FCC Part 15C
Measurement and Test Report

For

Minicute limited

F14, Huafeng Xin'an Youth Entrepreneurship Building, No. 31 Jia'an Rd.,

Xin'an St., Bao'an District, Shenzhen, China

FCC ID: 2AB92-MEZ5W

FCC Rule(s):	FCC Part 15.249
Product Description:	Minicute wireless mouse
Tested Model:	Minicute Ezmouse 5nd wireless
Report No.:	STR14048018I
Tested Date:	2014-04-01 to 2014-08-06
Issued Date:	2014-08-06
Tested By:	Jason Su / Engineer
Reviewed By:	Lahm Peng / EMC Manager
Approved & Authorized By:	Jandy so / PSQ Manager

Prepared By:

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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:	Minicute limited
Address of applicant:	F14, Huafeng Xin'an Youth Entrepreneurship, Building, No. 31 Jia'an Rd., Xin'an St., Bao'an District, Shenzhen, China
Manufacturer:	Minicute limited
Address of manufacturer:	F14, Huafeng Xin'an Youth Entrepreneurship, Building, No. 31 Jia'an Rd., Xin'an St., Bao'an District, Shenzhen, China

General Description of EUT	
Product Name:	Minicute wireless mouse
Trade Name:	Minicute
Model No.:	Minicute Ezmouse 5nd wireless
Adding Model(s):	/
Rated Voltage:	Battery: DC 3V
Power Adapter Model:	/
Note: The test data is gathered from a production sample, provided by the manufacturer.	

Technical Characteristics of EUT	
Frequency Range:	2406-2476MHz
Max. Field Strength:	84.13dBuV/m
Data Rate:	/
Modulation:	GFSK
Quantity of Channels:	16
Channel Separation:	Max:11MHz ; Min;2MHz
Antenna Type:	PCB Antenna
Antenna Gain:	2.3dBi
Lowest Internal Frequency of EUT:	16MHz
Device Category:	Portable device

1.2 Test Standards

The following report is prepared on behalf of the Minicute 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 C63.4-2003, 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	2406MHz
TM2	Middle Channel	2447MHz
TM3	High Channel	2476\MHz

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.

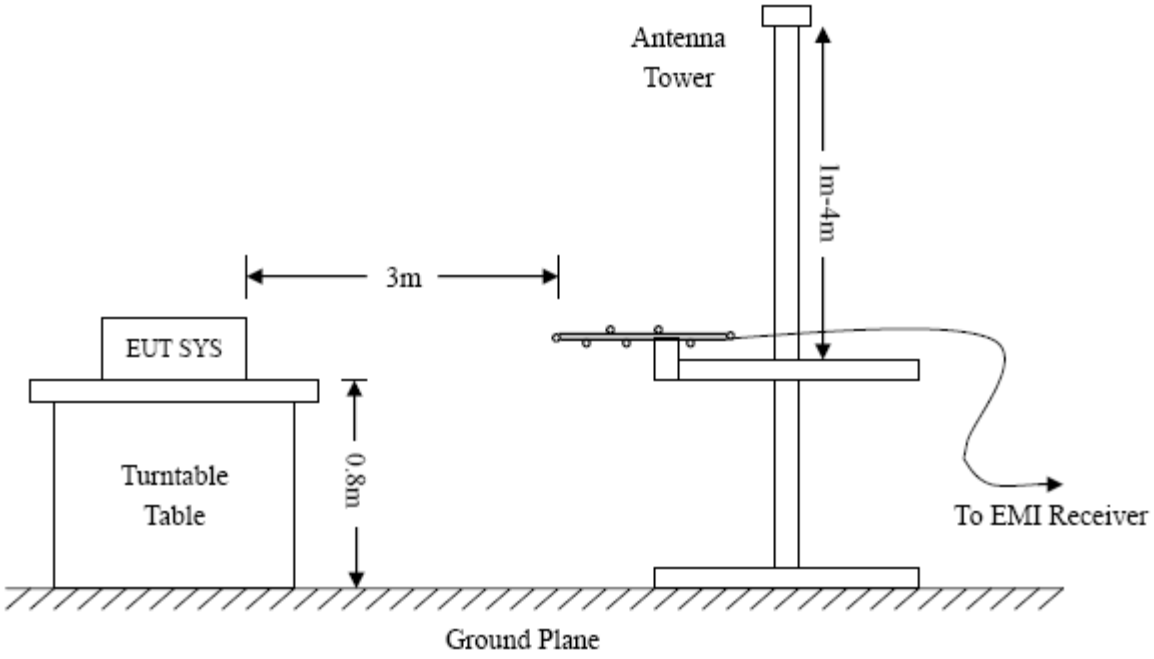
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

