

FCC Part 15C Measurement and Test Report

For

Acrox Technologies Co., Ltd.

4F., No.89, Minshan St., Neihu Dist., Taipei City 114, Taiwan, R.O.C

FCC ID: PRDKB30

FCC Rule(s):	<u>FCC Part 15.249</u>
Product Description:	<u>Wireless Keyboard</u>
Tested Model:	<u>KS4</u>
Report No.:	<u>STR18058008I</u>
Sample Receipt Date:	<u>2018-05-02</u>
Tested Date:	<u>2017-05-31 to 2017-06-02</u>
Issued Date:	<u>2018-05-03</u>
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Note: This test report is limited to the above client company and the product model only.
Part of the test data is cited the early report, Report Numbers is STR17058411I. It may not
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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Acrox Technologies Co., Ltd.
Address of applicant: 4F., No.89, Minshan St., Neihu Dist., Taipei City 114,
Taiwan, R.O.C

Manufacturer: Acrox Technologies Co., Ltd
Address of manufacturer: Hsinmin Industria, Changan Town, Dongguan City,
Guangdong, China

General Description of EUT	
Product Name:	Wireless Keyboard
Trade Name:	ACROX/Blackweb
Model No.:	KS4
Adding Model(s):	BWC17HO004, BWC17HO005, BWC17HO006
Rated Voltage:	DC 3V by 2 AAA battery
Power Adapter Model:	/
<i>Note: The test data is gathered from a production sample, provided by the manufacturer. The appearance of others models listed in the report is different from main-test model KS4, but the circuit and the electronic construction do not change, declared by the manufacturer.</i>	

Technical Characteristics of EUT	
Frequency Range:	2408-2474MHz
Max. Field Strength:	83.60dBuV/m (3m)
Data Rate:	/
Modulation:	FSK
Antenna Type:	PCB Antenna
Antenna Gain:	-5dBi
Lowest Internal Frequency of EUT:	12MHz

1.2 Test Standards

The following report is prepared on behalf of the Acrox Technologies Co., Ltd. in accordance with FCC Part 15, Subpart B, Subpart C, and section 15.107, 15.203, 15.205, 15.207, 15.209 and 15.249 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.107,15.203, 15.205, 15.207, 15.209 and 15.249 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which results in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices, and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.4 Test Facility

FCC – Registration No.: 125990

Shenzhen SEM Test Technology Co., Ltd. Laboratory has been recognized to perform compliance testing on equipment subject to the Commissions Declaration Of Conformity (DOC). The Designation Number is CN5010, and Test Firm Registration Number is 125990.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM.Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	Low Channel	2408MHz
TM2	Middle Channel	2440MHz
TM3	High Channel	2474MHz

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	$\pm 0.42\text{dB}$
Occupied Bandwidth	Conducted	$\pm 1.5\%$
Conducted Spurious Emission	Conducted	$\pm 2.17\text{dB}$
Conducted Emissions	Conducted	9-150kHz $\pm 3.74\text{dB}$
		0.15-30MHz $\pm 3.34\text{dB}$
Transmitter Spurious Emissions	Radiated	30-200MHz $\pm 4.52\text{dB}$
		0.2-1GHz $\pm 5.56\text{dB}$
		1-6GHz $\pm 3.84\text{dB}$
		6-18GHz $\pm 3.92\text{dB}$

1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2017-06-12	2018-06-11
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2017-06-12	2018-06-11
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2017-06-12	2018-06-11
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2017-06-12	2018-06-11
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2017-06-12	2018-06-11
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2017-06-08	2020-06-07
SEMT-1042	Horn Antenna	ETS	3117	00086197	2017-06-08	2020-06-07
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2017-06-08	2020-06-07
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-08	2020-06-07
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2017-06-12	2018-06-11
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2017-06-12	2018-06-11
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2017-06-12	2018-06-11
SEMT-1168	Pre-amplifier	Direction Systems Inc.	PAP-0126	14141-12838	2017-08-15	2018-08-14
SEMT-1169	Pre-amplifier	Direction Systems Inc.	PAP-2640	14145-14153	2017-08-15	2018-08-14
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2017-06-12	2018-06-11
SEMT-1170	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2018-03-19	2021-03-18

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 15.203	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§ 15.207(a)	Conducted Emission	N/A
§ 15.209(a)(f)	Radiated Spurious Emissions	Compliant
§15.249(a)	Field Strength of Emissions	Compliant
§15.249(d)	Out of Band Emission	Compliant
§15.215 (c)	Emission Bandwidth	Compliant

3. Antenna Requirements

3.1 Standard Applicable

According to FCC Part 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.

3.2 Test Result

This product has an integral antenna, fulfill the requirement of this section.

4. Radiated Emissions

4.1 Standard Applicable

According to §15.249(a), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field strength of fundamental (milli-volts/meter)	Field strength of Harmonics (micro-volts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

