RF TEST REPORT

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Report No.: 16020932-FCC-R1
Supersede Report No.: N/A

Applicant	Kohler Co.
Product Name	Kohler VAB Amplifier
Main Model	1263840
Serial Model	N/A
Test Standard	FCC Part 15.247: 2015, ANSI C63.10: 2013
Test Date	July 20 to July 25, 2016
Issue Date	July 26, 2016
Test Result	☑ **Pass** ☐ **Fail**
Equipment complied with the specification	☑
Equipment did not comply with the specification	☐

Louise Tu	Miro Bao	
Louise Tu **Test Engineer**	**Miro Bao** **Checked By**	

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Test result presented in this test report is applicable to the tested sample only

Issued by:
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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
16020932-FCC-R1	NONE	Original	July 26, 2016

2. Customer information

Applicant Name	Kohler Co.
Applicant Add	444 Highland Drive Kohler, Wisconsin USA 53044
Manufacturer 1	Dayton Audio
Manufacturer Add 1	705 Pleasant Valley Drive Springboro, Ohio 45066
Manufacturer 2	Sure Electronics Co., Ltd.
Manufacturer Add 2	3F, Building F6,No.9, Weidi Road, Xianlin, Qixia Dist.,Nanjing, China

3. Test site information

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.	986914
IC Test Site No.	4842B-1
Test Software	Labview of SIEMIC version 1.0

4. Equipment under Test (EUT) Information

Description of EUT:	Kohler VAB Amplifier
Main Model:	1263840
Serial Model:	N/A
Date EUT received:	July 07, 2016
Test Date(s):	July 20 to July 25, 2016
Equipment Category :	DSS
Antenna Gain:	Bluetooth: 4dBi
Type of Modulation:	Bluetooth: GFSK, π/4DQPSK, 8DPSK
RF Operating Frequency (ies):	Bluetooth: 2402-2480 MHz
Max. Output Power:	-3.145dBm
Number of Channels:	Bluetooth: 79CH
Port:	Power Port, RS485 Port
Power:	Adapter: INPUT: 100-240VAC 1.1A 50/60Hz OUTPUT: +24VDC 3.75A
Trade Name :	Kohler
FCC ID:	N82KOHLER017

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**
Conducted Emissions &Radiated Spurious Emissions	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	1.634dB / 3.952dB

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 PIFA antenna for Bluetooth, the gain is 4dBi for Bluetooth.

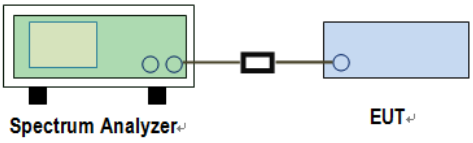
The antenna meets up with the ANTENNA REQUIREMENT.

Result: Compliance.

6.2 Channel Separation

Temperature	25℃
Relative Humidity	53%
Atmospheric Pressure	1001mbar
Test date :	July 25, 2016
Tested By :	Louise Tu

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247(a)(1)	a)	Channel Separation < 20dB BW and 20dB BW < 25KHz ; Channel Separation Limit=25KHz Chanel Separation < 20dB BW and 20dB BW > 25kHz ; Channel Separation Limit=2/3 20dB BW	☑
Test Setup			
Test Procedure	The test follows FCC Public Notice DA 00-705 Measurement Guidelines. Use the following spectrum analyzer settings: - 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	☑ Pass ☐ 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	0.928	Pass
	Adjacency Channel	2403			
	Mid Channel	2441	0.996	0.922	Pass
	Adjacency Channel	2440			
	High Channel	2480	0.993	0.863	Pass
	Adjacency Channel	2479			
CH Separation π/4 DQPSK	Low Channel	2402	0.987	0.806	Pass
	Adjacency Channel	2403			
	Mid Channel	2441	0.999	0.851	Pass
	Adjacency Channel	2440			
	High Channel	2480	1.005	0.819	Pass
	Adjacency Channel	2479			
CH Separation 8DPSK	Low Channel	2402	1.005	0.812	Pass
	Adjacency Channel	2403			
	Mid Channel	2441	1.008	0.853	Pass
	Adjacency Channel	2440			
	High Channel	2480	1.011	0.839	Pass
	Adjacency Channel	2479			

Test Plots

Channel Separation measurement result

GFSK - Low Channel

GFSK - Middle Channel

GFSK - High Channel

π/4 DQPSK - Low Channel

π/4 DQPSK - Middle Channel

π/4 DQPSK - High Channel

8DPSK - Low Channel

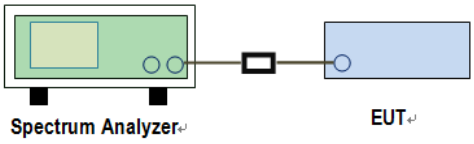
8DPSK - Middle Channel

8DPSK - High Channel

6.3 20dB Bandwidth

Temperature	24℃
Relative Humidity	53%
Atmospheric Pressure	1001mbar
Test date :	July 25, 2016
Tested By :	Louise Tu

Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(a) (1)	a)	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.	☑
Test Setup			
Test Procedure	The test follows FCC Public Notice DA 00-705 Measurement Guidelines. Use the following spectrum analyzer settings: - Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel - RBW ≥1% of the 20 dB bandwidth - VBW ≥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 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	☑ Pass ☐ Fail		

Test Data ☑ Yes ☐ N/A

Test Plot ☑ Yes (See below) ☐ N/A

Measurement result

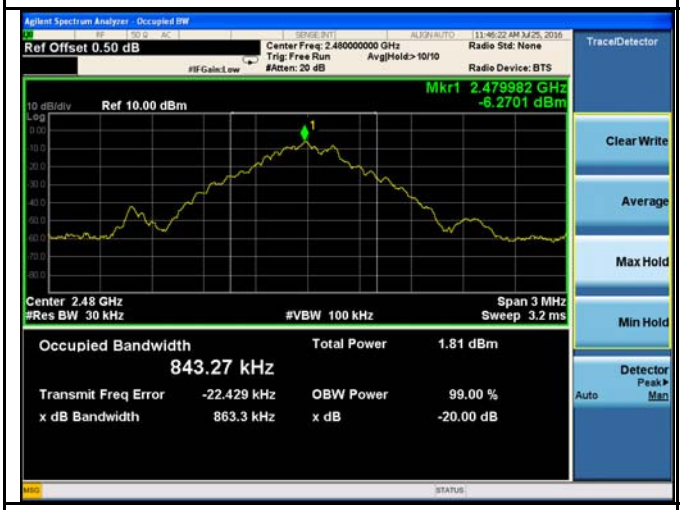
Modulation	CH	CH Frequency (MHz)	20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
GFSK	Low	2402	0.9280	0.8569
	Mid	2441	0.9218	0.8468
	High	2480	0.8633	0.8433
π/4 DQPSK	Low	2402	1.209	1.1701
	Mid	2441	1.276	1.1731
	High	2480	1.229	1.1716
8DPSK	Low	2402	1.218	1.1638
	Mid	2441	1.280	1.1627
	High	2480	1.258	1.1565

Test Plots

20dB Bandwidth measurement result

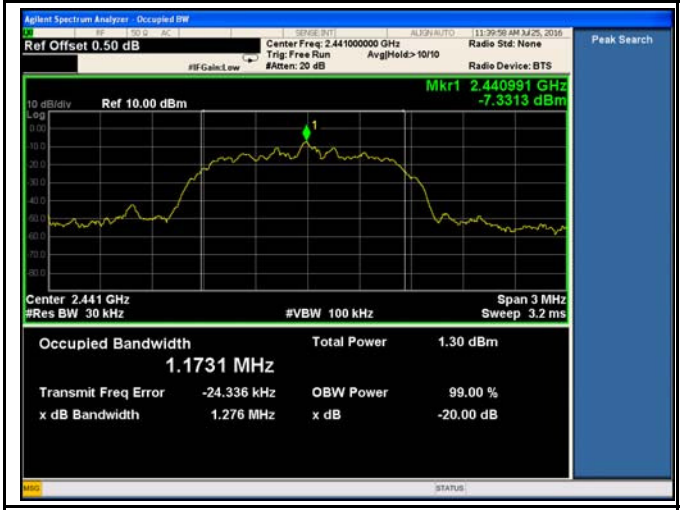
GFSK - Low Channel

GFSK - Middle Channel



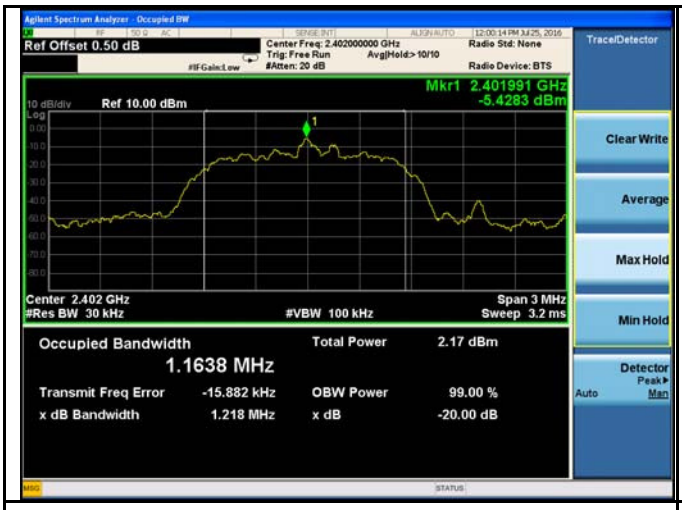
GFSK - High Channel

π/4 DQPSK - Low Channel

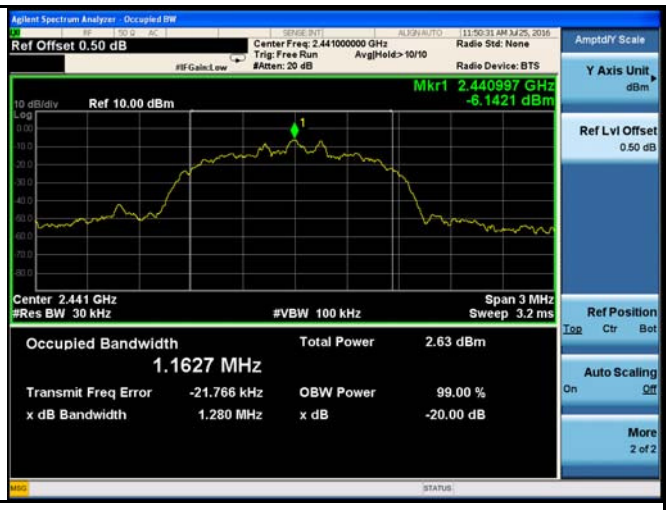


π/4 DQPSK - Middle Channel

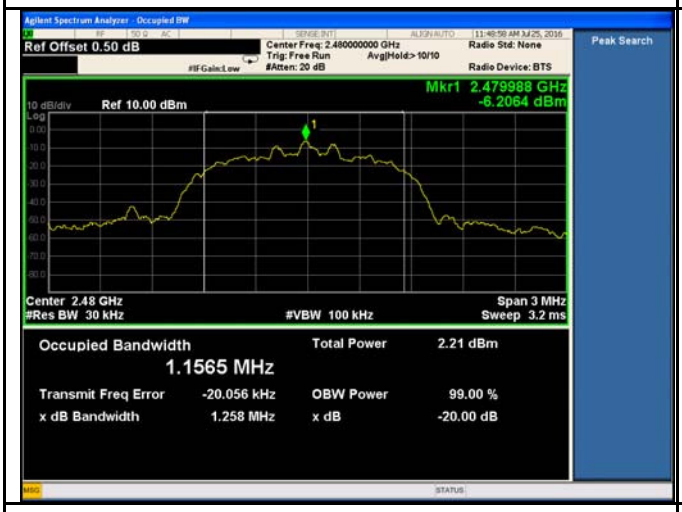
π/4 DQPSK - High Channel



8DPSK - Low Channel



8DPSK - Middle Channel

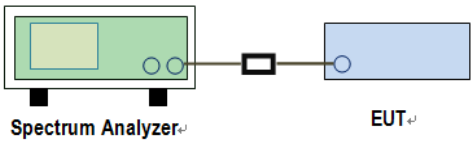


8DPSK - High Channel

6.4 Peak Output Power

Temperature	24℃
Relative Humidity	53%
Atmospheric Pressure	1001mbar
Test date :	July 21, 2016
Tested By :	Louise Tu

Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(b) (3)	a)	FHSS in 2400-2483.5MHz with ≥ 75 channels: ≤1 Watt	☑
	b)	FHSS in 5725-5850MHz: ≤1 Watt	☐
	c)	For all other FHSS in the 2400-2483.5MHz band: ≤0.125 Watt.	☑
	d)	FHSS in 902-928MHz with ≥ 50 channels: ≤1 Watt	☐
	e)	FHSS in 902-928MHz with ≥ 25 & <50 channels: ≤0.25 Watt	☐
	f)	DTS in 902-928MHz, 2400-2483.5MHz: ≤1 Watt	☐
Test Setup			
Test Procedure	The test follows FCC Public Notice DA 00-705 Measurement Guidelines. Use the following spectrum analyzer settings: - Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel - RBW > the 20 dB bandwidth of the emission being measured - VBW ≥RBW - Sweep = auto - Detector function = peak - Trace = max hold - Allow the trace to stabilize. - 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	☑ Pass ☐ 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)	Conducted Power (mW)	Limit (mW)	Result
Output power	GFSK	Low	2402	-3.350	0.462	1000	Pass
		Mid	2441	-3.635	0.433	1000	Pass
		High	2480	**-3.145**	**0.485**	1000	Pass
	π/4 DQPSK	Low	2402	-4.417	0.362	125	Pass
		Mid	2441	-5.377	0.290	125	Pass
		High	2480	-5.047	0.313	125	Pass
	8DPSK	Low	2402	-4.260	0.375	125	Pass
		Mid	2441	-4.824	0.329	125	Pass
		High	2480	-5.180	0.303	125	Pass

