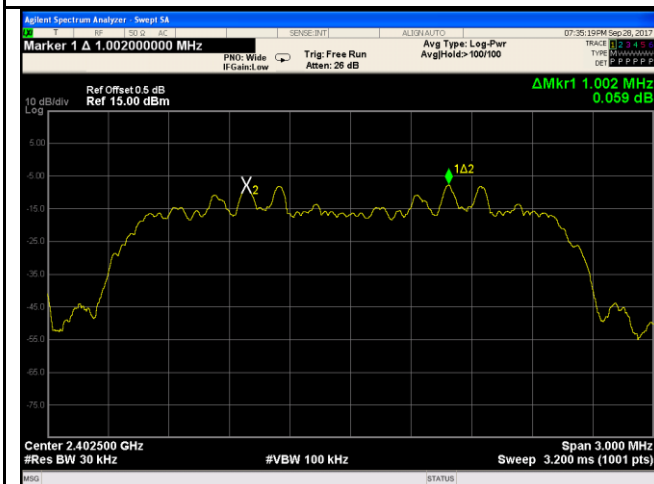
### Channel Separation measurement result



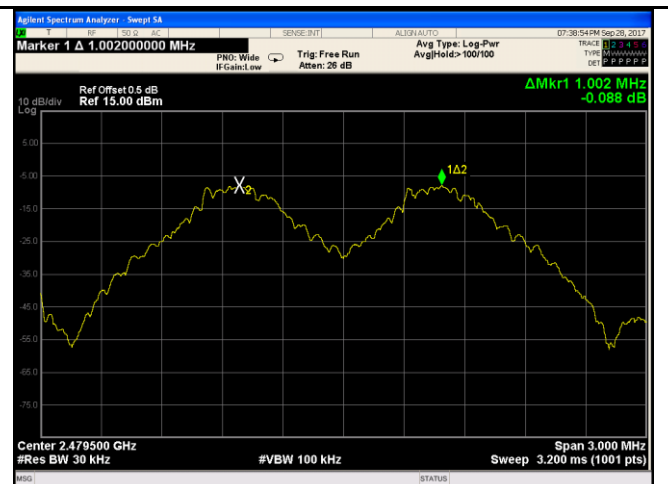
GFSK - Low Channel



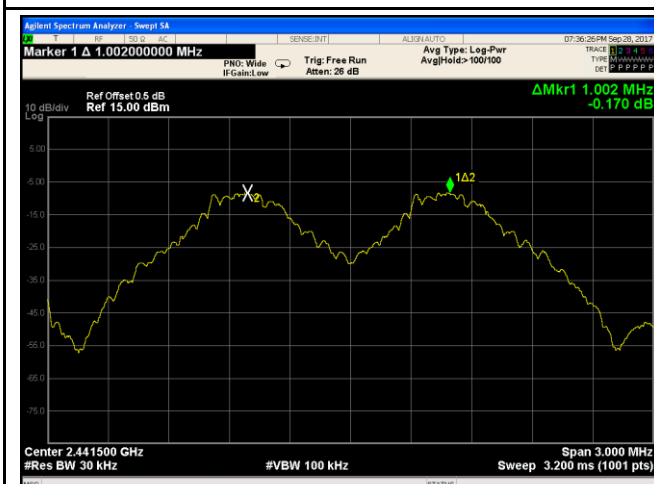
GFSK - Middle Channel



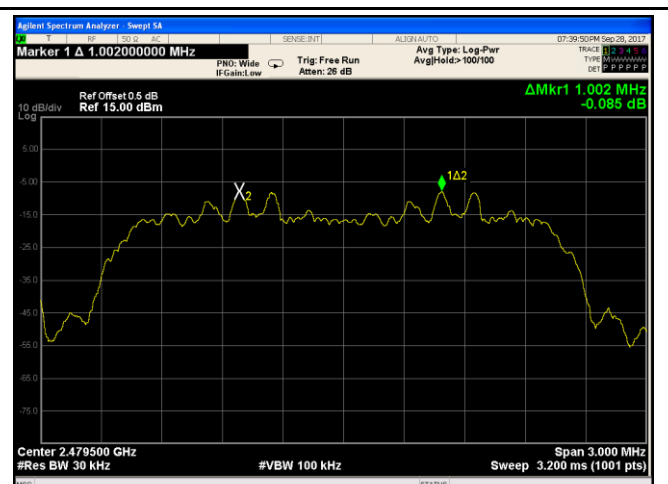
GFSK - High Channel



$\pi/4$  DPSK - Low Channel



$\pi/4$  DQPSK - Middle Channel


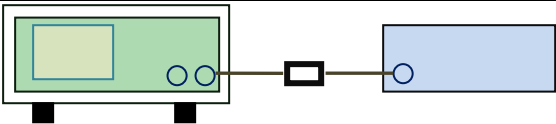


$\pi/4$  DQPSK - High Channel

### 6.3 20dB Bandwidth

Temperature	23°C
Relative Humidity	54%
Atmospheric Pressure	1020mbar
Test date :	September 28, 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.	
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></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

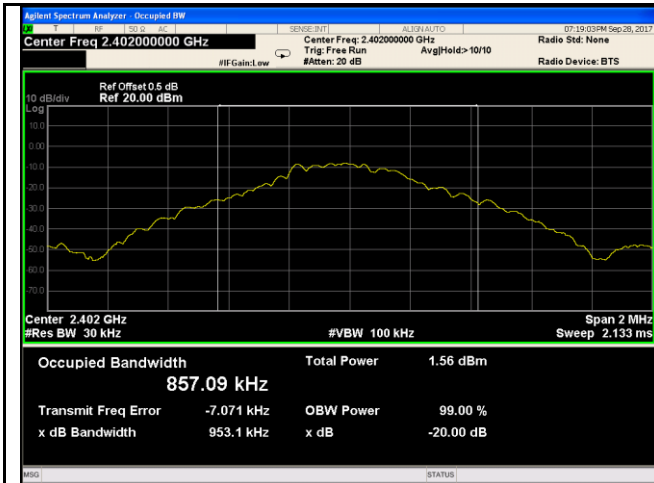
Test Plot ☒ Yes (See below) ☐ N/A

#### Measurement result

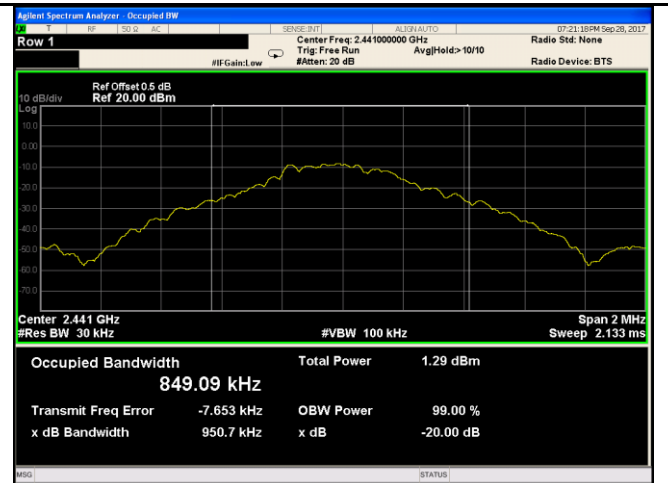
Modulation	CH	CH Frequency (MHz)	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
GFSK	Low	2402	0.953	0.8571
	Mid	2441	0.951	0.8491
	High	2480	0.955	0.8522
$\pi$ /4 DQPSK	Low	2402	1.281	1.1680
	Mid	2441	1.281	1.1678
	High	2480	1.282	1.1684

## Test Plots

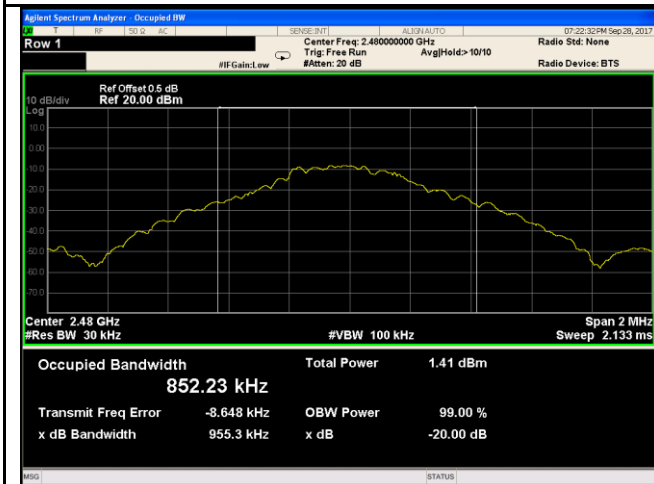
### 20dB Bandwidth measurement result



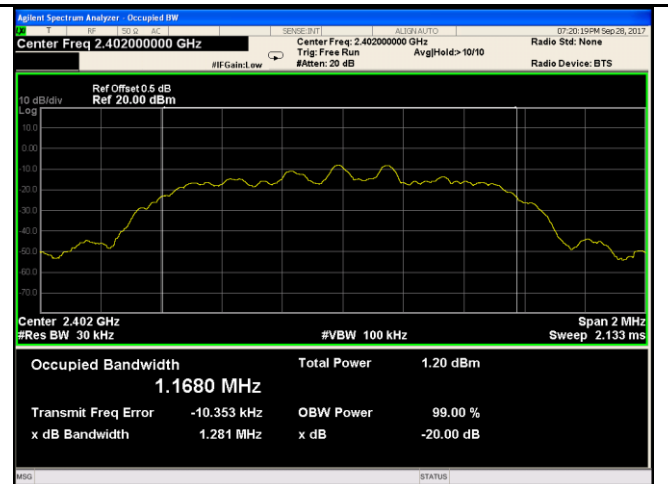
GFSK - Low Channel



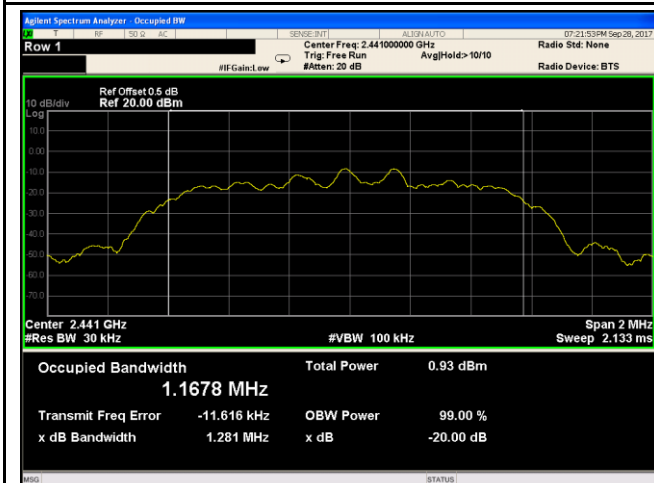
GFSK - Middle Channel



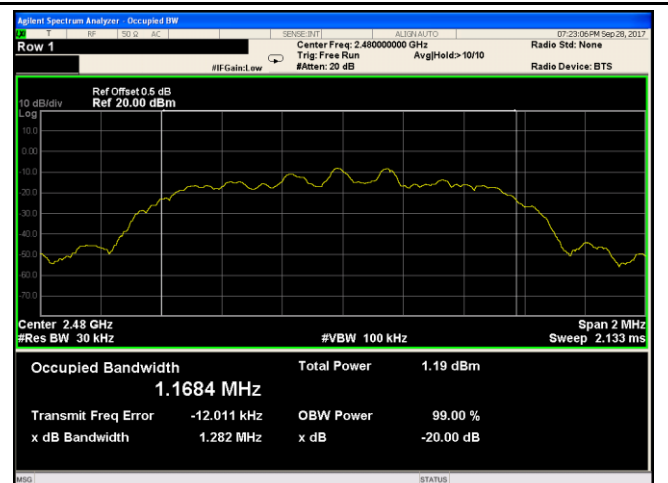
GFSK - High Channel



$\pi/4$  DPSK - Low Channel



$\pi/4$  DQPSK - Middle Channel



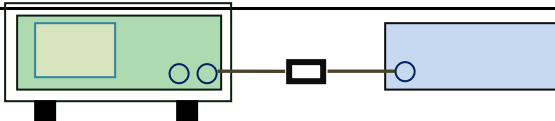
$\pi/4$  DQPSK - High Channel

## 6.4 Peak Output Power

Temperature	23°C
Relative Humidity	54%
Atmospheric Pressure	1020mbar
Test date :	September 28, 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	 <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> <ul style="list-style-type: none"> <li>- Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel</li> <li>- RBW <math>&gt;</math> the 20 dB bandwidth of the emission being measured</li> <li>- VBW <math>\geq</math> RBW</li> <li>- Sweep = auto</li> <li>- Detector function = peak</li> <li>- Trace = max hold</li> <li>- Allow the trace to stabilize.</li> </ul>
----------------	---