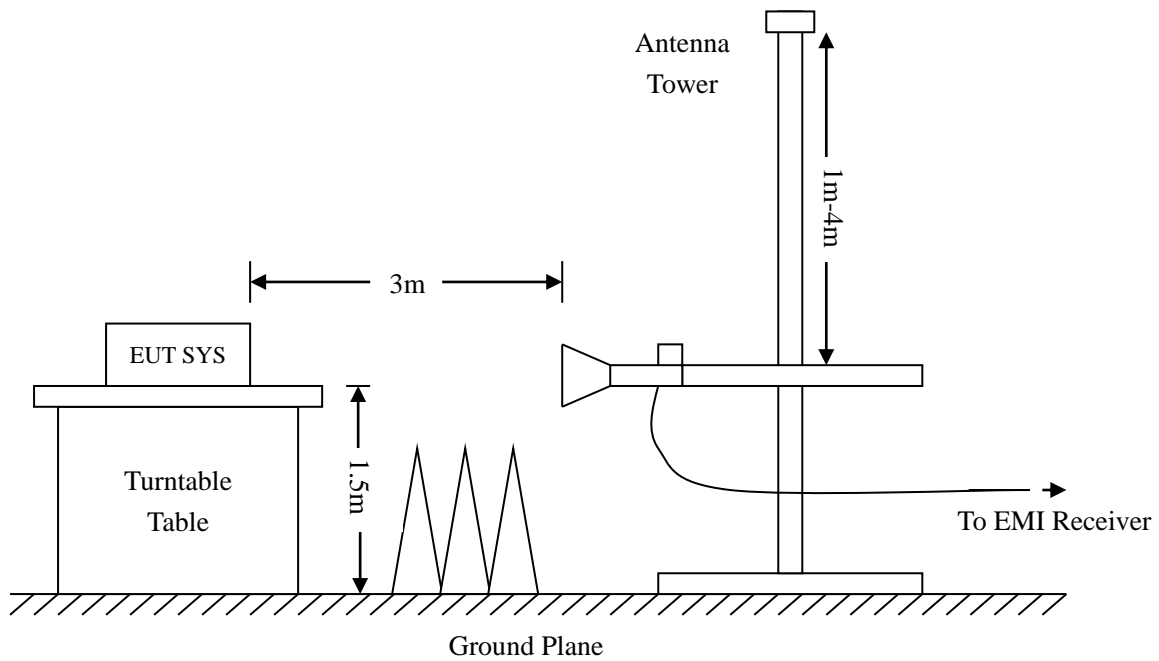
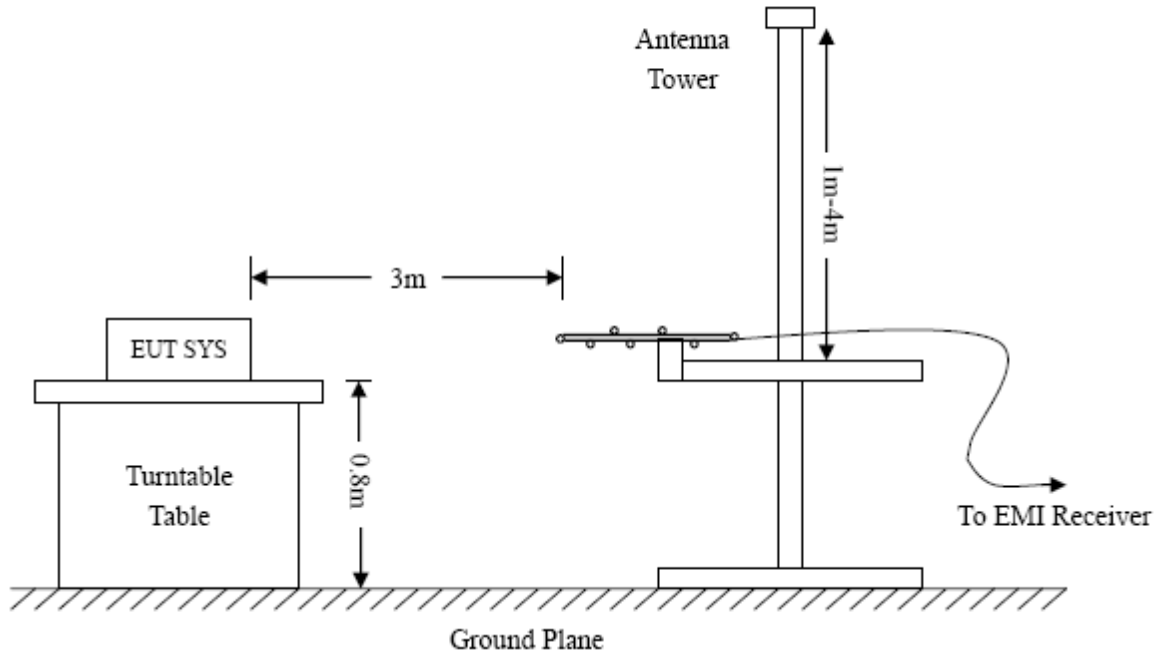
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

4.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.249(a) and FCC Part 15.209 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.



Frequency :9kHz-30MHz
 RBW=10KHz,
 VBW =30KHz
 Sweep time= Auto
 Trace = max hold
 Detector function = peak

Frequency :30MHz-1GHz
 RBW=120KHz,
 VBW=300KHz
 Sweep time= Auto
 Trace = max hold
 Detector function = peak, QP

Frequency :Above 1GHz
 RBW=1MHz,
 VBW=3MHz(Peak), 10Hz(AV)
 Sweep time= Auto
 Trace = max hold
 Detector function = peak, AV

4.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of $-6\text{dB}\mu\text{V}$ means the emission is $6\text{dB}\mu\text{V}$ below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15C Limit}$$

4.4 Environmental Conditions

Temperature:	24 °C
Relative Humidity:	60 %
ATM Pressure:	1012 mbar

4.5 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.249 standards, and had the worst margin of:

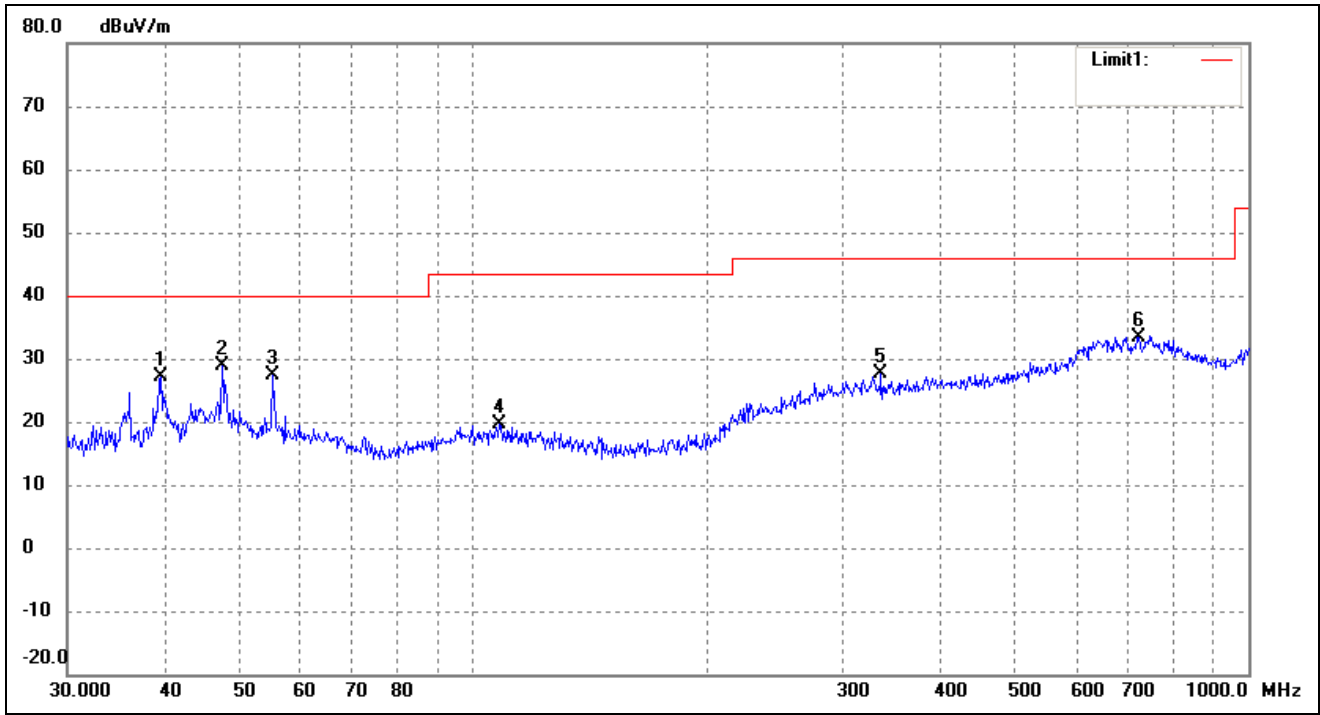
-6.33 dB at 47.9940 MHz in the Vertical polarization, Low Channel, 9 kHz to 25 GHz, 3Meters

Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

Plot of Radiated Emissions Test Data (30MHz to 1GHz)

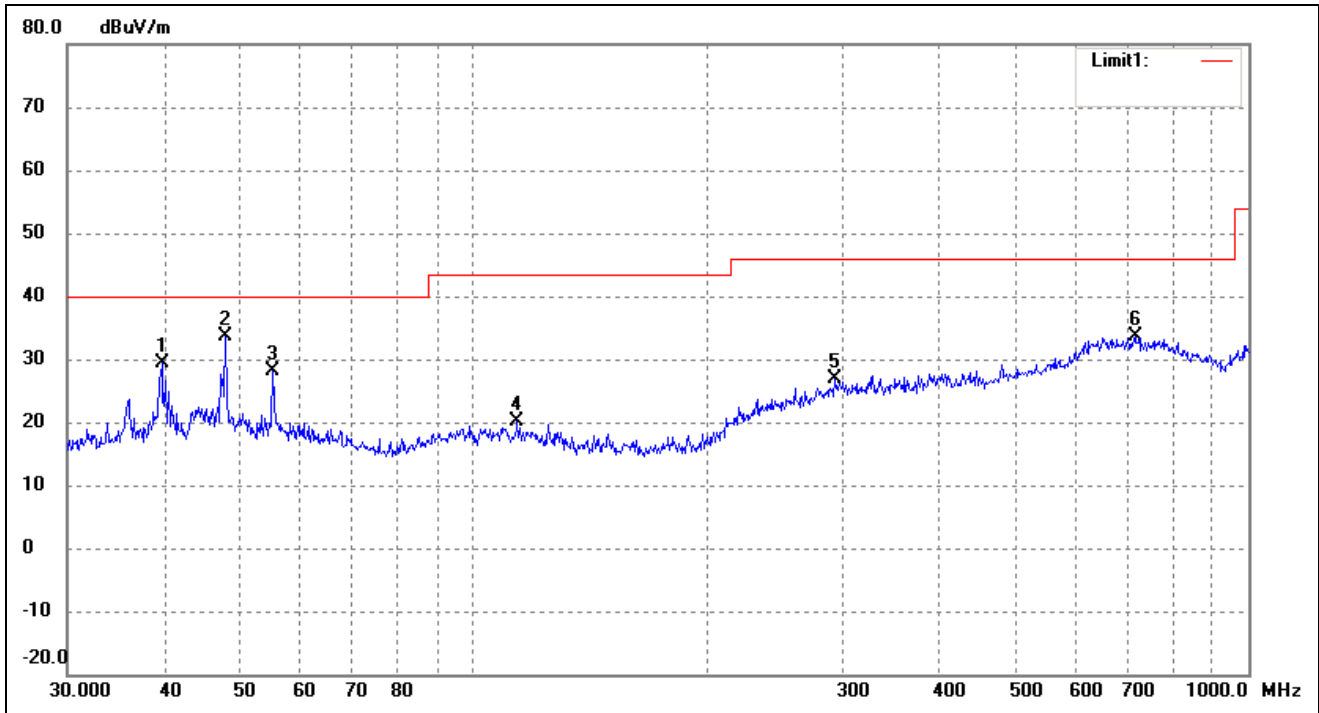
EUT: *Wireless Keyboard*
 Tested Model: *KS4*
 Operating Condition: *Transmitting Low Channel (2408MHz)*
 Comment: *DC 3V*

Test Specification: *Horizontal*



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (*)	Height (cm)	Remark
1	39.5757	22.24	4.87	27.11	40.00	-12.89	72	100	peak
2	47.4918	23.85	4.96	28.81	40.00	-11.19	164	100	peak
3	55.2207	22.46	5.02	27.48	40.00	-12.52	99	100	peak
4	108.2667	14.67	4.88	19.55	43.50	-23.95	122	100	peak
5	336.0352	16.17	11.48	27.65	46.00	-18.35	238	100	peak
6	721.7259	15.57	17.91	33.48	46.00	-12.52	136	100	peak