Test Plots
Output Power measurement result

GFSK Output power - Low CH 2402

GFSK Output power - Mid CH 2441

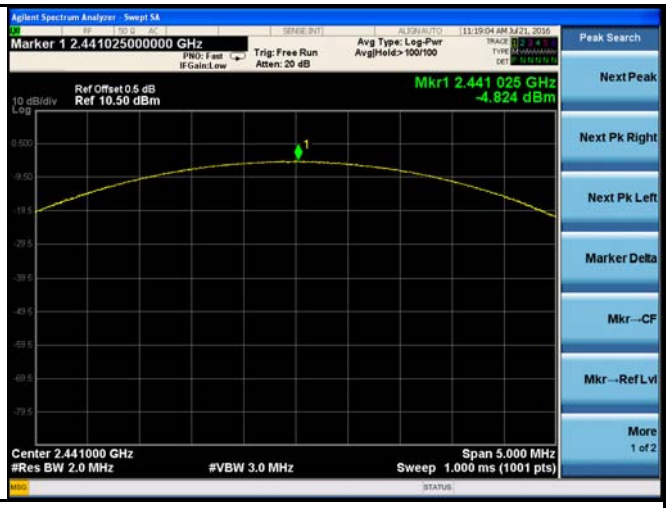
GFSK Output power - High CH 2480

π/4 DQPSK Output power - Low CH 2402

π/4 DQPSK Output power - Mid CH 2441

π/4 DQPSK Output power - High CH 2480

8DPSK Output power - Low CH 2402



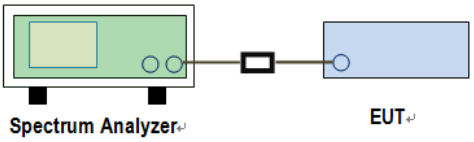
8DPSK Output power - Mid CH 2441

8DPSK Output power - High CH 2480

6.5 Number of Hopping Channel

Temperature	24℃
Relative Humidity	53%
Atmospheric Pressure	1001mbar
Test date :	July 25, 2016
Tested By :	Louise Tu

Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(a)(1)(iii)	a)	FHSS in 2400-2483.5MHz ≥ 15 channels	☑
Test Setup			
Test Procedure	The test follows FCC Public Notice DA 00-705 Measurement Guidelines. Use the following spectrum analyzer settings: The EUT must have its hopping function enabled. - 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	☑ Pass ☐ Fail		

Test Data ☑ Yes ☐ N/A

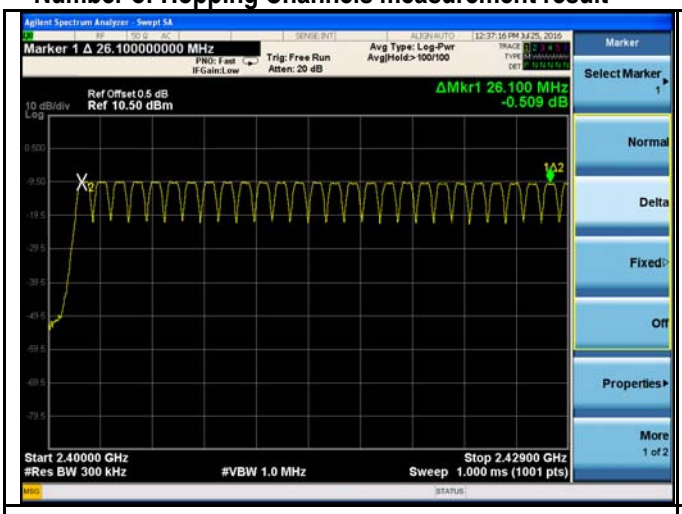
Test Plot ☑ Yes (See below) ☐ N/A

Number of Hopping Channel measurement result

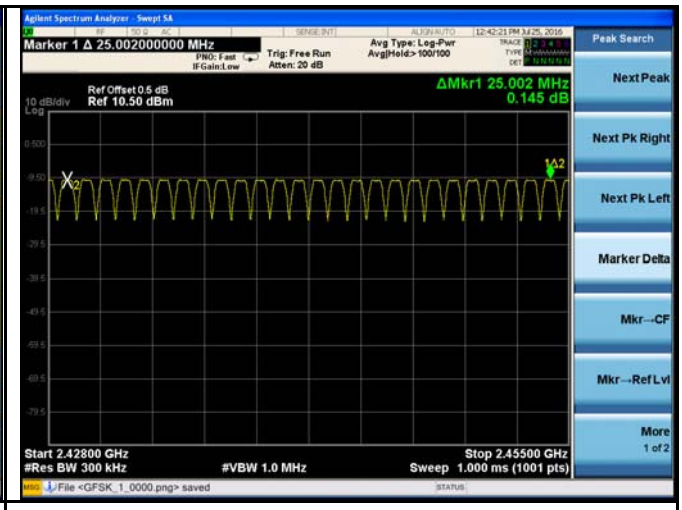
Type	Modulation	Frequency Range	Number of Hopping Channel	Limit
Number of Hopping Channel	GFSK	2400-2483.5	79	15
	π/4 DQPSK	2400-2483.5	79	15
	8-DPSK	2400-2483.5	79	15

Test Plots

Number of Hopping Channels measurement result

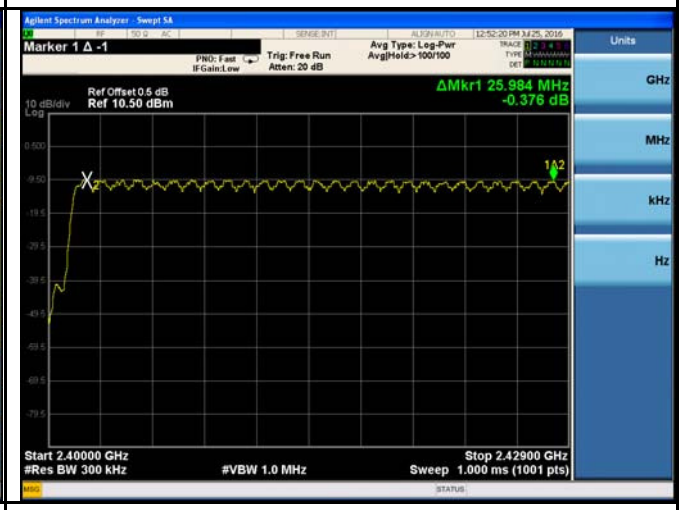


GFSK

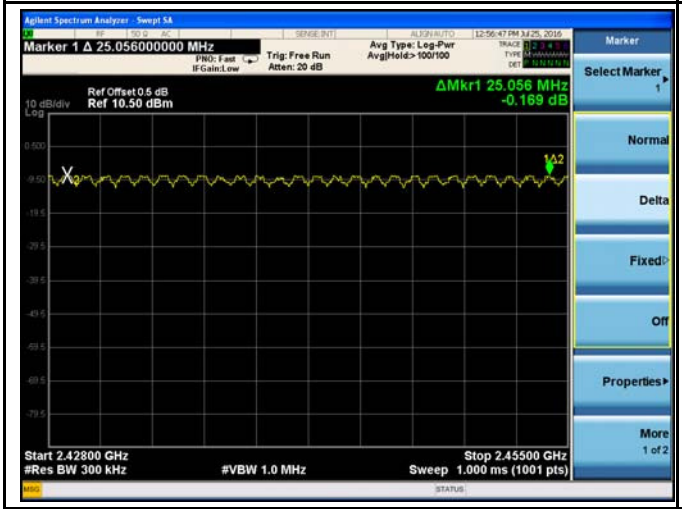


GFSK

GFSK

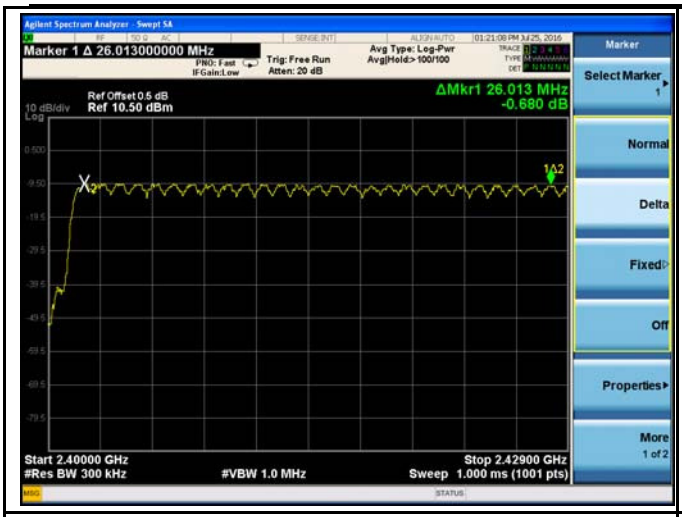


π/4DQPSK

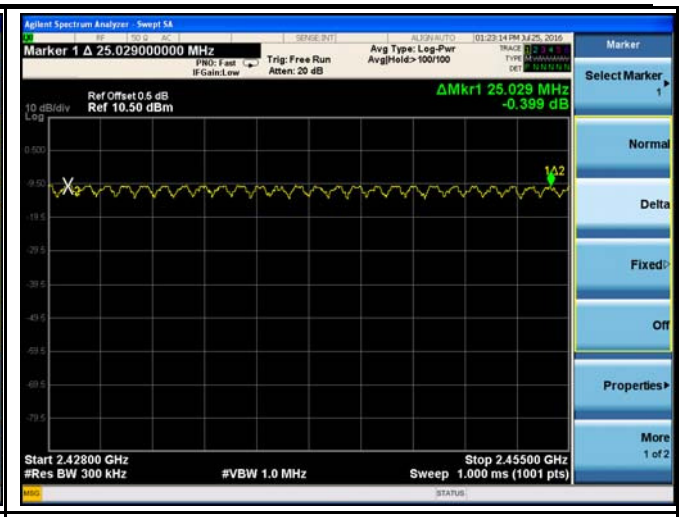


π/4DQPSK

π/4DQPSK



8DPSK



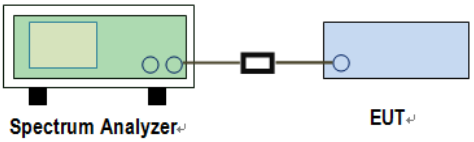
8DPSK

8DPSK

6.6 Time of Occupancy (Dwell Time)

Temperature	24℃
Relative Humidity	53%
Atmospheric Pressure	1001mbar
Test date :	July 25, 2016
Tested By :	Louise Tu

Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(a)(1)(iii)	a)	Dwell Time < 0.4s	☑
Test Setup			
Test Procedure	The test follows FCC Public Notice DA 00-705 Measurement Guidelines. Use the following spectrum analyzer - 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	☑ Pass ☐ Fail		

Test Data ☑ Yes ☐ N/A

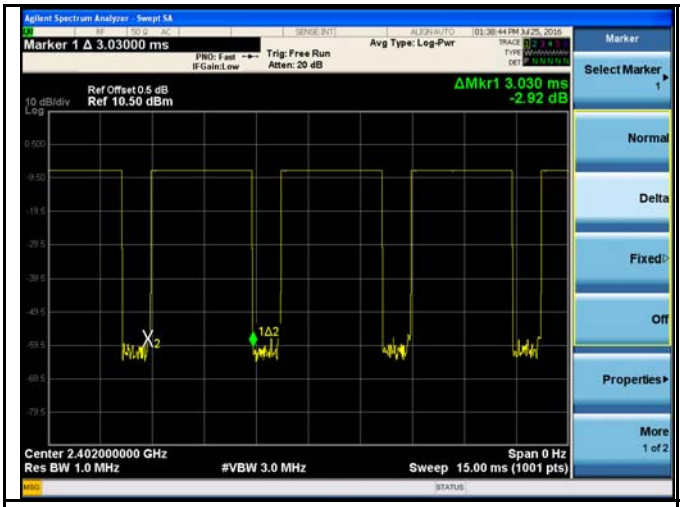
Test Plot ☑ Yes (See below) ☐ N/A

Dwell Time measurement result

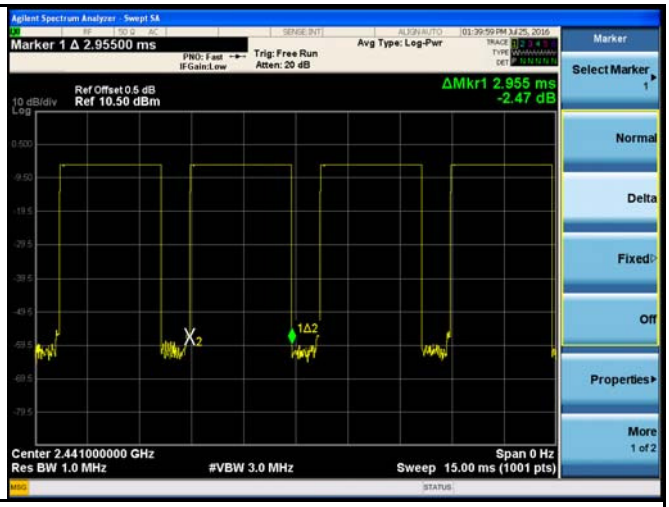
Type	Modulation	CH	Pulse Width (ms)	Dwell Time (ms)	Limit (ms)	Result
Dwell Time (DH5)	GFSK	Low	3.030	323.200	400	Pass
		Mid	2.955	315.200	400	Pass
		High	3.000	320.000	400	Pass
	π/4 DQPSK	Low	3.015	321.600	400	Pass
		Mid	3.000	320.000	400	Pass
		High	3.015	321.600	400	Pass
	8-DPSK	Low	3.000	320.000	400	Pass
		Mid	2.970	316.800	400	Pass
		High	3.030	323.200	400	Pass
Note: Dwell time (DH5)=Pulse Time (ms) × (1600 ÷ 6 ÷ 79) ×31.6						

Note: We tested the Dwell time all the modes: DH1, DH3, DH5; but we only show the worst case DH5 in this report.