	<p>- Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power (see the note above regarding external attenuation and cable loss). The limit is specified in one of the subparagraphs of this Section. Submit this plot. A peak responding power meter may be used instead of a spectrum analyzer.</p>
Remark	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

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

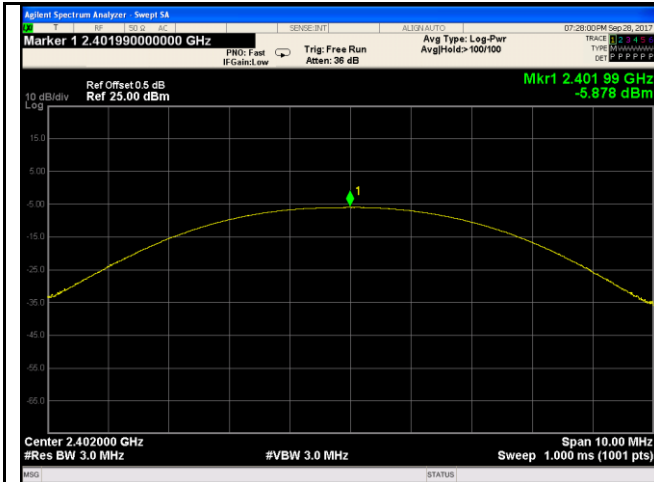
#### Peak Output Power measurement result

Type	Modulation	CH	Frequency (MHz)	Conducted Power (dBm)	Limit (mW)	Result
Output power	GFSK	Low	2402	-5.878	1000	Pass
		Mid	2441	-5.892	1000	Pass
		High	2480	-5.983	1000	Pass
	$\pi/4$ DQPSK	Low	2402	-4.849	125	Pass
		Mid	2441	-4.830	125	Pass
		High	2480	-4.828	125	Pass

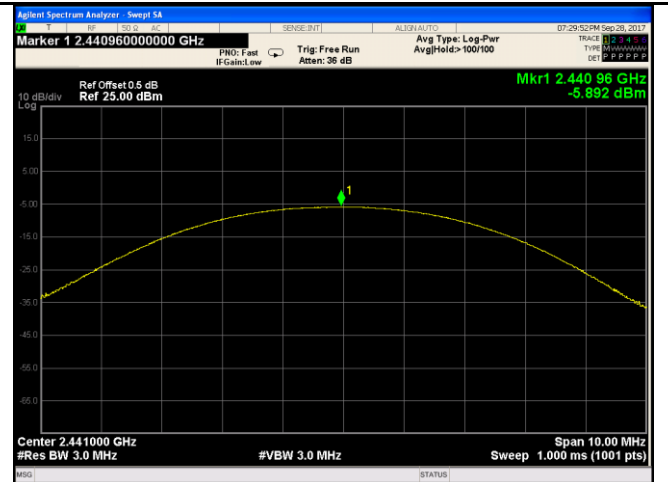


## Test Plots

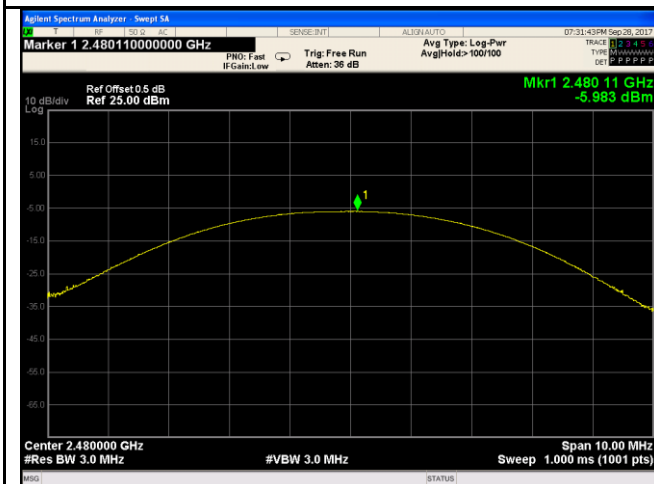
### Output Power measurement result



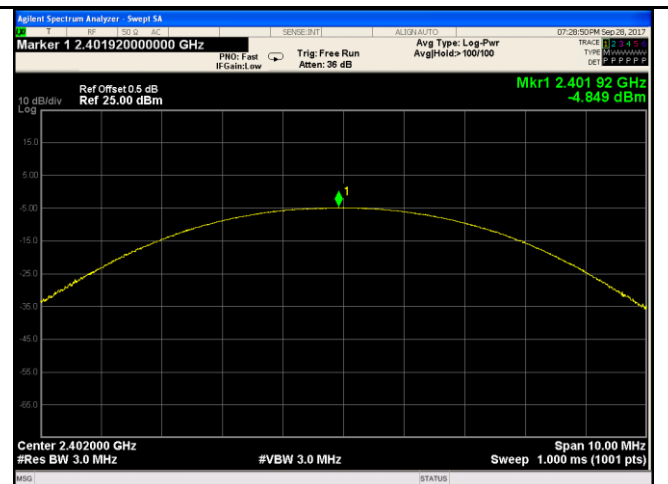
GFSK Output power - Low CH 2402



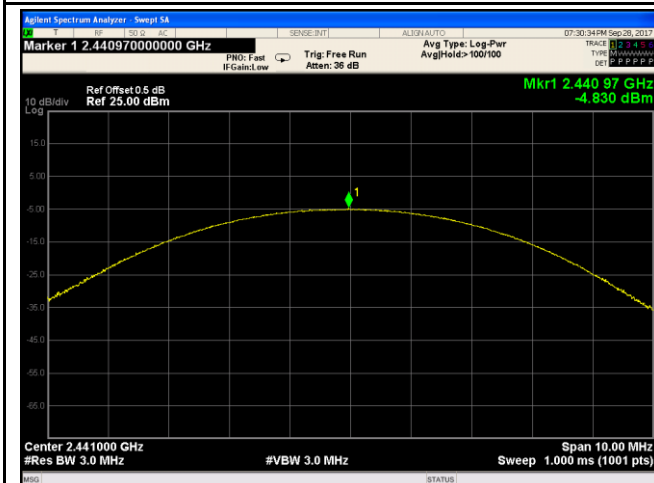
GFSK Output power - Mid CH 2441



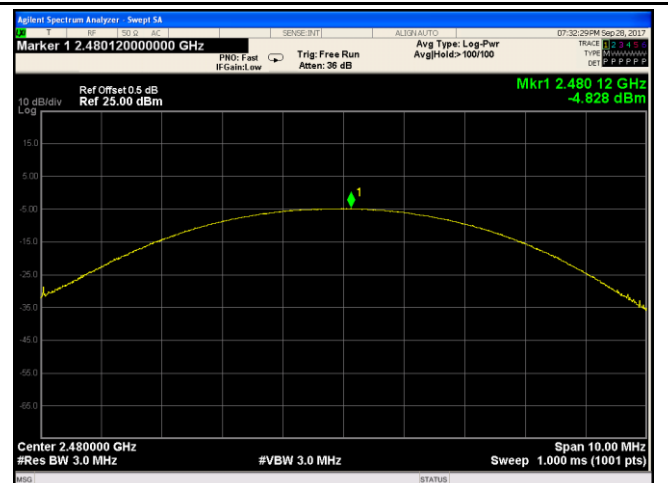
GFSK Output power - High CH 2480



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



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

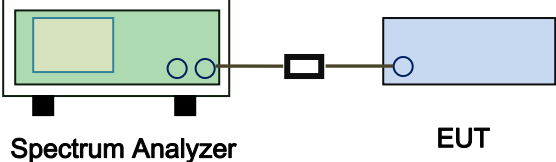


$\pi/4$  DQPSK Output power - High CH 2480

## 6.5 Number of Hopping Channel

Temperature	23°C
Relative Humidity	54%
Atmospheric Pressure	1020mbar
Test date :	September 28, 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.  <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 ≥ 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		

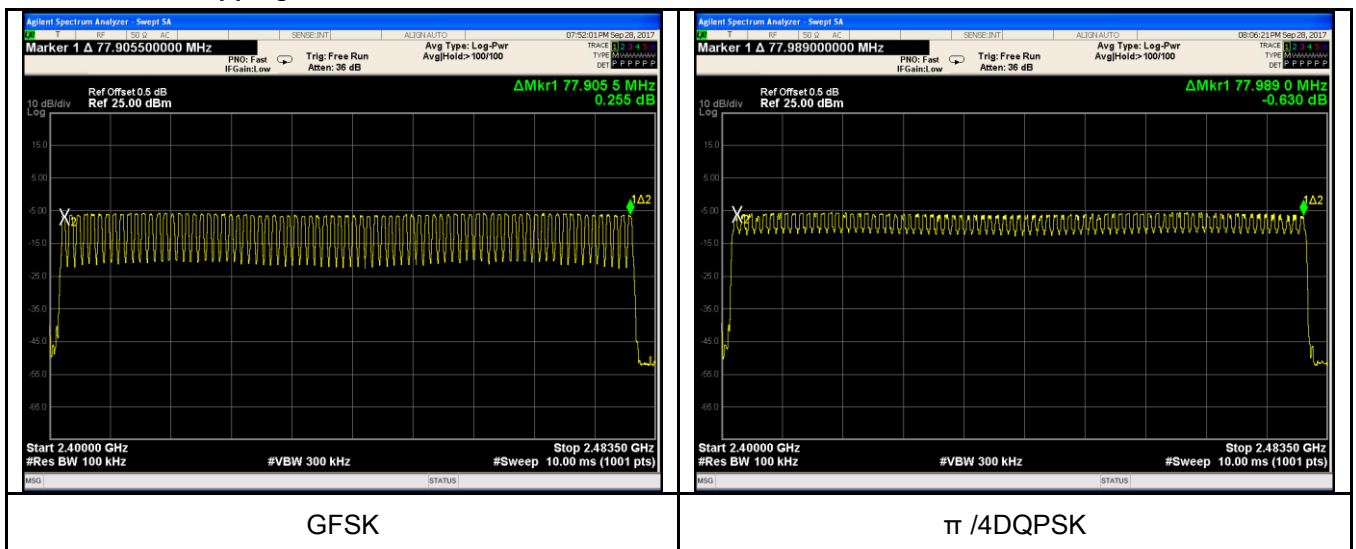
Test Data    ☒ Yes                      ☐ N/A  
 Test Plot    ☒ Yes (See below)                      ☐ N/A