Test Specification: Vertical

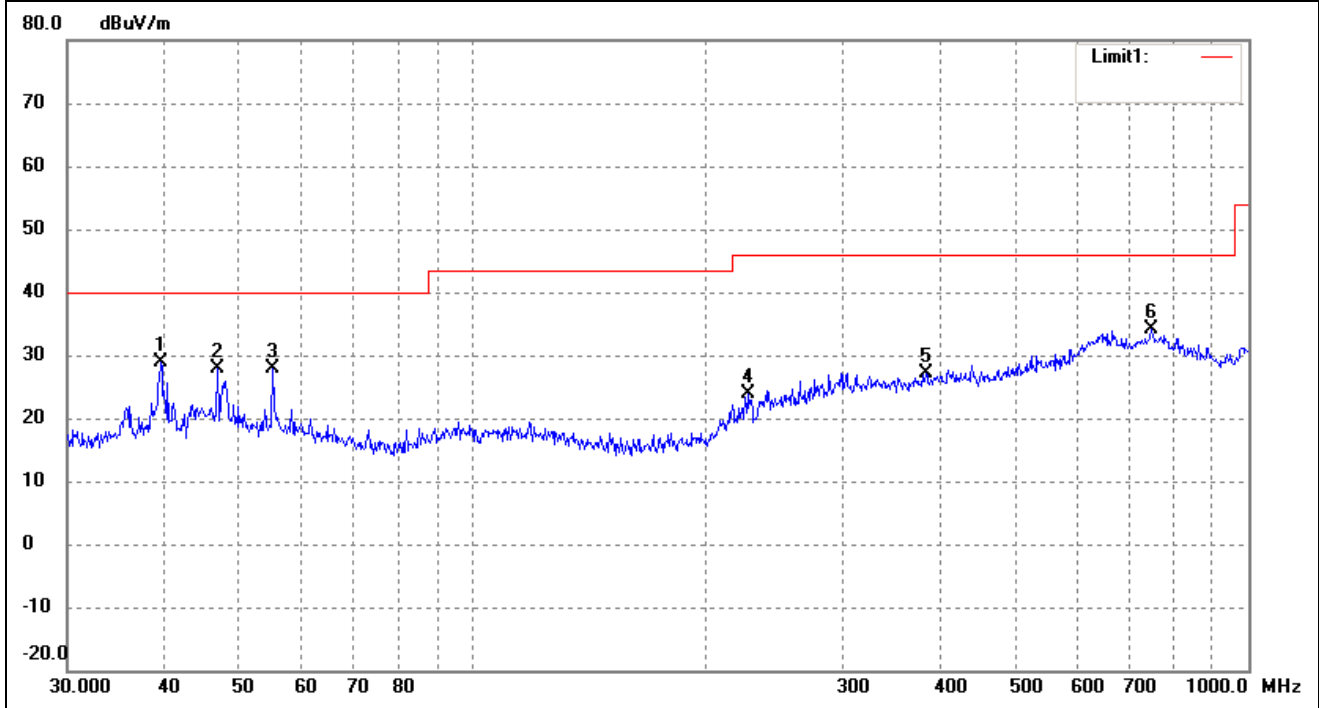


No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (*)	Height (cm)	Remark
1	39.7147	24.53	4.89	29.42	40.00	-10.58	194	100	peak
2	47.9940	28.71	4.96	33.67	40.00	-6.33	99	100	peak
3	55.2207	23.14	5.02	28.16	40.00	-11.84	135	100	peak
4	114.1138	15.27	4.85	20.12	43.50	-23.38	94	100	peak
5	293.0842	15.23	11.69	26.92	46.00	-19.08	153	100	peak
6	714.1734	15.98	17.63	33.61	46.00	-12.39	181	100	peak

Operating Condition: Transmitting Middle Channel (2440MHz)

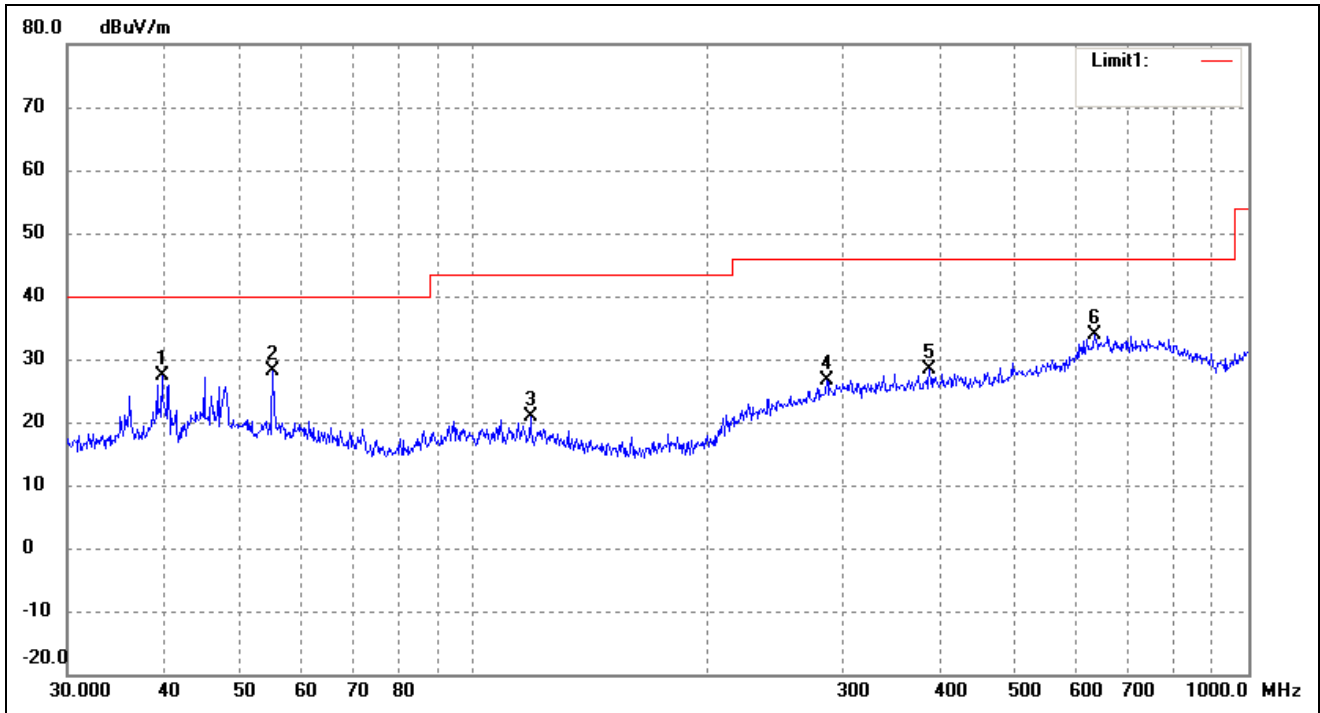
Comment: DC 3V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (*)	Height (cm)	Remark
1	39.5757	24.06	4.87	28.93	40.00	-11.07	256	100	peak
2	46.8303	22.97	4.96	27.93	40.00	-12.07	100	100	peak
3	55.2207	22.84	5.02	27.86	40.00	-12.14	95	100	peak
4	226.0994	15.87	8.05	23.92	46.00	-22.08	309	100	peak
5	383.9318	15.11	11.97	27.08	46.00	-18.92	160	100	peak
6	750.1083	15.55	18.58	34.13	46.00	-11.87	298	100	peak