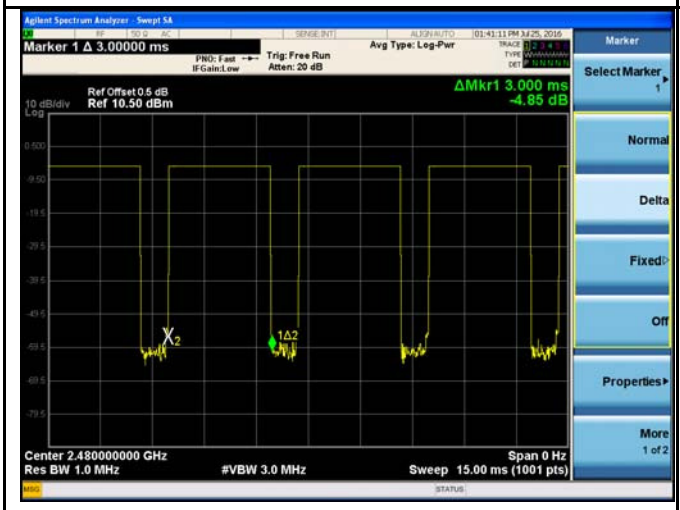
Test Plots
Dwell Time measurement result



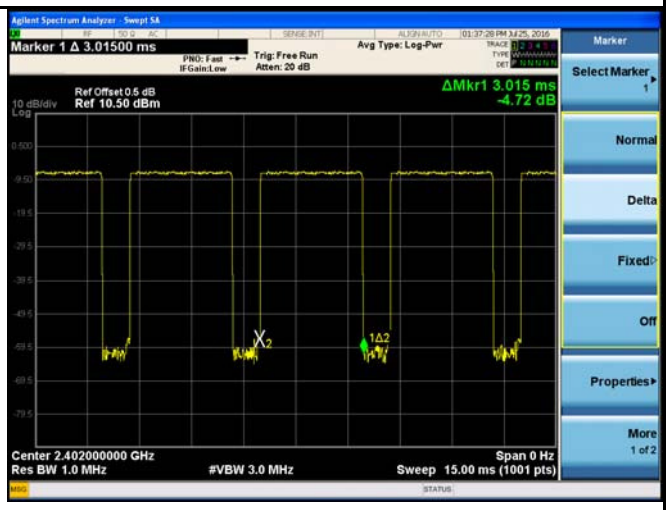
GFSK - Low CH 2402-DH5



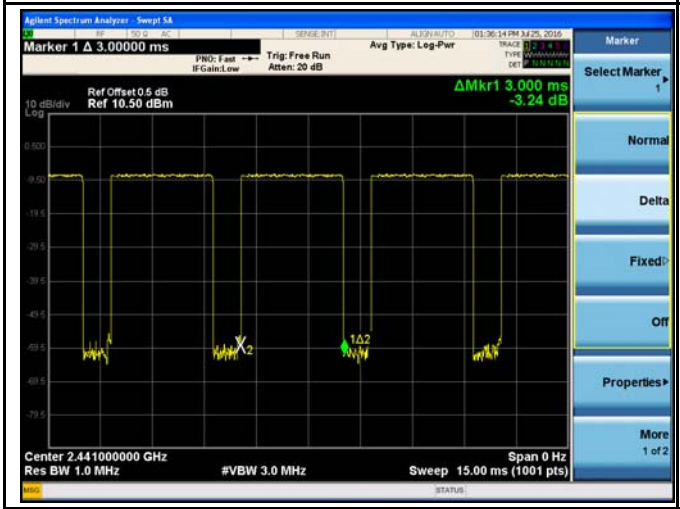
GFSK - Mid CH 2441-DH5



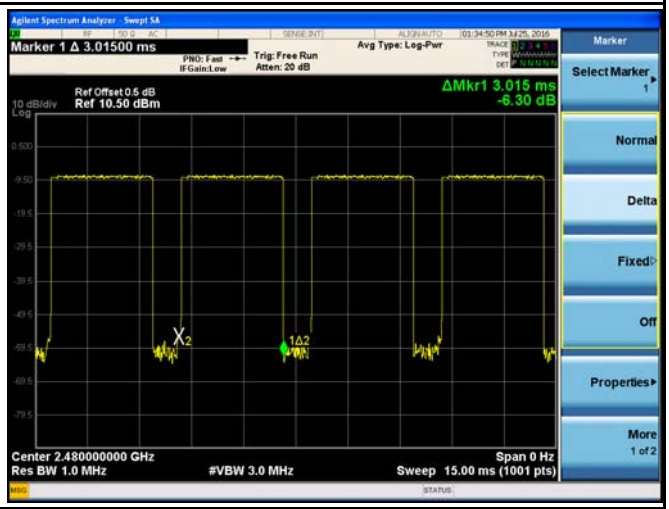
GFSK - High CH 2480-DH5



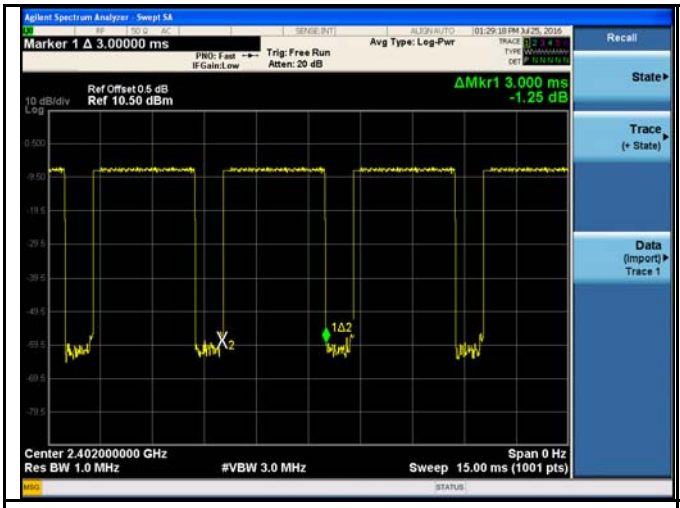
π/4 DQPSK - Low CH 2402-DH5



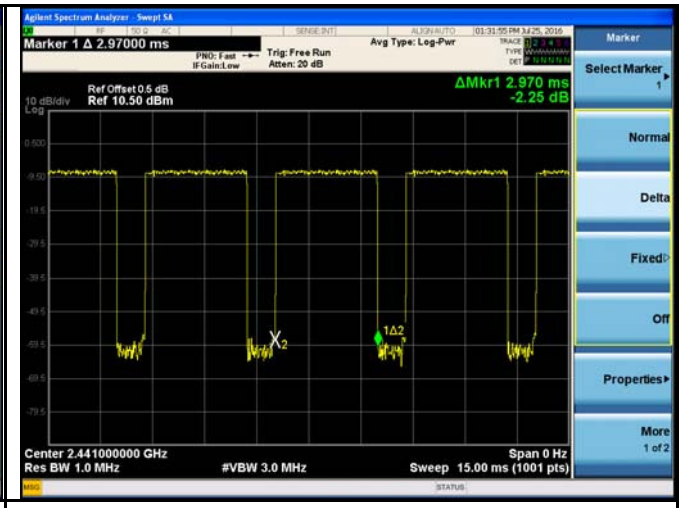
π/4 DQPSK - Mid CH 2441-DH5



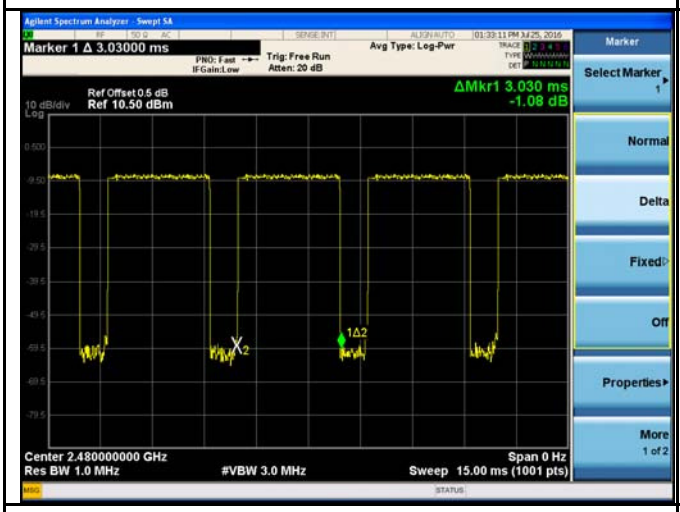
π/4 DQPSK - High CH 2480-DH5



8DPSK - Low CH 2402-DH5



8DPSK - Mid CH 2441-DH5



8DPSK - High CH 2480-DH5

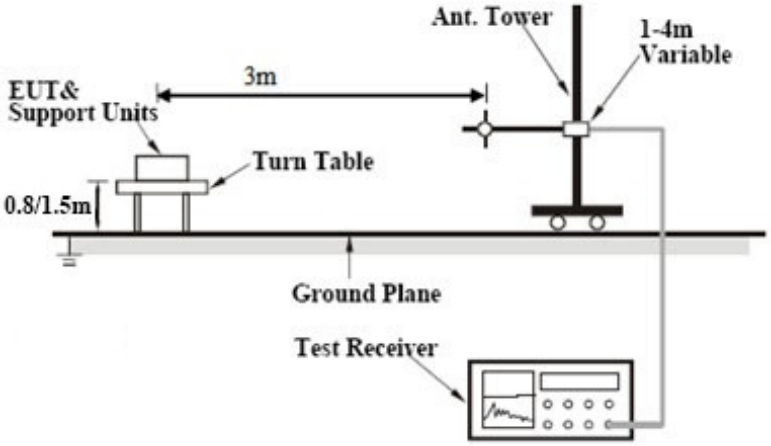
6.7 Band Edge & Restricted Band

Temperature	22℃
Relative Humidity	55%
Atmospheric Pressure	1013mbar
Test date :	July 25, 2016
Tested By :	Louise Tu

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.	☑

Test Setup



Test Procedure

The test follows FCC Public Notice DA 00-705 Measurement Guidelines.

