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: PRDMU30

FCC Rule(s):	FCC Part 15.249
Product Description:	2.4G Optical Mouse
Tested Model:	G11
Report No.:	STR14108197I
Tested Date:	2014-10-30 to 2014-11-06
Issued Date:	2014-11-06
Tested By:	Jason Su / Engineer
Reviewed By:	Lahm Peng / EMC Manager
Approved & Authorized By:	Jandy so / PSQ Manager

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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.

TABLE OF CONTENTS

1. GENERAL INFORMATION 3
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) 3
1.2 TEST STANDARDS 4
1.3 TEST METHODOLOGY 4
1.4 TEST FACILITY 4
1.5 EUT SETUP AND TEST MODE 5
2. SUMMARY OF TEST RESULTS 6
3. ANTENNA REQUIREMENTS 7
3.1 STANDARD APPLICABLE 7
3.2 TEST RESULT 7
4. RADIATED EMISSIONS 8
4.1 MEASUREMENT UNCERTAINTY 8
4.2 STANDARD APPLICABLE 8
4.3 TEST EQUIPMENT LIST AND DETAILS 8
4.4 TEST PROCEDURE 9
4.5 CORRECTED AMPLITUDE & MARGIN CALCULATION 9
4.6 ENVIRONMENTAL CONDITIONS 10
4.7 SUMMARY OF TEST RESULTS/PLOTS 10
5. OUT OF BAND EMISSIONS 19
5.1 STANDARD APPLICABLE 19
5.2 TEST EQUIPMENT LIST AND DETAILS 19
5.3 TEST PROCEDURE 19
5.4 ENVIRONMENTAL CONDITIONS 19
5.5 SUMMARY OF TEST RESULTS/PLOTS 19
6. EMISSION BANDWIDTH 22
6.1 STANDARD APPLICABLE 22
6.2 TEST EQUIPMENT LIST AND DETAILS 22
6.3 TEST PROCEDURE 22
6.4 ENVIRONMENTAL CONDITIONS 22
6.5 SUMMARY OF TEST RESULTS/PLOTS 22

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:	2.4G Optical Mouse
Trade Name:	ACROX
Model No.:	G11
Adding Model(s):	/
Rated Voltage:	Battery:DC3V
Power Adapter Model:	/
Note: The test data is gathered from a production sample, provided by the manufacturer.	

Technical Characteristics of EUT	
Frequency Range:	2408-2474MHz
Max. Field Strength:	84.13dBuV/m
Data Rate:	/
Modulation:	FSK
Quantity of Channels:	34
Channel Separation:	2MHz
Antenna Type:	PCB Antenna
Antenna Gain:	-5dBi
Lowest Internal Frequency of EUT:	12MHz
Device Category:	Portable device

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 C63.4-2003, 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).

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
/	/	/	/

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	Compliant
§ 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 Measurement Uncertainty

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is ±5.10 dB.

4.2 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.

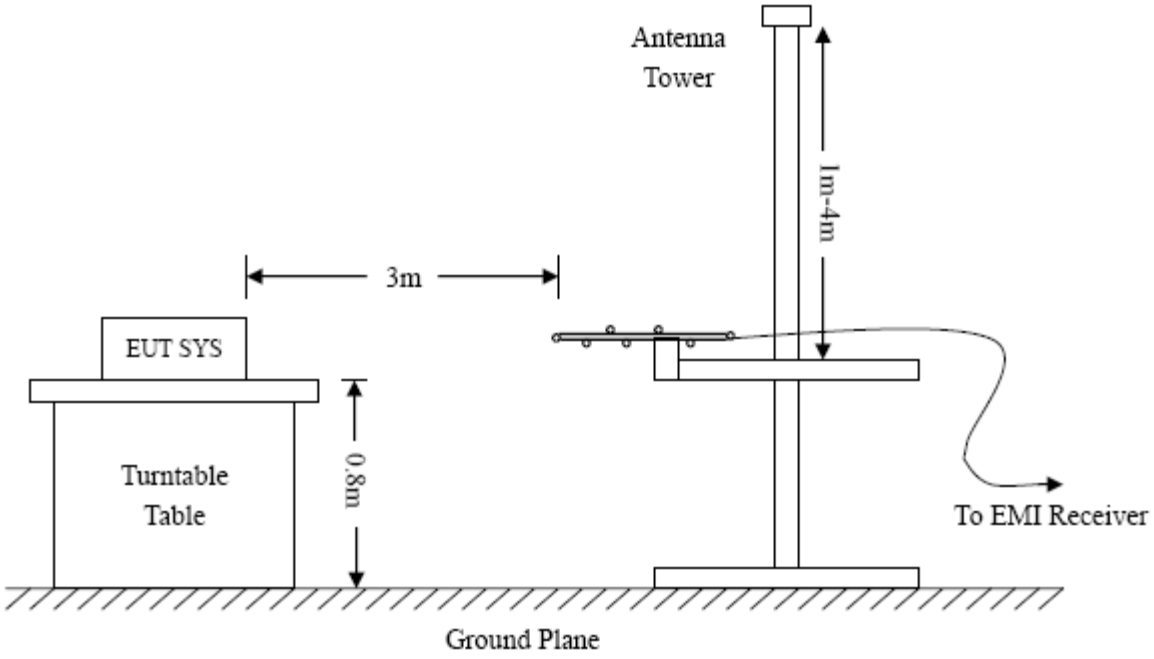
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

4.3 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	R&S	FSP	836079/035	2014-05-28	2015-05-27
EMI Test Receiver	R&S	ESVB	825471/005	2014-05-28	2015-05-27
Pre-amplifier	Agilent	8447F	3113A06717	2014-05-28	2015-05-27
Pre-amplifier	Compliance Direction	PAP-0118	24002	2014-05-28	2015-05-27
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2014-05-24	2015-05-23
Horn Antenna	ETS	3117	00086197	2014-05-24	2015-05-23
Horn Antenna	ETS	3116B	00088203	2014-05-24	2015-05-23
Loop Antenna	SCHWARZECK	HFRA 5165	9365	2014-05-24	2015-05-23