### 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

### Test Plots

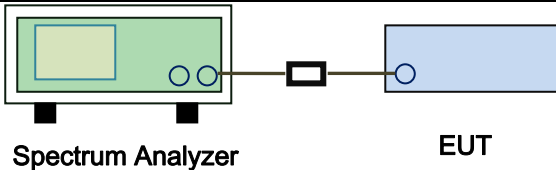
#### Number of Hopping Channels measurement result



## 6.6 Time of Occupancy (Dwell Time)

Temperature	23°C
Relative Humidity	54%
Atmospheric Pressure	1020mbar
Test date :	September 28, 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	 <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

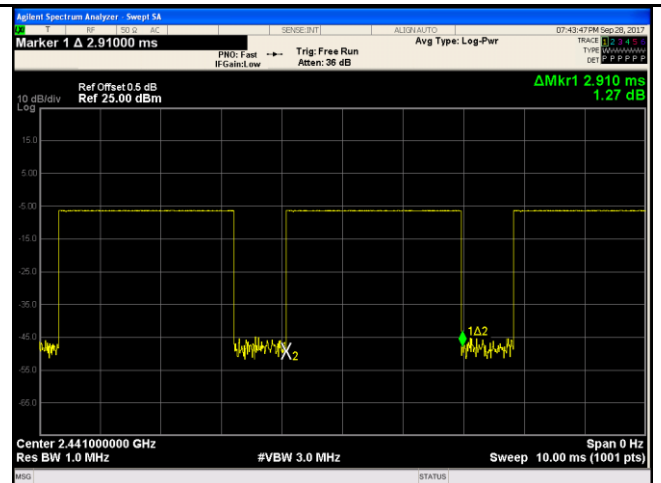
#### Dwell Time measurement result

Type	Modulation	CH	Pulse Width (ms)	Dwell Time (ms)	Limit (ms)	Result
Dwell Time	GFSK	Low	2.91	310.400	400	Pass
		Mid	2.91	310.400	400	Pass
		High	2.93	312.533	400	Pass
	$\pi$ /4 DQPSK	Low	2.92	311.467	400	Pass
		Mid	2.92	311.467	400	Pass
		High	2.92	311.467	400	Pass

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

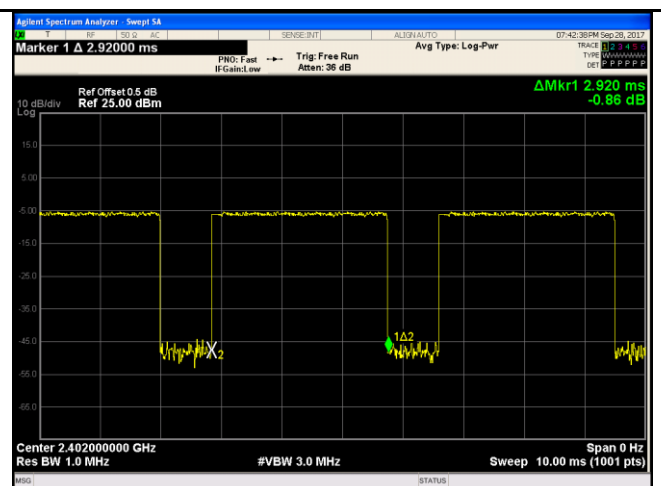
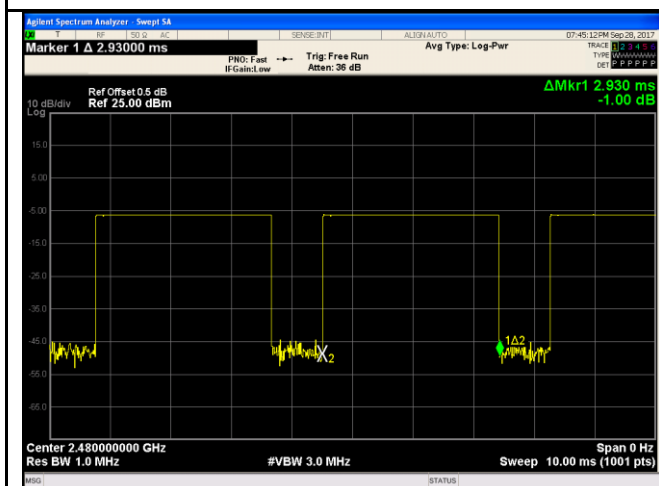
## Test Plots

### Dwell Time measurement result



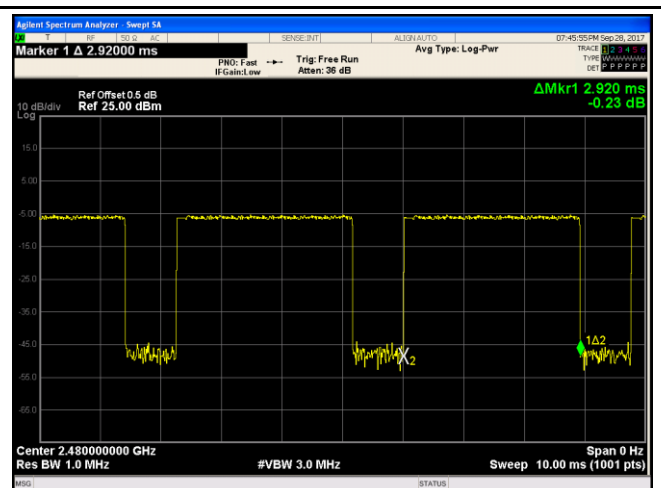
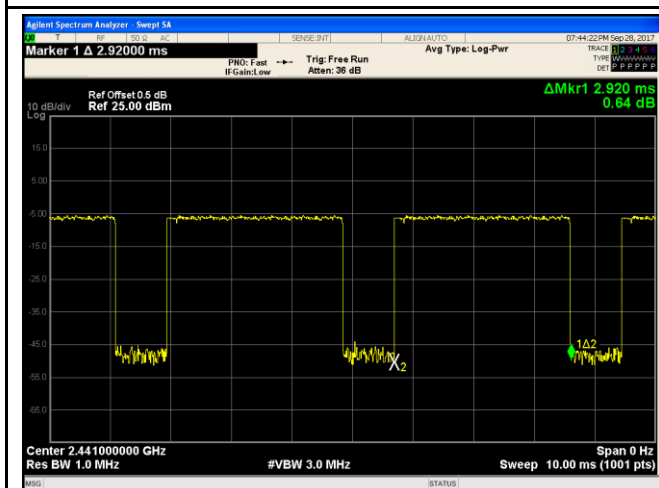
GFSK - Low CH 2402

GFSK - Mid CH 2441



GFSK - High CH 2480

$\pi/4$  DQPSK - Low CH 2402



$\pi/4$  DQPSK - Mid CH 2441

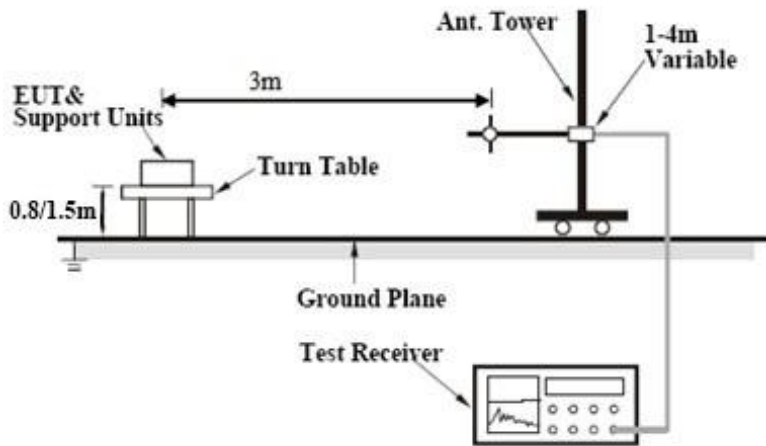
$\pi/4$  DQPSK - High CH 2480

## 6.7 Band Edge & Restricted Band

Temperature	23°C
Relative Humidity	54%
Atmospheric Pressure	1020mbar
Test date :	September 28, 2017
Tested By :	Evans He

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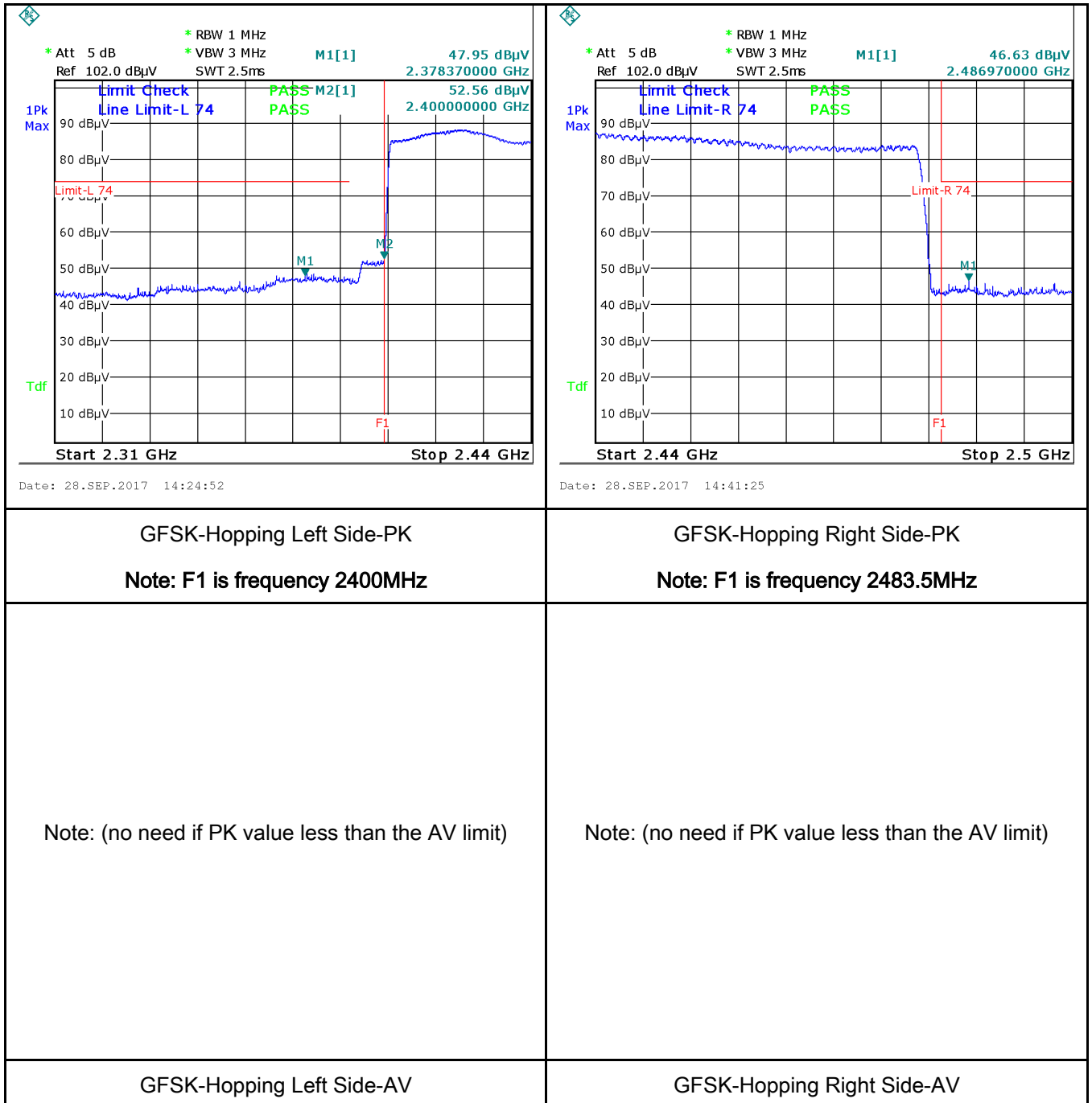
	<p>and make sure the instrument is operated in its linear range.</p> <ul style="list-style-type: none"> <li>- 3. First, set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, check the emission of EUT, if pass then set Spectrum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