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:

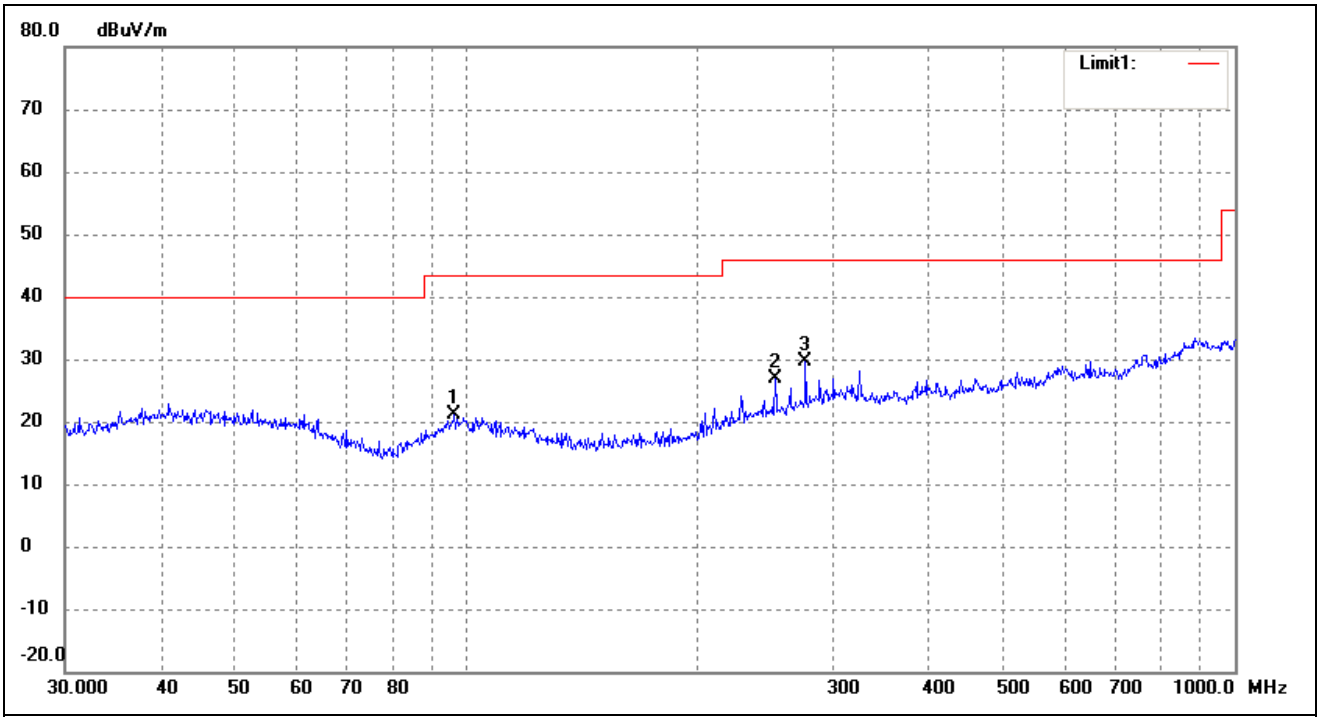
-14.77 dB at **32.4059 MHz** in the **Vertical** polarization, **High Channel of Antenna 1, 9 kHz to 25 GHz, 3Meters**

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)