Radiated Method Only

- 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, and make sure the instrument is operated in its linear range.
- 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:
  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	☑ Pass ☐ Fail

Test Data ☑ Yes ☐ N/A

Test Plot ☐ Yes (See below) ☑ N/A

Results for Band edge Testing (Radiated)

Low Channel: GFSK Mode (Worst Case) (2402 MHz)-Non-hopping

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2375.26	46.02	PK	H	30.23	5.8	35.2	46.85	74	-27.15
2375.26	33.43	AV	H	30.23	5.8	35.2	34.26	54	-19.74
2389.47	47.48	PK	H	30.23	5.81	35.2	48.32	74	-25.68
2389.47	34.89	AV	H	30.23	5.81	35.2	35.73	54	-18.27
2376.98	45.62	PK	V	30.23	5.8	35.2	46.45	74	-27.55
2376.98	33.59	AV	V	30.23	5.8	35.2	34.42	54	-19.58
2389.23	49.33	PK	V	30.23	5.81	35.2	50.17	74	-23.83
2389.23	38.17	AV	V	30.23	5.81	35.2	39.01	54	-14.99

High Channel: GFSK Mode (Worst Case) (2480 MHz) -Non-hopping

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2483.72	49.41	PK	H	30.35	5.8	35	50.36	74	-23.64
2483.72	35.06	AV	H	30.35	5.8	35	36.01	54	-17.99
2487.76	45.31	PK	H	30.35	5.81	35	47.47	74	-26.53
2487.76	32.66	AV	H	30.35	5.81	35	34.82	54	-19.18
2484.49	50.55	PK	V	30.35	5.8	35	50.7	74	-23.3
2484.49	36.37	AV	V	30.35	5.8	35	36.52	54	-17.48
2488.54	47.48	PK	V	30.35	5.81	35	49.14	74	-24.86
2488.54	34.12	AV	V	30.35	5.81	35	35.78	54	-18.22

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

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2376.5	45.96	PK	H	30.23	5.8	35.2	46.79	74	-27.21
2376.5	32.21	AV	H	30.23	5.8	35.2	33.04	54	-20.96
2390.22	48.32	PK	H	30.23	5.81	35.2	49.16	74	-24.84
2390.22	35.44	AV	H	30.23	5.81	35.2	36.28	54	-17.72
2376.97	46.29	PK	V	30.23	5.8	35.2	47.12	74	-26.88
2376.97	33.28	AV	V	30.23	5.8	35.2	34.11	54	-19.89
2392.06	52.26	PK	V	30.23	5.81	35.2	53.1	74	-20.9
2392.06	40.76	AV	V	30.23	5.81	35.2	41.6	54	-12.4

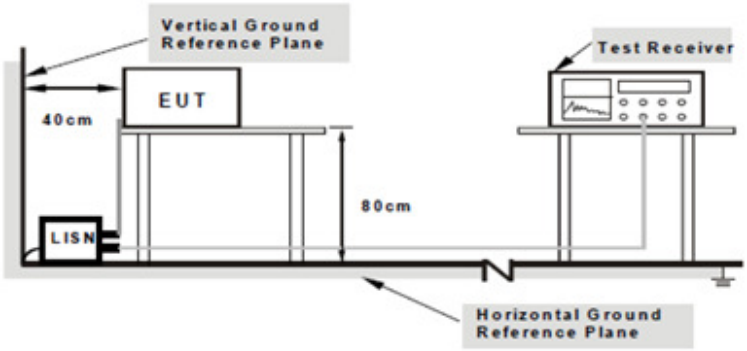
High Channel: GFSK Mode (Worst Case) (2480 MHz) - Hopping

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2483.89	38.42	PK	H	30.35	5.8	35	39.57	74	-34.43
2483.89	35.07	AV	H	30.35	5.8	35	36.22	54	-17.78
2484.31	46.09	PK	H	30.35	5.81	35	47.25	74	-26.75
2484.31	34.87	AV	H	30.35	5.81	35	36.03	54	-17.97
2485.51	48.76	PK	V	30.35	5.8	35	49.91	74	-24.09
2485.51	35.89	AV	V	30.35	5.8	35	37.04	54	-16.96
2487.71	46.65	PK	V	30.35	5.81	35	47.81	74	-26.19
2487.71	38.57	AV	V	30.35	5.81	35	39.73	54	-14.27

6.8 AC Power Line Conducted Emissions

Temperature	25℃
Relative Humidity	55%
Atmospheric Pressure	1013mbar
Test date :	July 21, 2016
Tested By :	Louise Tu

Requirement(s):

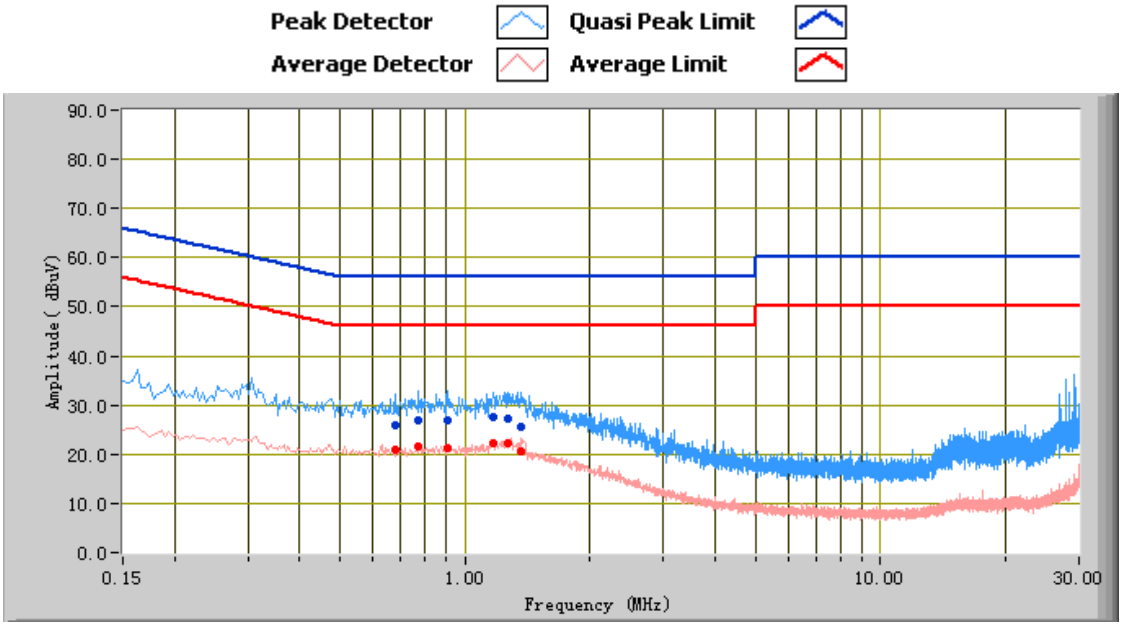
<table>
<tr><th>Spec</th><th>Item</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>47CFR§15.207, RSS210 (A8.1)</td><td>a)</td><td>For Low-power radio-frequency devices that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto 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.
<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></td><td>☑</td></tr>
<tr><td>Test Setup</td><td colspan="3"> 

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.</td></tr>
<tr><td>Procedure</td><td colspan="3">1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a 50W/50mH EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss 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).</td></tr>
<tr><td>Remark</td><td colspan="3"></td></tr>
<tr><td>Result</td><td colspan="3">☑ Pass ☐ Fail</td></tr>
</table>

Test Data ☑ Yes ☐ N/A

Test Plot ☑ Yes (See below) ☐ N/A

Test Mode:	Transmitting Mode

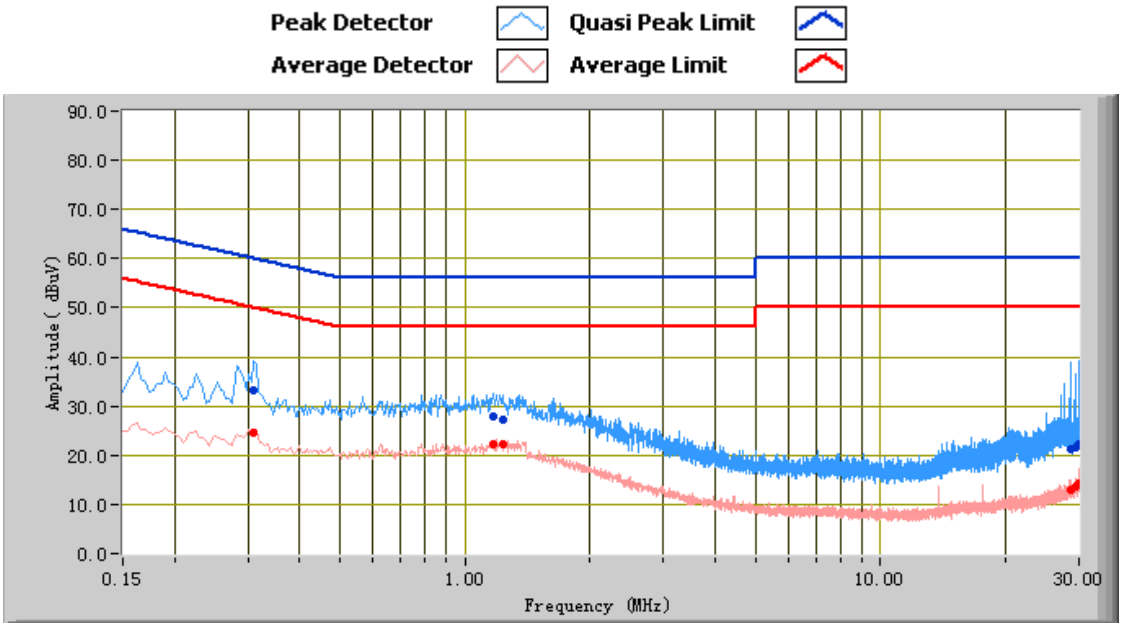


Test Data

Phase Line Plot at AC 120V 60Hz

Frequency (MHz)	Quasi Peak (dBμV)	Limit (dBμV)	Margin (dB)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Factors (dB)
0.91	27.02	56.00	-28.98	21.34	46.00	-24.66	10.76
0.77	26.83	56.00	-29.17	21.56	46.00	-24.44	10.87
1.26	27.36	56.00	-28.64	22.17	46.00	-23.83	10.73
1.36	25.72	56.00	-30.28	20.68	46.00	-25.32	10.75
1.17	27.69	56.00	-28.31	22.17	46.00	-23.83	10.71
0.68	26.05	56.00	-29.95	20.90	46.00	-25.10	10.94

Test Mode:	Transmitting Mode

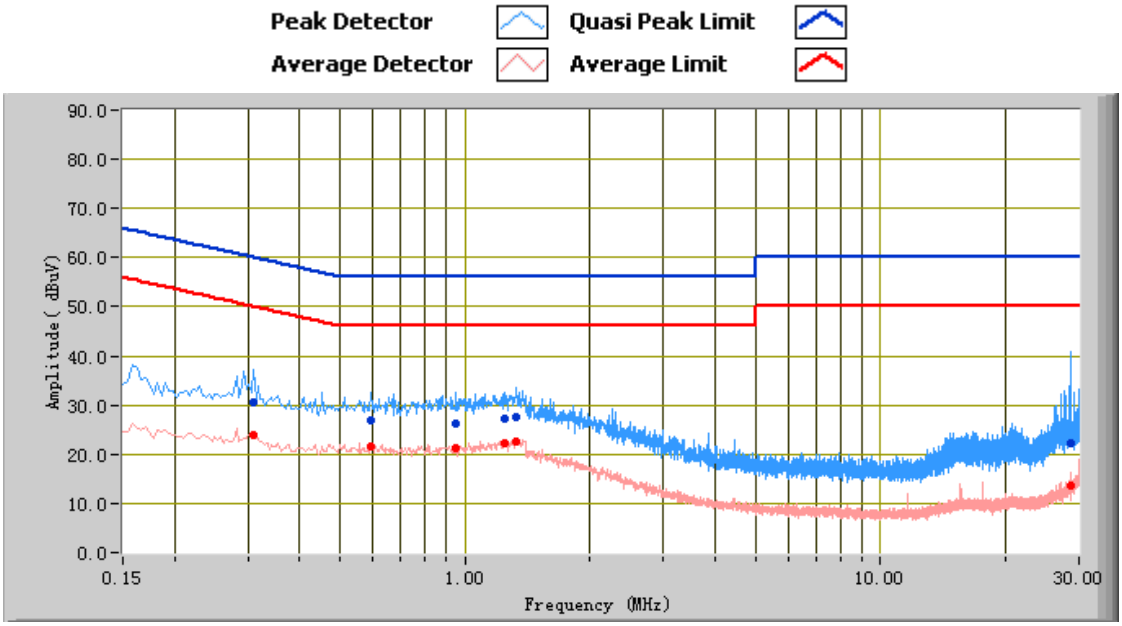


Test Data

Phase Neutral Plot at AC 120V 60Hz

Frequency (MHz)	Quasi Peak (dBµV)	Limit (dBµV)	Margin (dB)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Factors (dB)
0.31	33.31	59.97	-26.66	24.65	49.97	-25.32	11.36
29.94	22.33	60.00	-37.67	14.29	50.00	-35.71	11.89
28.80	21.35	60.00	-38.65	13.01	50.00	-36.99	11.85
29.56	21.45	60.00	-38.55	13.62	50.00	-36.38	11.88
1.17	27.75	56.00	-28.25	22.30	46.00	-23.70	10.74
1.23	27.17	56.00	-28.83	22.09	46.00	-23.91	10.75

Test Mode:	Transmitting Mode

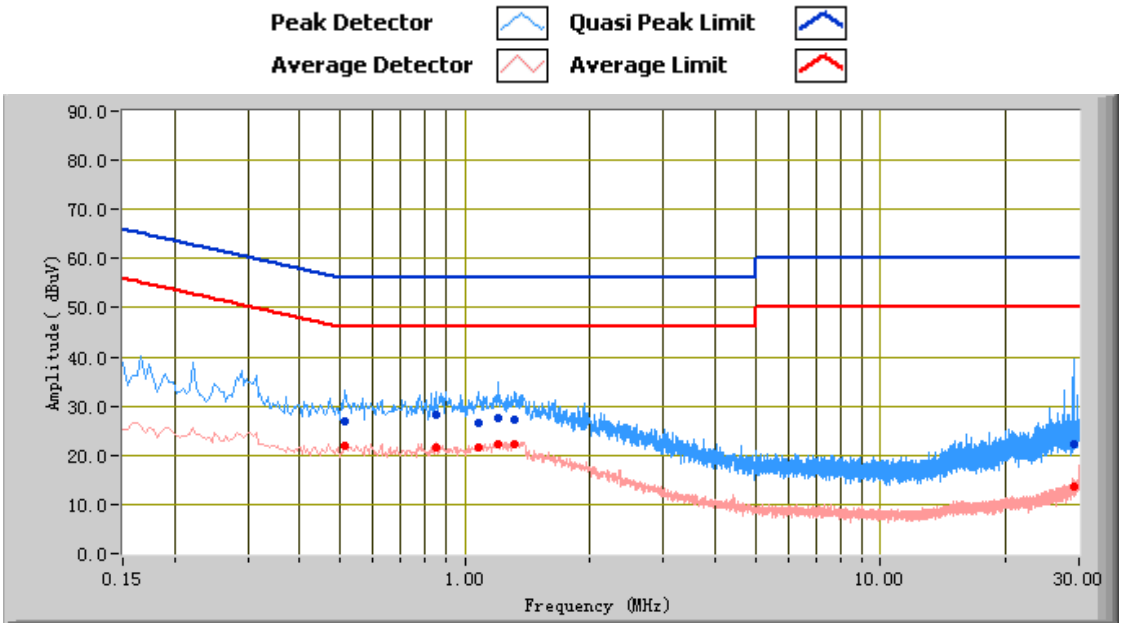


Test Data

Phase Line Plot at AC 240V 60Hz

Frequency (MHz)	Quasi Peak (dBµV)	Limit (dBµV)	Margin (dB)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Factors (dB)
28.79	22.19	60.00	-37.81	13.76	50.00	-36.24	11.83
1.33	27.67	56.00	-28.33	22.46	46.00	-23.54	10.75
0.31	30.52	59.97	-29.45	24.02	49.97	-25.95	11.37
0.95	26.26	56.00	-29.74	21.19	46.00	-24.81	10.72
1.25	27.33	56.00	-28.67	22.30	46.00	-23.70	10.73
0.59	26.76	56.00	-29.24	21.58	46.00	-24.42	11.01