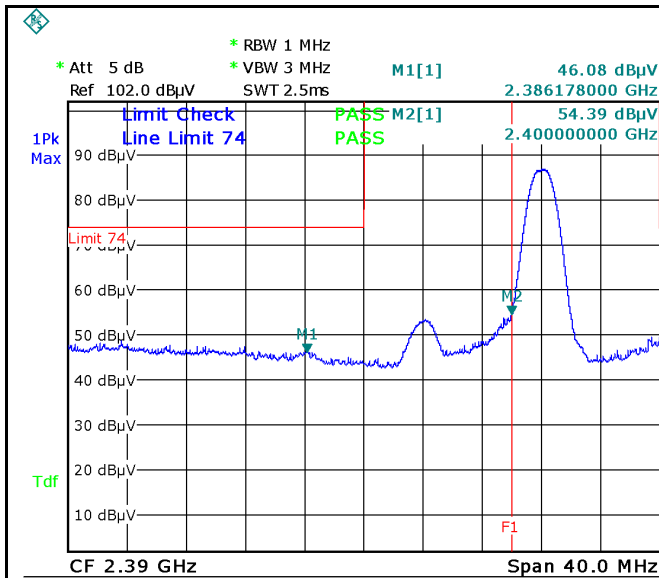


## Test Plots

### GFSK Mode:



Note: Both Horizontal and vertical polarities were investigated.



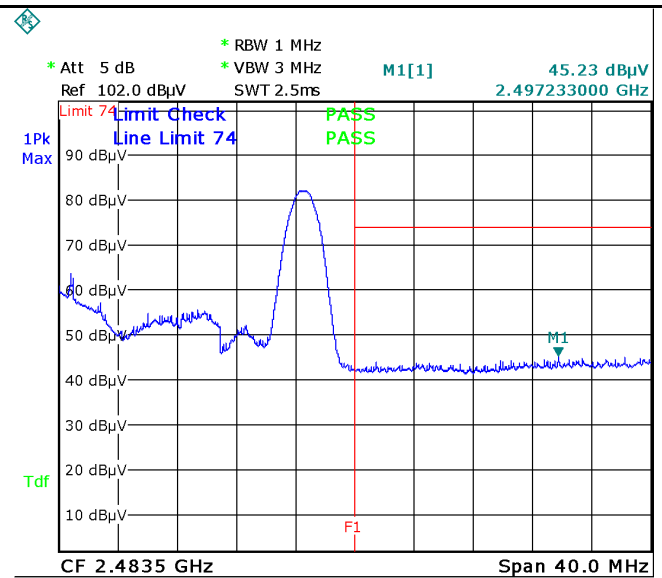
Date: 28.SEP.2017 14:34:53

GFSK-Left Side-PK

Note: F1 is frequency 2400MHz

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

GFSK-Left Side-AV



Date: 28.SEP.2017 14:36:56

GFSK-Right Side-PK

Note: F1 is frequency 2483.5MHz

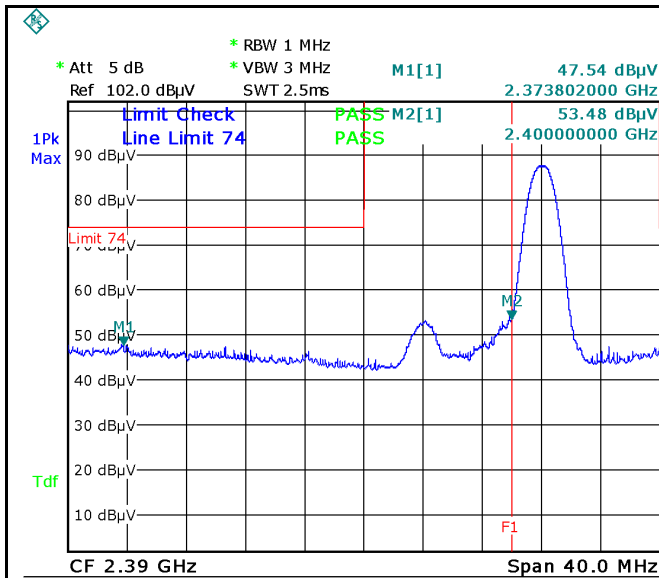
Note: (no need if PK value less than the AV limit)

GFSK-Right Side-AV

Note: Both Horizontal and vertical polarities were investigated.

<p>* Att 5 dB Ref 102.0 dBμV RBW 1 MHz VBW 3 MHz SWT 2.5ms</p> <p>M1[1] 47.52 dBμV 2.376040000 GHz</p> <p>Limit Check Line Limit-L 74</p> <p>PASS M2[1] PASS 52.45 dBμV 2.400000000 GHz</p> <p>Start 2.31 GHz Stop 2.44 GHz</p> <p>Date: 28.SEP.2017 14:27:42</p>	<p>* Att 5 dB Ref 102.0 dBμV RBW 1 MHz VBW 3 MHz SWT 2.5ms</p> <p>M1[1] 44.02 dBμV 2.489370000 GHz</p> <p>Limit Check Line Limit-R 74</p> <p>PASS M2[1] PASS 52.45 dBμV 2.400000000 GHz</p> <p>Start 2.44 GHz Stop 2.5 GHz</p> <p>Date: 28.SEP.2017 14:41:48</p>
<p><math>\pi/4</math> DQPSK-Hopping Left Side-PK</p> <p>Note: F1 is frequency 2400MHz</p>	<p><math>\pi/4</math> DQPSK-Hopping Right Side-PK</p> <p>Note: F1 is frequency 2483.5MHz</p>
<p>Note: (no need if PK value less than the AV limit)</p>	<p>Note: (no need if PK value less than the AV limit)</p>
<p><math>\pi/4</math> DQPSK-Hopping Left-AV</p>	<p><math>\pi/4</math> DQPSK-Hopping Right-AV</p>

Note: Both Horizontal and vertical polarities were investigated.

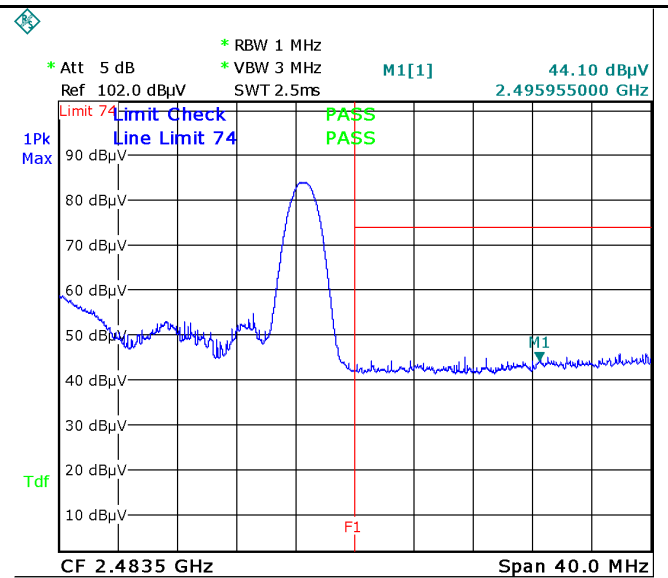


Date: 28.SEP.2017 14:35:36

$\pi/4$  DQPSK-Left Side-PK  
 Note: F1 is frequency 2400MHz

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

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



Date: 28.SEP.2017 14:37:08

$\pi/4$  DQPSK-Right Side-PK  
 Note: F1 is frequency 2483.5MHz

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

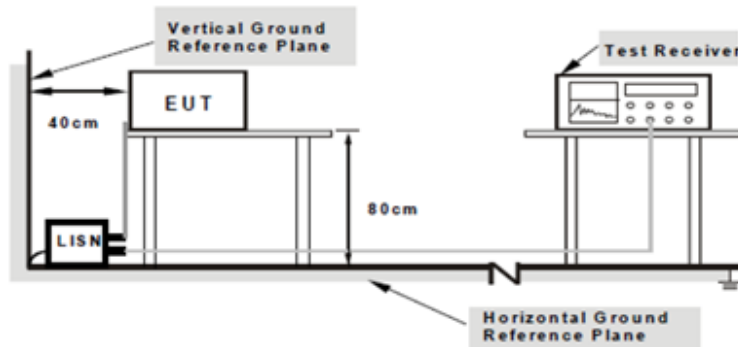
$\pi/4$  DQPSK-Right Side-AV

Note: Both Horizontal and vertical polarities were investigated.

## 6.8 AC Power Line Conducted Emissions

Temperature	23°C
Relative Humidity	54%
Atmospheric Pressure	1020mbar
Test date :	September 28, 2017
Tested By :	Evans He

### Requirement(s):

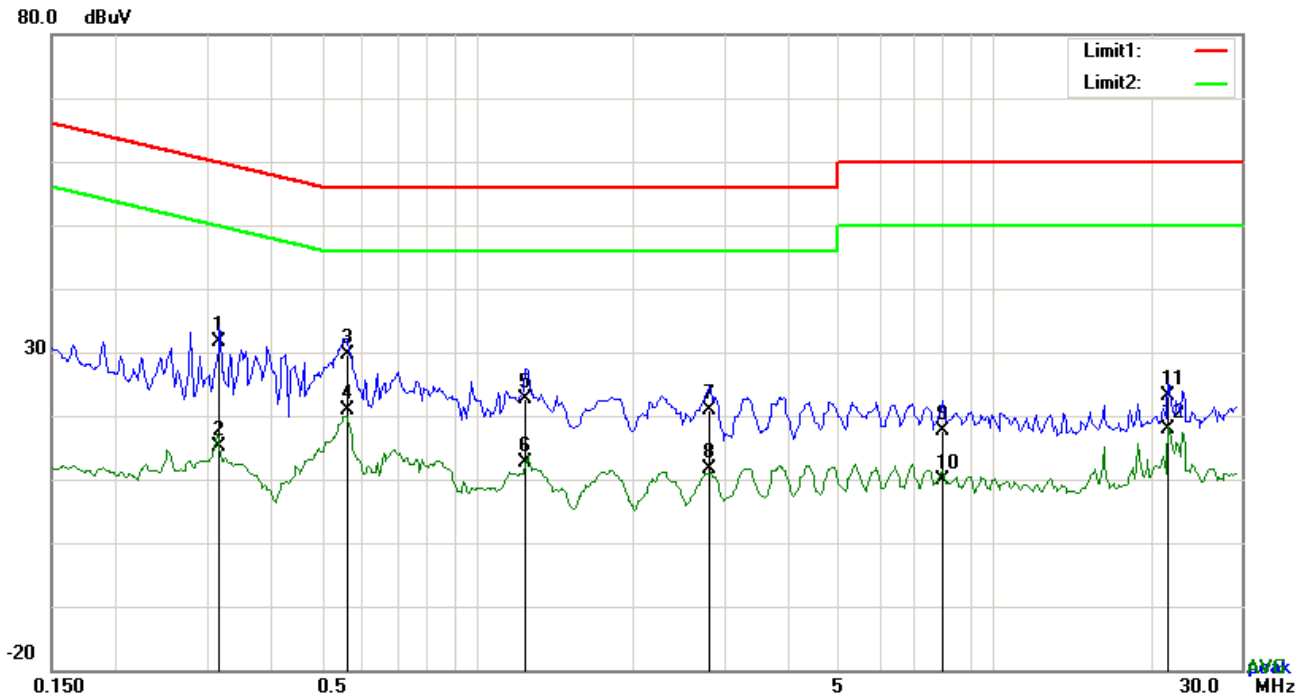
Spec	Item	Requirement	Applicable														
47CFR§15.207, RSS210 (A8.1)	a)	For Low-power radio-frequency devices that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within 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><p>Note: 1.Support units were connected to second LISN. 2.Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.</p></div>																
Procedure		<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.</div><div>2. The power supply for the EUT was fed through a 50W/50mH EUT LISN, connected to filtered mains.</div><div>3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss</div></div>															