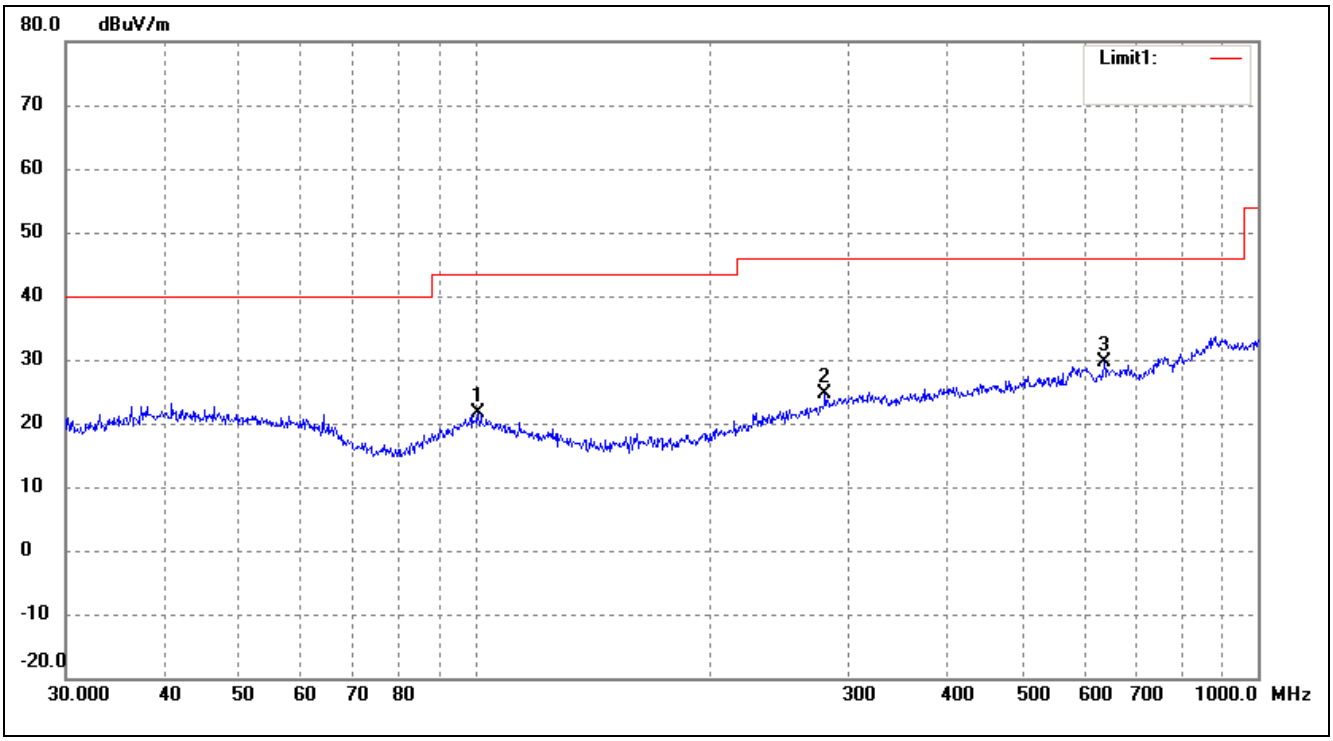
EUT: *Minicute wireless mouse*
Tested Model: *Minicute Ezmouse 5nd wireless*
Operating Condition: *Transmitting Low Channel (2406MHz)*
Comment: *Transmitter*

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	96.4362	15.78	5.24	21.02	43.50	-22.48	324	100	peak
2	252.0627	20.01	6.76	26.77	46.00	-19.23	102	200	peak
3	276.1236	21.42	8.14	29.56	46.00	-16.44	98	100	peak

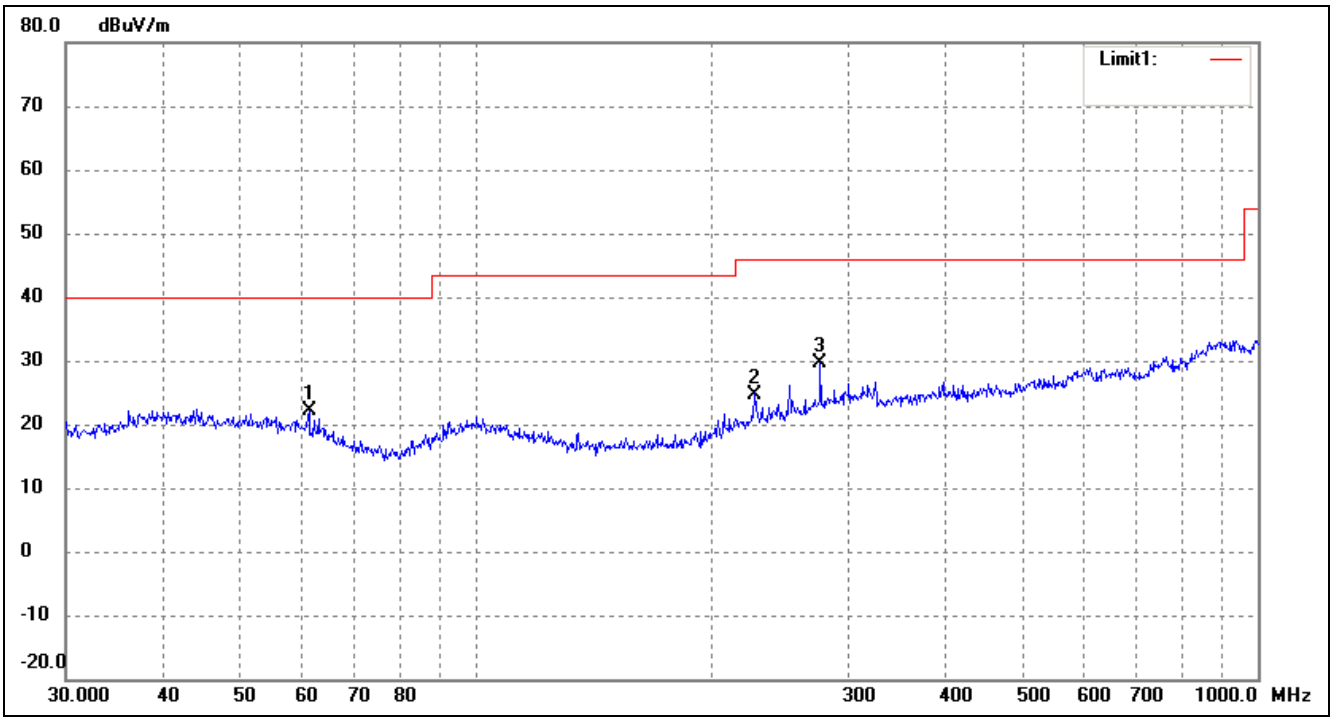
Test Specification: *Vertical*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	100.9340	15.49	6.03	21.52	43.50	-21.98	234	100	peak
2	280.0238	16.26	8.40	24.66	46.00	-21.34	118	100	QP
3	636.1340	17.18	12.49	29.67	46.00	-16.33	164	100	QP

