

RF TEST REPORT



Report No.: 17070487-FCC-R

Supersede Report No.: N/A

Applicant	KINGRAY ELECTRONICS Co., LTD	
Product Name	Bluetooth earphone	
Model No.	BB487	
Serial No.	BB488 BB492 MG507 MG508 BB959 BB960 MG509 BB489 BB490 BB499 BB485 BB486 BB487 BB429 BB430	
Test Standard	FCC Part 15.247: 2016, ANSI C63.10: 2013	
Test Date	June 22 to 29, 2017	
Issue Date	June 30, 2017	
Test Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
Equipment complied with the specification	<input checked="" type="checkbox"/>	
Equipment did not comply with the specification	<input type="checkbox"/>	
<i>Vera Zhang</i>	<i>David Huang</i>	
Vera Zhang Test Engineer	David Huang Checked By	
<p>This test report may be reproduced in full only</p> <p>Test result presented in this test report is applicable to the tested sample only</p>		

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
17070487-FCC-R	NONE	Original	June 30, 2017

2. Customer information

Applicant Name	KINGRAY ELECTRONICS Co., LTD
Applicant Add	Building B, Ge Tailong Industrial Park , No.445, Bulong Rd , BanTian , LongGang , Shenzhen , China
Manufacturer	KINGRAY ELECTRONICS Co., LTD
Manufacturer Add	Building B, Ge Tailong Industrial Park , No.445, Bulong Rd , BanTian , LongGang , Shenzhen , China

3. Test site information

Lab performing tests	SIEMIC (Shenzhen-China) LABORATORIES
Lab Address	Zone A, Floor 1, Building 2 Wan Ye Long Technology Park South Side of Zhoushi Road, Bao' an District, Shenzhen, Guangdong China 518108
FCC Test Site No.	718246
IC Test Site No.	4842E-1
Test Software of Radiated Emission	Radiated Emission Program-To Shenzhen v2.0
Test Software of Conducted Emission	EZ-EMC(ver.lcp-03A1)

4. Equipment under Test (EUT) Information

Description of EUT:	Bluetooth earphone
Main Model:	BB487
Serial Model:	BB488 BB492 MG507 MG508 BB959 BB960 MG509 BB489 BB490 BB499 BB485 BB486 BB487 BB429 BB430
Date EUT received:	June 22, 2017
Test Date(s):	June 22 to 29, 2017
Equipment Category :	DSS
Antenna Gain:	0dBi
Antenna Type:	PCB antenna
Type of Modulation:	GFSK, π /4DQPSK
RF Operating Frequency (ies):	2402-2480 MHz
Max. Output Power:	-5.547dBm
Number of Channels:	79CH
Port:	USB Port
Input Power:	Battery: Model: 350926 Spec: 3.7Vdc,55mAh Charge Limit: 5Vdc USB Port: DC 5V



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Trade Name : KINGRAY

FCC ID: 2AML6BB430

5. Test Summary

The product was tested in accordance with the following specifications.

All testing has been performed according to below product classification:

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

Measurement Uncertainty

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

6. Measurements, Examination And Derived Results

6.1 Antenna Requirement

Applicable Standard

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

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

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

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

Antenna Connector Construction

The EUT has 1 antenna:

A permanently attached PCB antenna for Bluetooth, the gain is 0dBi for Bluetooth.

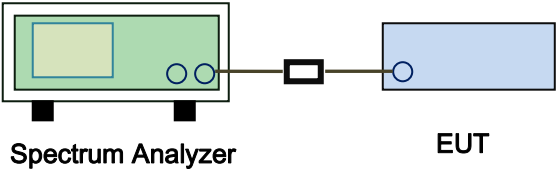
The antenna meets up with the ANTENNA REQUIREMENT.

Result: Compliance.

6.2 Channel Separation

Temperature	22°C
Relative Humidity	55%
Atmospheric Pressure	1025mbar
Test date :	June 28, 2017
Tested By :	Vera 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	<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"> - The EUT must have its hopping function enabled - Span = wide enough to capture the peaks of two adjacent channels - Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span - Video (or Average) Bandwidth (VBW) ≥ RBW - Sweep = auto - Detector function = peak - Trace = max hold - 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. 		

Remark	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Test Data Yes N/A

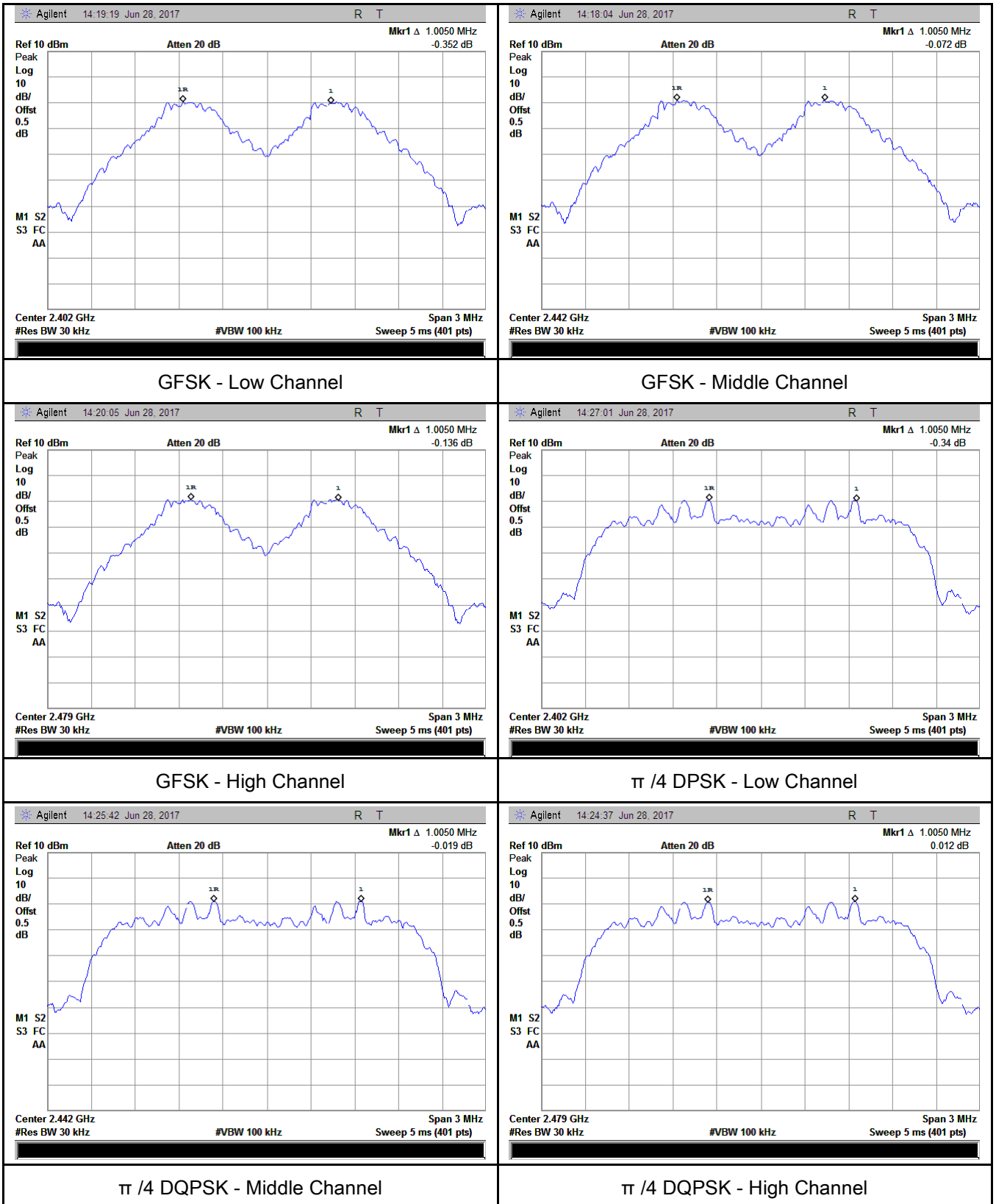
Test Plot Yes (See below) N/A

Channel Separation measurement result

Type/ Modulation	CH	CH Frequency (MHz)	CH Separation (MHz)	Limit (MHz)	Result
CH Separation GFSK	Low Channel	2402	1.005	0.952	Pass
	Adjacency Channel	2403			
	Mid Channel	2440	1.005	0.954	Pass
	Adjacency Channel	2441			
	High Channel	2480	1.005	0.953	Pass
	Adjacency Channel	2479			
CH Separation π /4 DQPSK	Low Channel	2402	1.005	0.862	Pass
	Adjacency Channel	2403			
	Mid Channel	2440	1.005	0.865	Pass
	Adjacency Channel	2441			
	High Channel	2480	1.005	0.865	Pass
	Adjacency Channel	2479			

Test Plots

Channel Separation measurement result

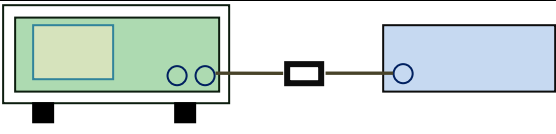


6.3 20dB Bandwidth

Temperature	22°C
Relative Humidity	55%
Atmospheric Pressure	1025mbar
Test date :	June 28, 2017
Tested By :	Vera 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>
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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"> - Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel - RBW \geq 1% of the 20 dB bandwidth - VBW \geq RBW - Sweep = auto - Detector function = peak - Trace = max hold. - 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
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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

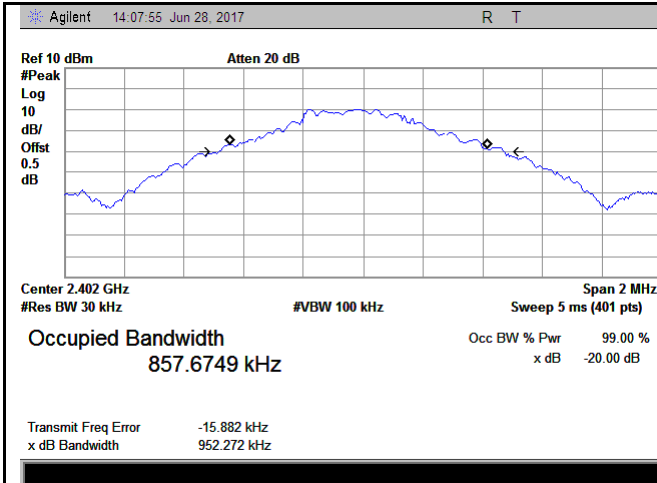
Test Plot Yes (See below) N/A

Measurement result

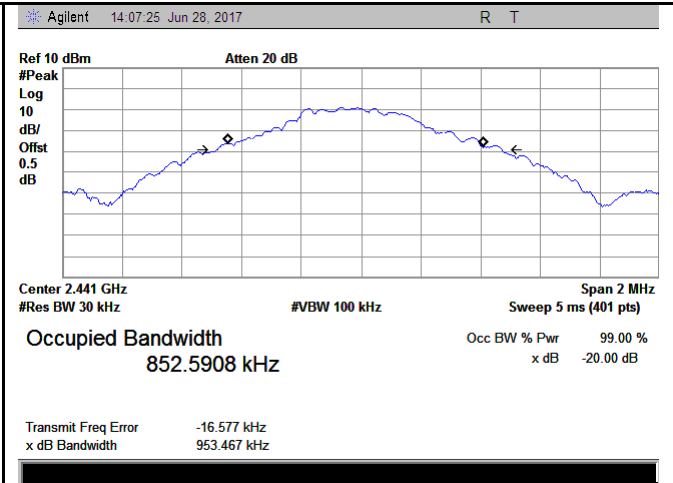
Modulation	CH	CH Frequency (MHz)	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
GFSK	Low	2402	0.9523	0.8577
	Mid	2441	0.9535	0.8526
	High	2480	0.9531	0.8534
$\pi/4$ DQPSK	Low	2402	1.293	1.1659
	Mid	2441	1.298	1.1680
	High	2480	1.298	1.1679