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	coaxial cable. 4. All other supporting equipment were powered separately from another main supply. 5. The EUT was switched on and allowed to warm up to its normal operating condition. 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. 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. 8. Step 7 was then repeated for the LIVE line (for AC mains) or DC line (for DC power).
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

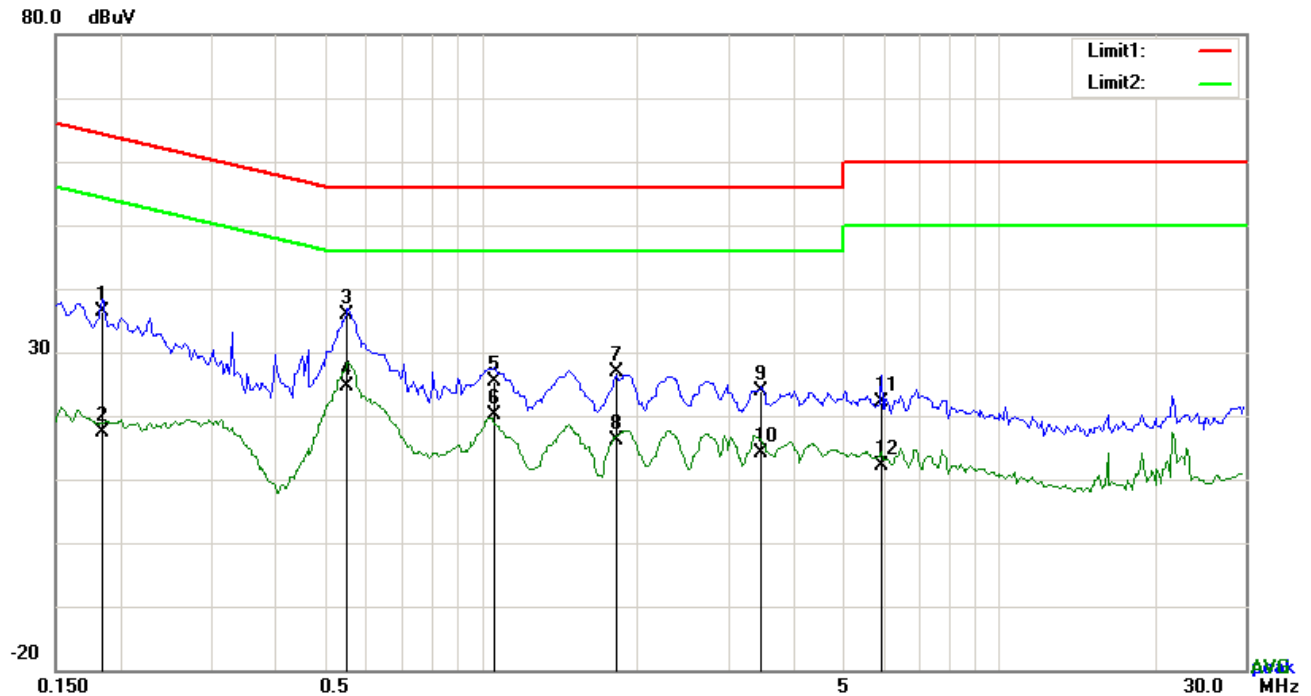


### Test Data

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

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB)	(dBuV)	(dBuV)	(dB)
1	L1	0.3177	19.01	QP	12.58	31.59	59.77	-28.18
2	L1	0.3177	2.54	AVG	12.58	15.12	49.77	-34.65
3	L1	0.5595	17.91	QP	11.84	29.75	56.00	-26.25
4	L1	0.5595	9.13	AVG	11.84	20.97	46.00	-25.03
5	L1	1.2420	11.18	QP	11.43	22.61	56.00	-33.39
6	L1	1.2420	1.25	AVG	11.43	12.68	46.00	-33.32
7	L1	2.7981	9.24	QP	11.62	20.86	56.00	-35.14
8	L1	2.7981	0.11	AVG	11.62	11.73	46.00	-34.27
9	L1	7.9101	5.07	QP	12.66	17.73	60.00	-42.27
10	L1	7.9101	-2.69	AVG	12.66	9.97	50.00	-40.03
11	L1	21.6654	7.42	QP	15.73	23.15	60.00	-36.85
12	L1	21.6654	2.24	AVG	15.73	17.97	50.00	-32.03

**Test Mode:** Bluetooth Mode



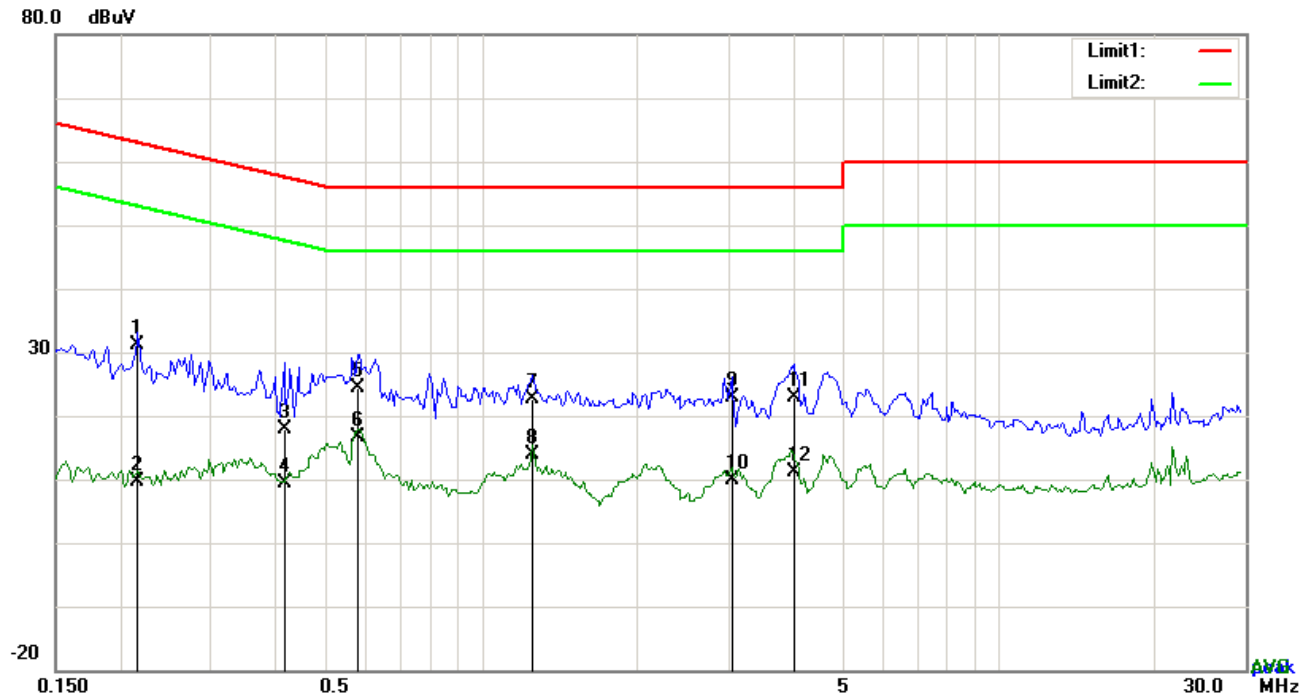
**Test Data**

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

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB)	(dBuV)	(dBuV)	(dB)
1	N	0.1851	23.34	QP	13.07	36.41	64.25	-27.84
2	N	0.1851	4.36	AVG	13.07	17.43	54.25	-36.82
3	N	0.5517	23.95	QP	11.85	35.80	56.00	-20.20
4	N	0.5517	12.68	AVG	11.85	24.53	46.00	-21.47
5	N	1.0587	14.06	QP	11.41	25.47	56.00	-30.53
6	N	1.0587	8.61	AVG	11.41	20.02	46.00	-25.98
7	N	1.8192	15.34	QP	11.50	26.84	56.00	-29.16
8	N	1.8192	4.69	AVG	11.50	16.19	46.00	-29.81
9	N	3.4758	12.28	QP	11.71	23.99	56.00	-32.01
10	N	3.4758	2.42	AVG	11.71	14.13	46.00	-31.87
11	N	5.9523	10.03	QP	12.15	22.18	60.00	-37.82
12	N	5.9523	0.06	AVG	12.15	12.21	50.00	-37.79