Test Specification: Vertical

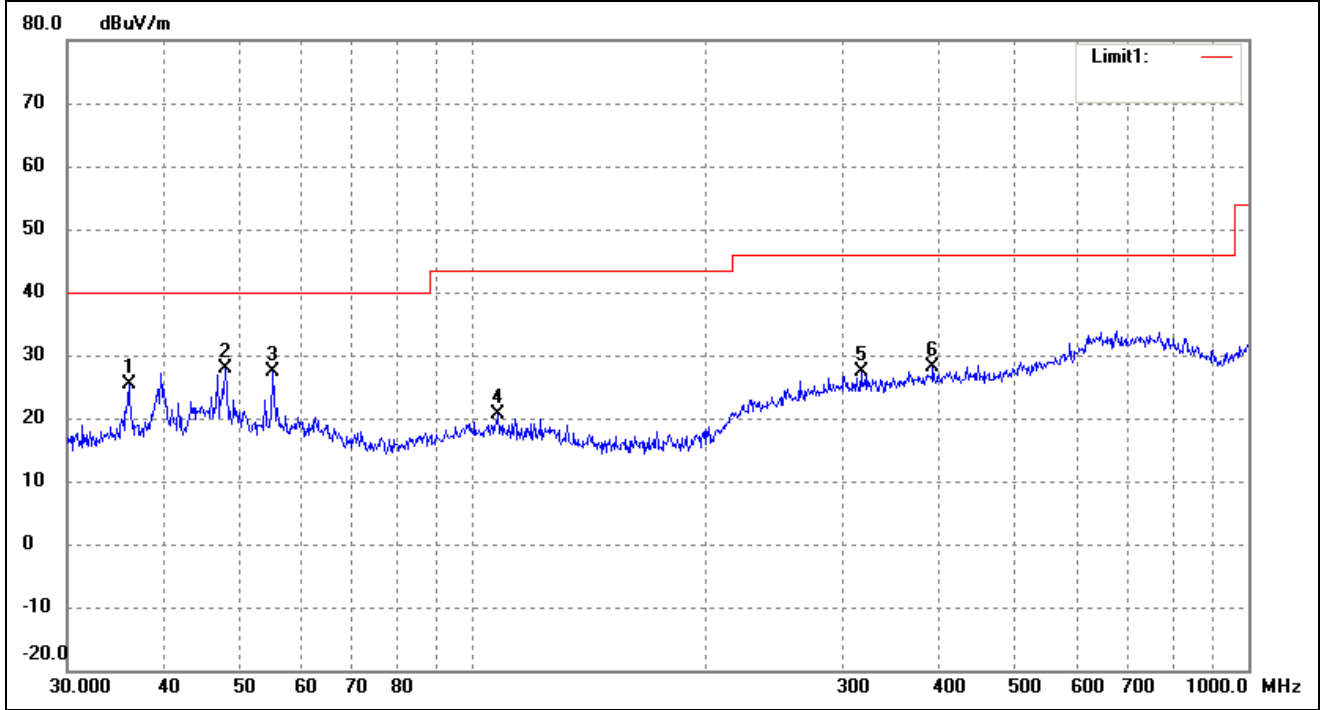


No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (*)	Height (cm)	Remark
1	39.7147	22.58	4.89	27.47	40.00	-12.53	61	100	peak
2	55.2207	23.01	5.02	28.03	40.00	-11.97	231	100	peak
3	118.6014	16.17	4.82	20.99	43.50	-22.51	81	100	peak
4	285.9778	15.19	11.39	26.58	46.00	-19.42	261	100	peak
5	387.9920	16.16	12.14	28.30	46.00	-17.70	181	100	peak
6	633.9073	15.91	17.86	33.77	46.00	-12.23	208	100	peak

Operating Condition: Transmitting High Channel (2474MHz)

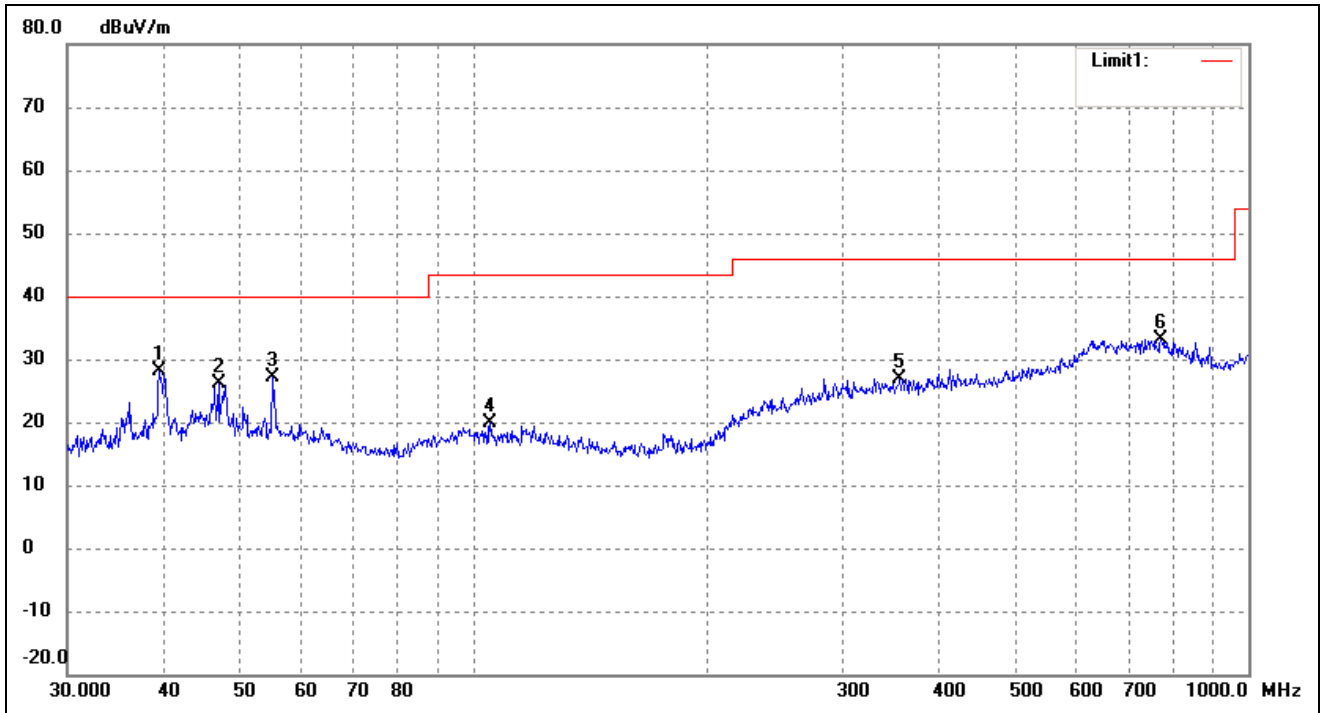
Comment: DC 3V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (*)	Height (cm)	Remark
1	36.0007	20.97	4.33	25.30	40.00	-14.70	268	100	peak
2	47.9940	22.91	4.96	27.87	40.00	-12.13	92	100	peak
3	55.2207	22.30	5.02	27.32	40.00	-12.68	165	100	peak
4	107.8877	15.74	4.88	20.62	43.50	-22.88	100	100	peak
5	316.5890	15.47	11.96	27.43	46.00	-18.57	193	100	peak
6	392.0951	15.69	12.33	28.02	46.00	-17.98	258	100	peak

