Rode Liu Silin Chen Jungso



FCC Part 15C Measurement and Test Report

For

BeeRaider Limited

Rosferrard House, Beaulieu, Drogheda, County Louth, Ireland

FCC ID: 2AH8UBR1KENOP

FCC Rule(s): FCC Part 15.249

Product Description: Wireless Keyboard

Tested Model: BR1KENOP

Report No.: <u>STR160481231</u>

Tested Date: <u>2016-04-14 to 2016-04-28</u>

Issued Date: <u>2016-04-28</u>

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Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Shenzhen SEM.Test Technology Co., Ltd.



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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: BeeRaider Limited

Address of applicant: Rosferrard House, Beaulieu, Drogheda, County

Louth, Ireland

Manufacturer: SHENZHEN F&G ELECTRON CO., LIMITED

Address of manufacturer: 10i, Jindacheng Bldg, Shajing Town, Bao'An District,

Shenzhen, China

General Description of EUT	
Product Name:	Wireless Keyboard
Trade Name:	BeeRaider
Model No.:	BR1KENOP
Adding Model(s):	BR1KENQW, BR1000, FK3313, BRK1000
Rated Voltage:	DC 3.0V

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 BR1KENOP, but the circuit and the electronic construction do not change, declared by the manufacturer.

Technical Characteristics of EUT				
Frequency Range:	2402-2480MHz			
Max. Field Strength:	80.73dBuV/m			
Data Rate:	1			
Modulation:	GFSK			
Quantity of Channels:	79			
Channel Separation:	1MHz			
Antenna Type:	PCB Antenna			
Antenna Gain:	0 dBi			
Lowest Internal Frequency of EUT:	16MHz			
Device Category:	Portable device			



1.2 Test Standards

The following report is prepared on behalf of the BeeRaider Limited 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.: 934118

Shenzhen SEM.Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 934118.

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.

CNAS Registration No.: L4062

Shenzhen SEM. Test Technology Co., Ltd. is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L4062. All measurement facilities used to collect the measurement data are located at 1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road, Bao'an District, Shenzhen, P.R.C (518101).

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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	2402MHz			
TM2	Middle Channel	2441MHz			
TM3	High Channel	2480MHz			

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	±0.42dB				
Occupied Bandwidth	Conducted	±1.5%				
Conducted Spurious Emission	Conducted	±2.17dB				
Conducted Emissions	Conducted	±2.88dB				
Transmitter Spurious Emissions	Radiated	±5.1dB				

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1.7 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
Spectrum Analyzer	Agilent	E4407B	MY41440400	2015-06-17	2016-06-16
Spectrum Analyzer	Rohde & Schwarz	FSP	836079/035	2015-06-17	2016-06-16
EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2015-06-17	2016-06-16
Amplifier	Agilent	8447F	3113A06717	2015-06-17	2016-06-16
Amplifier	C&D	PAP-1G18	2002	2015-06-17	2016-06-16
Broadband Antenna	Schwarz beck	VULB9163	9163-333	2015-06-17	2016-06-16
Horn Antenna	ETS	3117	00086197	2015-06-17	2016-06-16
Horn Antenna	ETS	3116B	00088203	2015-06-17	2016-06-16
Loop Antenna	Schwarz beck	FMZB 1516	9773	2015-06-17	2016-06-16
EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2015-06-17	2016-06-16
L.I.S.N	Schwarz beck	NSLK8126	8126-224	2015-06-17	2016-06-16
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2015-06-17	2016-06-16



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.

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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	Field strength of Harmonics
	(milli-volts/meter)	(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.

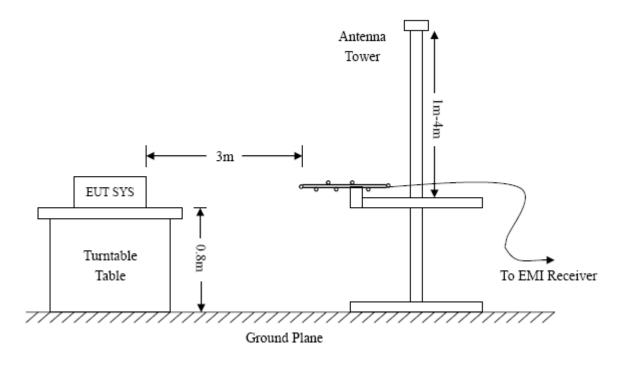
4.2 Test Procedure

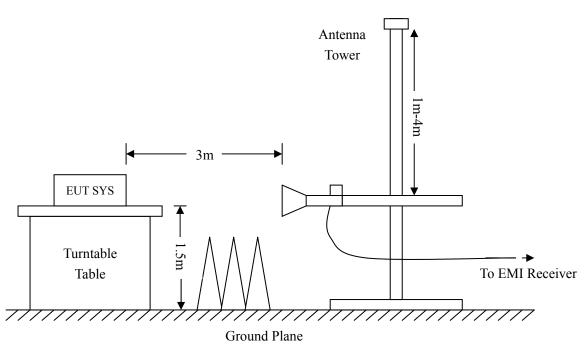
The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.205 15.249(a) and FCC Part 15.209 Limit.