4.4 Test Procedure

The setup of EUT is according with per ANSI C63.4-2003 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	Frequency :30MHz-1GHz	Frequency :Above 1GHz
RBW=10KHz,	RBW=120KHz,	RBW=1MHz,
VBW =30KHz	VBW=300KHz	VBW=3MHz(Peak), 10Hz(AV)
Sweep time= Auto	Sweep time= Auto	Sweep time= Auto
Trace = max hold	Trace = max hold	Trace = max hold
Detector function = peak	Detector function = peak, QP	Detector function = peak, AV

4.5 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:

Corr. Ampl. = Indicated Reading + Ant. Factor + Cable Loss – Ampl. Gain

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

Margin = Corr. Ampl. – FCC Part 15C Limit

4.6 Environmental Conditions

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

4.7 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:

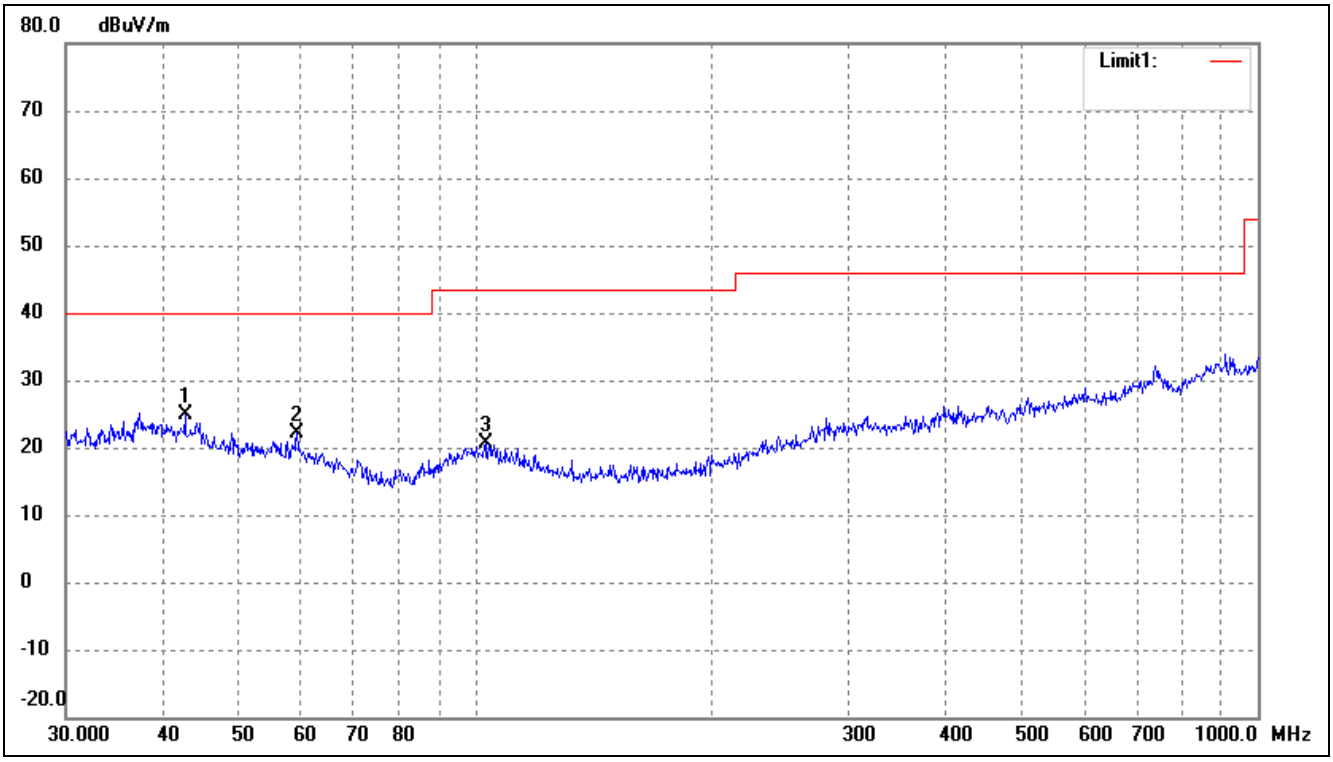
-13.00 dB at **44.2752 MHz** in the ***Vertical*** polarization, **Middle Channel, 9 kHz to 25 GHz, 3Meters**