Test Specification: Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (*)	Height (cm)	Remark
1	39.4372	23.27	4.85	28.12	40.00	-11.88	323	100	peak
2	46.9948	21.07	4.96	26.03	40.00	-13.97	97	100	peak
3	55.2207	22.07	5.02	27.09	40.00	-12.91	82	100	peak
4	105.2718	14.88	4.89	19.77	43.50	-23.73	116	100	peak
5	355.4273	15.21	11.78	26.99	46.00	-19.01	109	100	peak
6	771.4486	15.70	17.39	33.09	46.00	-12.91	316	100	peak

Spurious Emissions Above 1GHz

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2408MHz							
2408	84.76	-4.44	80.32	114	-33.68	H	PK
2408	85.04	-4.44	80.60	94	-13.40	H	AV
4816	49.42	-0.96	48.46	74	-25.54	H	PK
4816	38.34	-0.96	37.38	54	-16.62	H	AV
7224	45.85	1.34	47.19	74	-26.81	H	PK
7224	33.94	1.34	35.28	54	-18.72	H	AV
2408	88.05	-4.45	83.60	114	-30.40	V	PK
2408	86.08	-4.44	81.64	94	-12.36	V	AV
4816	47.82	-0.96	46.86	74	-27.14	V	PK
4816	36.47	-0.96	35.51	54	-18.49	V	AV
7224	45.83	1.34	47.17	74	-26.83	V	PK
7224	33.59	1.34	34.93	54	-19.07	V	AV
Middle Channel-2440MHz							
2440	85.16	-4.42	80.74	114	-33.26	H	PK
2440	84.82	-4.42	80.40	94	-13.60	H	AV
4880	50.02	-0.78	49.24	74	-24.76	H	PK
4880	36.92	-0.78	36.14	54	-17.86	H	AV
7320	45.01	1.39	46.40	74	-27.60	H	PK
7320	34.08	1.39	35.47	54	-18.53	H	AV
2440	85.19	-4.42	80.77	114	-33.23	V	PK
2440	84.48	-4.42	80.06	94	-13.94	V	AV
4880	49.84	-0.78	49.06	74	-24.94	V	PK
4880	36.93	-0.78	36.15	54	-17.85	V	AV
7320	44.28	1.34	45.62	74	-28.38	V	PK
7320	34.37	1.34	35.71	54	-18.29	V	AV

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2474MHz							
2474	84.83	-4.37	80.46	114	-33.54	H	PK
2474	83.92	-4.37	79.55	94	-14.45	H	AV
4948	48.90	-0.62	48.28	74	-25.72	H	PK
4948	36.90	-0.62	36.28	54	-17.72	H	AV
7422	45.16	1.44	46.60	74	-27.40	H	PK
7422	32.65	1.44	34.09	54	-19.91	H	AV
2474	84.24	-4.37	79.87	114	-34.13	V	PK
2474	83.70	-4.37	79.33	94	-14.67	V	AV
4948	49.35	-0.62	48.73	74	-25.27	V	PK
4948	38.45	-0.62	37.83	54	-16.17	V	AV
7422	43.73	1.44	45.17	74	-28.83	V	PK
7422	33.96	1.44	35.40	54	-18.60	V	AV

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 5th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

The measurements greater than 20dB below the limit from 9kHz to 30MHz..

5. Out of Band Emissions

5.1 Standard Applicable

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

5.2 Test Procedure

As the radiation test, set the Lowest and Highest Transmitting Channel, observed the outside band of 2400MHz to 2483.5MHz, than mark the higher-level emission for comparing with the FCC rules.