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.

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 $Frequency: 9kHz\hbox{-}30MHz$

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:

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

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:

-3.90 dB at 139.1250 MHz in the Vertical polarization, Middle Channel, 9 kHz to 25 GHz, 3Meters

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

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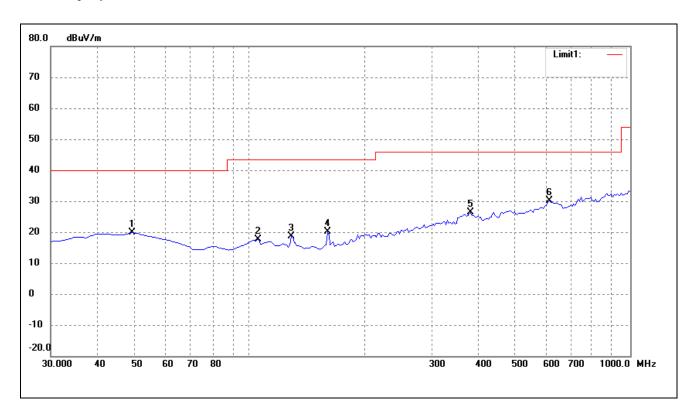
Plot of Radiated Emissions Test Data (30MHz to 1GHz)

EUT: Wireless Mouse
Tested Model: BR1KENOP

Operating Condition: Transmitting Low Channel (2402MHz)

Comment: DC 3.0V

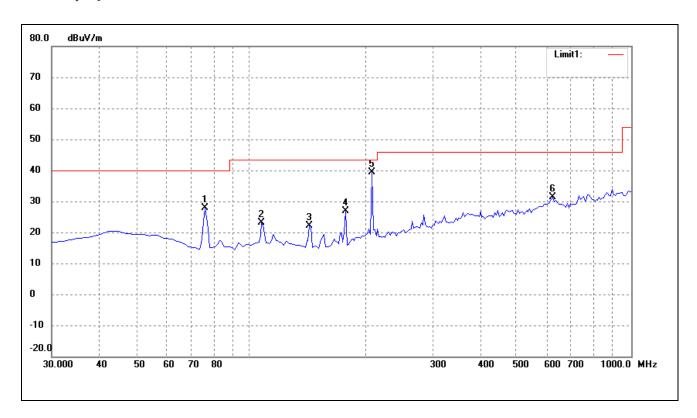
Test Specification: Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	44.5500	28.08	-7.96	20.12	40.00	-19.88	100	100	peak
2	88.2000	30.99	-12.77	18.22	43.50	-25.28	100	100	peak
3	190.0500	32.30	-9.99	22.31	43.50	-21.19	100	100	peak
4	379.2000	28.91	-2.14	26.77	46.00	-19.23	100	100	peak
5	628.9750	29.56	1.01	30.57	46.00	-15.43	100	100	peak
6	752.6500	29.93	1.92	31.85	46.00	-14.15	100	100	peak



Test Specification: Vertical



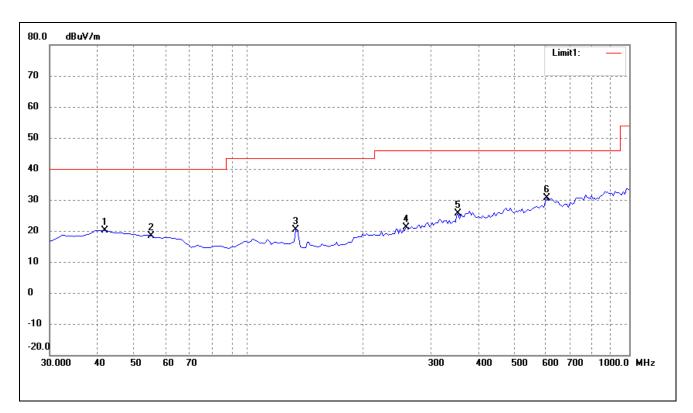
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	76.0750	40.11	-12.32	27.79	40.00	-12.21	100	100	peak
2	107.6000	34.18	-11.10	23.08	43.50	-20.42	100	100	peak
3	143.9750	34.59	-12.50	22.09	43.50	-21.41	100	100	peak
4	177.9250	38.24	-11.45	26.79	43.50	-16.71	100	100	peak
5	209.4500	48.16	-8.74	39.42	43.50	-4.08	100	100	peak
6	626.5500	30.20	1.07	31.27	46.00	-14.73	100	100	peak