**Test Mode:** Bluetooth Mode

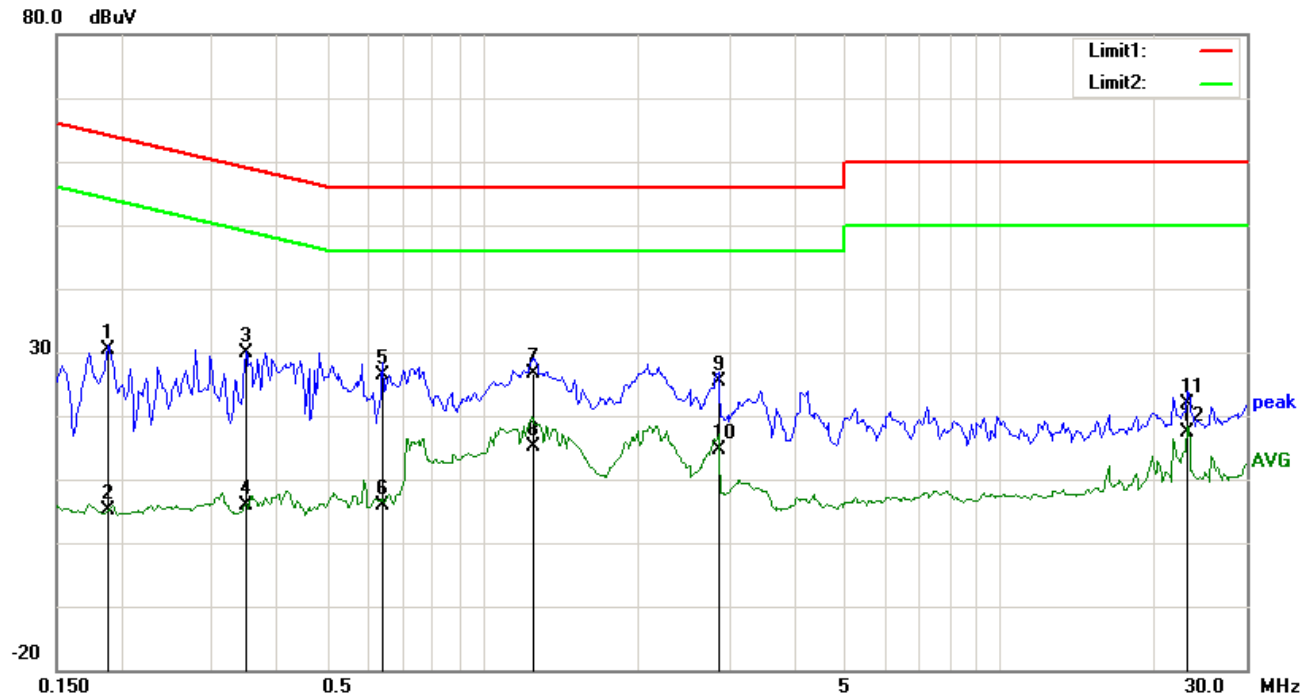


**Test Data**

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

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB)	(dBuV)	(dBuV)	(dB)
1	L1	0.2163	18.15	QP	12.95	31.10	62.96	-31.86
2	L1	0.2163	-3.44	AVG	12.95	9.51	52.96	-43.45
3	L1	0.4152	5.55	QP	12.21	17.76	57.54	-39.78
4	L1	0.4152	-2.91	AVG	12.21	9.30	47.54	-38.24
5	L1	0.5790	12.51	QP	11.82	24.33	56.00	-31.67
6	L1	0.5790	4.87	AVG	11.82	16.69	46.00	-29.31
7	L1	1.2537	11.29	QP	11.40	22.69	56.00	-33.31
8	L1	1.2537	2.59	AVG	11.40	13.99	46.00	-32.01
9	L1	3.0429	11.39	QP	11.40	22.79	56.00	-33.21
10	L1	3.0429	-1.43	AVG	11.40	9.97	46.00	-36.03
11	L1	4.0062	11.45	QP	11.40	22.85	56.00	-33.15
12	L1	4.0062	-0.35	AVG	11.40	11.05	46.00	-34.95

**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	0.1890	17.44	QP	13.06	30.50	64.08	-33.58
2	N	0.1890	-8.03	AVG	13.06	5.03	54.08	-49.05
3	N	0.3489	17.30	QP	12.46	29.76	58.99	-29.23
4	N	0.3489	-6.55	AVG	12.46	5.91	48.99	-43.08
5	N	0.6414	14.62	QP	11.76	26.38	56.00	-29.62
6	N	0.6414	-5.77	AVG	11.76	5.99	46.00	-40.01
7	N	1.2576	15.20	QP	11.43	26.63	56.00	-29.37
8	N	1.2576	3.76	AVG	11.43	15.19	46.00	-30.81
9	N	2.8566	13.80	QP	11.63	25.43	56.00	-30.57
10	N	2.8566	3.06	AVG	11.63	14.69	46.00	-31.31
11	N	23.1279	5.56	QP	16.29	21.85	60.00	-38.15
12	N	23.1279	1.03	AVG	16.29	17.32	50.00	-32.68

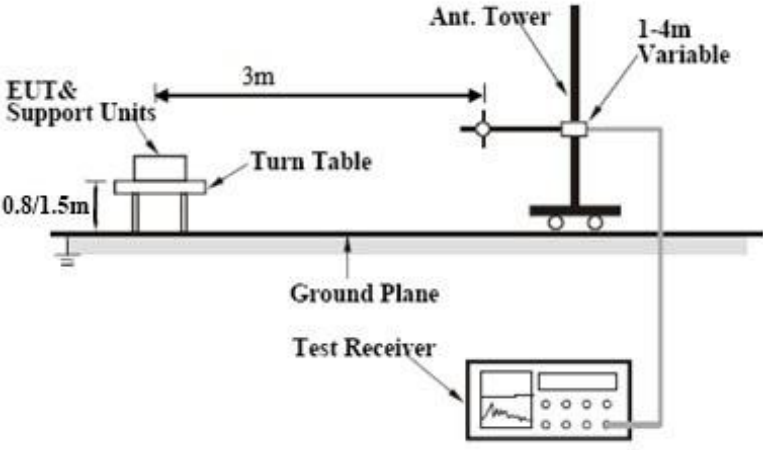
## 6.9 Radiated Emissions & Restricted Band

Temperature	23°C
Relative Humidity	54%
Atmospheric Pressure	1020mbar
Test date :	September 28, 2017
Tested By :	Evans He

### 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>0.009~0.490</td><td>2400/F(KHz)</td></tr><tr><td>0.490~1.705</td><td>24000/F(KHz)</td></tr><tr><td>1.705~30.0</td><td>30</td></tr><tr><td>30 – 88</td><td>100</td></tr><tr><td>88 – 216</td><td>150</td></tr><tr><td>216 960</td><td>200</td></tr><tr><td>Above 960</td><td>500</td></tr></table>		Frequency range (MHz)	Field Strength (µV/m)	0.009~0.490	2400/F(KHz)	0.490~1.705	24000/F(KHz)	1.705~30.0	30	30 – 88	100	88 – 216	150	216 960	200	Above 960	500
		Frequency range (MHz)		Field Strength (µV/m)															
		0.009~0.490		2400/F(KHz)															
		0.490~1.705		24000/F(KHz)															
		1.705~30.0		30															
		30 – 88		100															
		88 – 216		150															
		216 960		200															
Above 960	500																		

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

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

## Test Result:

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

Frequency range: 9KHz - 30MHz

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

### Note:

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

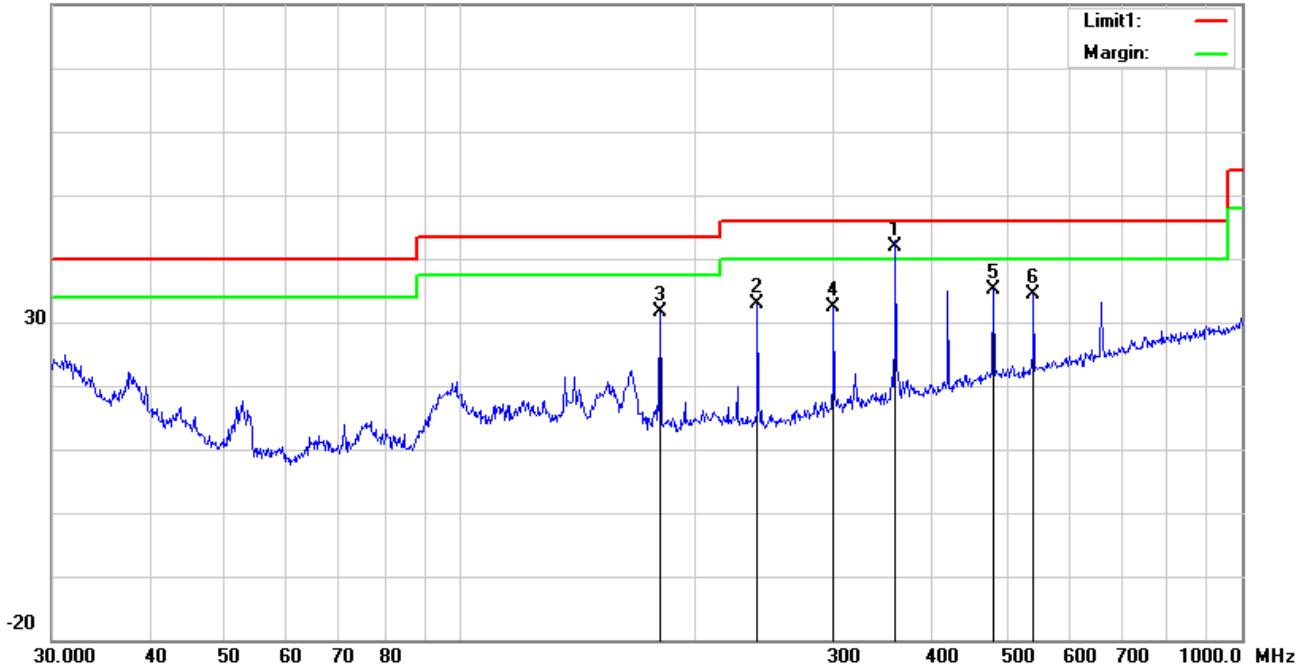
Distance extrapolation factor =  $40 \log (\text{specific distance}/\text{test distance})$ (dB);

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

**Test Mode:** Bluetooth Mode

**30MHz -1GHz**

80.0 dBuV/m



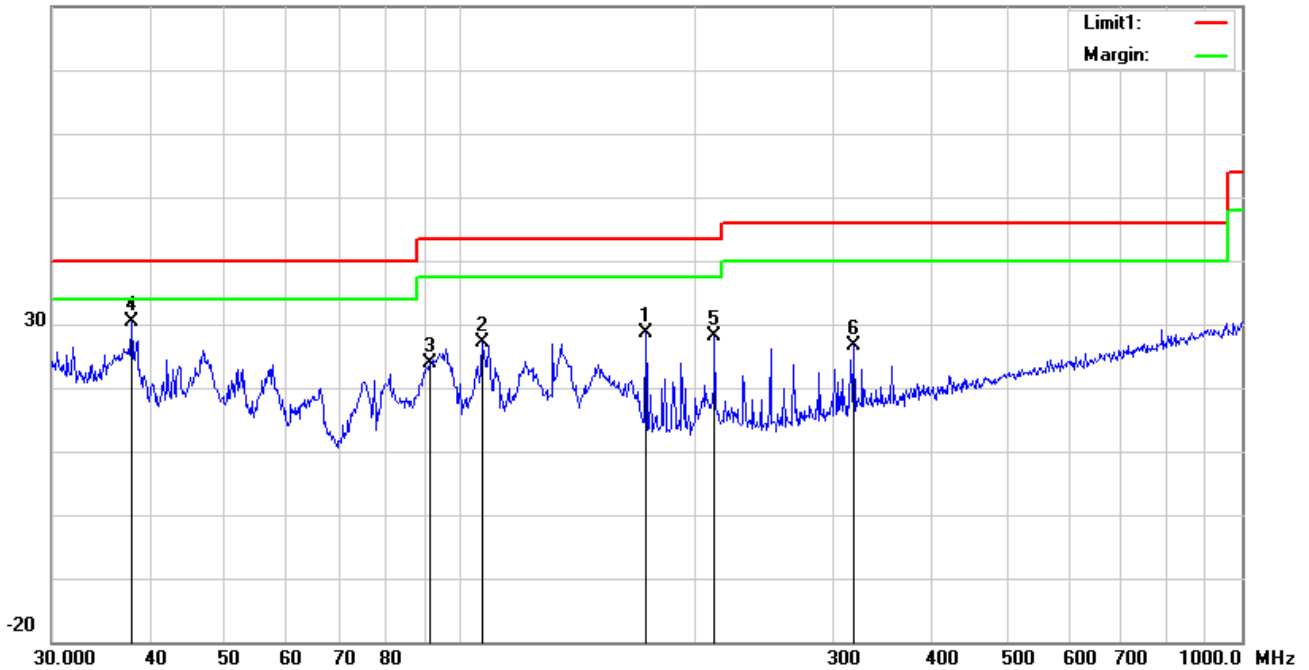
**Test Data**

**Horizontal Polarity Plot @3m**

No.	P/L	Frequency	Reading	Detect or	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degr ee
		(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	( ° )
1	H	360.4477	47.00	QP	14.87	22.12	2.03	41.78	46.00	-4.22	100	269
2	H	239.9873	42.01	peak	11.54	22.31	1.67	32.91	46.00	-13.09	100	30
3	H	180.0165	41.62	peak	11.00	22.25	1.36	31.73	43.50	-11.77	100	96
4	H	300.3673	39.19	peak	13.61	22.29	1.79	32.30	46.00	-13.70	100	115
5	H	480.5276	37.36	peak	17.31	21.85	2.31	35.13	46.00	-10.87	100	270
6	H	541.3725	35.42	peak	18.28	21.71	2.47	34.46	46.00	-11.54	100	298