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

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

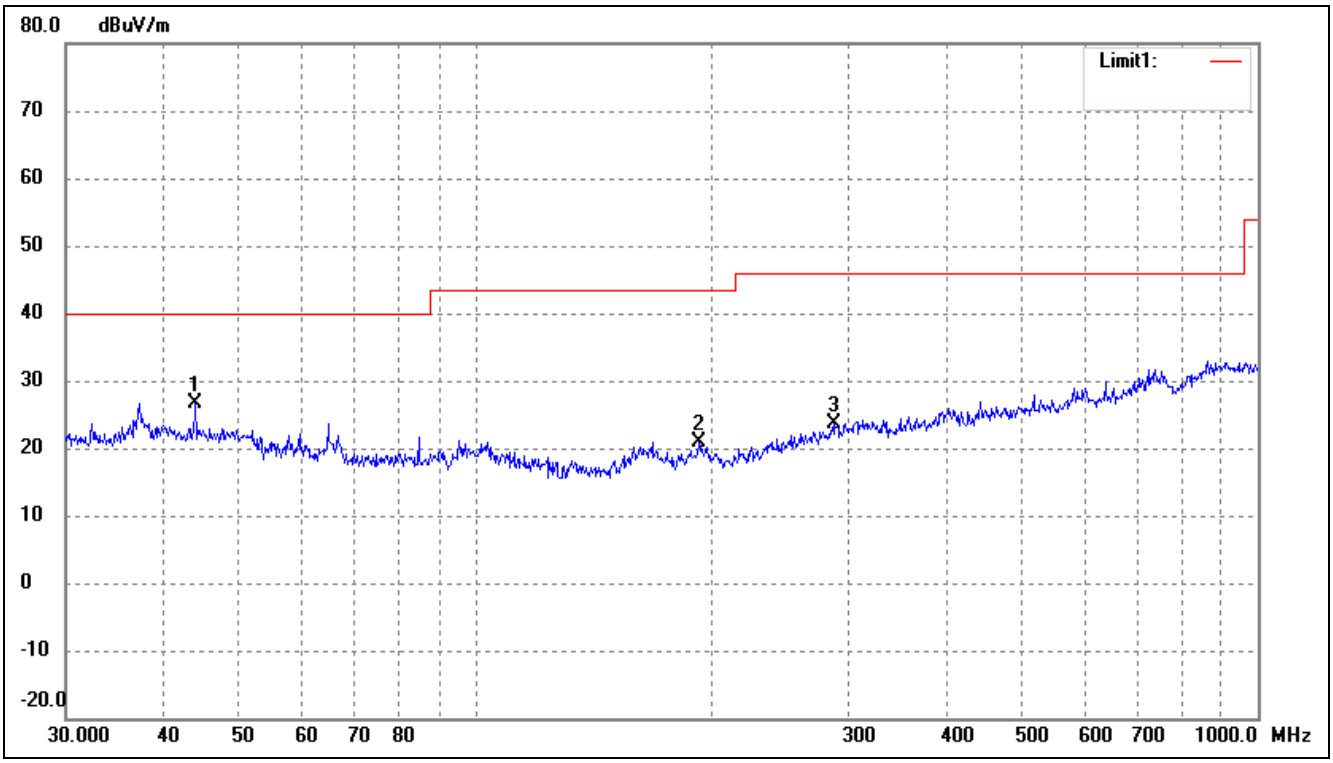
EUT: *2.4G Optical Mouse*
Tested Model: *G11*
Operating Condition: *Transmitting Low Channel (2408MHz)*
Comment: *DC 3V*

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	42.6000	17.78	6.99	24.77	40.00	-15.23	89	100	peak
2	59.2325	16.78	5.45	22.23	40.00	-17.77	135	100	peak
3	103.0800	14.87	5.81	20.68	43.50	-22.82	165	100	peak

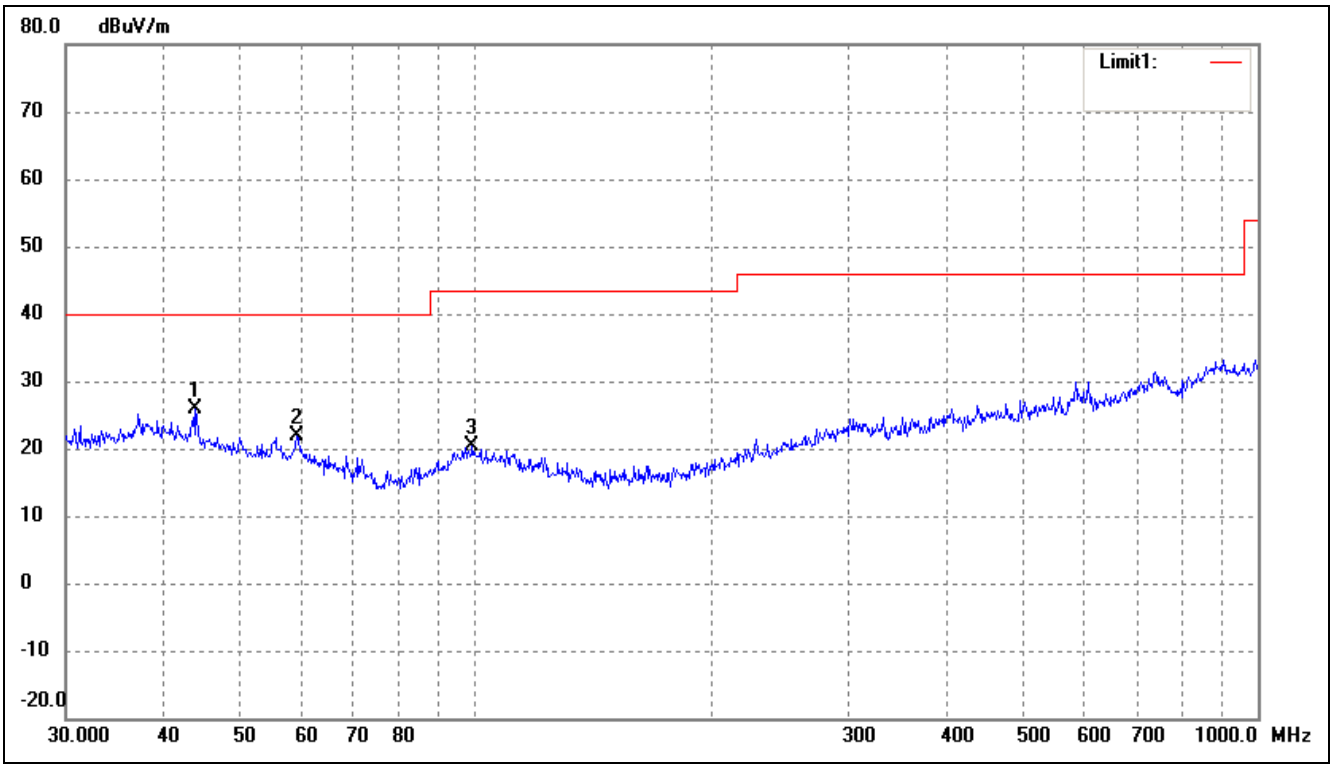
Test Specification: *Vertical*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	43.9658	18.63	8.07	26.70	40.00	-13.30	76	100	peak
2	193.0945	17.64	3.35	20.99	43.50	-22.51	135	100	peak
3	287.9904	14.98	8.71	23.69	46.00	-22.31	198	100	peak