Test Mode:	Transmitting Mode



Test Data

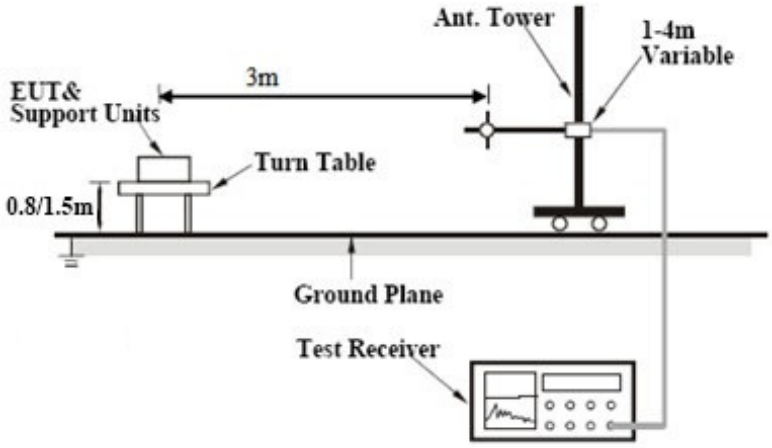
Phase Neutral Plot at AC 240V 60Hz

Frequency (MHz)	Quasi Peak (dBµV)	Limit (dBµV)	Margin (dB)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Factors (dB)
29.25	22.17	60.00	-37.83	13.65	50.00	-36.35	11.87
1.20	27.48	56.00	-28.52	22.27	46.00	-23.73	10.74
0.51	26.99	56.00	-29.01	22.00	46.00	-24.00	11.05
0.85	28.16	56.00	-27.84	21.73	46.00	-24.27	10.81
1.07	26.64	56.00	-29.36	21.60	46.00	-24.40	10.72
1.31	27.28	56.00	-28.72	22.39	46.00	-23.61	10.77

6.9 Radiated Spurious Emissions & Restricted Band

Temperature	25℃
Relative Humidity	55%
Atmospheric Pressure	1013mbar
Test date :	July 20, 2016
Tested By :	Louise Tu

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 Frequency range (MHz) / Field Strength (μV/m) 30 – 88 / 100 88 – 216 / 150 216 – 960 / 200 Above 960 / 500	☑
Test Setup			
Procedure	1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner: a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen. b. The EUT was then rotated to the direction that gave the maximum emission. c. Finally, the antenna height was adjusted to the height that gave the maximum emission. 3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasiy Peak detection at frequency below 1GHz. 4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak measurement at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz with Peak detection for Average Measurement as below at frequency above 1GHz. 5. 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

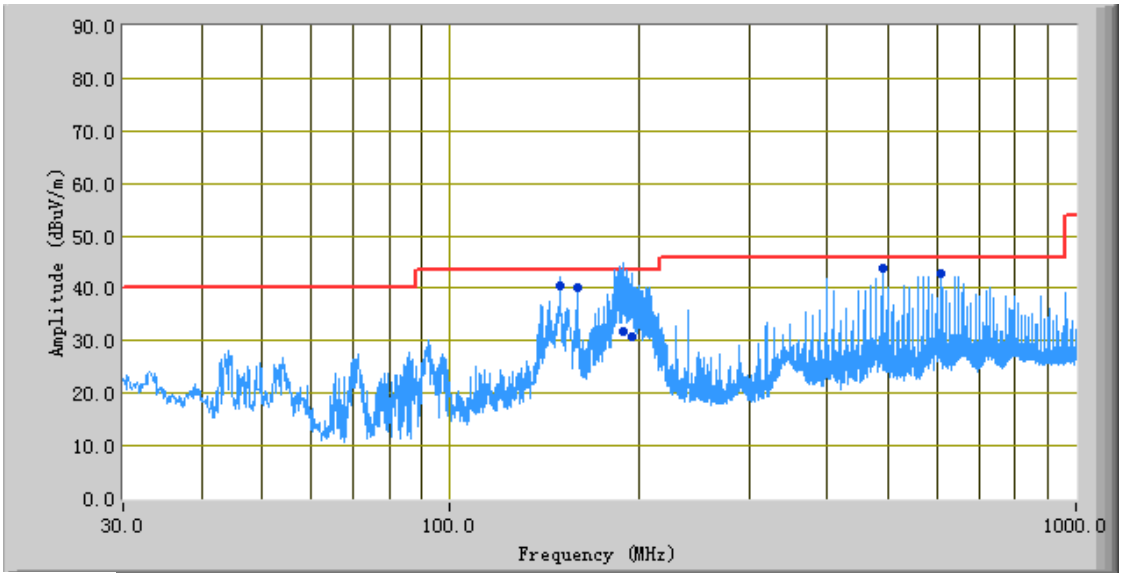
Test Plot ☑ Yes (See below) ☐ N/A

Test Mode:	**Transmitting Mode**

Below 1GHz

Peak Detector

Quasi Peak Limit



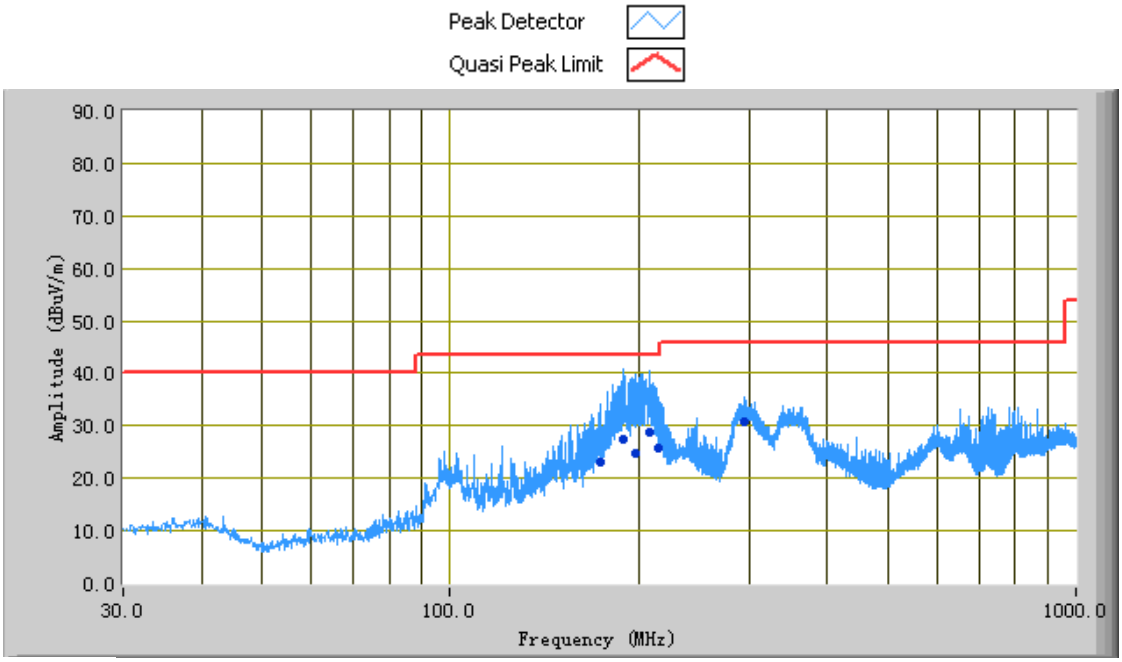
Test Data

Vertical Polarity Plot @3m

Frequency (MHz)	Quasi Peak (dBµV/m)	Azimuth	Polarity (H/V)	Height (cm)	Limit (dBµV/m)	Margin (dB)	Factors (dB)
188.94	31.62	280.00	V	135.00	43.50	-11.88	31.86
195.01	30.64	278.00	V	122.00	43.50	-12.86	31.96
149.99	40.63	282.00	V	118.00	43.50	-2.87	31.21
489.96	43.86	290.00	V	120.00	46.00	-2.14	28.64
609.97	42.71	342.00	V	108.00	46.00	-3.29	22.69
159.99	40.09	301.00	V	103.00	43.50	-3.41	31.37

Test Mode:	Transmitting Mode

Below 1GHz



Test Data

Horizontal Polarity Plot @3m

Frequency (MHz)	Quasi Peak (dBµV/m)	Azimuth	Polarity (H/V)	Height (cm)	Limit (dBµV/m)	Margin (dB)	Factors (dB)
189.21	27.28	220.00	H	242.00	43.50	-16.22	31.52
208.72	28.73	234.00	H	227.00	43.50	-14.77	30.87
198.12	24.89	186.00	H	239.00	43.50	-18.61	31.54
215.29	25.76	212.00	H	143.00	43.50	-17.74	30.37
173.67	22.93	217.00	H	156.00	43.50	-20.57	31.50
294.71	30.70	95.00	H	100.00	46.00	-15.30	29.08

Test Mode:	Transmitting Mode (Above 1GHz)

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

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4803.5	34.97	AV	V	33.83	6.86	31.72	43.94	54	-10.06
4803.5	33.47	AV	H	33.83	6.86	31.72	42.44	54	-11.56
4803.5	46.7	PK	V	33.83	6.86	31.72	55.67	74	-18.33
4803.5	45.36	PK	H	33.83	6.86	31.72	54.33	74	-19.67

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

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4882.75	32.26	AV	V	33.86	6.82	31.82	41.12	54	-12.88
4882.75	31.37	AV	H	33.86	6.82	31.82	40.23	54	-13.77
4882.75	44.89	PK	V	33.86	6.82	31.82	53.75	74	-20.25
4882.75	43.95	PK	H	33.86	6.82	31.82	52.81	74	-21.19

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

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4959.25	32.31	AV	V	33.9	6.76	31.92	41.05	54	-12.95
4959.25	31.57	AV	H	33.9	6.76	31.92	40.31	54	-13.69
4959.25	45.11	PK	V	33.9	6.76	31.92	53.85	74	-20.15
4959.25	44.19	PK	H	33.9	6.76	31.92	52.93	74	-21.07

Note:

*1, The testing has been conformed to 10*2480MHz=24,800MHz*

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

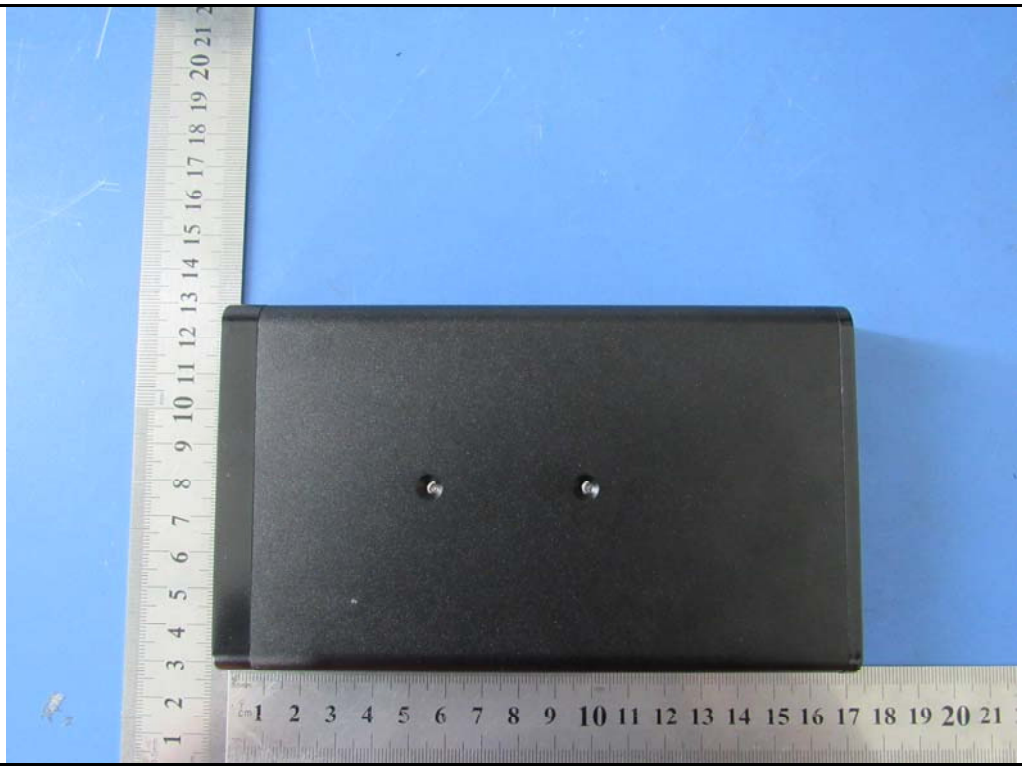
3, X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.