Test Plots

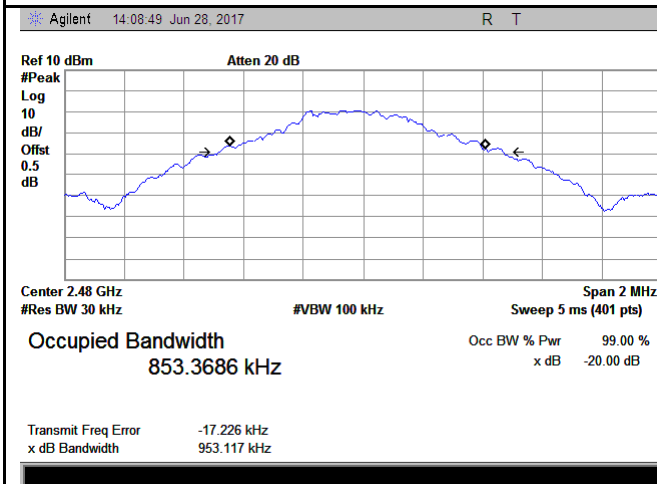
20dB Bandwidth measurement result



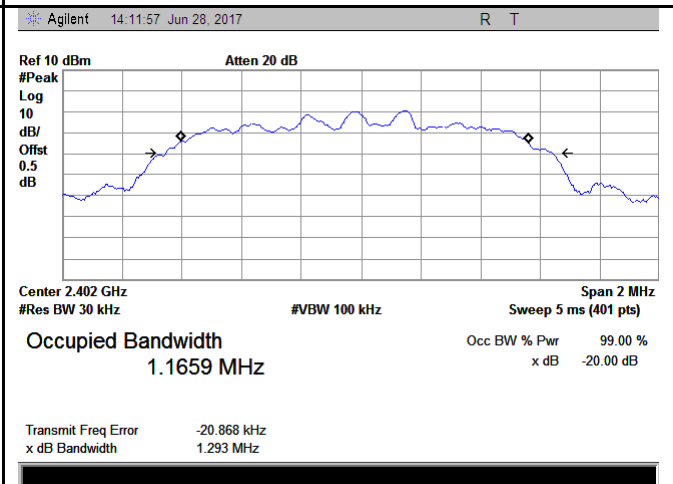
GFSK - Low Channel



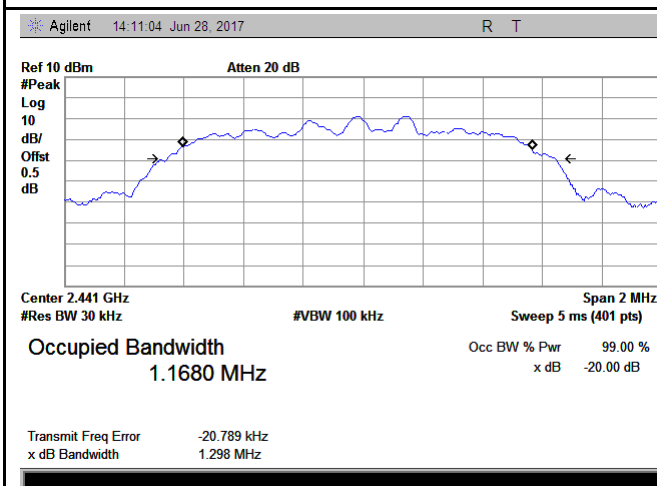
GFSK - Middle Channel



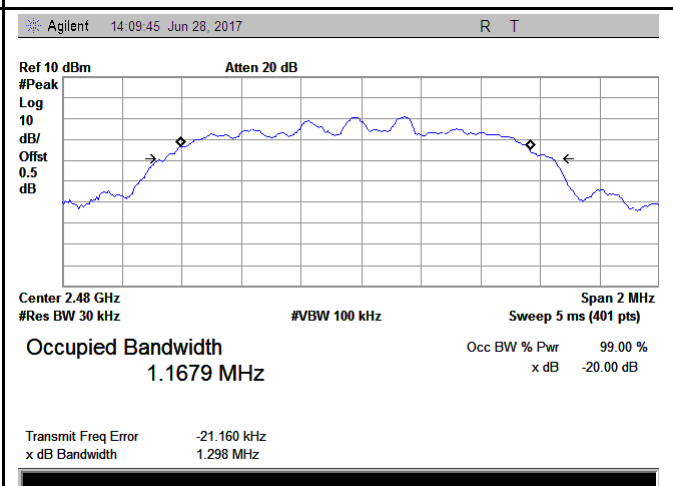
GFSK - High Channel



$\pi/4$ DPSK - Low Channel



$\pi/4$ DPSK - Middle Channel



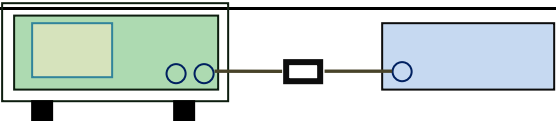
$\pi/4$ DPSK - High Channel

6.4 Peak Output Power

Temperature	22°C
Relative Humidity	55%
Atmospheric Pressure	1025mbar
Test date :	June 28, 2017
Tested By :	Vera Zhang

Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(b) (3)	a)	FHSS in 2400-2483.5MHz with ≥ 75 channels: ≤ 1 Watt	<input checked="" type="checkbox"/>
	b)	FHSS in 5725-5850MHz: ≤ 1 Watt	<input type="checkbox"/>
	c)	For all other FHSS in the 2400-2483.5MHz band: ≤ 0.125 Watt.	<input checked="" type="checkbox"/>
	d)	FHSS in 902-928MHz with ≥ 50 channels: ≤ 1 Watt	<input type="checkbox"/>
	e)	FHSS in 902-928MHz with ≥ 25 & < 50 channels: ≤ 0.25 Watt	<input type="checkbox"/>
	f)	DTS in 902-928MHz, 2400-2483.5MHz: ≤ 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.</p> <p><u>Use the following spectrum analyzer settings:</u></p> <ul style="list-style-type: none"> - Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel - RBW > the 20 dB bandwidth of the emission being measured - VBW \geq RBW - Sweep = auto - Detector function = peak - Trace = max hold - Allow the trace to stabilize.
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	<ul style="list-style-type: none"> - 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.
Remark	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Test Data Yes N/A

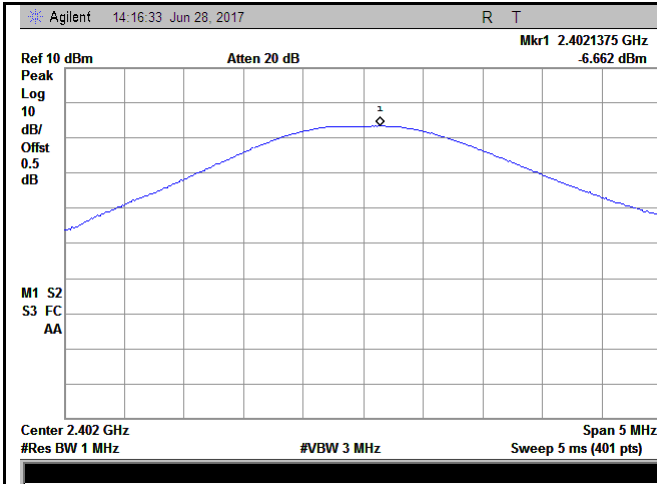
Test Plot Yes (See below) N/A

Peak Output Power measurement result

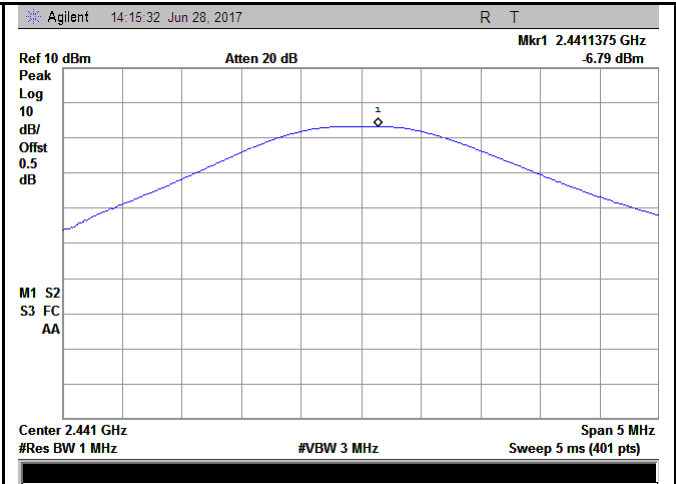
Type	Modulation	CH	Frequency (MHz)	Conducted Power (dBm)	Limit (mW)	Result
Output power	GFSK	Low	2402	-6.662	1000	Pass
		Mid	2441	-6.790	1000	Pass
		High	2480	-6.968	1000	Pass
	$\pi/4$ DQPSK	Low	2402	-6.110	125	Pass
		Mid	2441	-5.547	125	Pass
		High	2480	-5.768	125	Pass

Test Plots

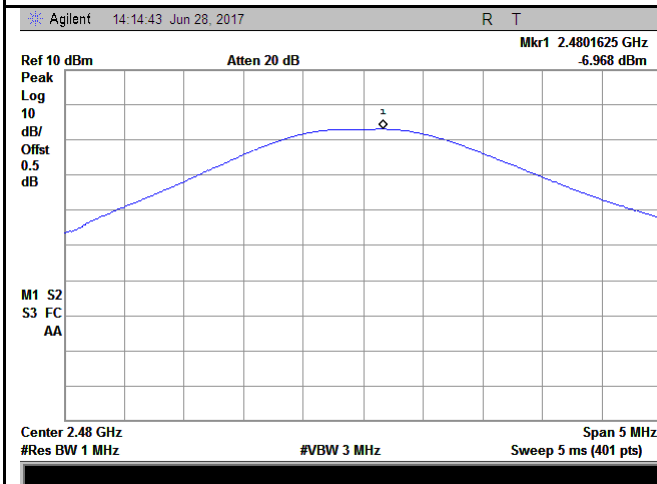
Output Power measurement result



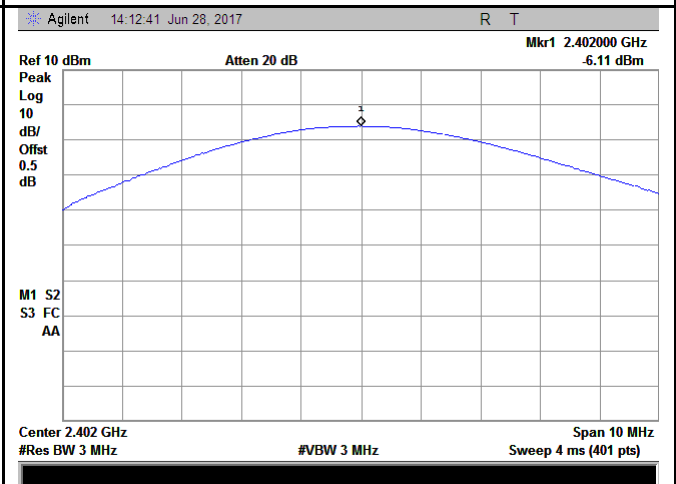
GFSK Output power - Low CH 2402



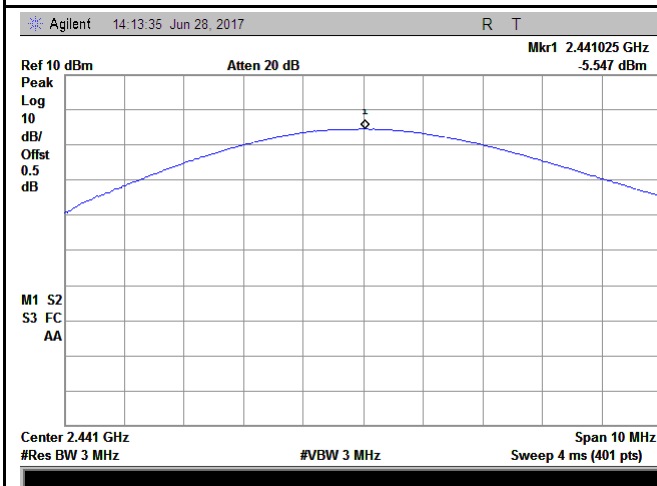
GFSK Output power - Mid CH 2441



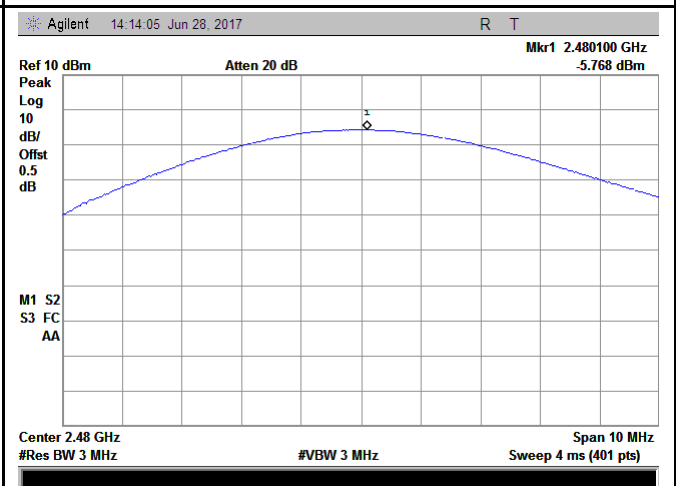
GFSK Output power - High CH 2480



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



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

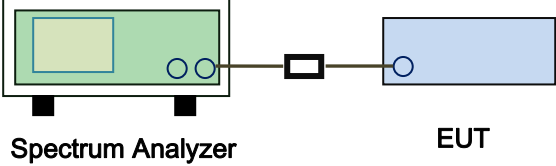


$\pi/4$ DQPSK Output power - High CH 2480

6.5 Number of Hopping Channel

Temperature	22°C
Relative Humidity	55%
Atmospheric Pressure	1025mbar
Test date :	June 28, 2017
Tested By :	Vera Zhang