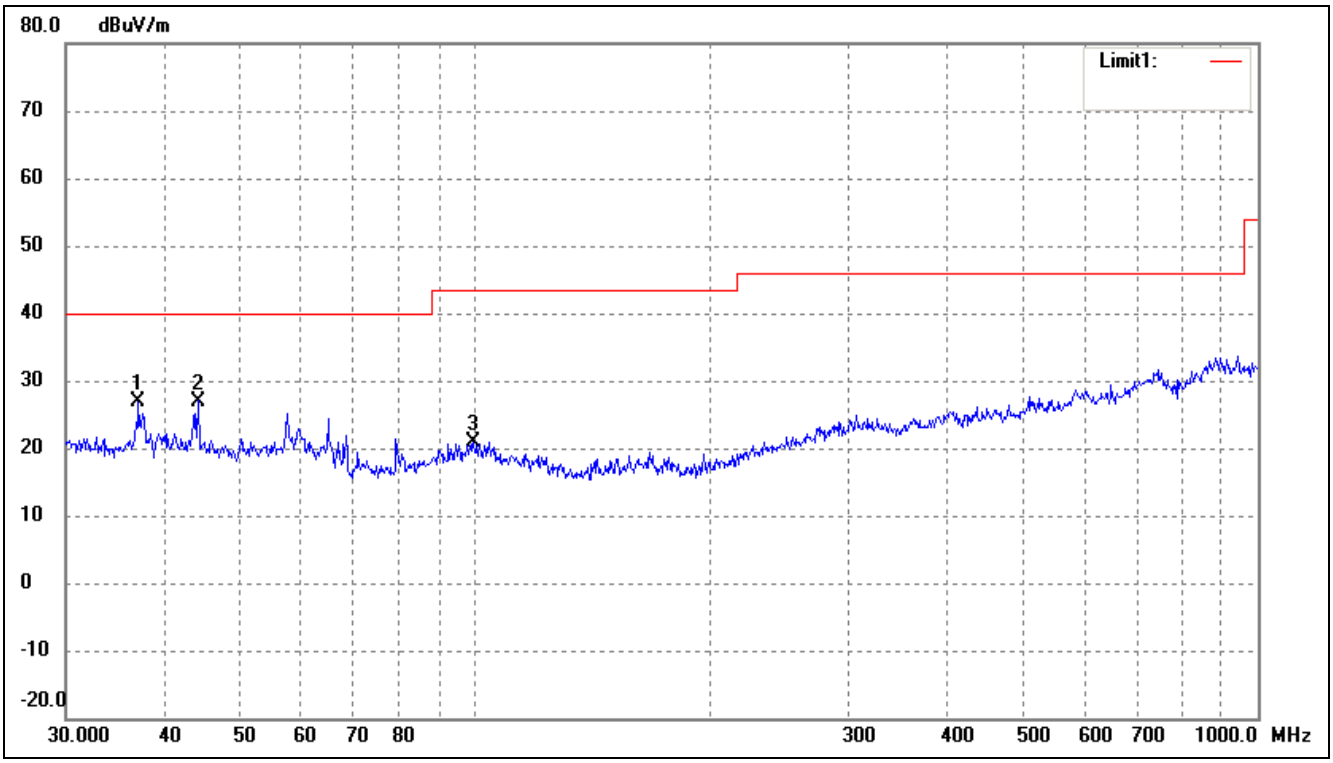
Operating Condition: *Transmitting Middle Channel (2440MHz)*
Comment: *DC 3V*

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	43.9658	18.94	6.86	25.80	40.00	-14.20	152	100	peak
2	59.2325	16.49	5.45	21.94	40.00	-18.06	102	100	peak
3	99.1797	14.53	5.92	20.45	43.50	-23.05	94	100	peak

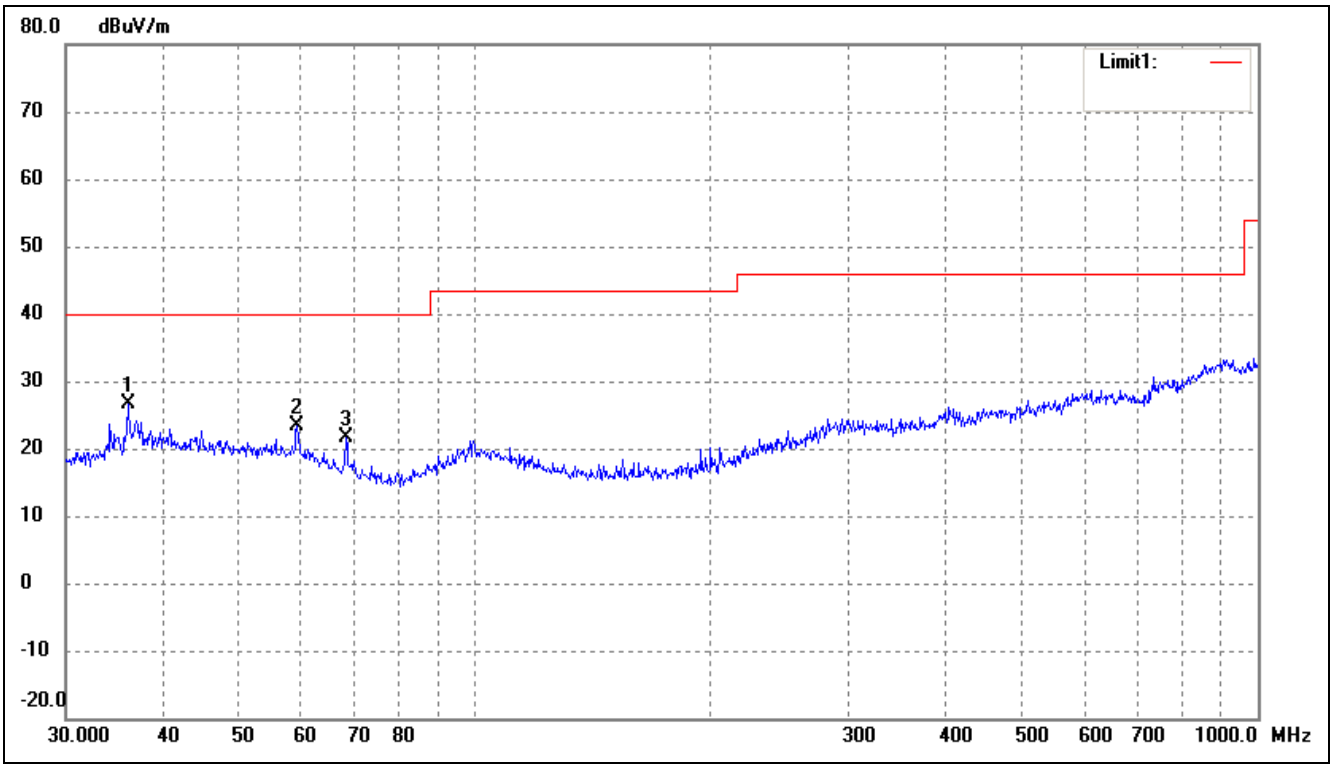
Test Specification: *Vertical*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	37.1550	18.16	8.76	26.92	40.00	-13.08	257	100	peak
2	44.2752	19.02	7.98	27.00	40.00	-13.00	198	100	peak
3	99.5281	14.87	6.01	20.88	43.50	-22.62	135	100	peak