Annex A. TEST INSTRUMENT

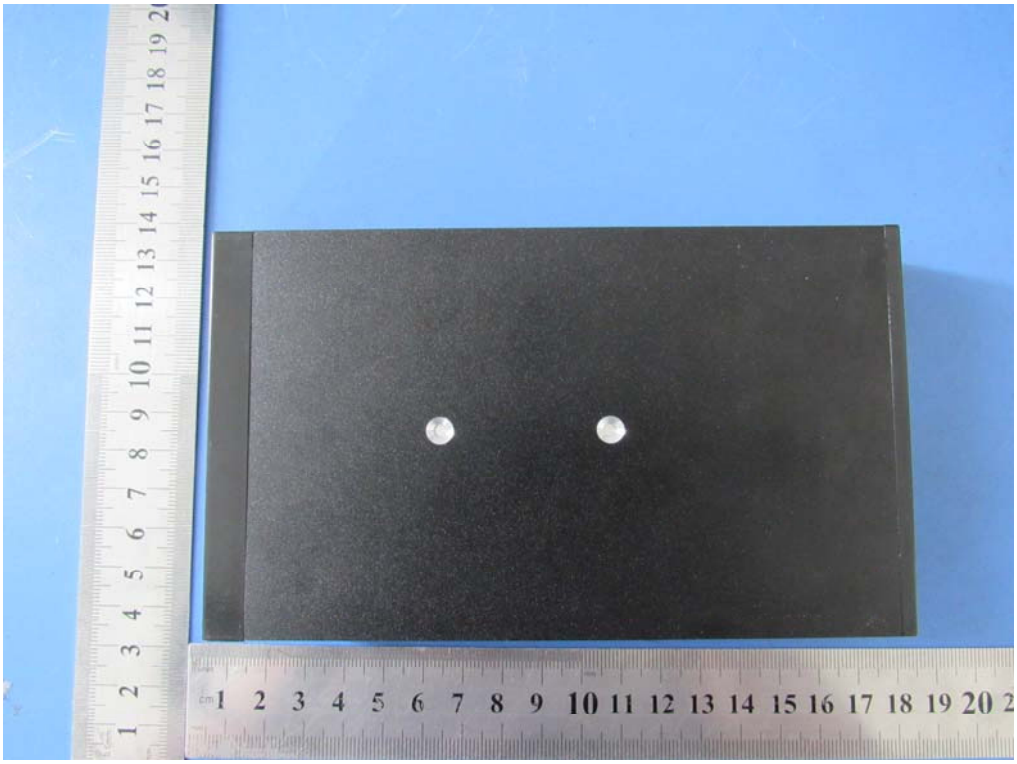
Instrument	Model	Serial #	Cal Date	Cal Due	In use
AC Line Conducted Emissions					
R&S EMI Test Receiver	ESPI3	101216	03/31/2016	03/31/2017	☑
V-LISN	ESH3-Z5	838979/005	03/31/2016	03/31/2017	☑
SIEMIC Conducted Emissions software	V1.0	N/A	N/A	N/A	☑
RF conducted test					
R&S EMI Receiver	ESPI3	101216	03/31/2016	03/31/2017	☑
Radiated Emissions					
Agilent Technologies Spectrum Analyzer	N9010A	MY47191130	03/11/2016	03/10/2017	☑
R&S EMI Receiver	ESPI3	101216	03/31/2016	03/31/2017	☑
Antenna (30MHz~6GHz)	JB6	A121411	10/31/2015	10/31/2016	☑
EMCO Horn Antenna (1 ~18GHz)	3115	N/A	10/09/2015	10/08/2016	☑
INFOMW Antenna (1 ~18GHz)	JXTXLB-10180	J2031081120092	10/31/2015	10/31/2016	☑
Hp Agilent Pre-Amplifier	8447F	1937A01160	10/30/2015	10/30/2016	☑
MITEQ Pre-Amplifier (0.1 ~ 18GHz)	AMF-7D-00101800-30-10P	1451709	10/27/2015	10/26/2016	☑
SIEMIC Radiated Emissions software	V1.0	N/A	N/A	N/A	☑