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"> - Span = the frequency band of operation - RBW ≥ 1% of the span - VBW ≥ RBW - Sweep = auto - Detector function = peak - Trace = max hold - Allow trace to fully stabilize. - 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). 		
Remark			
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail		

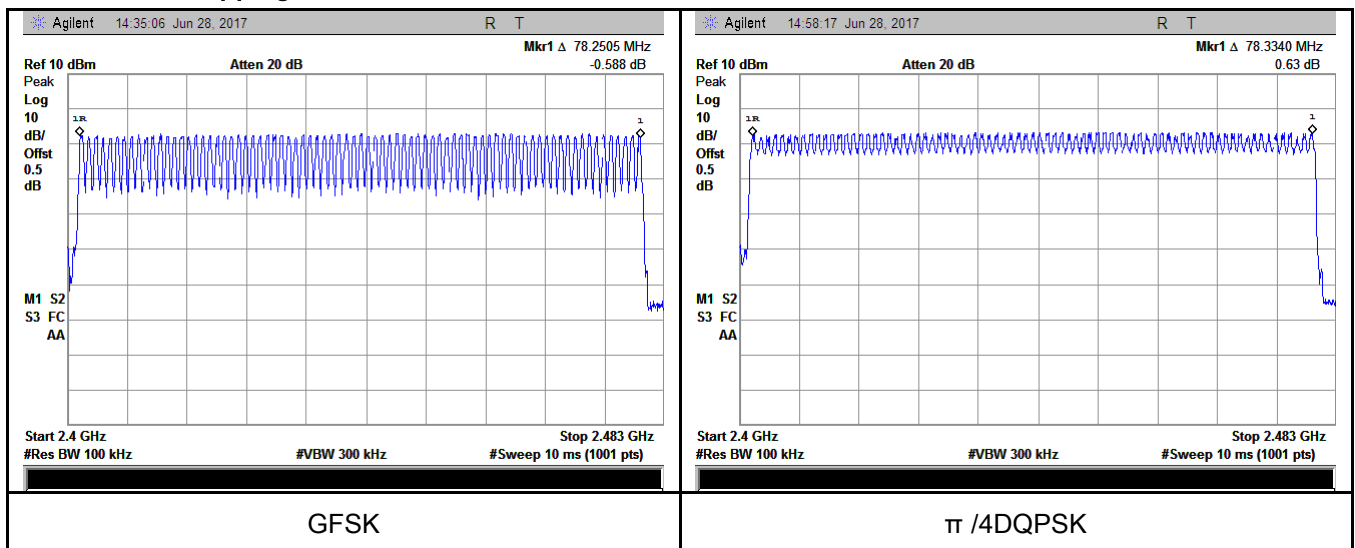
Test Data Yes N/A
 Test Plot Yes (See below) N/A

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

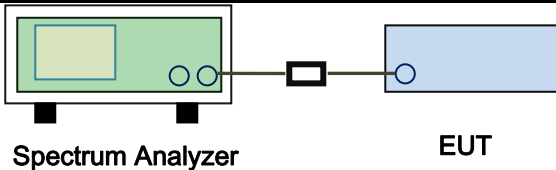
Number of Hopping Channels measurement result



6.6 Time of Occupancy (Dwell Time)

Temperature	22°C
Relative Humidity	55%
Atmospheric Pressure	1025mbar
Test date :	June 28, 2017
Tested By :	Vera 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"> - Span = zero span, centered on a hopping channel - RBW = 1 MHz - VBW ≥ RBW - Sweep = as necessary to capture the entire dwell time per hopping channel - Detector function = peak - Trace = max hold - use the marker-delta function to determine the dwell time 		
Remark			
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail		

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

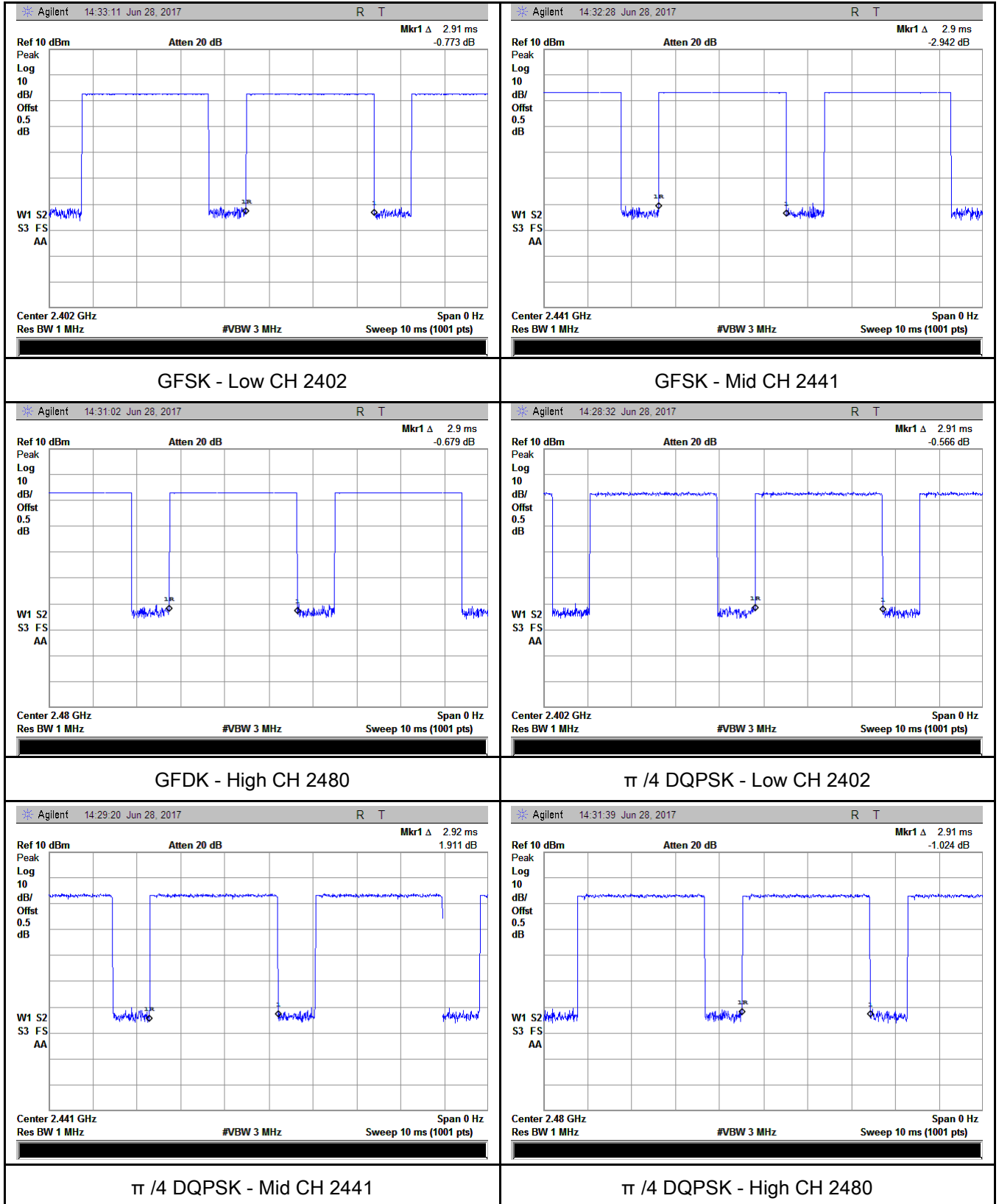
Dwell Time measurement result

Type	Modulation	CH	Pulse Width (ms)	Dwell Time (ms)	Limit (ms)	Result
Dwell Time	GFSK	Low	2.91	310.400	400	Pass
		Mid	2.90	309.333	400	Pass
		High	2.90	309.333	400	Pass
	π /4 DQPSK	Low	2.91	310.400	400	Pass
		Mid	2.92	311.467	400	Pass
		High	2.91	310.400	400	Pass

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

Test Plots

Dwell Time measurement result

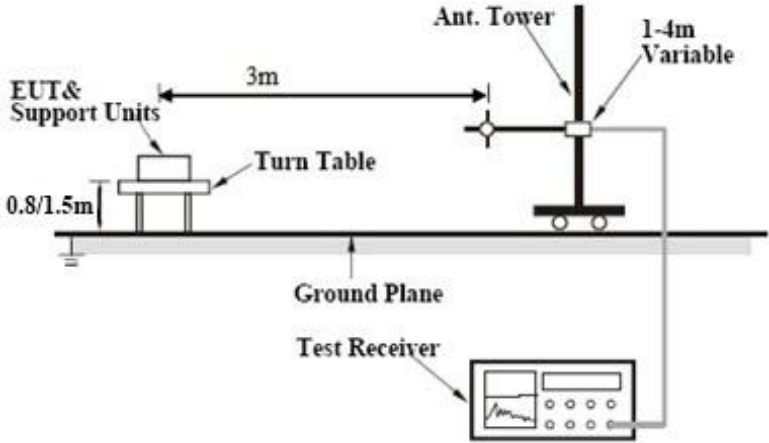


6.7 Band Edge & Restricted Band

Temperature	22°C
Relative Humidity	55%
Atmospheric Pressure	1025mbar
Test date :	June 28, 2017
Tested By :	Vera 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	
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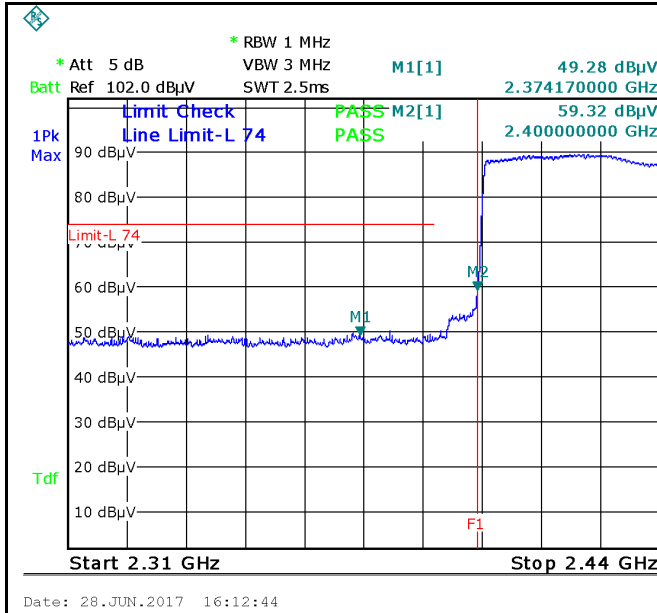
Test Procedure	<p>The test follows FCC Public Notice DA 00-705 Measurement Guidelines. Radiated Method Only</p> <ul style="list-style-type: none"> - 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator. - 2. Position the 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,
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	<p>and make sure the instrument is operated in its linear range.</p> <ul style="list-style-type: none"> - 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"> a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasiy Peak detection at frequency below 1GHz. 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. 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. - 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. - 5. Repeat above procedures until all measured frequencies were complete.
Remark	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