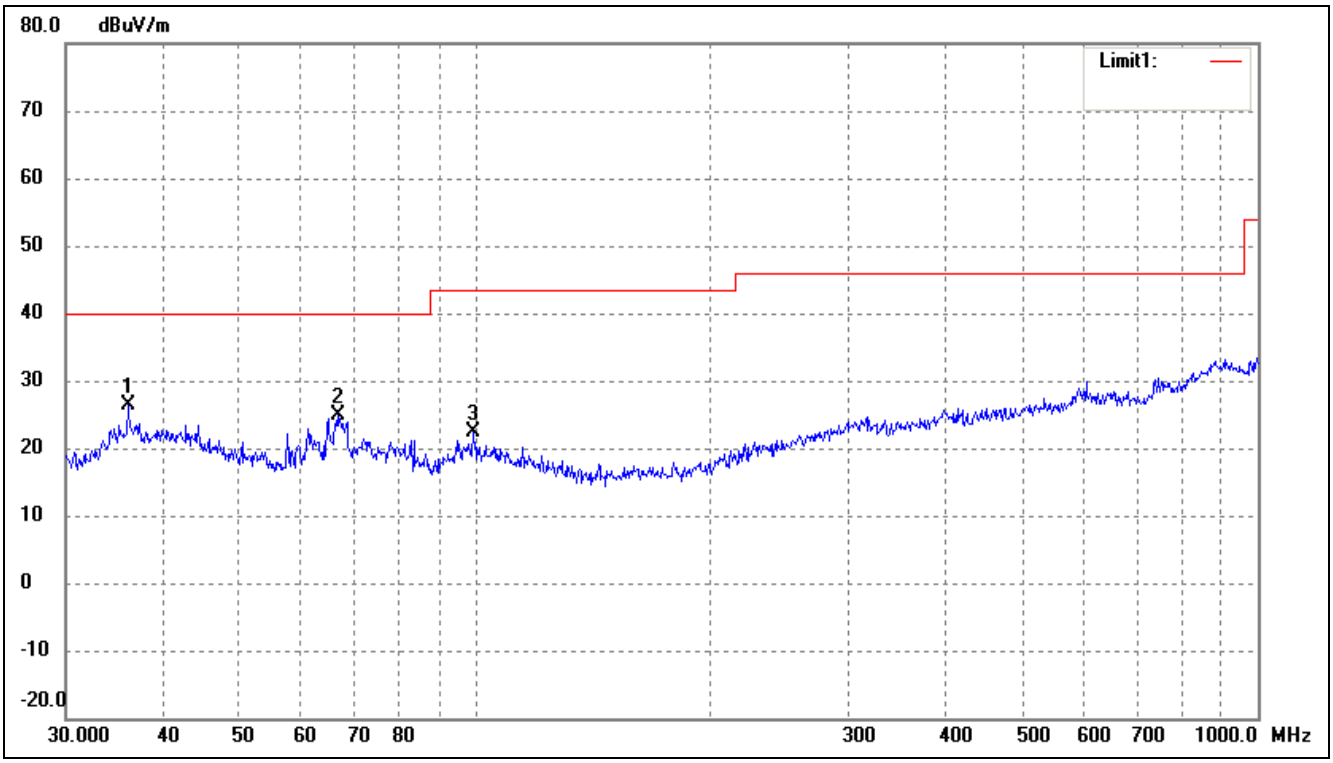
Operating Condition: *Transmitting High Channel (2474MHz)*
Comment: *DC 3V*