5.3 Environmental Conditions

Temperature:	24 °C
Relative Humidity:	60 %
ATM Pressure:	1012 mbar

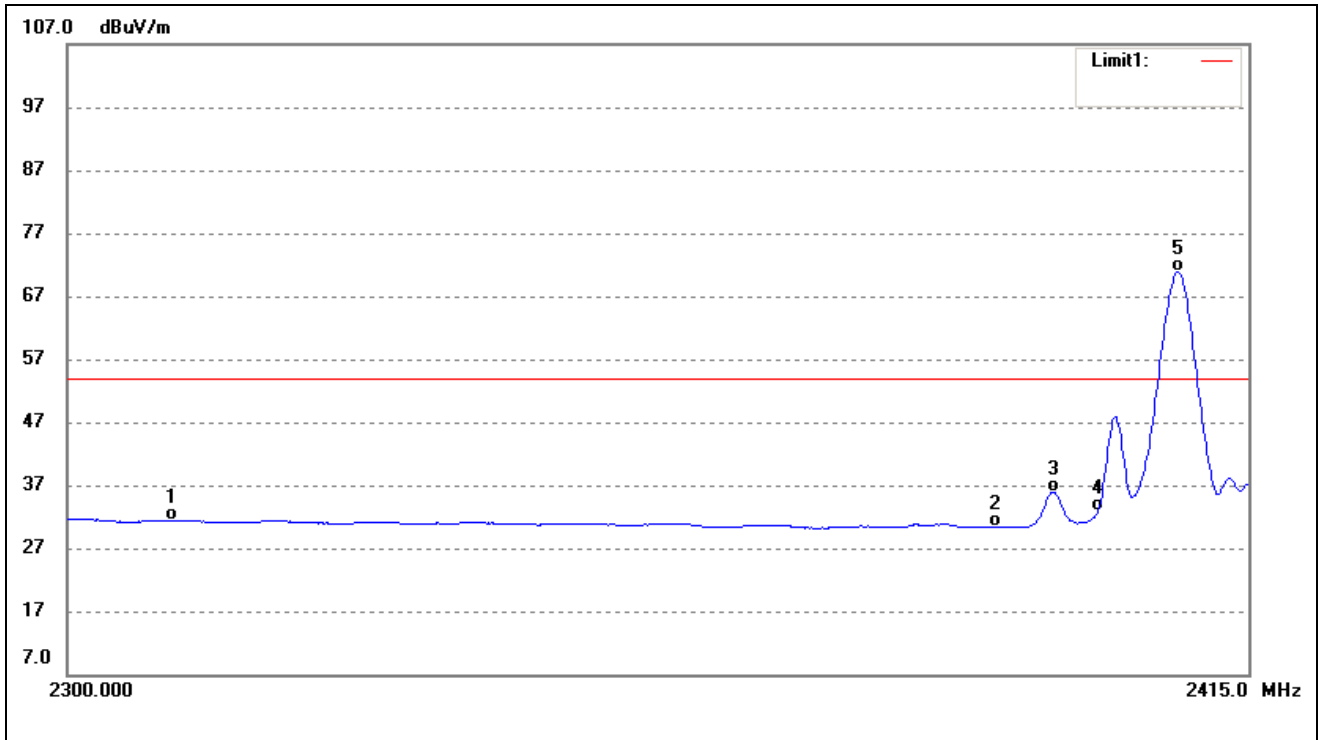
5.4 Summary of Test Results/Plots

Test mode	Frequency	Limit	Result
	MHz	dBuV / dBc	
Lowest	2310.00	<54 dBuV	Pass
	2390.00	<54 dBuV	Pass
	2400.00	<54 dBuV	Pass
Highest	2483.50	<54 dBuV	Pass
	2500.00	<54 dBuV	Pass

The edge emissions are below the FCC 15.209 Limits or complies with the 15.249 requirements.

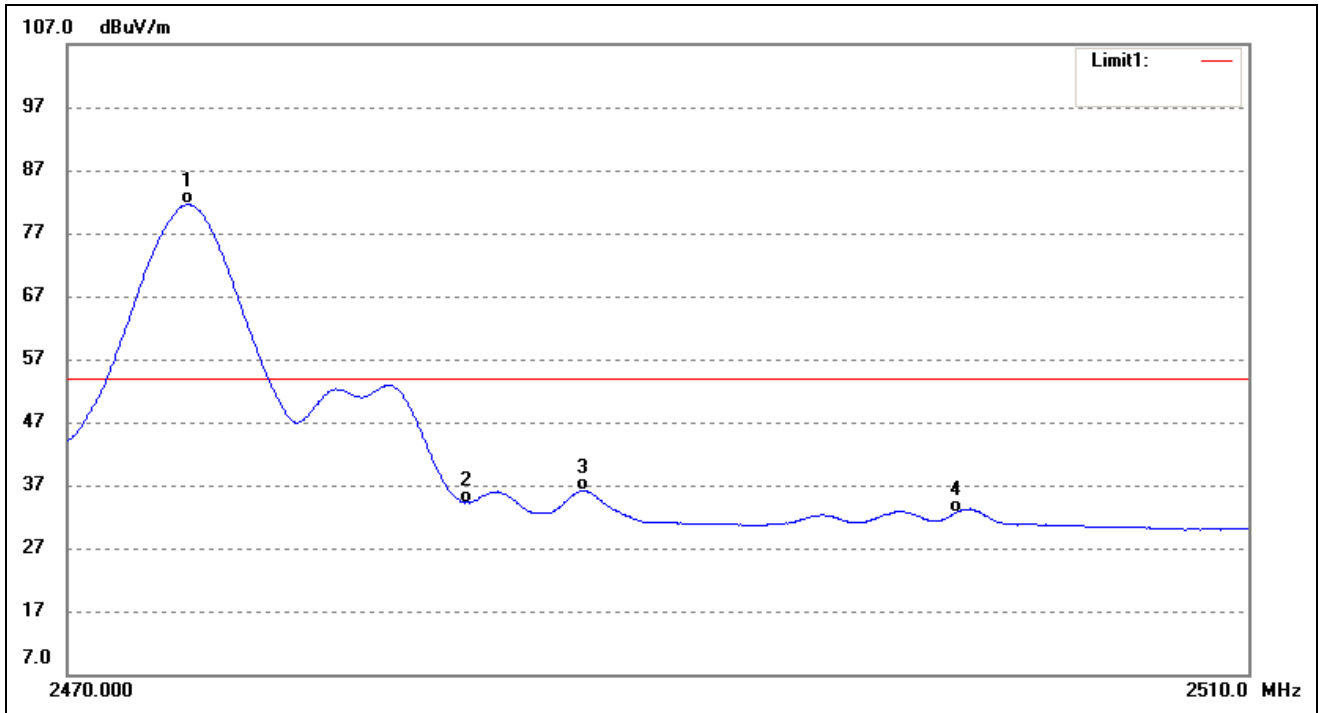
Please refer to the test plots as below.

Lowest Bandedge
Vertical (Worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.00	34.84	-3.35	31.49	54.00	-22.51	Average Detector
		45.65	-3.35	42.30	74.00	-31.70	Peak Detector
2	2390.00	34.66	-4.29	30.37	54.00	-23.63	Average Detector
		47.59	-4.29	43.30	74.00	-30.70	Peak Detector
3	2395.64	40.34	-4.35	35.99	54.00	-18.01	Average Detector
		56.31	-4.35	51.96	74.00	-22.04	Peak Detector
4	2400.00	37.38	-4.40	32.98	54.00	-21.02	Average Detector
		51.66	-4.40	47.26	74.00	-26.74	Peak Detector

Highest Bandedge
Vertical (Worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2474.05	85.94	-4.36	81.58	/	/	Average Detector
	2473.49	88.20	-4.36	83.84	/	/	Peak Detector
2	2483.50	38.59	-4.36	34.23	54.00	-19.77	Average Detector
	2483.50	49.13	-4.36	44.77	74.00	-29.23	Peak Detector
3	2487.40	40.47	-4.35	36.12	54.00	-17.88	Average Detector
	2484.33	50.77	-4.36	46.41	74.00	-27.59	Peak Detector
4	2500.00	36.99	-4.34	32.65	54.00	-21.35	Average Detector
	2500.00	47.14	-4.34	42.80	74.00	-31.20	Peak Detector

6. Emission Bandwidth

6.1 Standard Applicable

According to 15.215 (c), intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

6.2 Test Procedure

According to the ANSI 63.10-2013, the emission bandwidth test method as follows.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Set span = 1MHz, centered on a transmitting channel

RBW \geq 1% 20dB Bandwidth, VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

All 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 and record the 20dB down and 99% bandwidth of the emission.