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

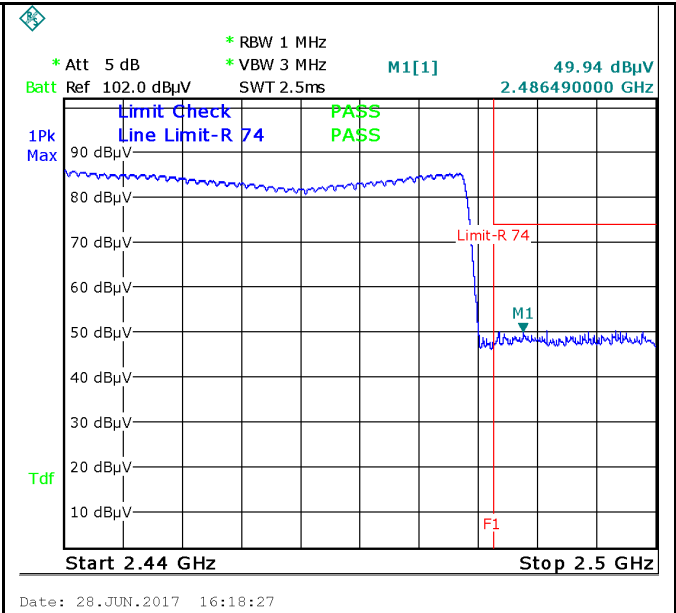
Test Plots

GFSK Mode:



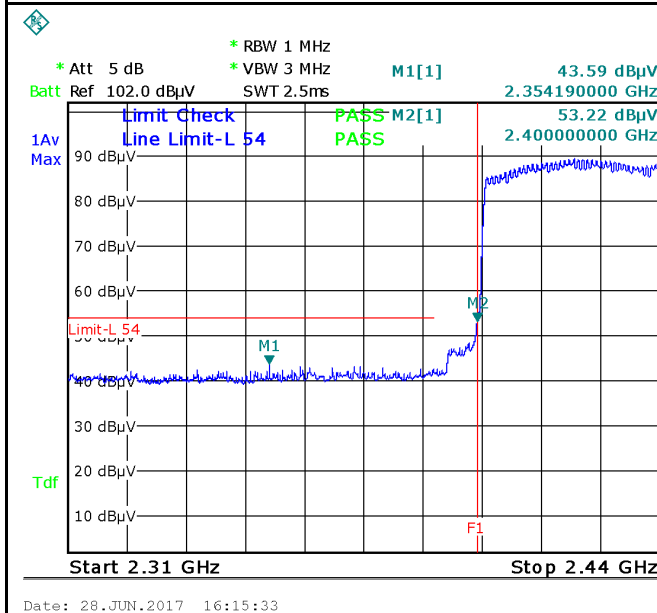
GFSK-Hopping Left Side-PK

Note: F1 is frequency 2400MHz



GFSK-Hopping Right Side-PK

Note: F1 is frequency 2483.5MHz

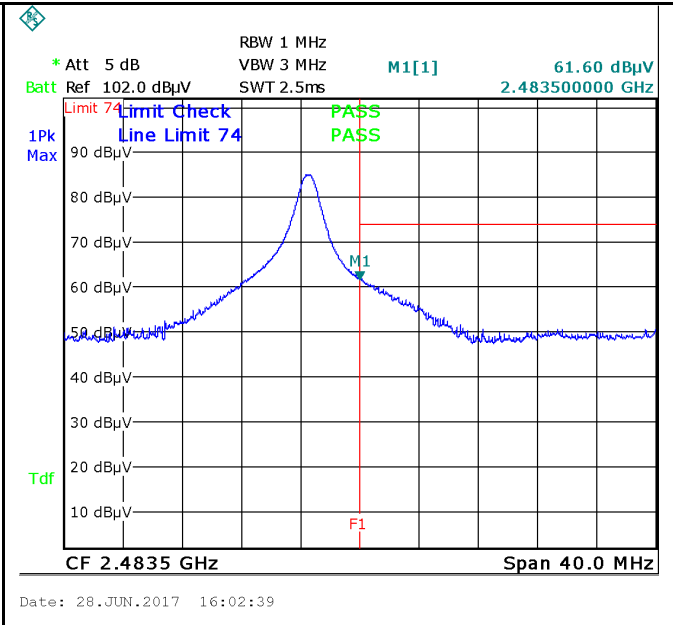
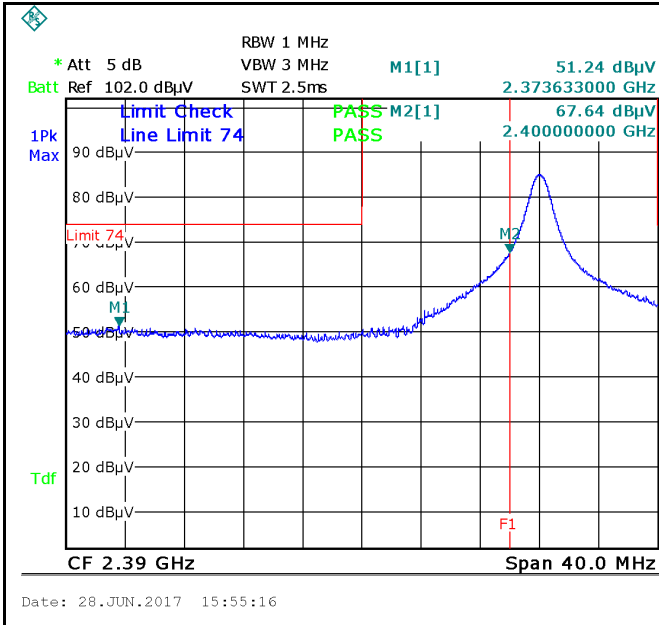


GFSK-Hopping Left Side-AV

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

GFSK-Hopping Right Side-AV

Note: Both Horizontal and vertical polarities were investigated.

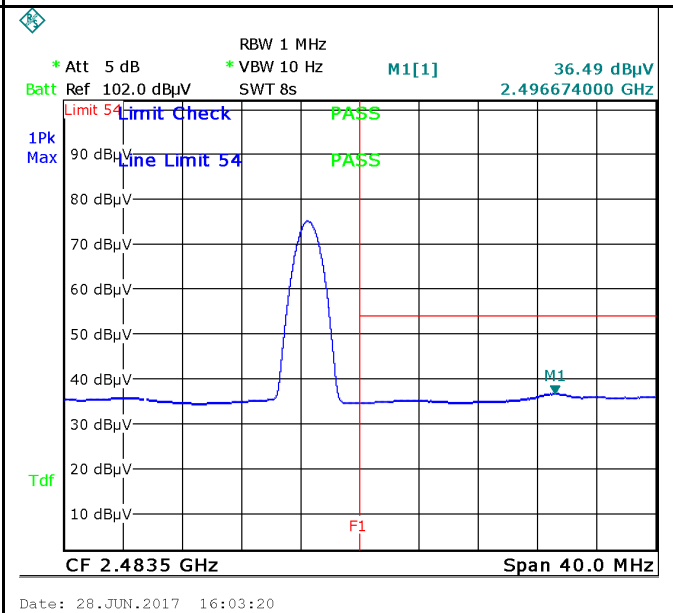
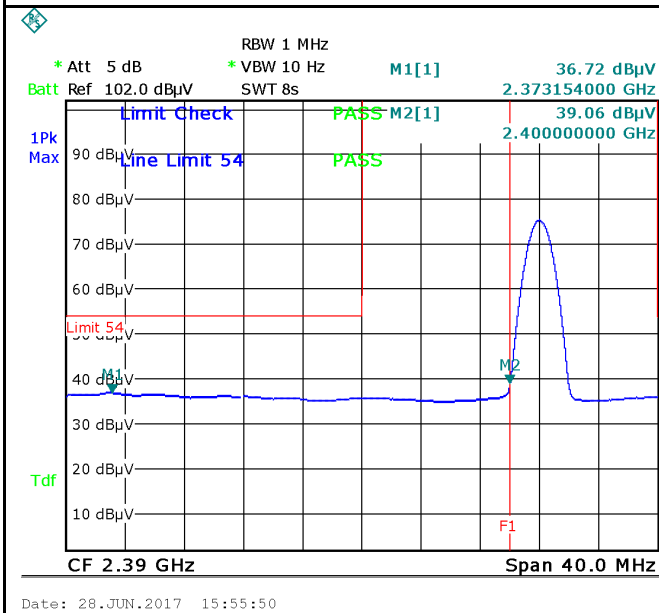


GFSK-Left Side-PK

Note: F1 is frequency 2400MHz

GFSK-Right Side-PK

Note: F1 is frequency 2483.5MHz

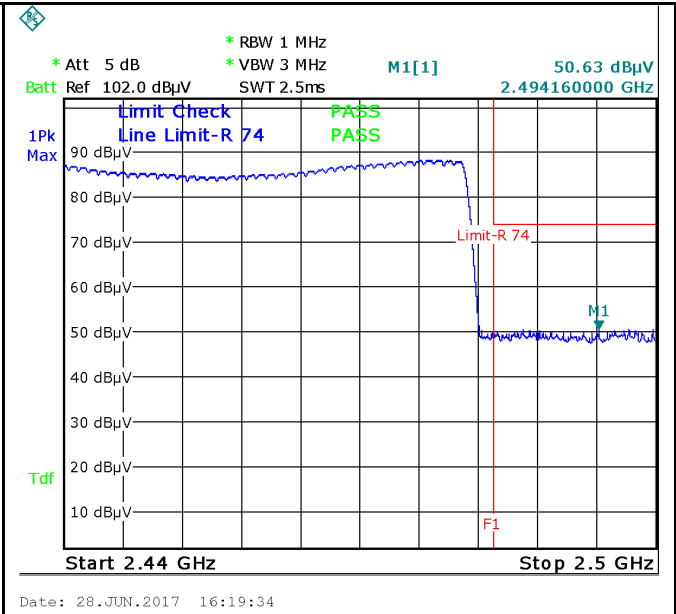
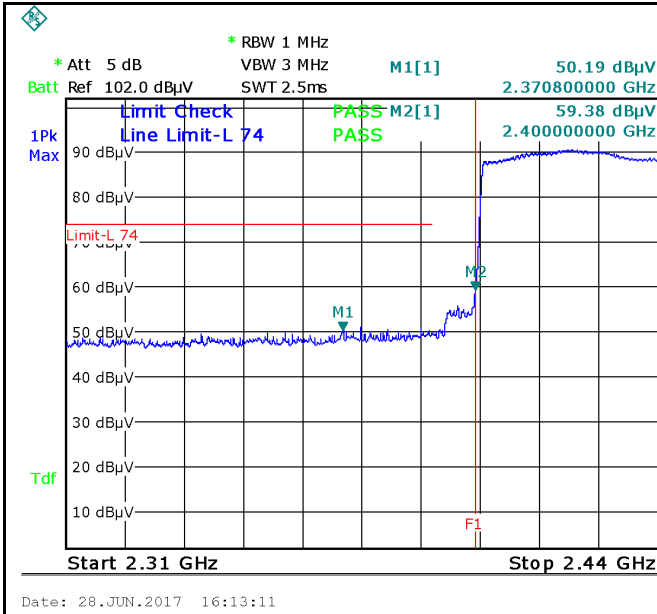


GFSK-Left Side-AV

GFSK-Right Side-AV

Note: Both Horizontal and vertical polarities were investigated.