### 30MHz -1GHz

80.0 dBuV/m



### Test Data

#### Vertical Polarity Plot @3m

No.	P/L	Frequency	Reading	Detect or	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
		(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)
1	V	172.5988	38.01	peak	11.59	22.26	1.36	28.70	43.50	-14.80	100	333
2	V	106.7587	36.77	peak	11.58	22.33	1.15	27.17	43.50	-16.33	200	238
3	V	91.4949	36.89	peak	8.36	22.32	0.96	23.89	43.50	-19.61	100	252
4	V	37.9450	36.52	peak	15.40	22.27	0.78	30.43	40.00	-9.57	100	207
5	V	211.5265	36.93	peak	11.94	22.36	1.58	28.09	43.50	-15.41	100	127
6	V	318.8170	32.95	peak	14.00	22.24	1.88	26.59	46.00	-19.41	100	235

## Above 1GHz

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

### Low Channel: $\pi/4$ DQPSK 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	40.21	AV	V	33.39	7.22	48.46	32.36	54	-21.64
4804	38.61	AV	H	33.39	7.22	48.46	30.76	54	-23.24
4804	54.72	PK	V	33.39	7.22	48.46	46.87	74	-27.13
4804	53.91	PK	H	33.39	7.22	48.46	46.06	74	-27.94
7473	32.05	AV	V	37.61	7.61	48.21	29.06	54	-24.94
7473	30.54	AV	H	37.61	7.61	48.21	27.55	54	-26.45
7473	44.53	PK	V	37.61	7.61	48.21	41.54	74	-32.46
7473	42.6	PK	H	37.61	7.61	48.21	39.61	74	-34.39

### Middle Channel: $\pi/4$ DQPSK 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	39.46	AV	V	33.62	7.53	48.36	32.25	54	-21.75
4882	37.26	AV	H	33.62	7.53	48.36	30.05	54	-23.95
4882	53.11	PK	V	33.62	7.53	48.36	45.9	74	-28.1
4882	52.86	PK	H	33.62	7.53	48.36	45.65	74	-28.35
11978	26.73	AV	V	39.85	12.92	46.01	33.49	54	-20.51
11978	24.55	AV	H	39.85	12.92	46.01	31.31	54	-22.69
11978	43.51	PK	V	39.85	12.92	46.01	50.27	74	-23.73
11978	41.21	PK	H	39.85	12.92	46.01	47.97	74	-26.03



**High Channel:  $\pi/4$  DQPSK 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	39.67	AV	V	33.89	7.86	48.31	33.11	54	-20.89
4960	38.42	AV	H	33.89	7.86	48.31	31.86	54	-22.14
4960	49.16	PK	V	33.89	7.86	48.31	42.6	74	-31.4
4960	47.52	PK	H	33.89	7.86	48.31	40.96	74	-33.04
17031	21.5	AV	V	40.17	16.78	45.66	32.79	54	-21.21
17031	20.43	AV	H	40.17	16.78	45.66	31.72	54	-22.28
17031	40.17	PK	V	40.17	16.78	45.66	51.46	74	-22.54
17031	39.85	PK	H	40.17	16.78	45.66	51.14	74	-22.86

**Note:**

1, The testing has been conformed to  $10 \times 2480 \text{ MHz} = 24,800 \text{ MHz}$

2, All other emissions more than 30 dB below the limit

3, X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.

4, The radiated spurious test above 18GHz is subcontracted to SIEMIC (Nanjing-China) Laboratories. and found 30dB below the limit at least.

## Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Due	In use
<b>AC Line Conducted</b>					
EMI test receiver	ESCS30	8471241027	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
Line Impedance	LI-125A	191106	09/23/2017	09/22/2018	<input checked="" type="checkbox"/>
Line Impedance	LI-125A	191107	09/23/2017	09/22/2018	<input checked="" type="checkbox"/>
ISN	ISN T800	34373	09/23/2017	09/22/2018	<input type="checkbox"/>
Transient Limiter	LIT-153	531118	08/30/2017	08/29/2018	<input checked="" type="checkbox"/>
<b>RF conducted test</b>					
Agilent ESA-E SERIES	E4407B	MY45108319	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
Power Splitter	1#	1#	08/30/2017	08/29/2018	<input checked="" type="checkbox"/>
DC Power Supply	E3640A	MY40004013	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
<b>Radiated Emissions</b>					
EMI test receiver	ESL6	100262	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
Positioning Controller	UC3000	MF780208282	11/18/2016	11/17/2017	<input checked="" type="checkbox"/>
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	08/30/2017	08/29/2018	<input checked="" type="checkbox"/>
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/23/2017	03/22/2018	<input checked="" type="checkbox"/>
Horn Antenna	BBHA9170	3145226D1	09/27/2017	09/26/2018	<input checked="" type="checkbox"/>
Active Antenna (9kHz-30MHz)	AL-130	121031	10/13/2016	10/12/2017	<input checked="" type="checkbox"/>
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/19/2017	09/18/2018	<input checked="" type="checkbox"/>
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/22/2017	09/21/2018	<input checked="" type="checkbox"/>
Universal Radio Communication Tester	CMU200	121393	09/23/2017	09/22/2018	<input checked="" type="checkbox"/>

## Annex B. EUT And Test Setup Photographs

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

Whole Package View



EUT - Front View





EUT - Rear View



EUT - Top View



EUT - Bottom View



EUT - Left View



EUT - Right View





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

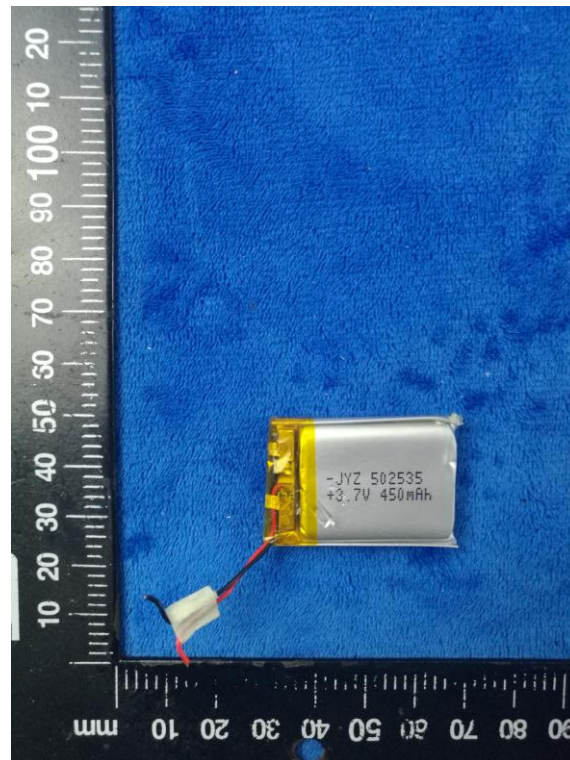
Cover Off - Top View 1



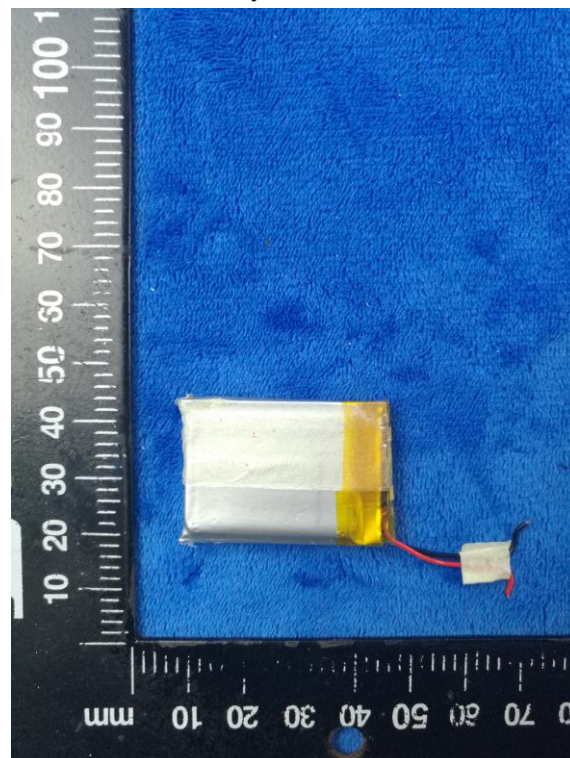
Cover Off - Top View 2



Battery - Front View

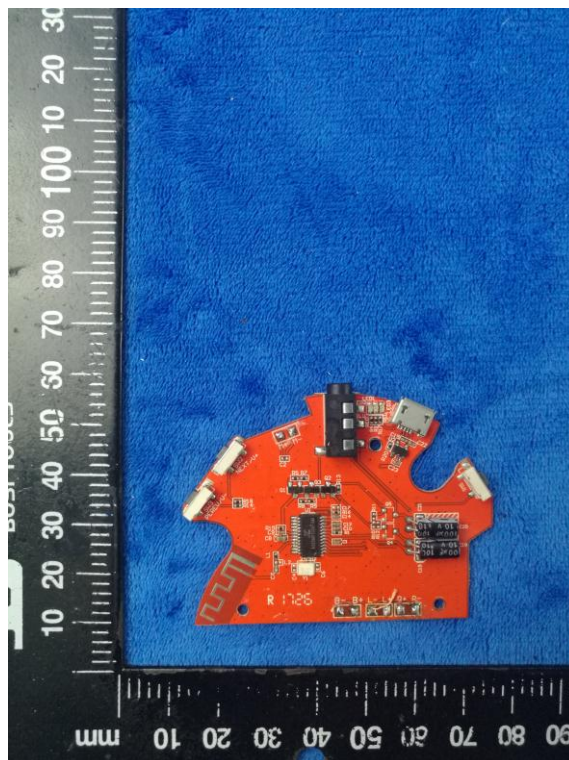


Battery - Rear View





Mainboard - Front View



Mainboard – Rear View



Antenna View



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



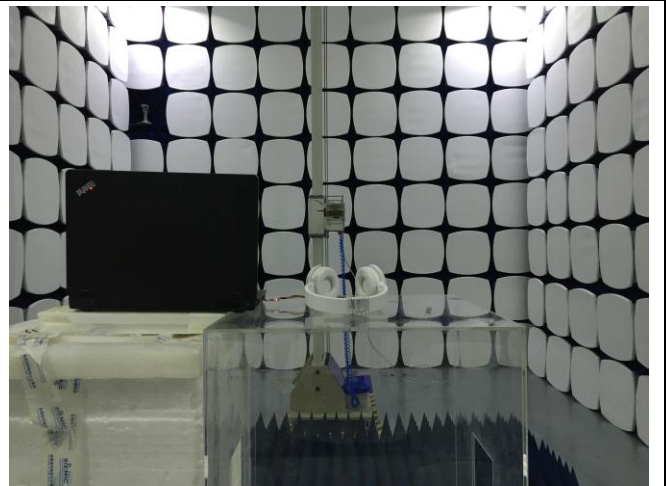
Conducted Emissions Test Setup Front View