Annex B. EUT And Test Setup Photographs

Annex B.i. Photograph: EUT External Photo

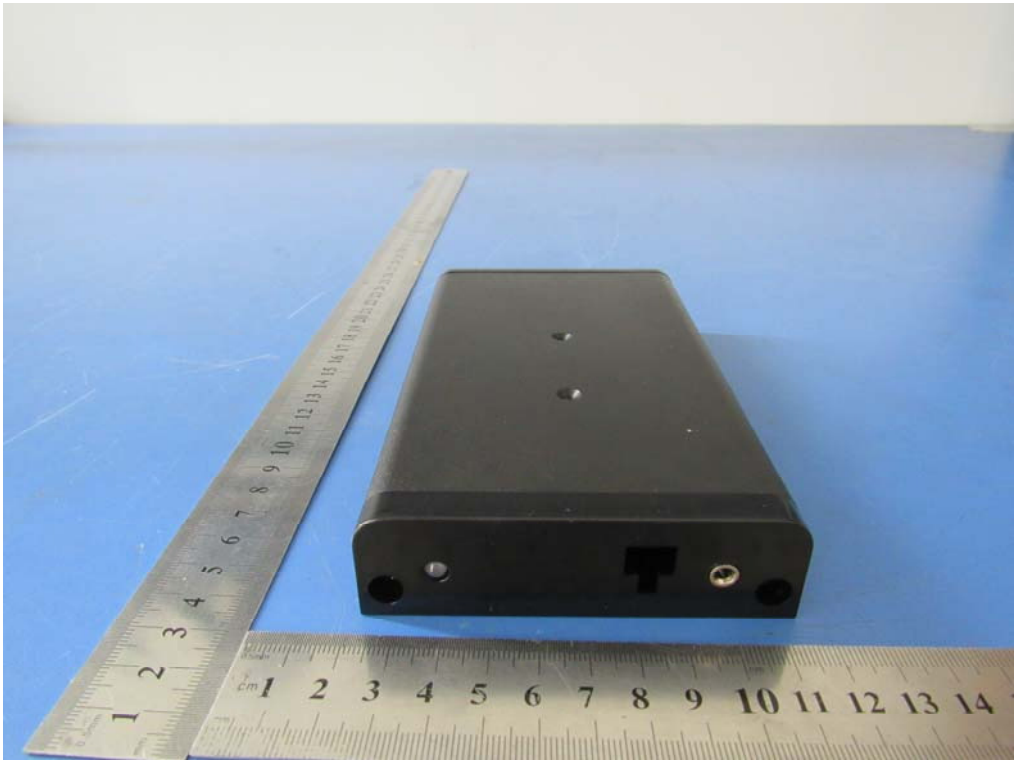


EUT- Front View

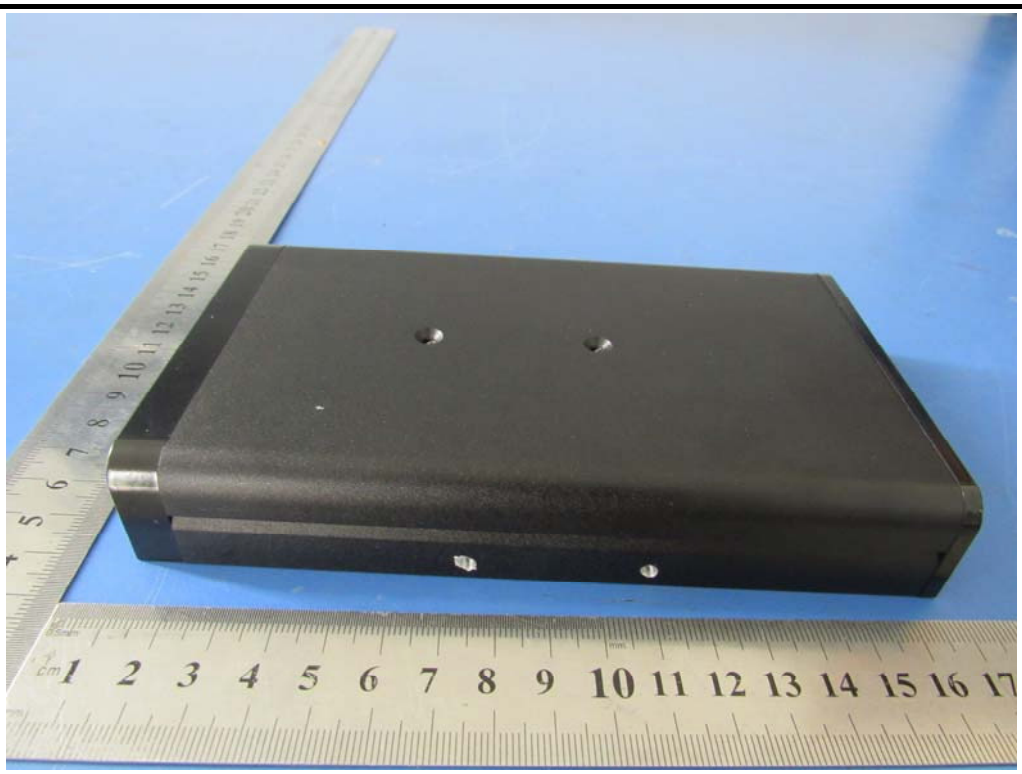


EUT- Rear View

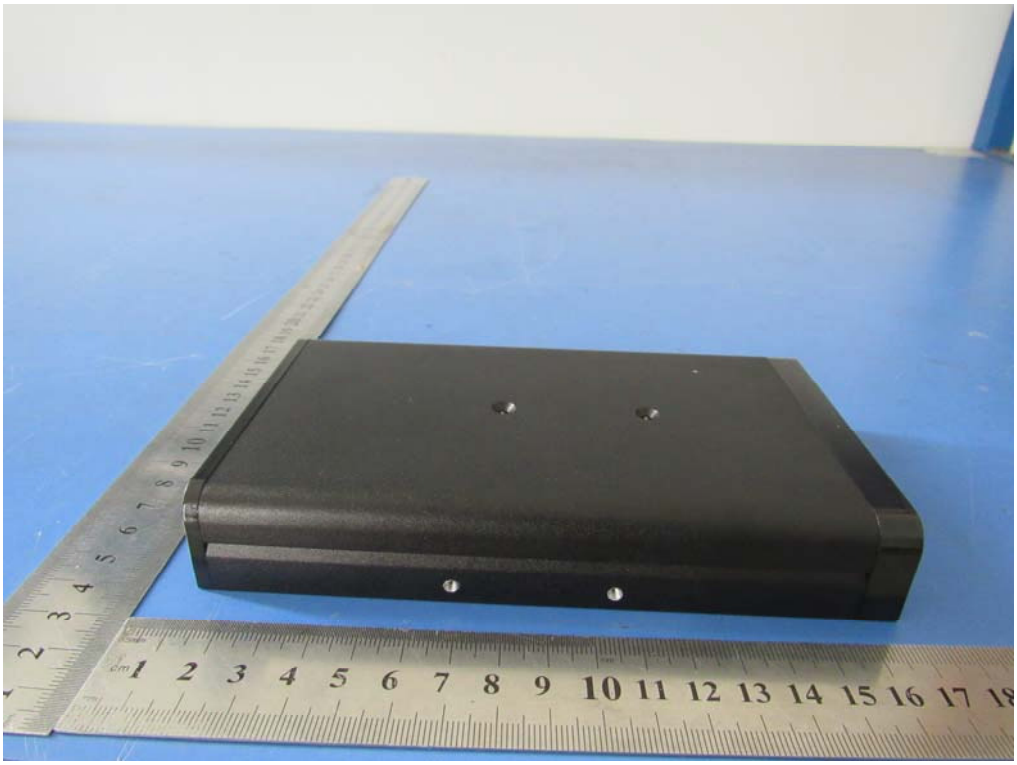
EUT- Top View



EUT- Bottom View

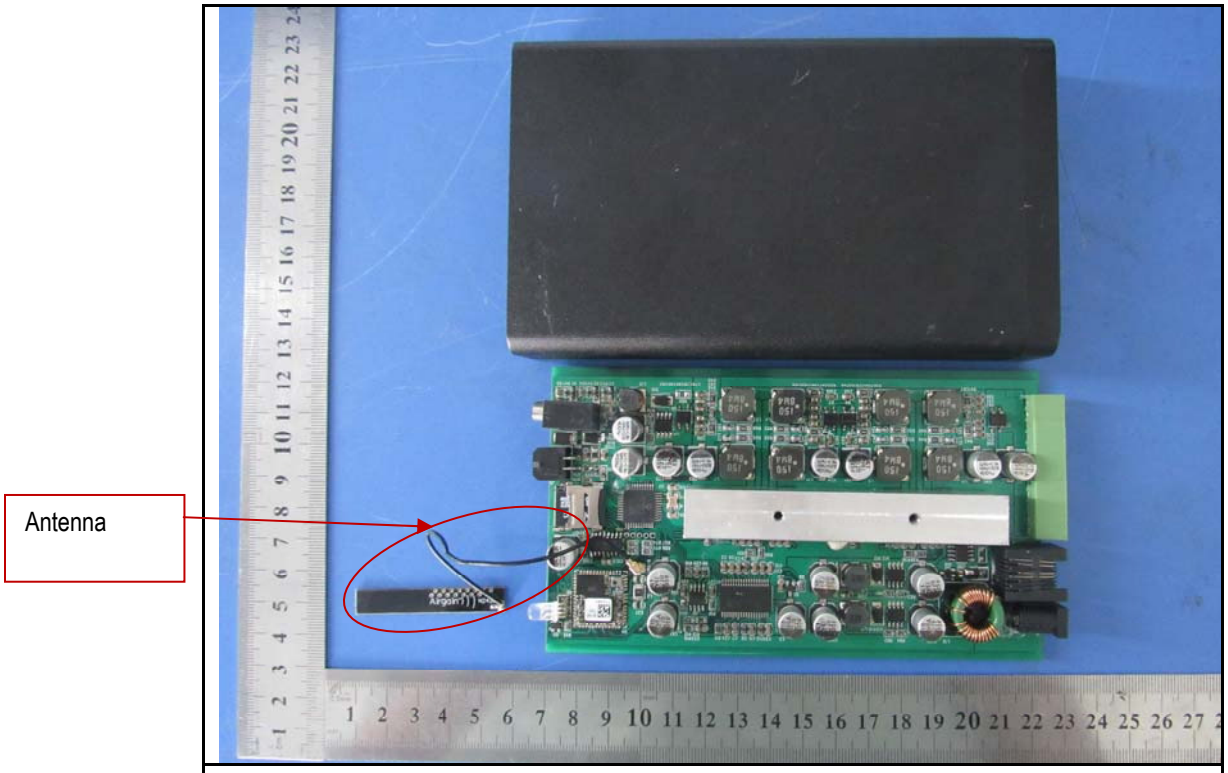


EUT- Left View

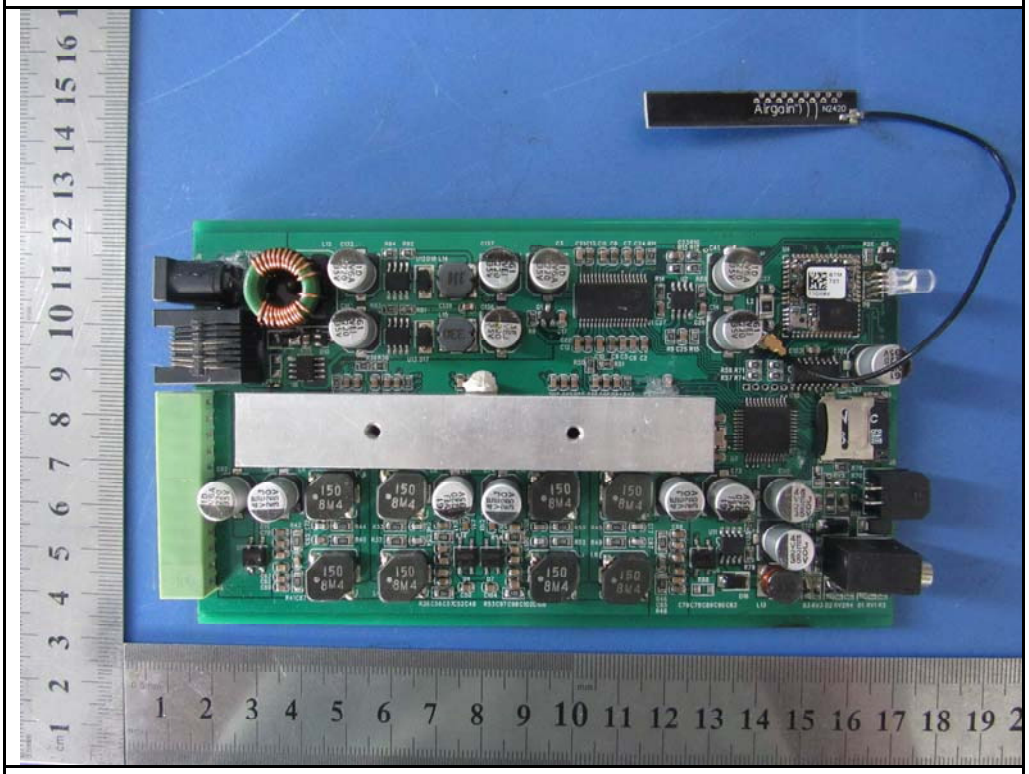


EUT- Right View

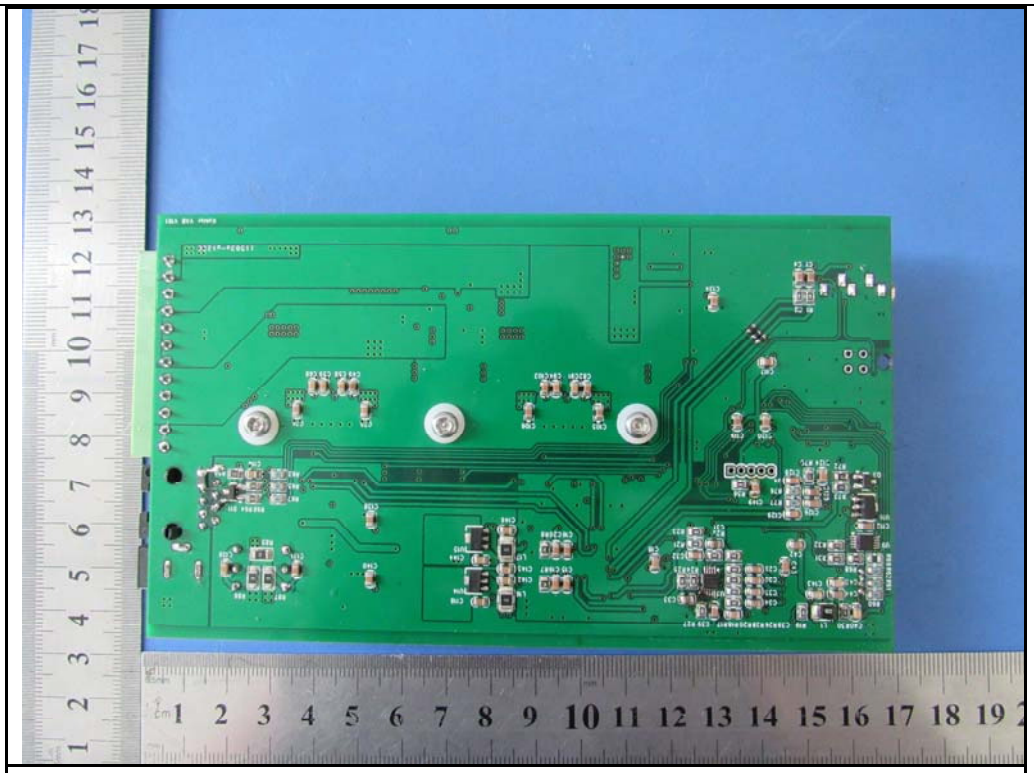
Annex B.ii. Photograph: EUT Internal Photo