π / 4 DQPSK Mode:

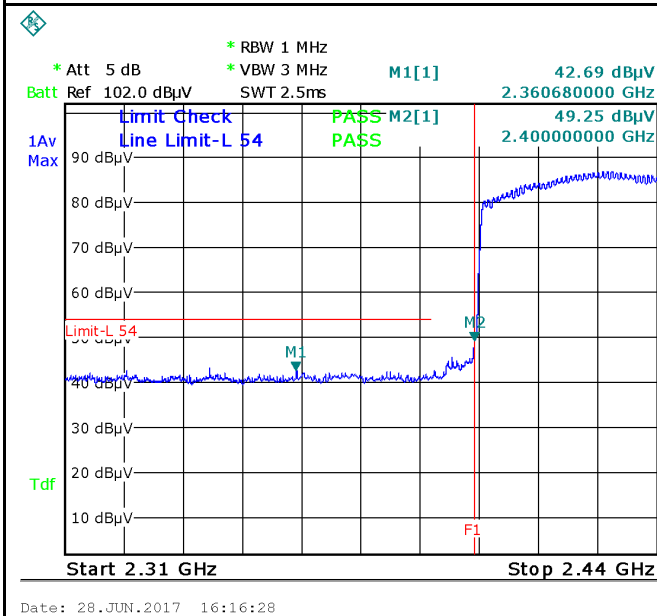


π / 4 DQPSK-Hopping Left Side-PK

Note: F1 is frequency 2400MHz

π / 4 DQPSK-Hopping Right Side-PK

Note: F1 is frequency 2483.5MHz

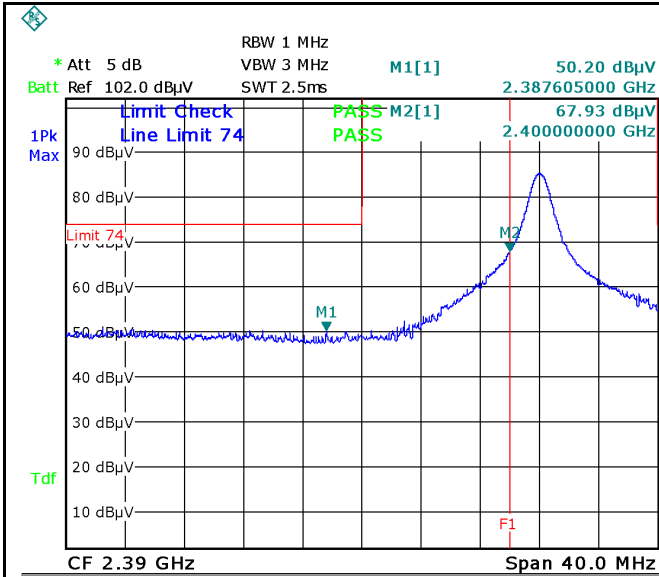


Note: (no need if PK value less than the AV limit)

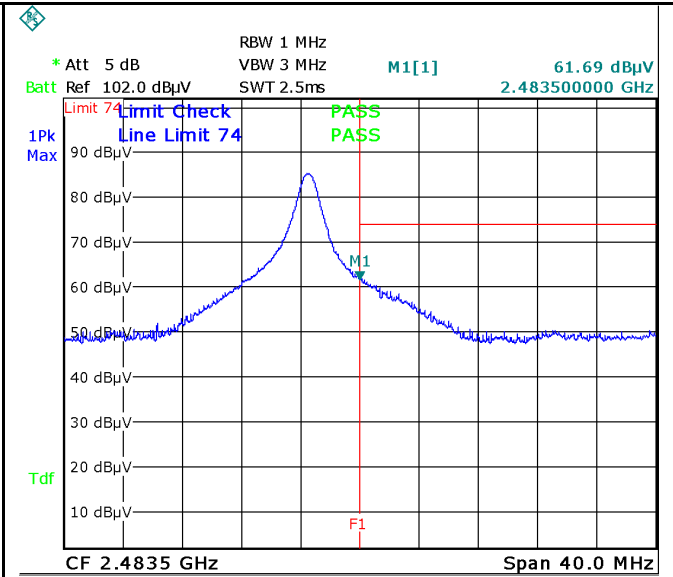
π / 4 DQPSK-Hopping Left-AV

π / 4 DQPSK-Hopping Right-AV

Note: Both Horizontal and vertical polarities were investigated.



Date: 28.JUN.2017 15:58:42



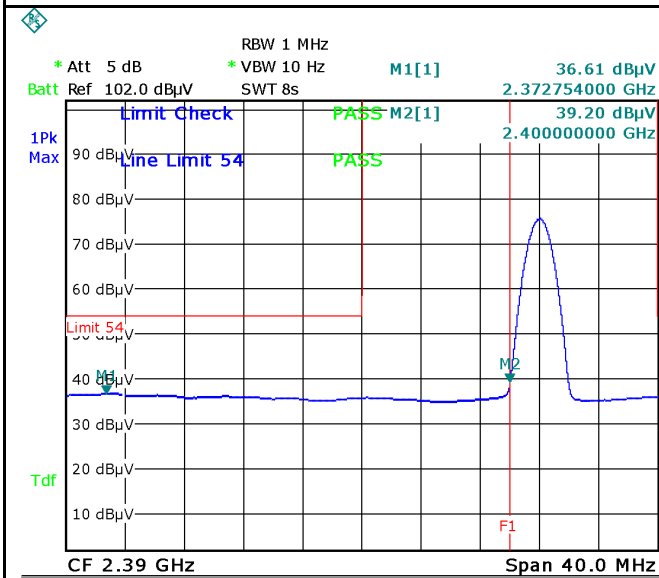
Date: 28.JUN.2017 16:05:44

π / 4 DQPSK-Left Side-PK

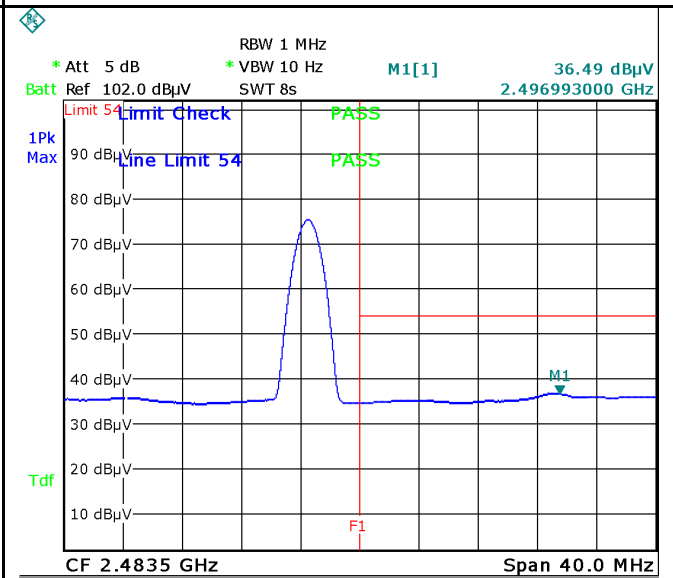
Note: F1 is frequency 2400MHz

π / 4 DQPSK-Right Side-PK

Note: F1 is frequency 2483.5MHz



Date: 28.JUN.2017 15:57:56



Date: 28.JUN.2017 16:05:08

π / 4 DQPSK-Left Side-AV

π / 4 DQPSK-Right Side-AV

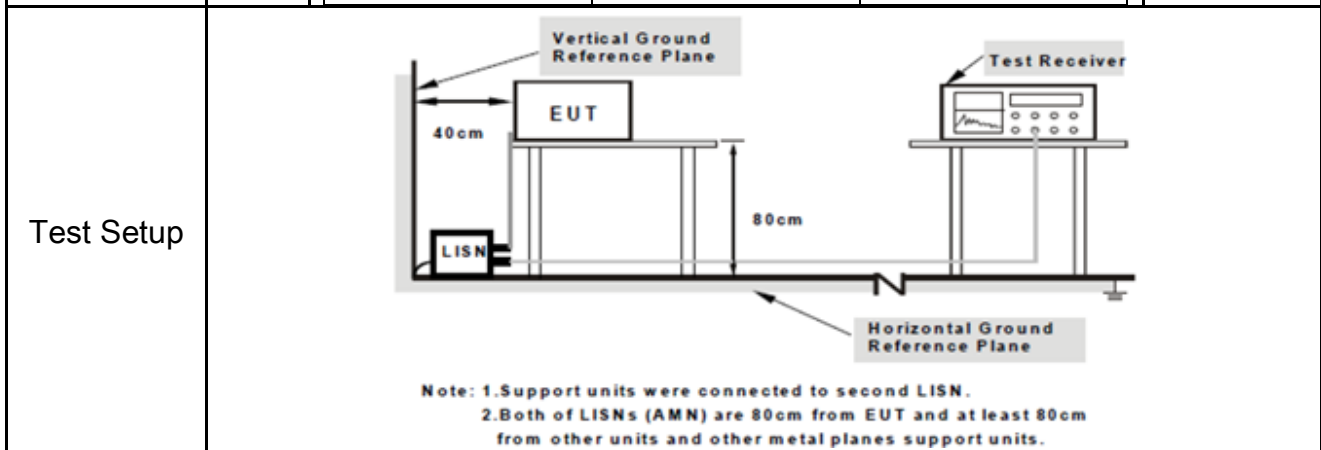
Note: Both Horizontal and vertical polarities were investigated.

6.8 AC Power Line Conducted Emissions

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

Requirement(s):

Spec	Item	Requirement	Applicable														
47CFR§15.207, RSS210 (A8.1)	a)	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 μ H/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequencies ranges.	☐														
		<table border="1"> <thead> <tr> <th rowspan="2">Frequency ranges (MHz)</th> <th colspan="2">Limit (dBμV)</th> </tr> <tr> <th>QP</th> <th>Average</th> </tr> </thead> <tbody> <tr> <td>0.15 ~ 0.5</td> <td>66 – 56</td> <td>56 – 46</td> </tr> <tr> <td>0.5 ~ 5</td> <td>56</td> <td>46</td> </tr> <tr> <td>5 ~ 30</td> <td>60</td> <td>50</td> </tr> </tbody> </table>		Frequency ranges (MHz)	Limit (dB μ V)		QP	Average	0.15 ~ 0.5	66 – 56	56 – 46	0.5 ~ 5	56	46	5 ~ 30	60	50
		Frequency ranges (MHz)			Limit (dB μ V)												
				QP	Average												
0.15 ~ 0.5	66 – 56	56 – 46															
0.5 ~ 5	56	46															
5 ~ 30	60	50															



Procedure	<ol style="list-style-type: none"> 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. The power supply for the EUT was fed through a 50W/50mH EUT LISN, connected to filtered mains. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss
-----------	---

	<p>coaxial cable.</p> <ol style="list-style-type: none"> 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 type="checkbox"/> Pass <input type="checkbox"/> Fail <input checked="" type="checkbox"/> N/A