Operating Condition: Transmitting Middle Channel (2441MHz)

Comment: DC 3V

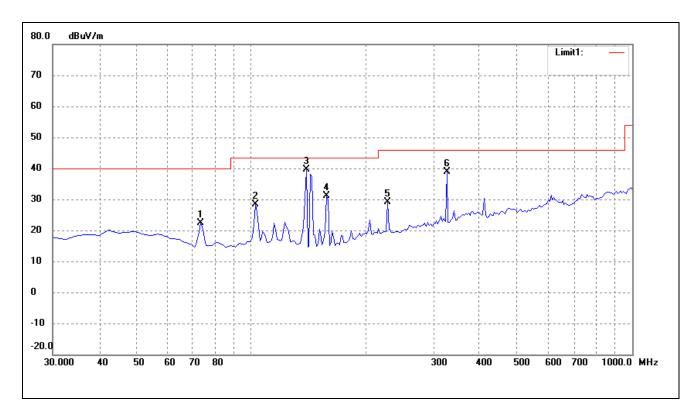
Test Specification: Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	42.1250	27.88	-7.81	20.07	40.00	-19.93	100	100	peak
2	55.4147	27.27	-9.00	18.27	40.00	-21.73	100	100	peak
3	134.2750	32.73	-12.23	20.50	43.50	-23.00	100	100	peak
4	260.3750	28.02	-6.93	21.09	46.00	-24.91	100	100	peak
5	357.3750	29.15	-3.48	25.67	46.00	-20.33	100	100	peak
6	612.0000	29.83	0.68	30.51	46.00	-15.49	100	100	peak



Test Specification: Vertical



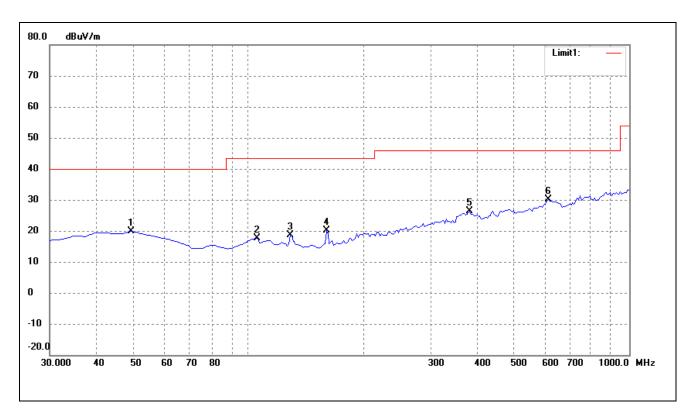
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	73.6500	34.82	-12.52	22.30	40.00	-17.70	100	100	peak
2	102.7500	39.26	-10.97	28.29	43.50	-15.21	100	100	peak
3	139.1250	52.11	-12.51	39.60	43.50	-3.90	100	100	peak
4	158.5250	43.44	-12.30	31.14	43.50	-12.36	100	100	peak
5	228.8500	37.76	-8.61	29.15	46.00	-16.85	100	100	peak
6	328.2750	43.74	-4.77	38.97	46.00	-7.03	100	100	peak



Operating Condition: Transmitting High Channel (2480MHz)

Comment: DC 3V

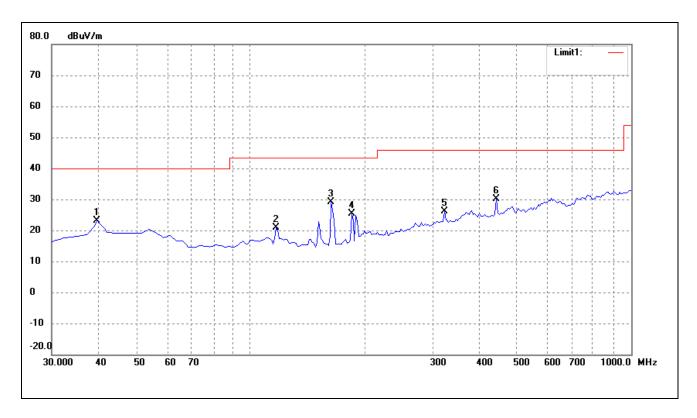
Test Specification: Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	49.4000	28.12	-8.28	19.84	40.00	-20.16	100	100	peak
2	105.1750	28.66	-11.04	17.62	43.50	-25.88	100	100	peak
3	129.4250	30.56	-11.96	18.60	43.50	-24.90	100	100	peak
4	160.9500	32.32	-12.23	20.09	43.50	-23.41	100	100	peak
5	384.0500	28.57	-2.30	26.27	46.00	-19.73	100	100	peak
6	614.4250	29.38	0.85	30.23	46.00	-15.77	100	100	peak