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	36.0007	20.56	6.16	26.72	40.00	-13.28	161	100	peak
2	59.2325	17.87	5.45	23.32	40.00	-16.68	278	100	peak
3	68.3908	18.93	2.70	21.63	40.00	-18.37	44	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	36.0007	17.74	8.56	26.30	40.00	-13.70	98	100	peak
2	66.7325	21.53	3.24	24.77	40.00	-15.23	132	100	peak
3	99.5281	16.30	6.01	22.31	43.50	-21.19	43	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	86.36	-3.49	82.87	114.00	-31.13	H	PK
2408	75.36	-3.49	71.87	94.00	-22.13	H	AV
4816	33.31	0.55	33.86	54.00	-20.14	H	PK
4816	44.64	0.55	45.19	74.00	-28.81	H	AV
7224	23.97	3.65	27.62	54.00	-26.38	H	PK
7224	36.61	3.67	40.28	74.00	-33.72	H	AV
2408	81.06	-3.49	77.57	114.00	-36.43	V	PK
2408	70.06	-3.49	66.57	94.00	-27.43	V	AV
4816	33.03	0.55	33.58	54.00	-20.42	V	PK
4816	42.80	0.55	43.35	74.00	-30.65	V	AV
7224	23.38	3.65	27.03	54.00	-26.97	V	PK
7224	35.01	3.67	38.68	74.00	-35.32	V	AV
Middle Channel-2440MHz							
2440	85.16	-3.41	81.75	114.00	-32.25	H	PK
2440	71.62	-3.41	68.21	94.00	-25.79	H	AV
4880	45.30	0.68	45.98	74.00	-28.02	H	PK
4880	33.28	0.68	33.96	54.00	-20.04	H	AV
7320	38.83	3.77	42.60	74.00	-31.40	H	PK
7320	26.89	3.82	30.71	54.00	-23.29	H	AV
2440	85.19	-3.41	81.78	114.00	-32.22	V	PK
2440	71.68	-3.41	68.27	94.00	-25.73	V	AV
4880	48.07	0.68	48.75	74.00	-25.25	V	PK
4880	34.77	0.68	35.45	54.00	-18.55	V	AV
7320	38.30	3.77	42.07	74.00	-31.93	V	PK
7320	38.30	3.77	42.07	74.00	-31.93	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	83.60	-3.33	80.27	114.00	-33.73	H	PK
2474	72.52	-3.33	69.19	94.00	-24-81	H	AV
4948	46.18	0.77	46.95	74.00	-27.05	H	PK
4948	33.24	0.77	34.01	54.00	-19.99	H	AV
7422	26.94	3.82	30.76	54.00	-23.24	H	PK
7422	38.28	3.84	42.12	74.00	-31.88	H	AV
2474	87.46	-3.33	84.13	114.00	-29.87	V	PK
2474	76.43	-3.33	73.10	94.00	-20.90	V	AV
4948	49.65	0.77	50.42	74.00	-23.58	V	PK
4948	35.28	0.77	36.05	54.00	-17.95	V	AV
7422	26.88	3.82	30.70	54.00	-23.30	V	PK
7422	37.48	3.84	41.32	74.00	-32.68	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 Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	R&S	FSP	836079/035	2014-05-28	2015-05-27
EMI Test Receiver	R&S	ESVB	825471/005	2014-05-28	2015-05-27
Pre-amplifier	Agilent	8447F	3113A06717	2014-05-28	2015-05-27
Pre-amplifier	Compliance Direction	PAP-0118	24002	2014-05-28	2015-05-27
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2014-05-24	2015-05-23
Horn Antenna	ETS	3117	00086197	2014-05-24	2015-05-23

5.3 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.

5.4 Environmental Conditions

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

5.5 Summary of Test Results/Plots

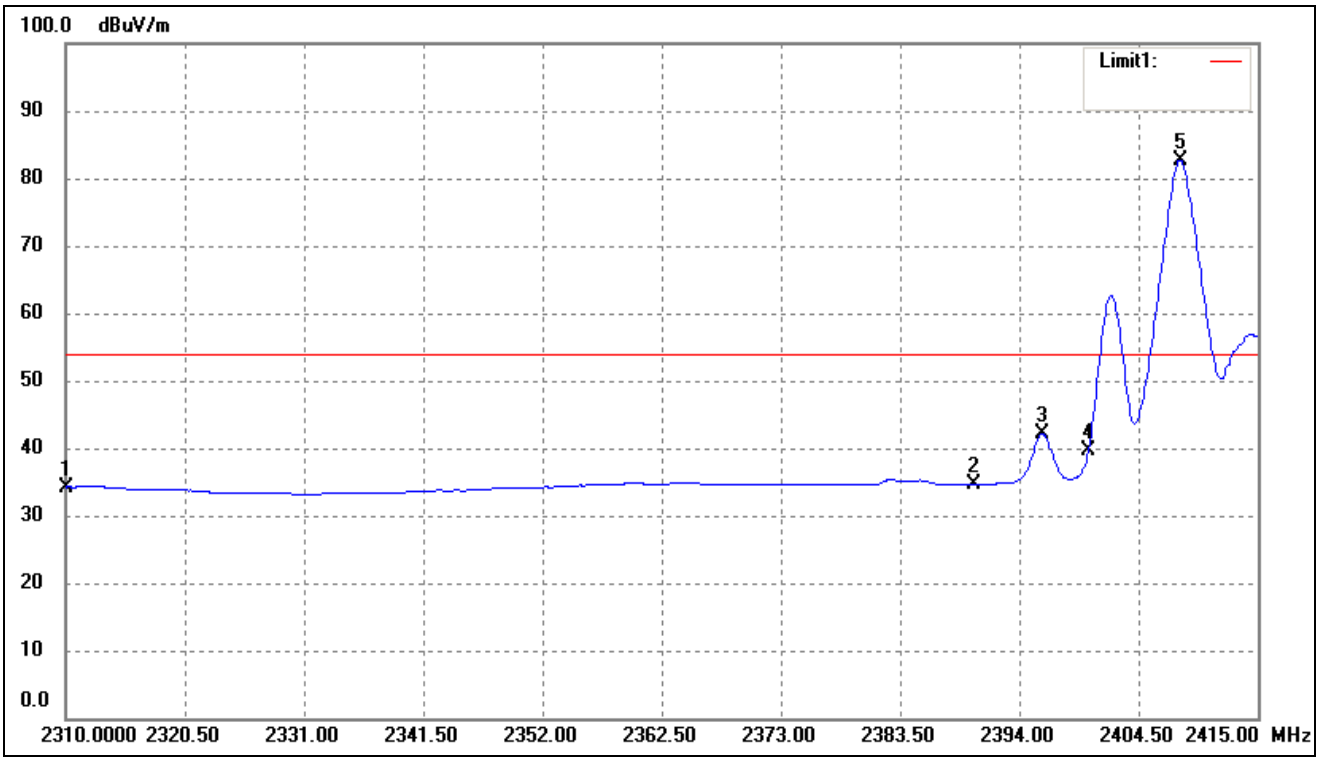
Test mode	Frequency	Limit	Result
	MHz	dBuV / dBc	
Lowest	2310.00	<54 dBuV	Pass
	2390.00	<54 dBuV	Pass
	2400.00	<54 dBuV	Pass
Highest	2483.50	<54 dBuV	Pass
	2500.00	<54 dBuV	Pass