Test Data Yes N/A

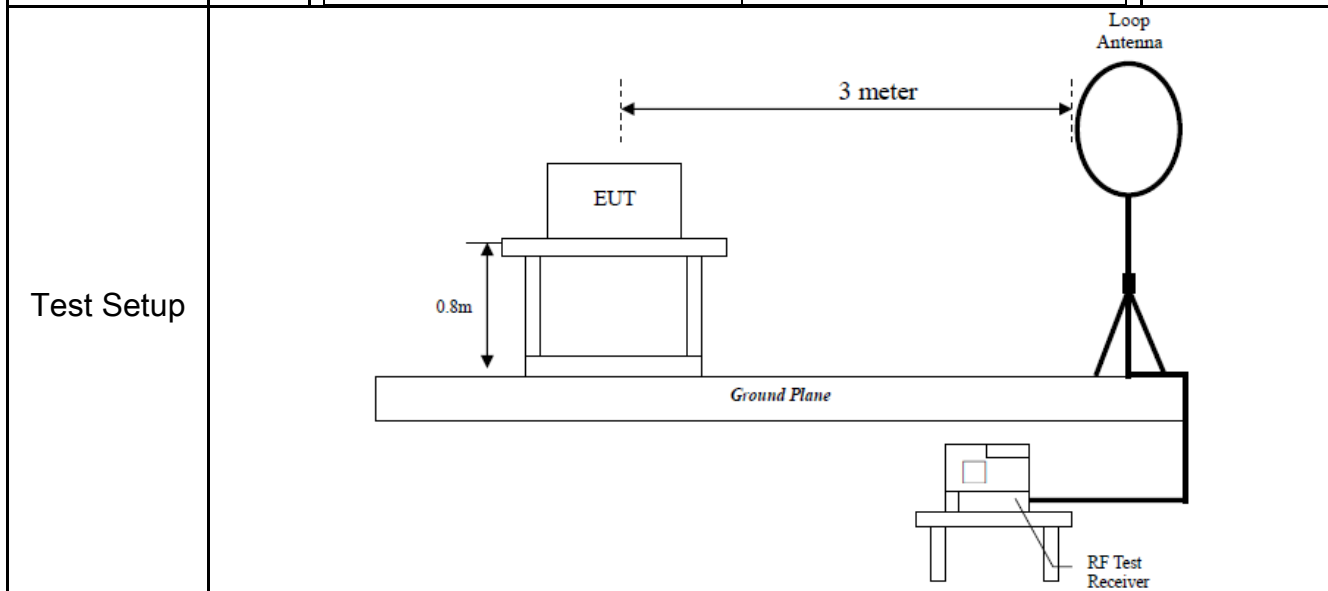
Test Plot Yes (See below) N/A

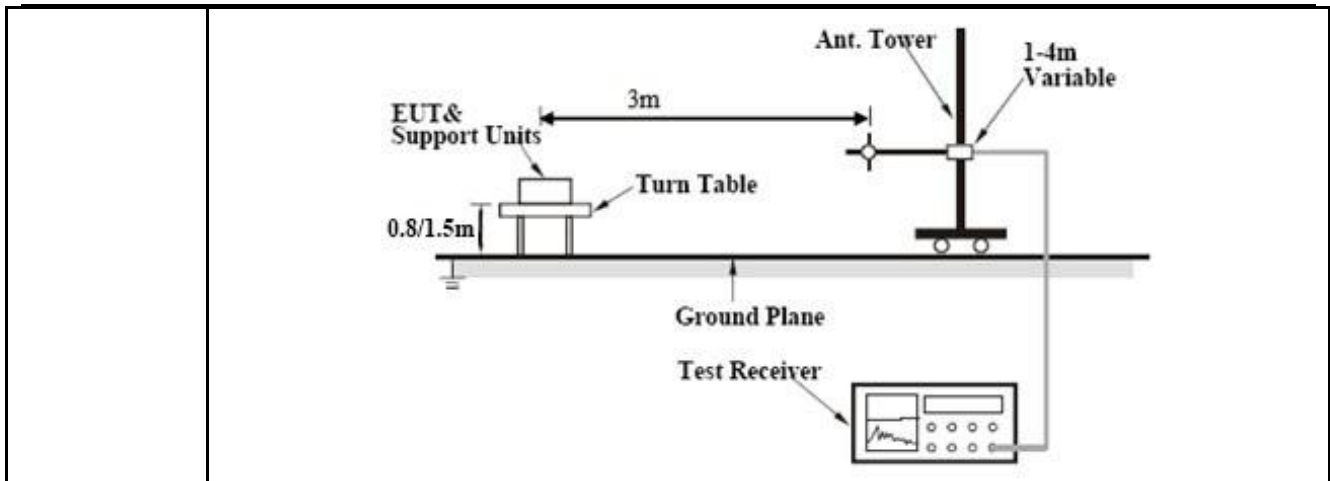
6.9 Radiated Emissions & Restricted Band

Temperature	22°C
Relative Humidity	55%
Atmospheric Pressure	1025mbar
Test date :	June 28, 2017
Tested By :	Vera 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	<input checked="" type="checkbox"/>																
		<table border="1"> <thead> <tr> <th>Frequency range (MHz)</th> <th>Field Strength ($\mu\text{V}/\text{m}$)</th> </tr> </thead> <tbody> <tr> <td>0.009~0.490</td> <td>2400/F(KHz)</td> </tr> <tr> <td>0.490~1.705</td> <td>24000/F(KHz)</td> </tr> <tr> <td>1.705~30.0</td> <td>30</td> </tr> <tr> <td>30 – 88</td> <td>100</td> </tr> <tr> <td>88 – 216</td> <td>150</td> </tr> <tr> <td>216 960</td> <td>200</td> </tr> <tr> <td>Above 960</td> <td>500</td> </tr> </tbody> </table>		Frequency range (MHz)	Field Strength ($\mu\text{V}/\text{m}$)	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 ($\mu\text{V}/\text{m}$)															
		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																		





Procedure

- The EUT was switched on and allowed to warm up to its normal operating condition.
- 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:
 - Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
 - The EUT was then rotated to the direction that gave the maximum emission.
 - Finally, the antenna height was adjusted to the height that gave the maximum emission.
- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi Peak detection at frequency below 1GHz.
- 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.
- Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.

Remark

Result Pass Fail

Test Data Yes N/A

Test Plot Yes (See below) N/A

Test Result:

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

Frequency range: 9KHz - 30MHz

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

Note:

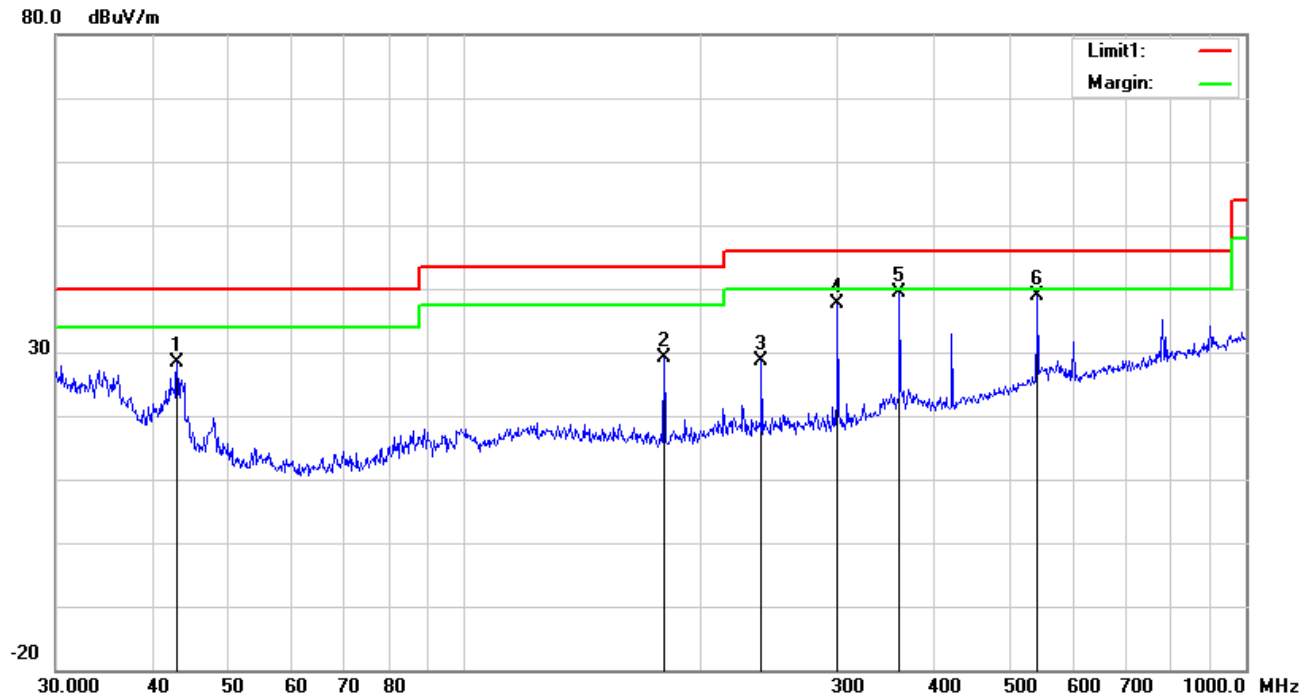
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

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

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

Test Mode:	Bluetooth Mode
-------------------	-----------------------

30MHz -1GHz

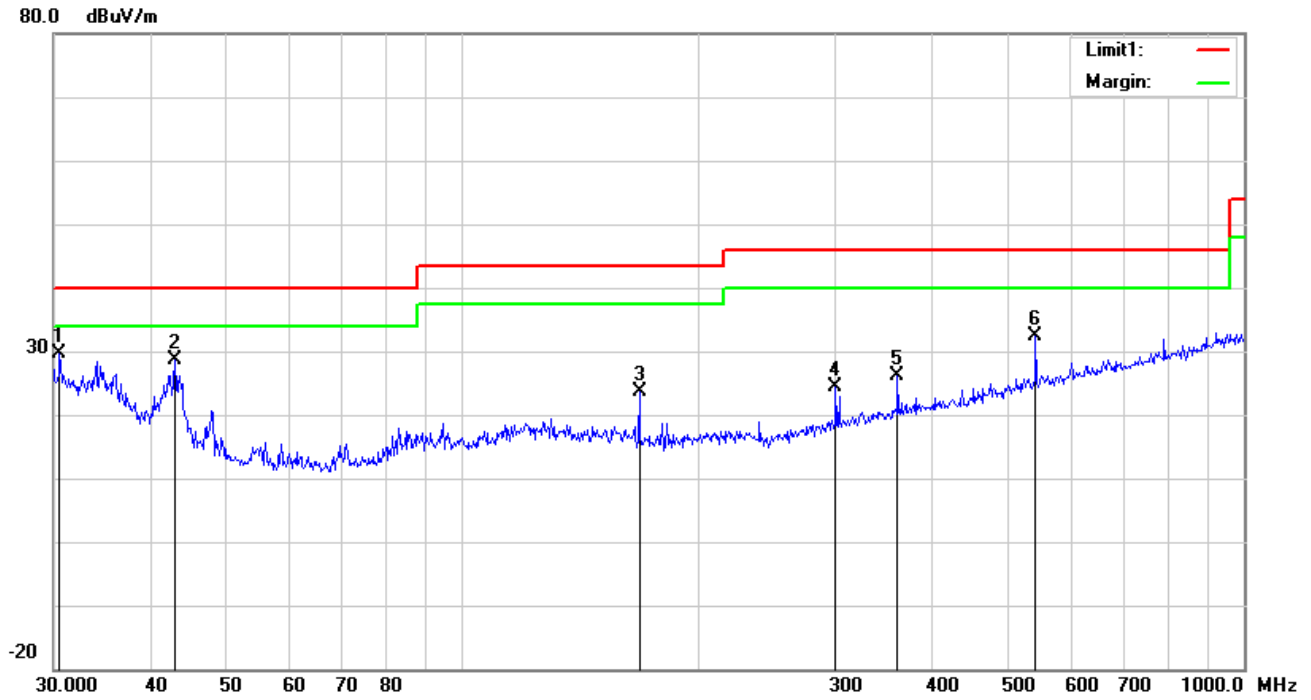


Test Data

Horizontal Polarity Plot @3m

No.	P/L	Frequency	Reading	Detect or	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
		(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	()
1	H	42.8998	37.85	peak	11.99	22.29	0.77	28.32	40.00	-11.68	100	121
2	H	180.0165	38.98	peak	11.00	22.25	1.36	29.09	43.50	-14.41	100	15
3	H	239.9873	37.71	peak	11.54	22.31	1.67	28.61	46.00	-17.39	100	212
4	H	300.3673	44.63	peak	13.61	22.29	1.79	37.74	46.00	-8.26	100	319
5	H	360.4477	44.54	peak	14.87	22.12	2.03	39.32	46.00	-6.68	100	41
6	H	541.3725	39.72	peak	18.28	21.71	2.47	38.76	46.00	-7.24	100	264

30MHz -1GHz



Test Data

Vertical Polarity Plot @3m

No.	P/L	Frequency (MHz)	Reading (dBuV/m)	Detect or	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degr ee ()
1	V	30.5306	30.17	peak	20.99	22.28	0.63	29.51	40.00	-10.49	100	87
2	V	42.8998	38.07	peak	11.99	22.29	0.77	28.54	40.00	-11.46	100	310
3	V	168.4138	32.52	peak	11.93	22.26	1.36	23.55	43.50	-19.95	100	90
4	V	300.3673	31.25	peak	13.61	22.29	1.79	24.36	46.00	-21.64	100	73
5	V	360.4477	31.43	peak	14.87	22.12	2.03	26.21	46.00	-19.79	200	195
6	V	541.3725	33.38	peak	18.28	21.71	2.47	32.42	46.00	-13.58	100	239

Above 1GHz

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

Low Channel: $\pi/4$ DQPSK Mode (Worst Case) (2402 MHz)

Frequency (MHz)	S.A. Reading (dB μ V)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
4804	43.15	AV	V	33.39	7.22	48.46	35.3	54	-18.7
4804	42.61	AV	H	33.39	7.22	48.46	34.76	54	-19.24
4804	52.87	PK	V	33.39	7.22	48.46	45.02	74	-28.98
4804	50.69	PK	H	33.39	7.22	48.46	42.84	74	-31.16
4403	53.25	AV	V	32.4	6.69	48.97	43.37	54	-10.63
4403	50.48	AV	H	32.4	6.69	48.97	40.6	54	-13.4
4403	62.35	PK	V	32.4	6.69	48.97	52.47	74	-21.53
4403	59.87	PK	H	32.4	6.69	48.97	49.99	74	-24.01

Middle Channel: $\pi/4$ DQPSK Mode (Worst Case) (2441 MHz)

Frequency (MHz)	S.A. Reading (dB μ V)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
4882	45.22	AV	V	33.62	7.53	48.36	38.01	54	-15.99
4882	43.97	AV	H	33.62	7.53	48.36	36.76	54	-17.24
4882	58.16	PK	V	33.62	7.53	48.36	50.95	74	-23.05
4882	57.3	PK	H	33.62	7.53	48.36	50.09	74	-23.91
7514	46.19	AV	V	37.61	7.61	48.21	43.2	54	-10.8
7514	44.28	AV	H	37.61	7.61	48.21	41.29	54	-12.71
7514	65.87	PK	V	37.61	7.61	48.21	62.88	74	-11.12
7514	63.42	PK	H	37.61	7.61	48.21	60.43	74	-13.57

High Channel: $\pi/4$ DQPSK Mode (Worst Case) (2480 MHz)

Frequency (MHz)	S.A. Reading (dB μ V)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
4960	44.12	AV	V	33.89	7.86	48.31	37.56	54	-16.44
4960	42.87	AV	H	33.89	7.86	48.31	36.31	54	-17.69
4960	58.94	PK	V	33.89	7.86	48.31	52.38	74	-21.62
4960	56.28	PK	H	33.89	7.86	48.31	49.72	74	-24.28
15520	31.57	AV	V	40.2	16.91	45.7	42.98	54	-11.02
15520	29.64	AV	H	40.2	16.91	45.7	41.05	54	-12.95
15520	46.59	PK	V	40.2	16.91	45.7	58	74	-16
15520	44.38	PK	H	40.2	16.91	45.7	55.79	74	-18.21

Note:

- 1, The testing has been conformed to $10 \times 2480 \text{ MHz} = 24,800 \text{ MHz}$
- 2, All other emissions more than 30 dB below the limit
- 3, X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.