Conducted Emissions Test Setup Side View



Radiated Spurious Emissions Test Setup Below 1GHz

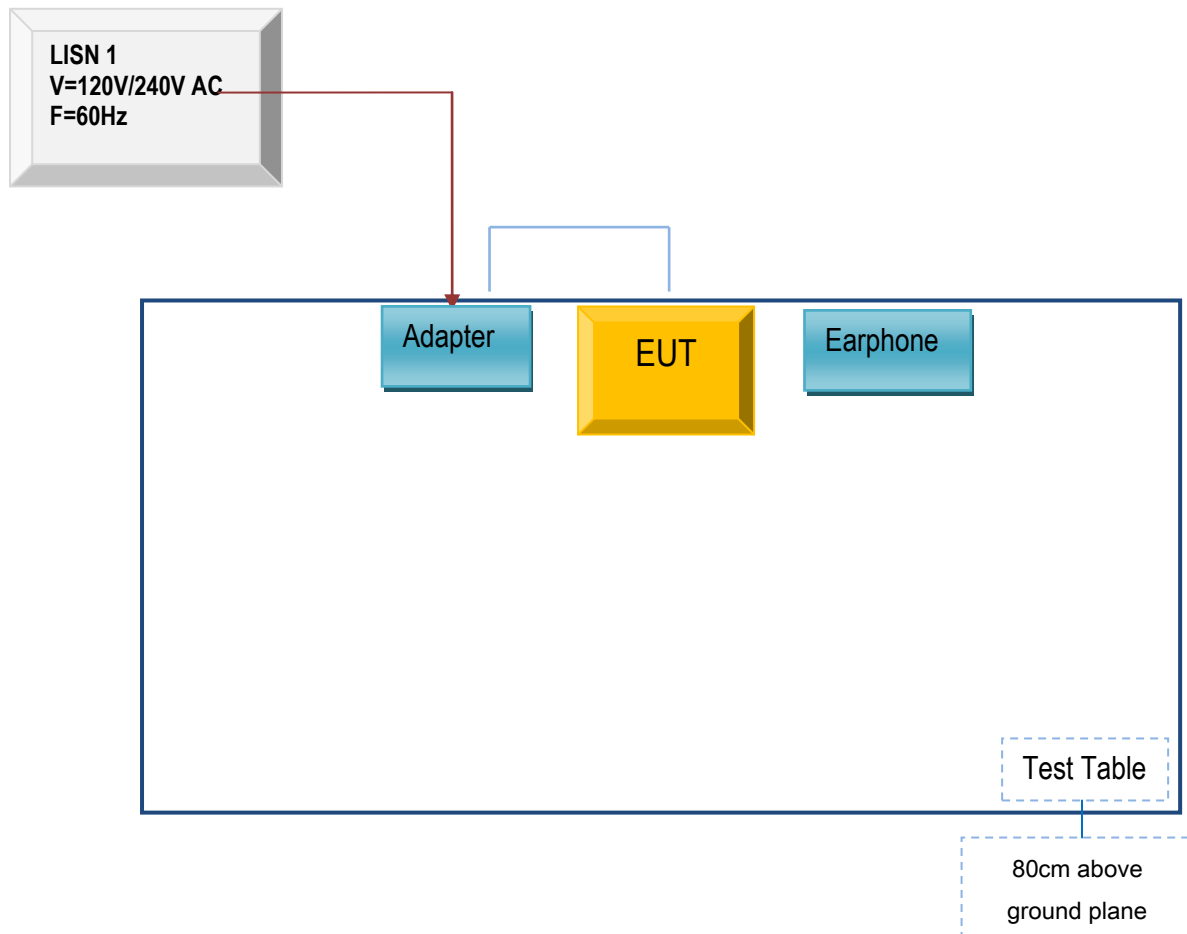


Radiated Spurious Emissions Test Setup Above  
1GHz

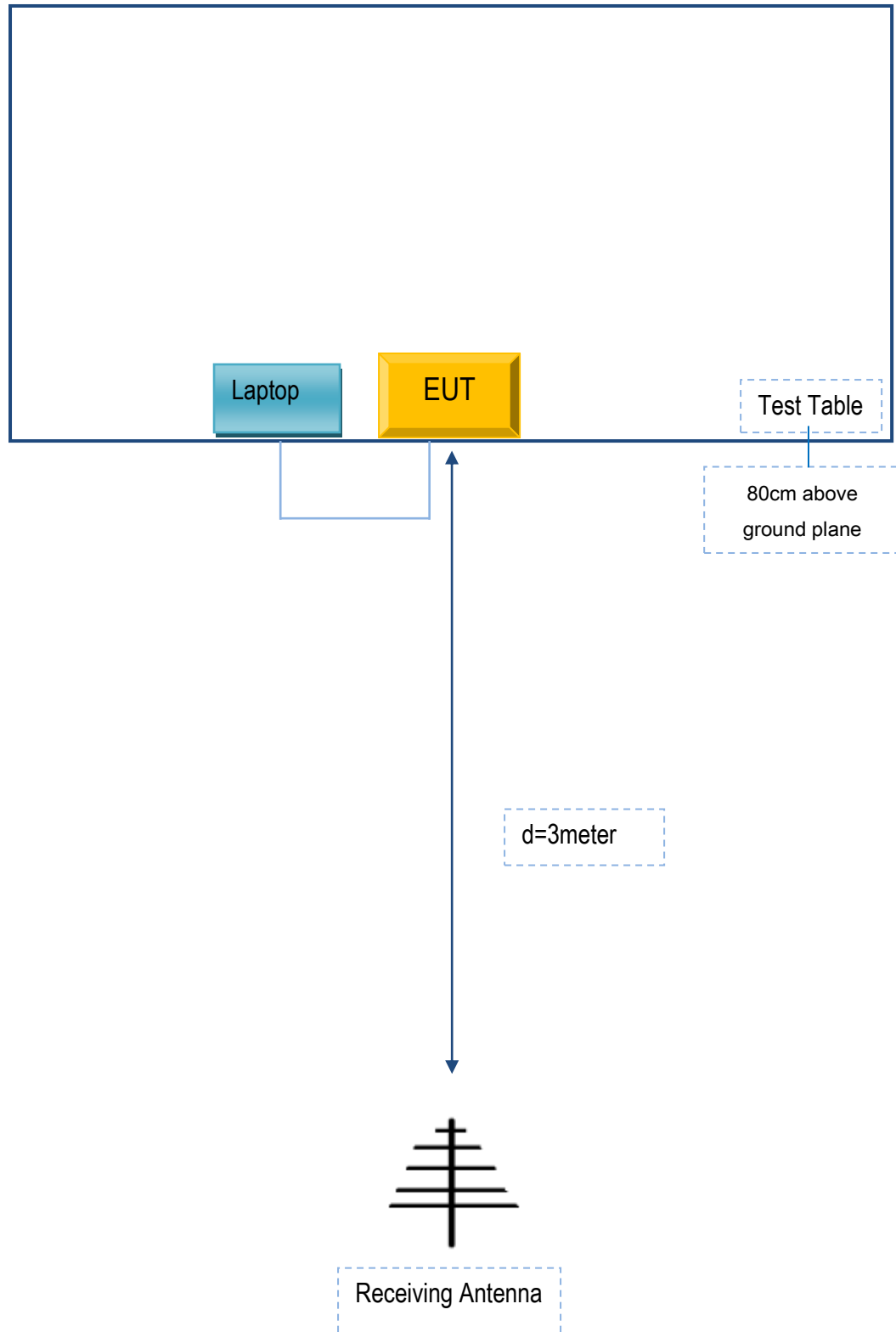
## Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

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

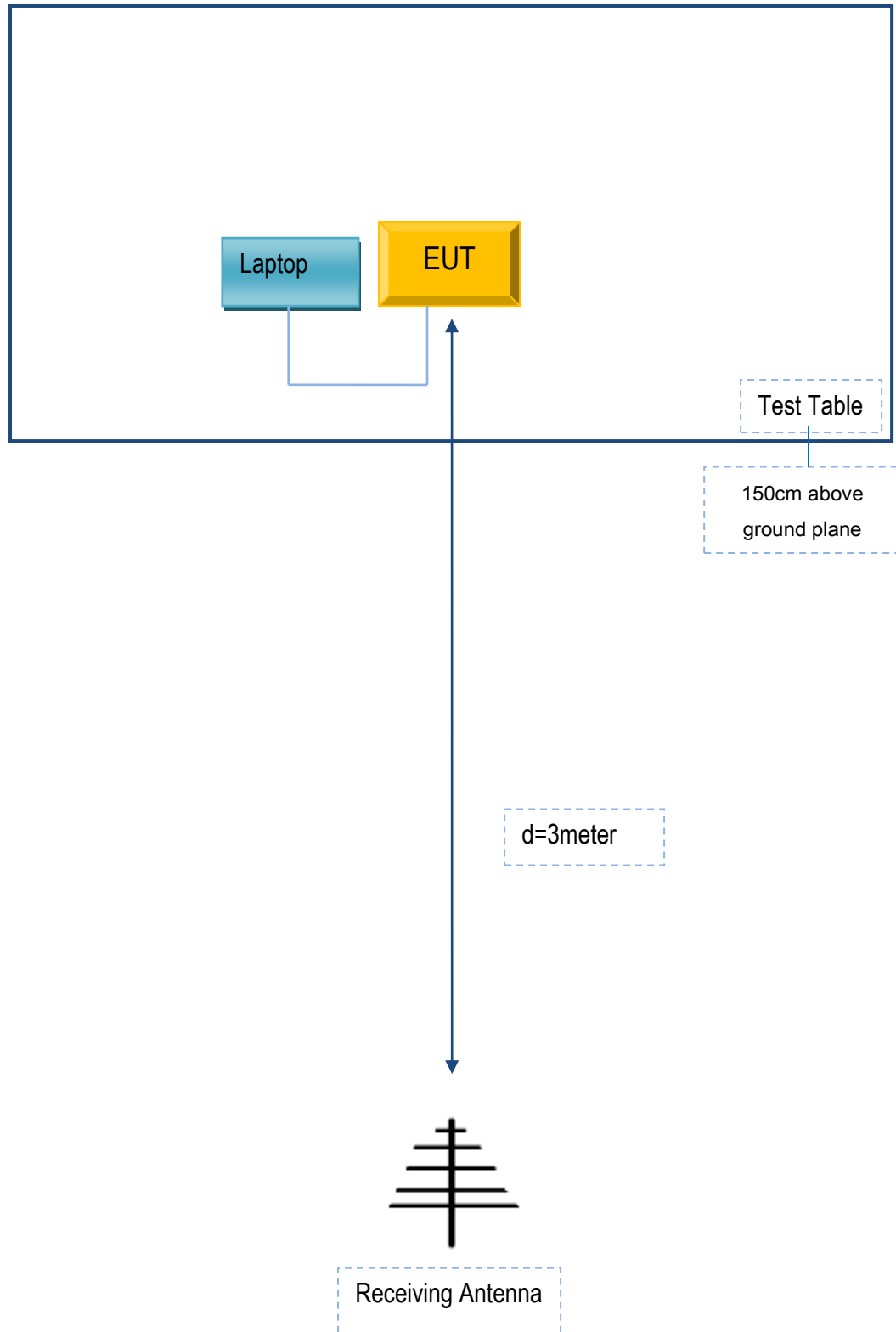
#### Block Configuration Diagram for AC Line Conducted Emissions



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



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



## **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
NOKIA	Phone	S6T	N/A
DCA	Adaptor	E2164A	N/A
Lenovo	Laptop	E40	N/A

### **Supporting Cable:**

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

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

Please see the attachment



## Annex E. DECLARATION OF SIMILARITY

N/A