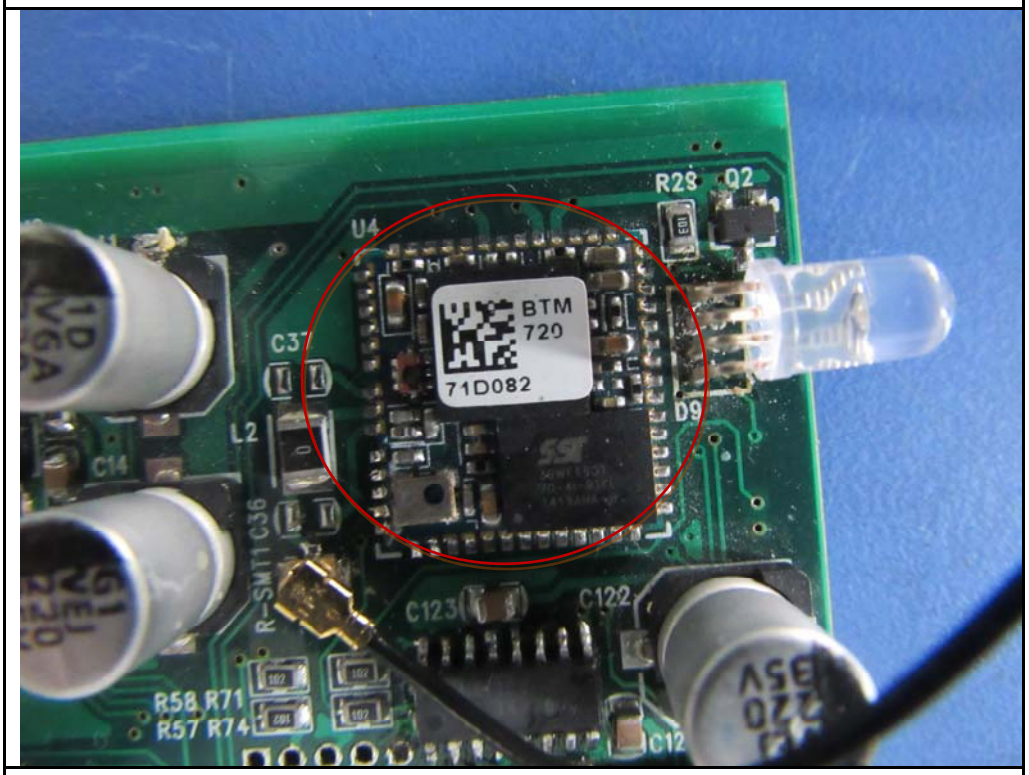
EUT Uncover - Front View



PCBA – Front View



PCBA – Rear View

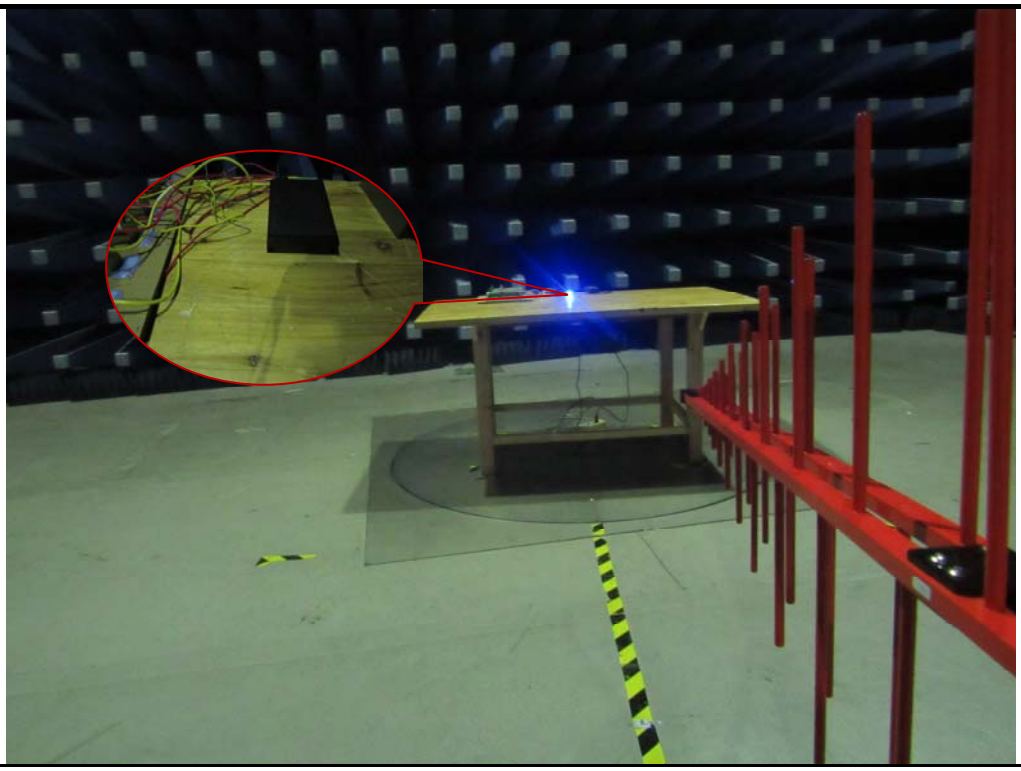


Antenna Module Front View

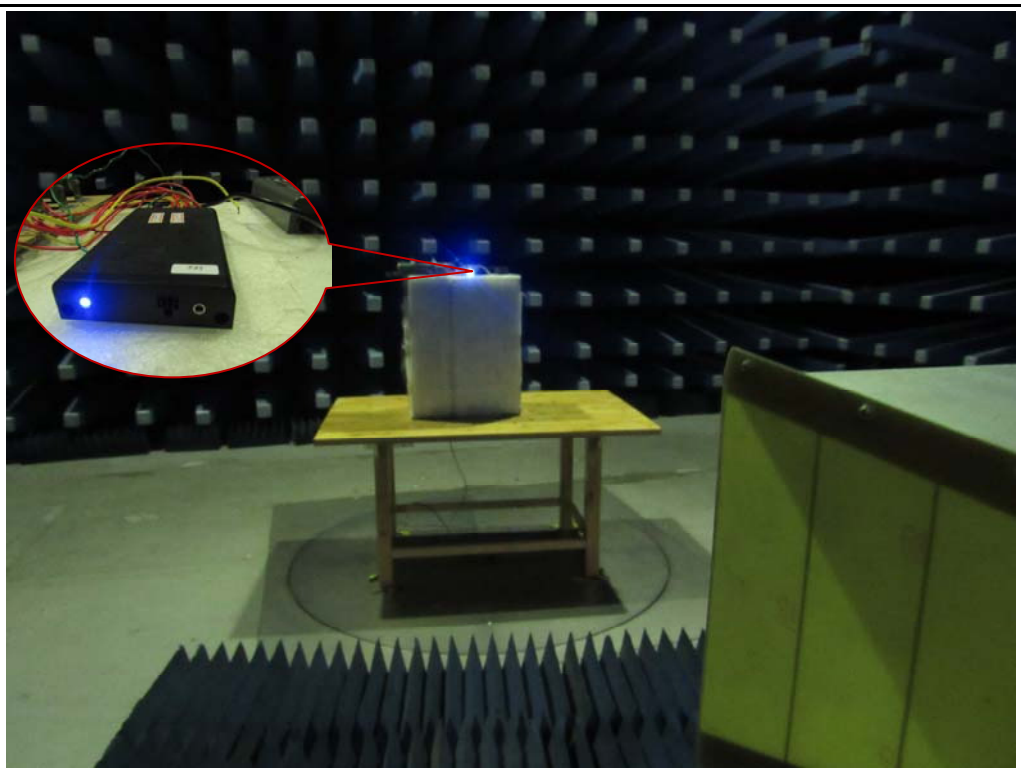
Annex B.iii. Photograph: Test Setup Photo

Conducted Emissions Test Setup Front View

Conducted Emissions Test Setup Side View



Radiated Spurious Emissions Test Setup Below 1GHz

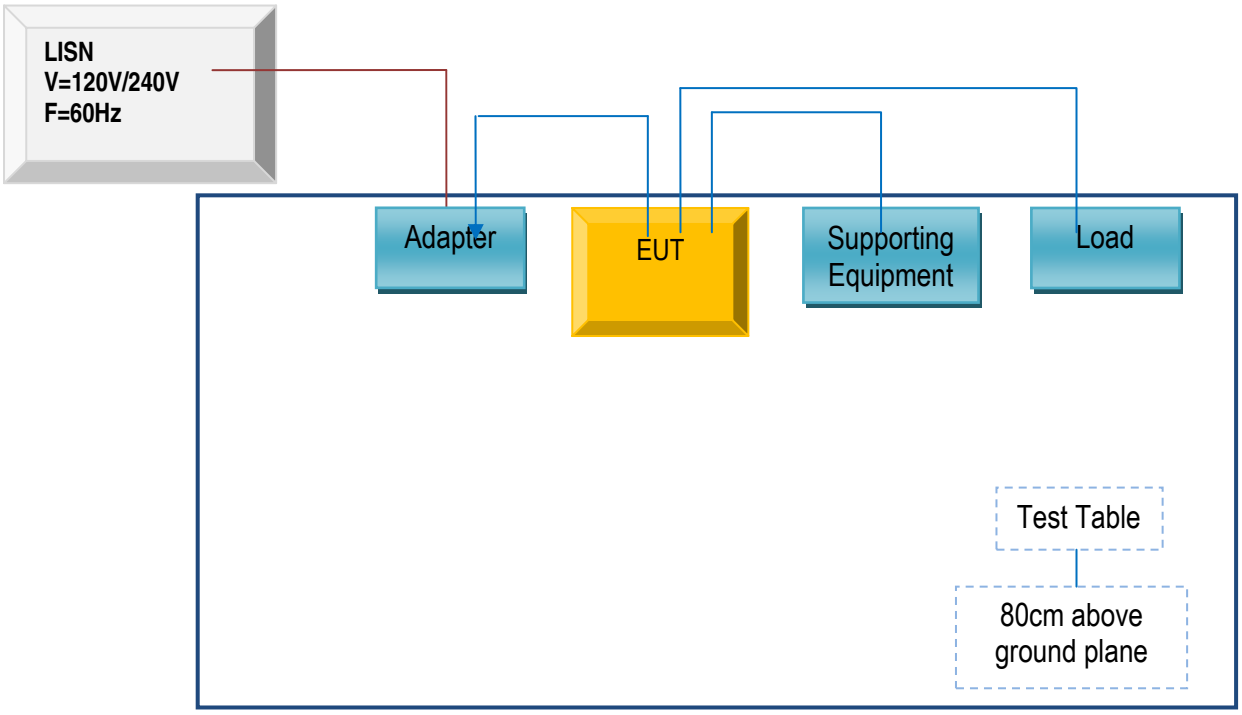


Radiated Spurious Emissions Test Setup Above 1GHz

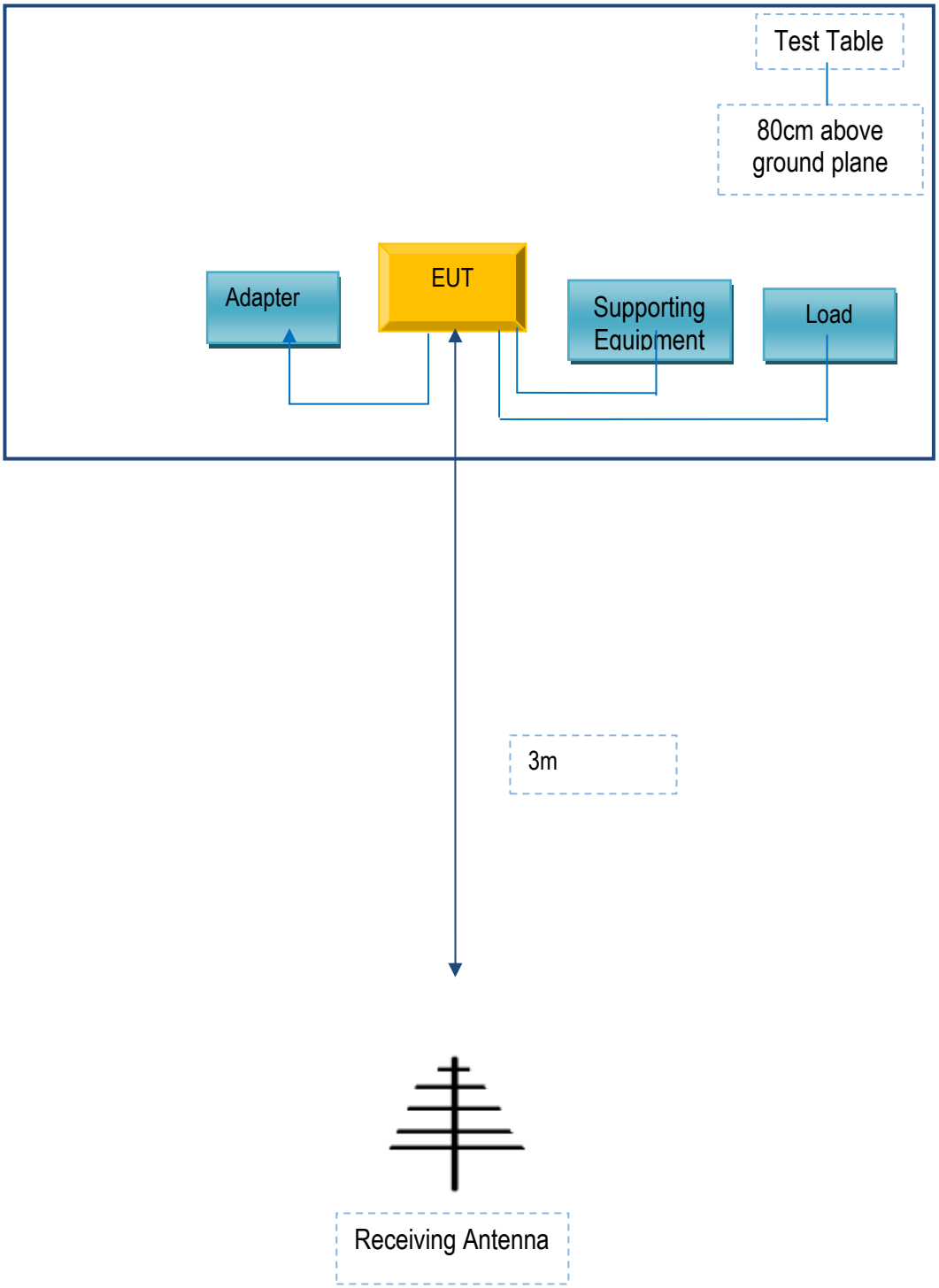
Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

Annex C.i. TEST SET UP BLOCK

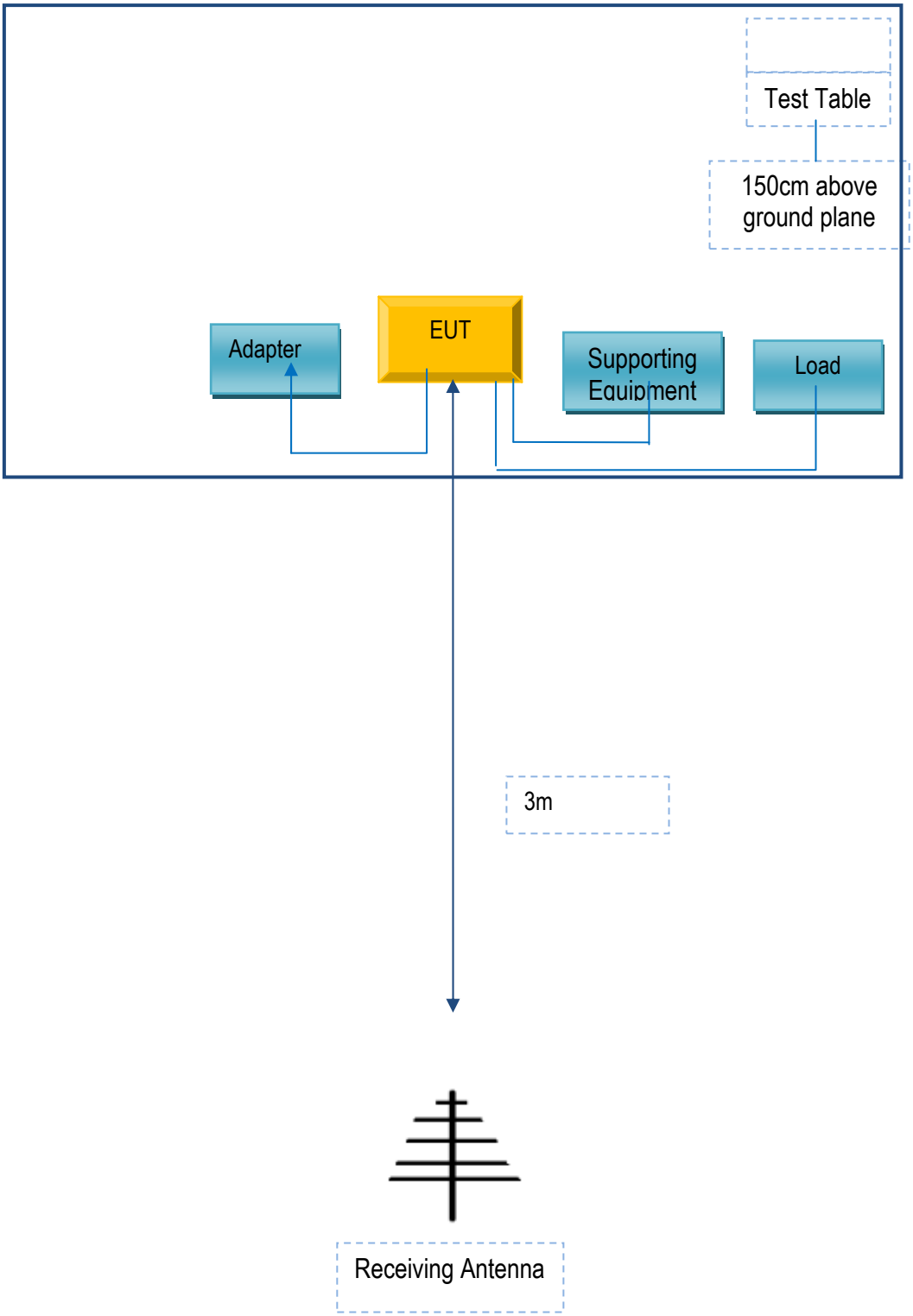
Block Configuration Diagram for AC Line Conducted Emissions



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



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



Annex 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
N/A	user interface for VAB system	UI	N/A
N/A	Load	N/A	N/A

Supporting Cable:

Cable type	Shield Type	Ferrite Core	Length	Serial No
Power Cable	Un-shielding	No	1.8m	42T441636200034

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

Please see attachment

Annex E. DECLARATION OF SIMILARITY

N/A