Annex A. TEST INSTRUMENT

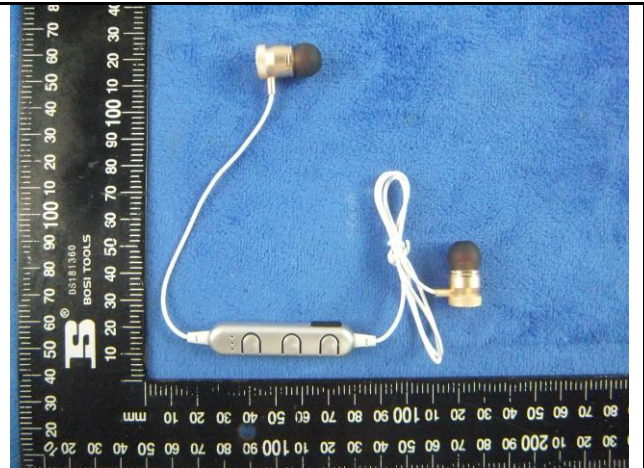
Instrument	Model	Serial #	Cal Date	Cal Due	In use
AC Line Conducted					
EMI test receiver	ESCS30	8471241027	09/16/2016	09/15/2017	<input type="checkbox"/>
Line Impedance	LI-125A	191106	09/24/2016	09/23/2017	<input type="checkbox"/>
Line Impedance	LI-125A	191107	09/24/2016	09/23/2017	<input type="checkbox"/>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

Annex B. EUT And Test Setup Photographs

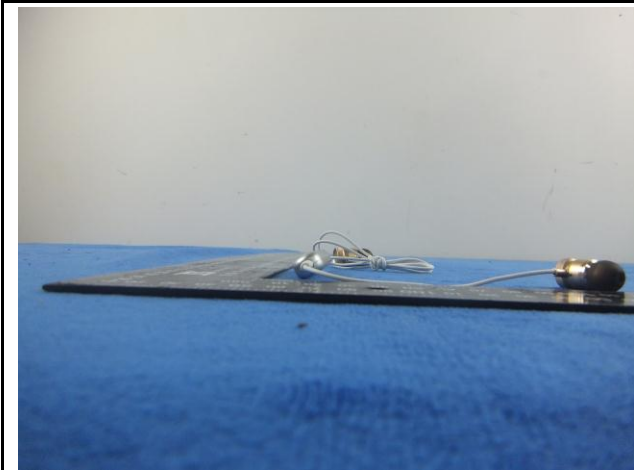
Annex B.i. Photograph: EUT External Photo



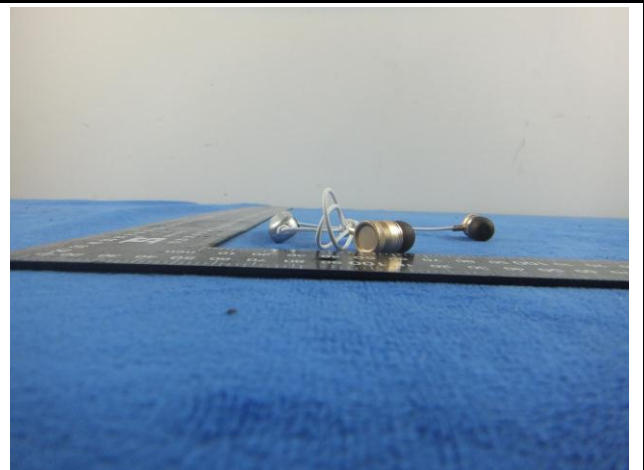
EUT - Front View



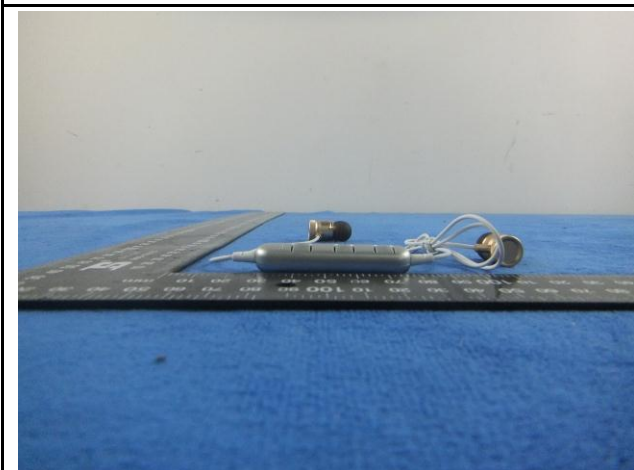
EUT - Rear View



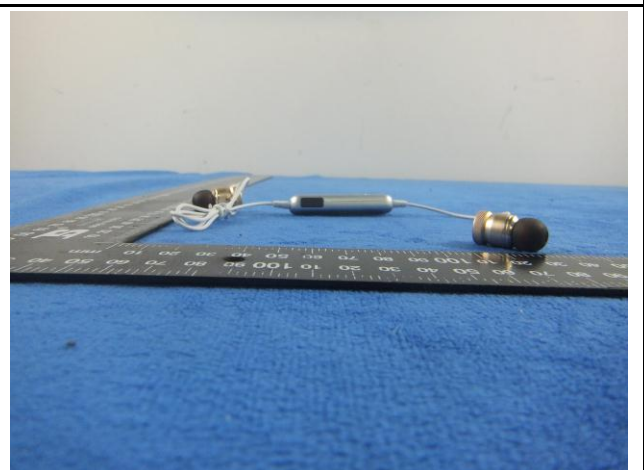
EUT - Top View



EUT - Bottom View

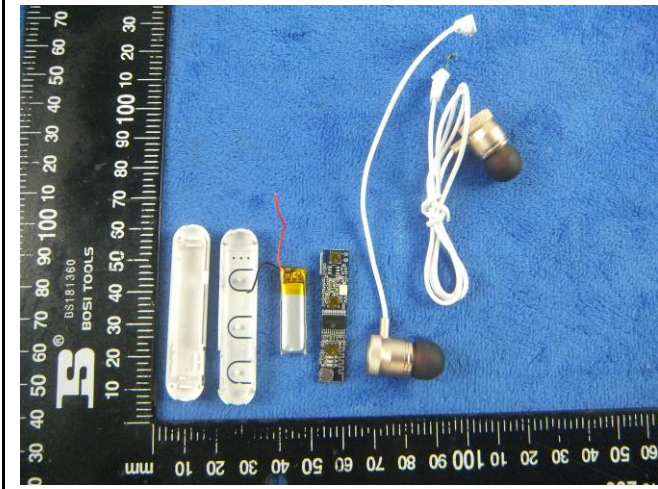


EUT - Left View

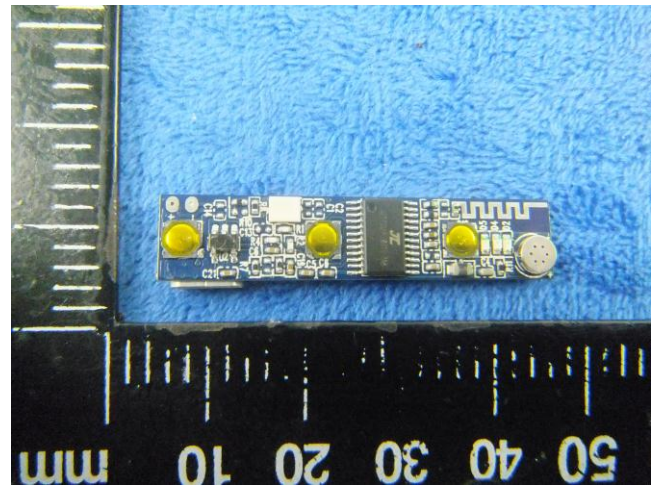


EUT - Right View

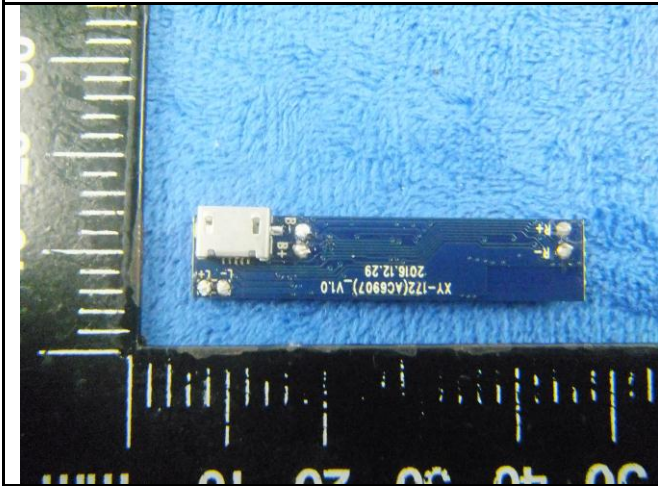
Annex B.ii. Photograph: EUT Internal Photo