6.3 Environmental Conditions

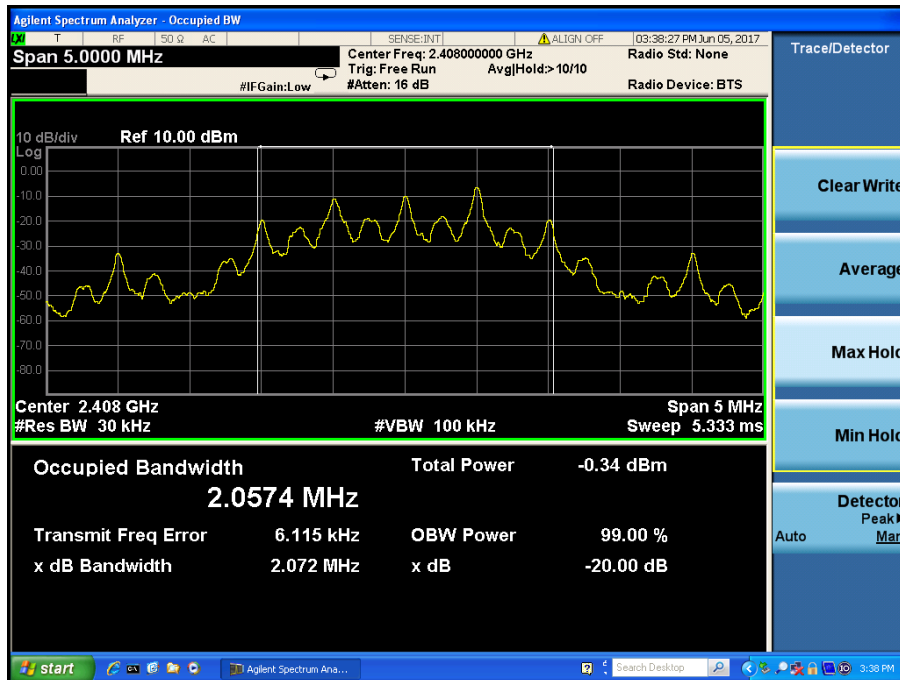
Temperature:	25 °C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

6.4 Summary of Test Results/Plots

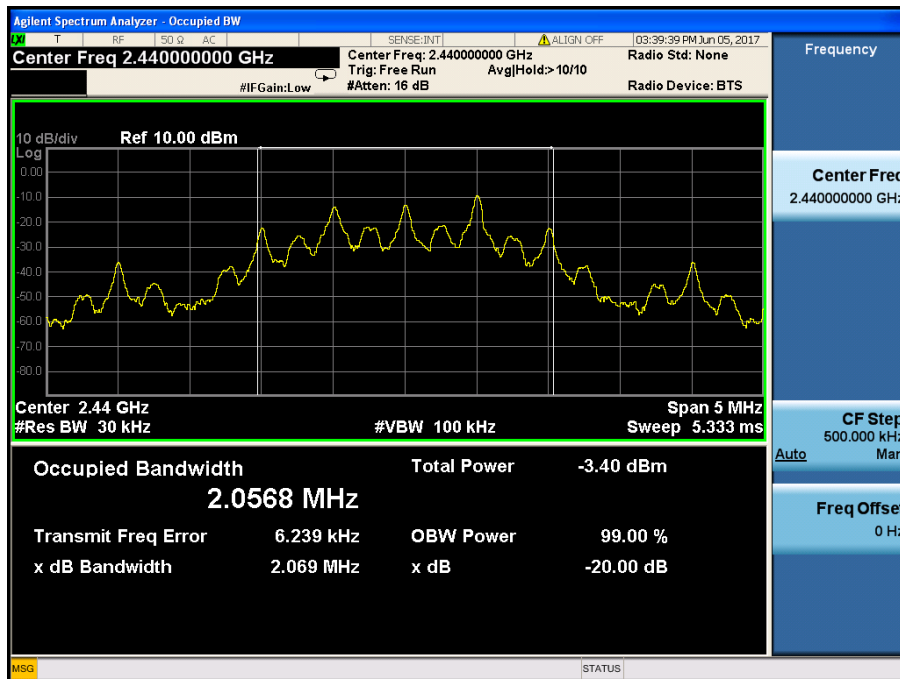
Channel	Frequency MHz	20dB Bandwidth kHz	99% Bandwidth kHz
Low Channel	2408	2072	2057.4
Middle Channel	2440	2069	2056.8
High Channel	2474	2070	2055.5

Please refer to the following test plots

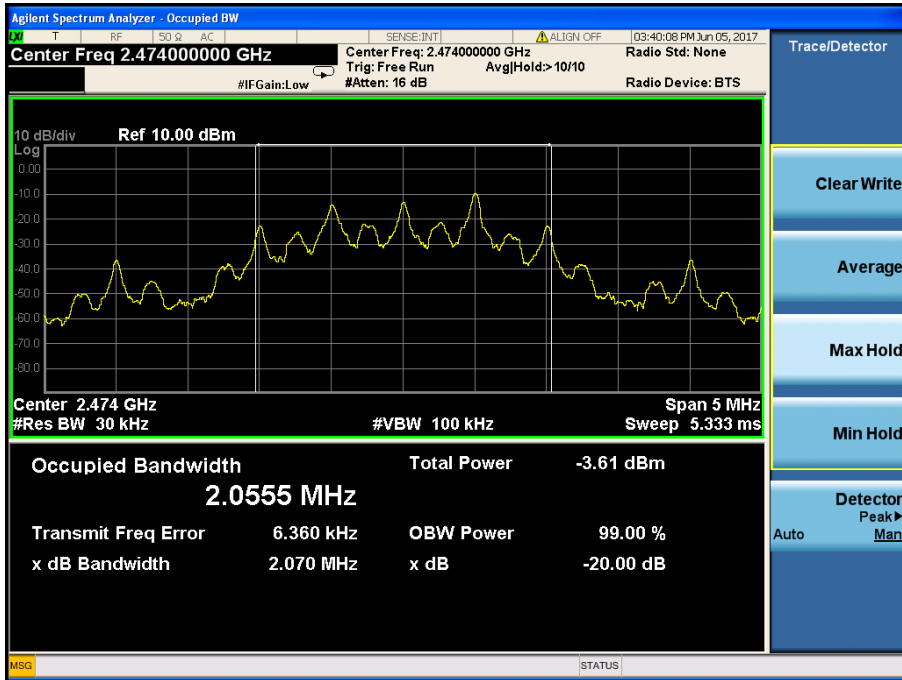
Low Channel:



Middle Channel:



High Channel:



***** END OF REPORT *****