Test Specification: Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	39.7000	30.80	-7.76	23.04	40.00	-16.96	100	100	peak
2	117.3000	32.26	-11.37	20.89	43.50	-22.61	100	100	peak
3	163.3750	41.20	-12.12	29.08	43.50	-14.42	100	100	peak
4	185.2000	36.02	-10.66	25.36	43.50	-18.14	100	100	peak
5	323.4250	30.87	-4.68	26.19	46.00	-19.81	100	100	peak
6	444.6750	32.91	-2.89	30.02	46.00	-15.98	100	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 Channe	el-2402MHz			
2402	84.08	-3.49	79.59	114	-34.41	Н	PK
2402	75.05	-3.49	70.56	94	-23.44	Н	AV
4804	60.81	0.57	60.38	74	-13.62	Н	PK
4804	46.75	0.57	46.32	54	-7.68	Н	AV
7206	40.82	7.18	49	74	-25.00	Н	PK
7206	28.80	7.18	36.98	54	-17.02	Н	AV
2402	83.22	-3.49	80.73	114	-33.27	V	PK
2402	78.24	-3.49	75.75	94	-18.25	V	AV
4804	48.39	0.57	49.96	74	-24.04	V	PK
4804	35.12	0.57	36.69	54	-17.31	V	AV
7206	40.12	5.89	47.01	74	-26.99	V	PK
7206	28.10	6.15	35.25	54	-18.75	V	AV
			Middle Chan	nel-2441MHz			
2441	81.03	-3.43	77.60	114	-35.40	Н	PK
2441	73.23	-3.43	69.80	94	-23.20	Н	AV
4882	57.47	0.66	58.13	74	-14.87	Н	PK
4882	42.89	0.66	43.55	54	-9.45	Н	AV
7323	41.08	3.11	44.19	74	-28.81	Н	PK
7323	28.93	3.33	32.26	54	-20.74	Н	AV
2441	82.48	-3.43	79.05	114	-33.95	V	PK
2441	75.13	-3.43	71.70	94	-21.30	V	AV
4882	49.01	0.66	49.67	74	-25.33	V	PK
4882	36.08	0.66	36.74	54	-16.26	V	AV
7323	41.03	7.18	48.21	74	-24.79	V	PK
7323	28.83	7.18	36.01	54	-16.99	V	AV



Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	H/V	
			Low Channe	el-2480MHz			
2480	84.03	-3.33	80.70	114	-33.30	Н	PK
2480	75.13	-3.33	71.80	94	-22.20	Н	AV
4960	53.18	0.75	53.93	74	-20.07	Н	PK
4960	39.56	0.75	40.31	54	-13.69	Н	AV
7440	40.49	7.11	47.60	74	-26.40	Н	PK
7440	28.70	7.18	35.88	54	-18.12	Н	AV
2480	82.30	-3.33	78.97	114	-35.03	V	PK
2480	76.15	-3.33	72.82	94	-21.18	V	AV
4960	46.52	0.75	47.27	74	-26.73	V	PK
4960	33.70	0.75	34.45	54	-19.55	V	AV
7440	41.30	7.23	48.53	74	-25.47	V	PK
7440	28.76	7.18	35.94	54	-18.06	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 mede	Frequency	Limit	D14	
Test mode	MHz	dBuV / dBc	Result	
	2310.00	<54 dBuV	Pass	
Lowest	2390.00	<54 dBuV	Pass	
	2400.00	<54 dBuV	Pass	
Highart	2483.50	<54 dBuV	Pass	
Highest	2500.00	<54 dBuV	Pass	

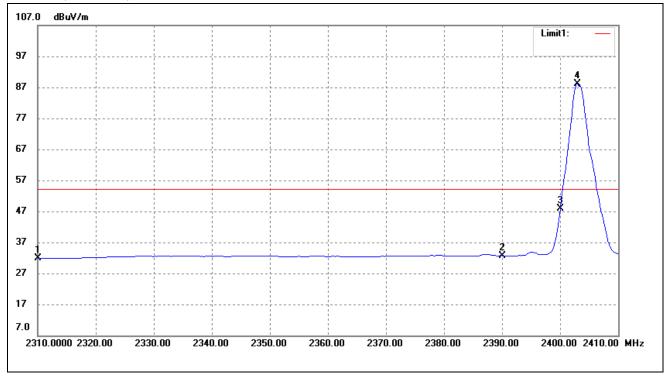
The edge emissions are below the FCC 15.209 Limits or complies with the 15.249 requirements.