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

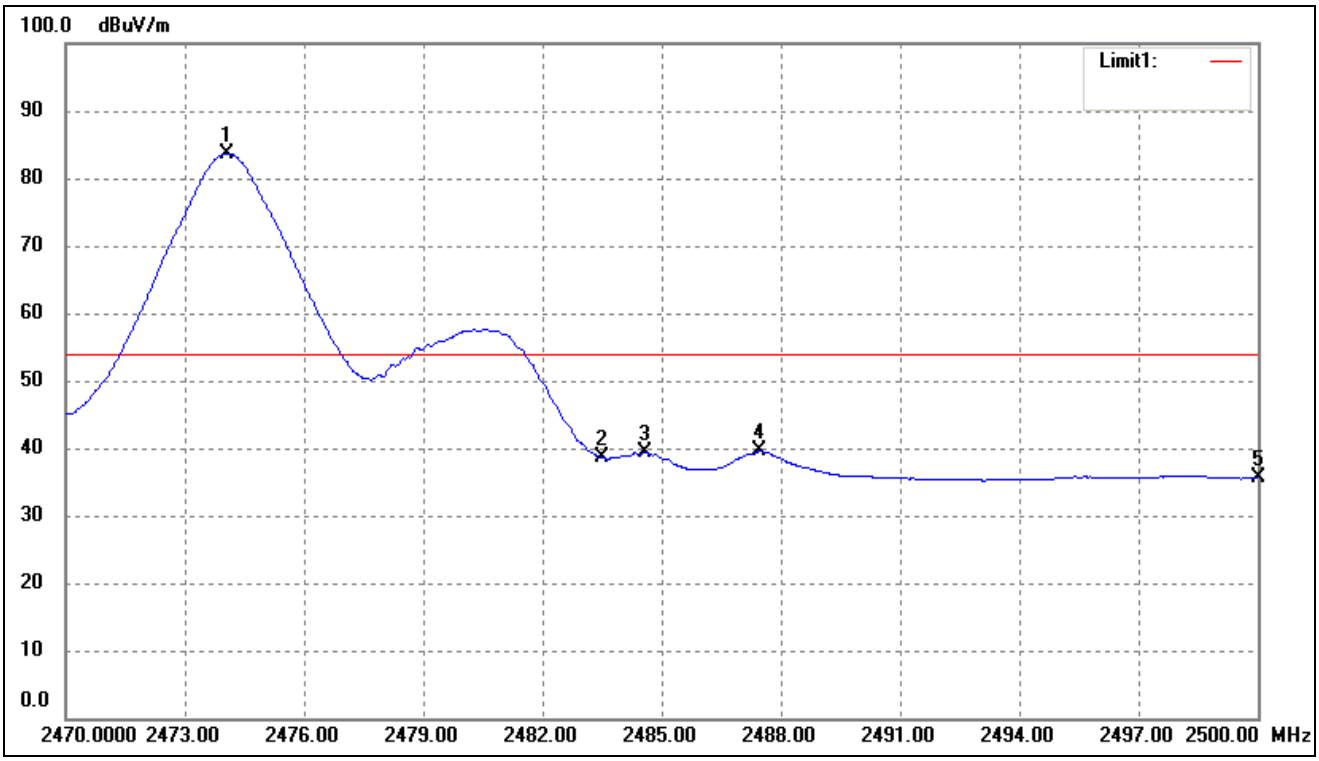
Worst case (Horizontal)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	17.90	16.34	34.24	54.00	-19.76	Ave Detector
	2310.000	31.38	16.34	47.72	74.00	-26.28	Peak Detector
2	2390.000	17.56	17.03	34.59	54.00	-19.41	Ave Detector
	2390.000	31.31	17.03	48.34	74.00	-25.66	Peak Detector
3	2395.995	25.07	17.08	42.15	54.00	-11.85	Ave Detector
	2395.995	25.07	17.08	42.15	54.00	-11.85	Peak Detector
4	2400.000	22.45	17.11	39.56	54.00	-14.44	Ave Detector
	2400.000	33.34	17.11	50.45	74.00	-23.55	Peak Detector
5	2408.175	65.55	17.16	82.71	/	/	Ave Detector

Highest Bandedge

Worst case (Horizontal)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2474.050	66.05	17.67	83.72	/	/	Ave Detector
	2473.510	68.27	17.67	85.94	/	/	Peak Detector
2	2483.500	20.86	17.73	38.59	54.00	-15.41	Ave Detector
	2483.500	34.04	17.73	51.77	74.00	-22.23	Peak Detector
3	2484.580	21.72	17.74	39.46	54.00	-14.54	Ave Detector
	2484.580	35.32	17.74	53.06	74.00	-20.94	Peak Detector
4	2487.460	21.79	17.75	39.54	54.00	-14.46	Ave Detector
	2487.460	34.74	17.75	52.49	74.00	-21.51	Peak Detector
5	2500.000	17.74	17.86	35.60	54.00	-18.40	Ave Detector
	2500.000	31.24	17.86	49.10	74.00	-24.90	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 Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	Agilent	E4402B	US41192821	2014-05-28	2015-05-27
Attenuator	ATTEN	ATS100-4-20	/	2014-05-28	2015-05-27

6.3 Test Procedure

According to the ANSI 63.4-2003, 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.