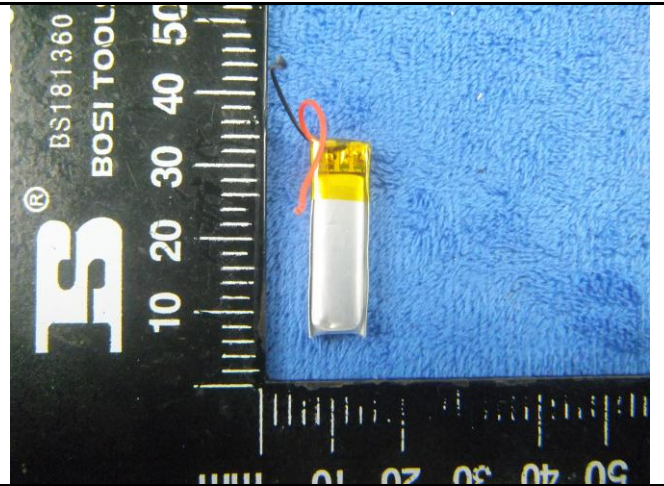
Cover Off - Top View



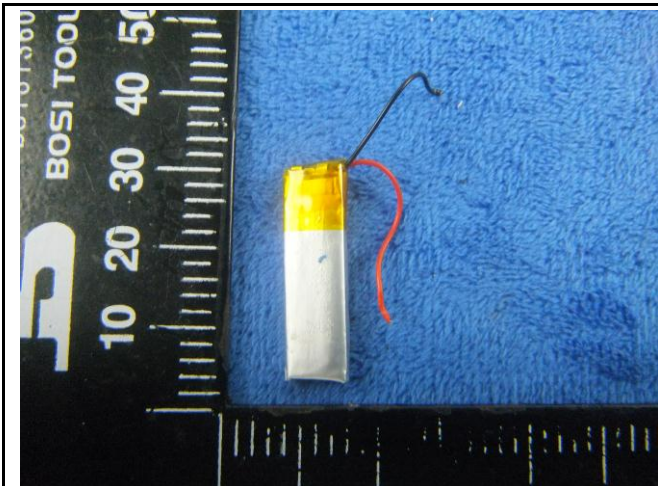
Mainboard - Front View



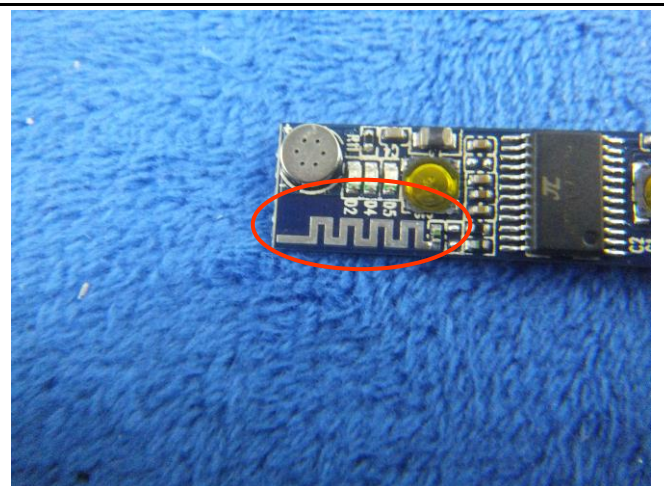
Mainboard - Rear View



Battery - Front View

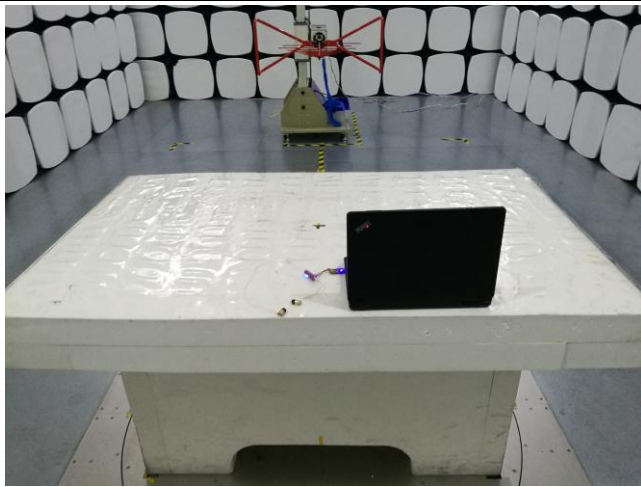


Battery - Rear View

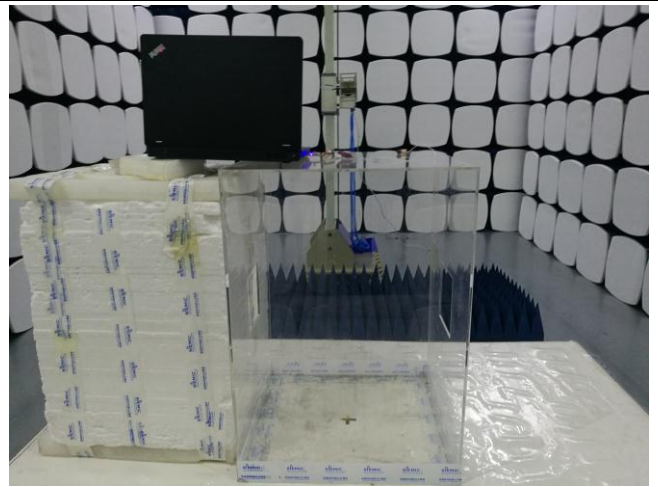


BT - Antenna View

Annex B.iii. Photograph: Test Setup Photo



Radiated Spurious Emissions Test Setup Below 1GHz

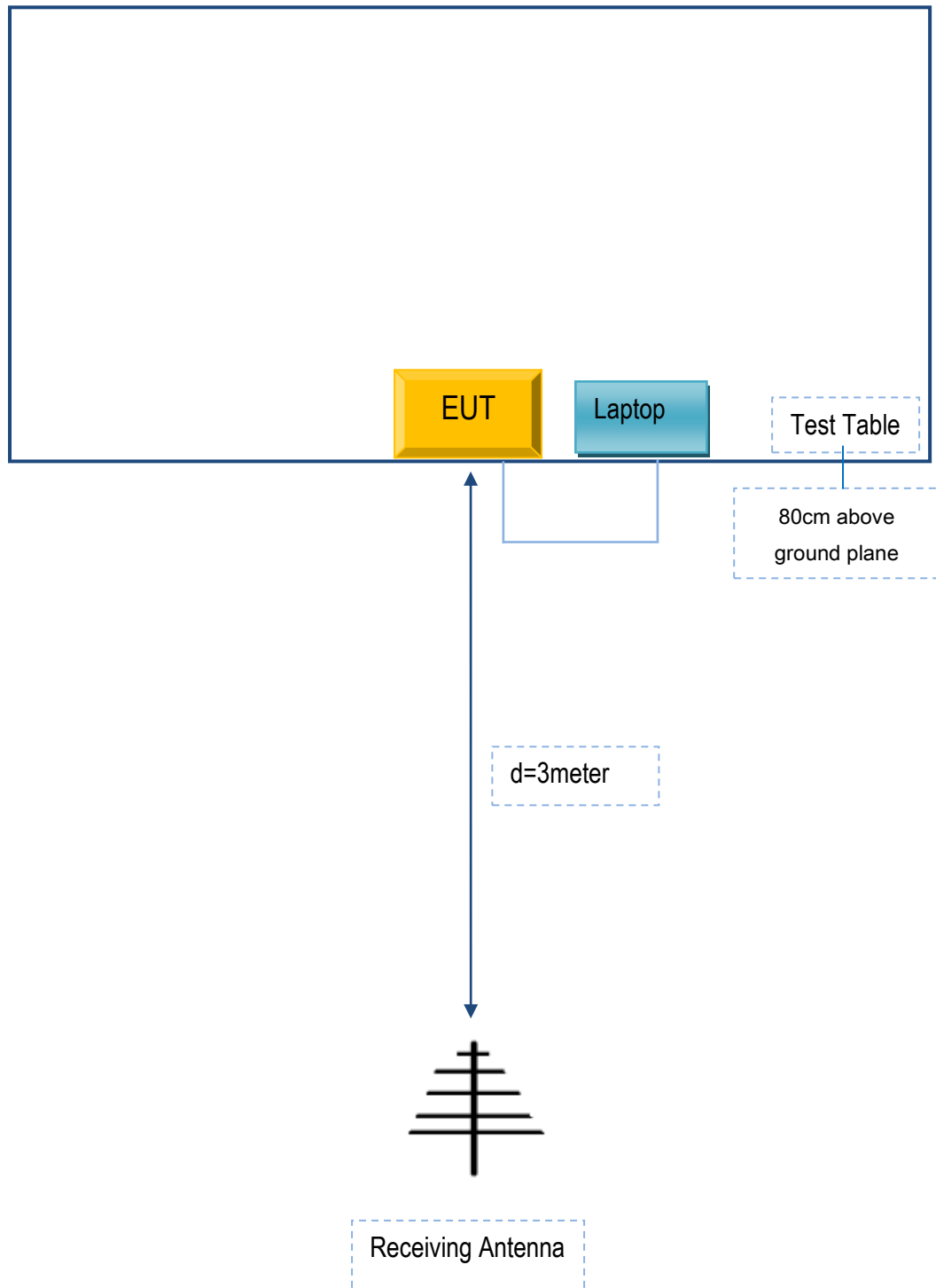


Radiated Spurious Emissions Test Setup Above
1GHz

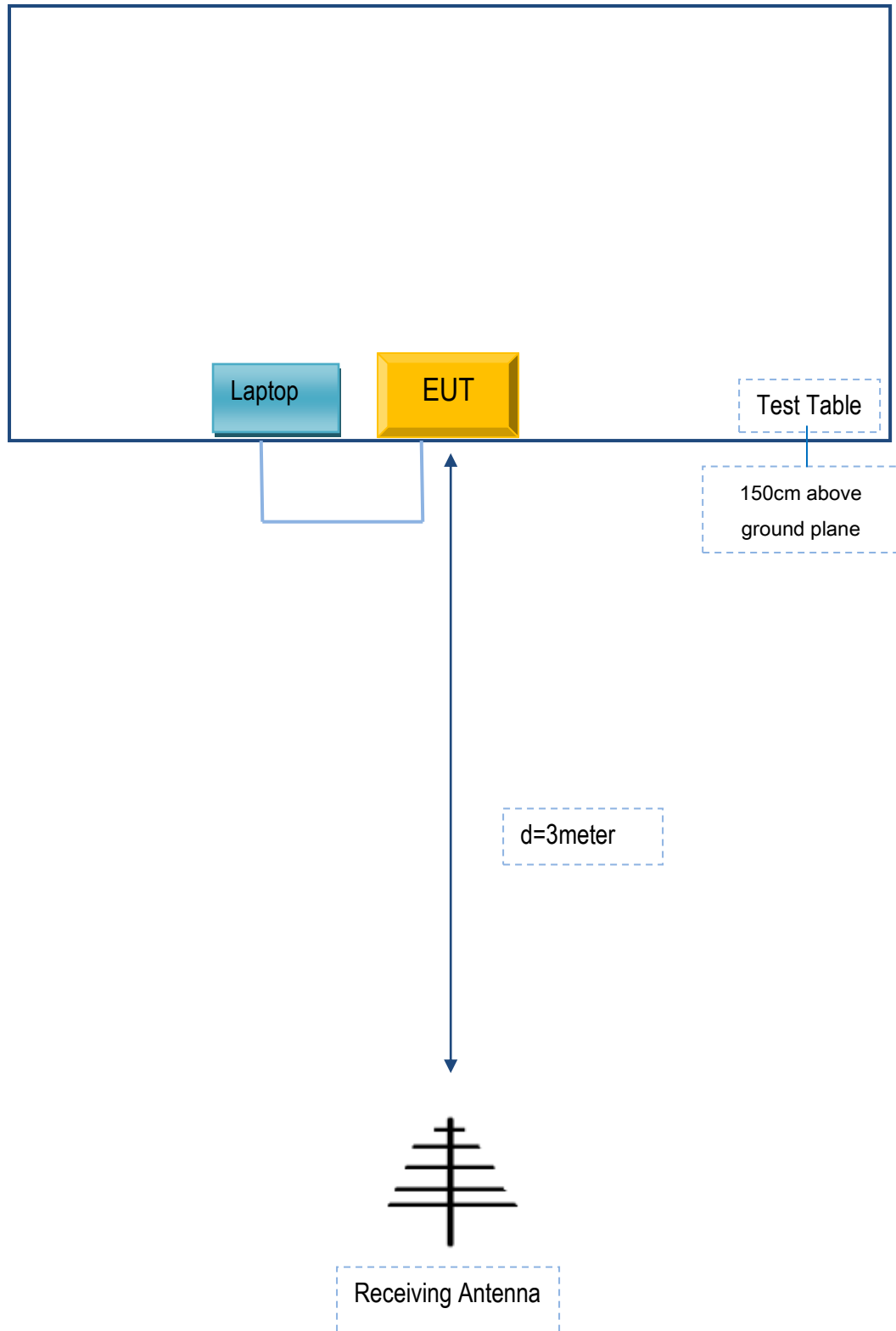
Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

Annex C.ii. TEST SET UP BLOCK

Block Configuration Diagram for 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
DCA	Adaptor	E2164A	X20170304
Lenovo	Laptop	E40	LR-1EHRX

Test Report	17070487-FCC-R
Page	46 of 47

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

Please see the attachment

Annex E. DECLARATION OF SIMILARITY

KINGRAY ELECTRONICS Co., LTD

To: SIEMIC ,775 Montague Expressway, Milpitas, CA 95035,USA

Declaration Letter

Dear Sir,

For our business issue and marketing requirement, we would like to list 17 model numbers on the **FCCID** certificates and reports, as following:

Model No: BB487

We declare that the difference of these is listed as below:

Main Model No	Serial Model No	Difference
BB487	BB488 BB492 MG507 MG508 BB959 BB960 MG509 BB489 BB490 BB499 BB485 BB486 BB487 BB488 BB429 BB430	Different color and model, the internal pcb layout is the same

Thank you!

Signature:



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