Please refer to the test plots as below.



Lowest Bandedge

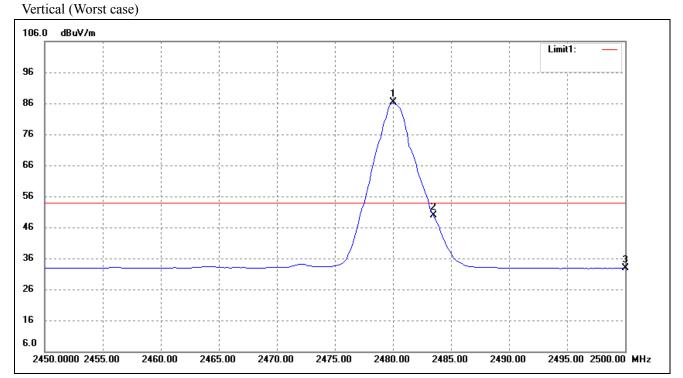
Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	32.40	-0.53	31.87	54.00	-22.13	Ave Detector
	2310.000	44.72	-0.53	44.19	74.00	-29.81	Peak Detector
2	2390.000	32.85	-0.14	32.71	54.00	-21.29	Ave Detector
	2390.000	45.47	-0.14	45.33	74.00	-28.67	Peak Detector
3	2400.000	48.00	-0.09	47.91	54.00	-6.09	Ave Detector
	2400.000	66.89	-0.09	66.80	74.00	-7.20	Peak Detector



Highest Bandedge



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
2	2483.500	49.55	0.32	49.87	54.00	-4.13	Ave Detector
	2483.500	64.86	0.32	65.18	74.00	-8.82	Peak Detector
3	2500.000	32.40	0.41	32.81	54.00	-21.19	Ave Detector
	2500.000	47.40	0.41	47.81	74.00	-26.19	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 63.4-2014, 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 ≥1% 20dB Bandwidth, VBW ≥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

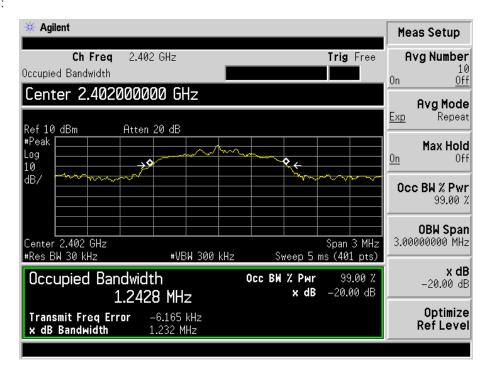
6.4 Summary of Test Results/Plots

Channel	Frequency	20dB Bandwidth	99% Bandwidth
	MHz	kHz	kHz
Low Channel	2402	1232	1242.8
Middle Channel	2441	1254	1223.7
High Channel	2479	1219	1212.7

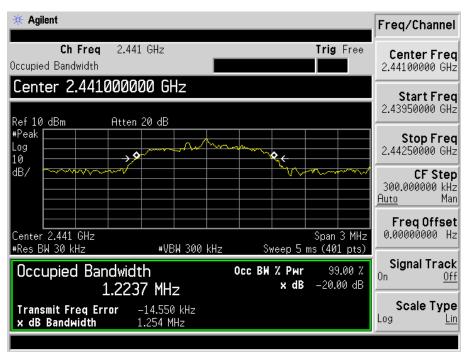
Please refer to the following test plots



Low Channel:

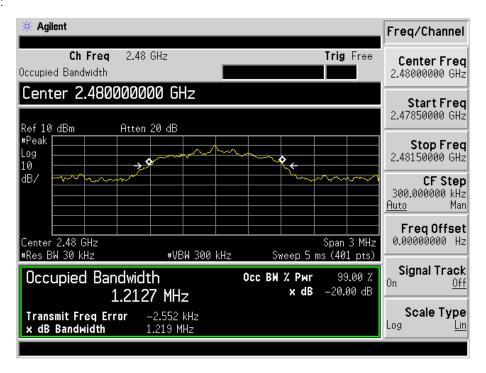


Middle Channel:





High Channel:



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