6.4 Environmental Conditions

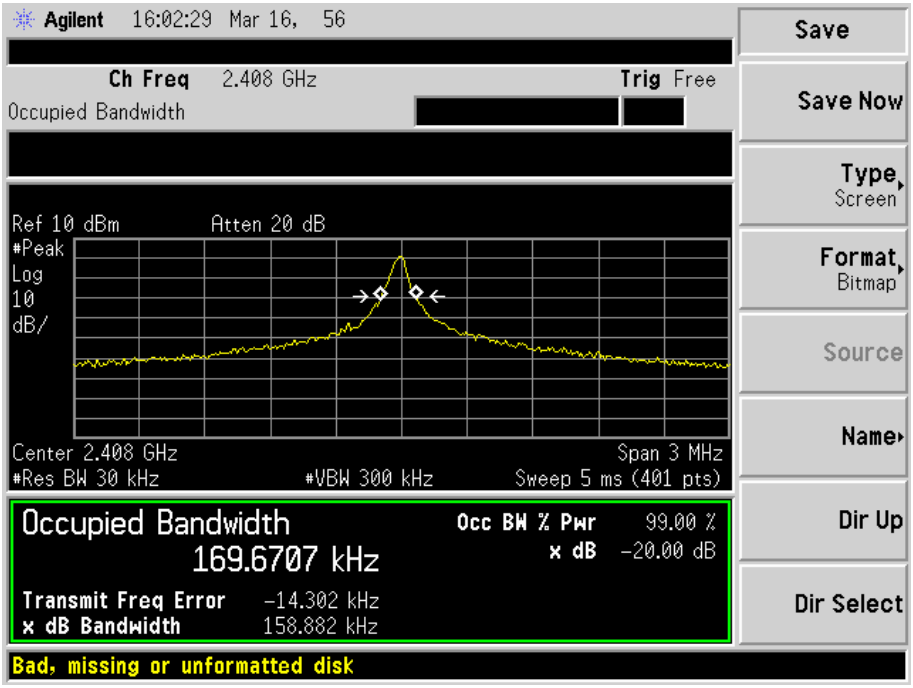
Temperature:	25 °C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

6.5 Summary of Test Results/Plots

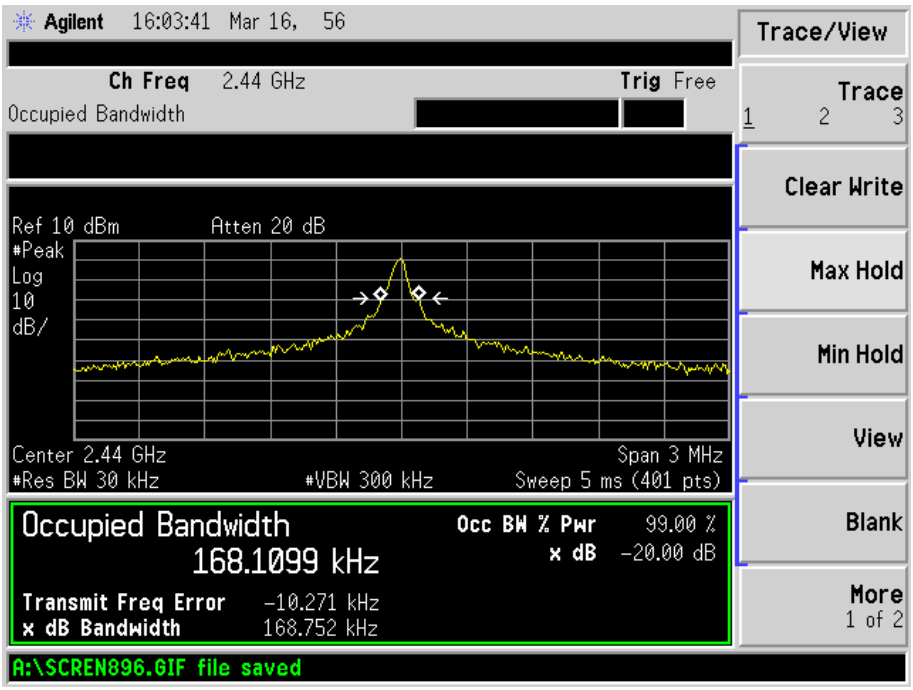
Channel	Frequency MHz	20dB Bandwidth kHz	99% Bandwidth kHz
Low Channel	2408	158.882	169.6707
Middle Channel	2440	168.752	168.1009
High Channel	2474	157.047	173.5073

Please refer to the following test plots

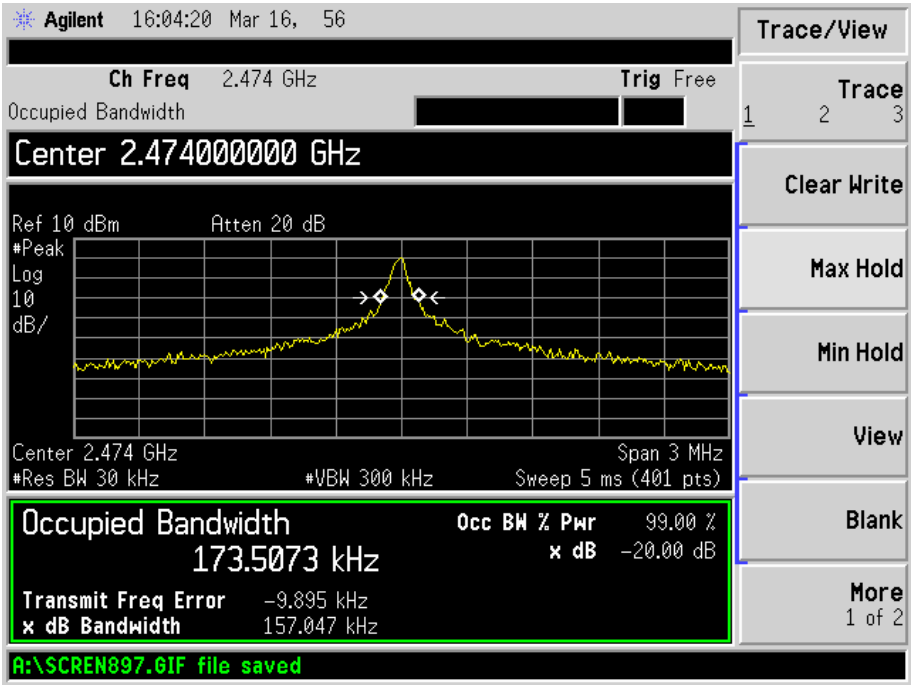
Low Channel:



Middle Channel:



High Channel:



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