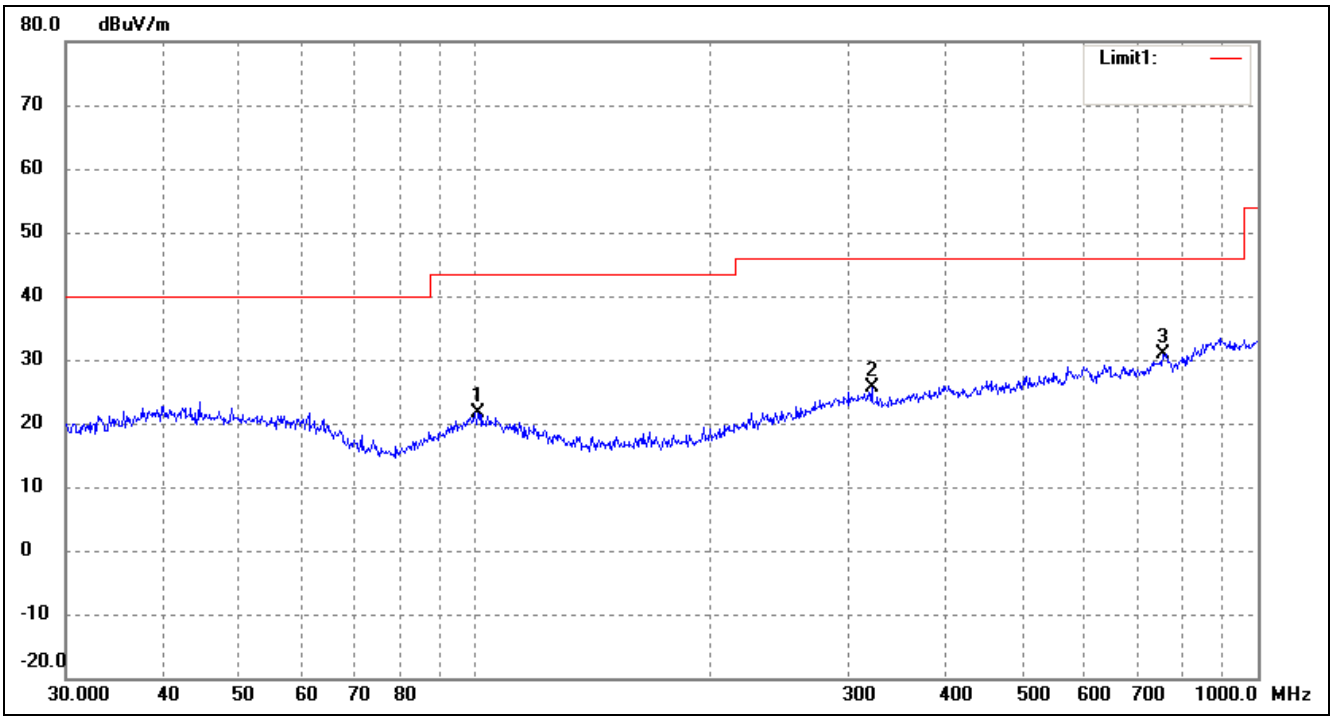
Operating Condition: *Transmitting Middle Channel (2447MHz)*
Comment: *Transmitter*

Test Specification: *Horizontal*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(°)	(cm)	
1	61.3463	17.30	4.95	22.25	40.00	-17.75	315	100	peak
2	227.6906	19.18	5.57	24.75	46.00	-21.25	102	100	peak
3	276.1236	21.61	8.14	29.75	46.00	-16.25	315	200	peak

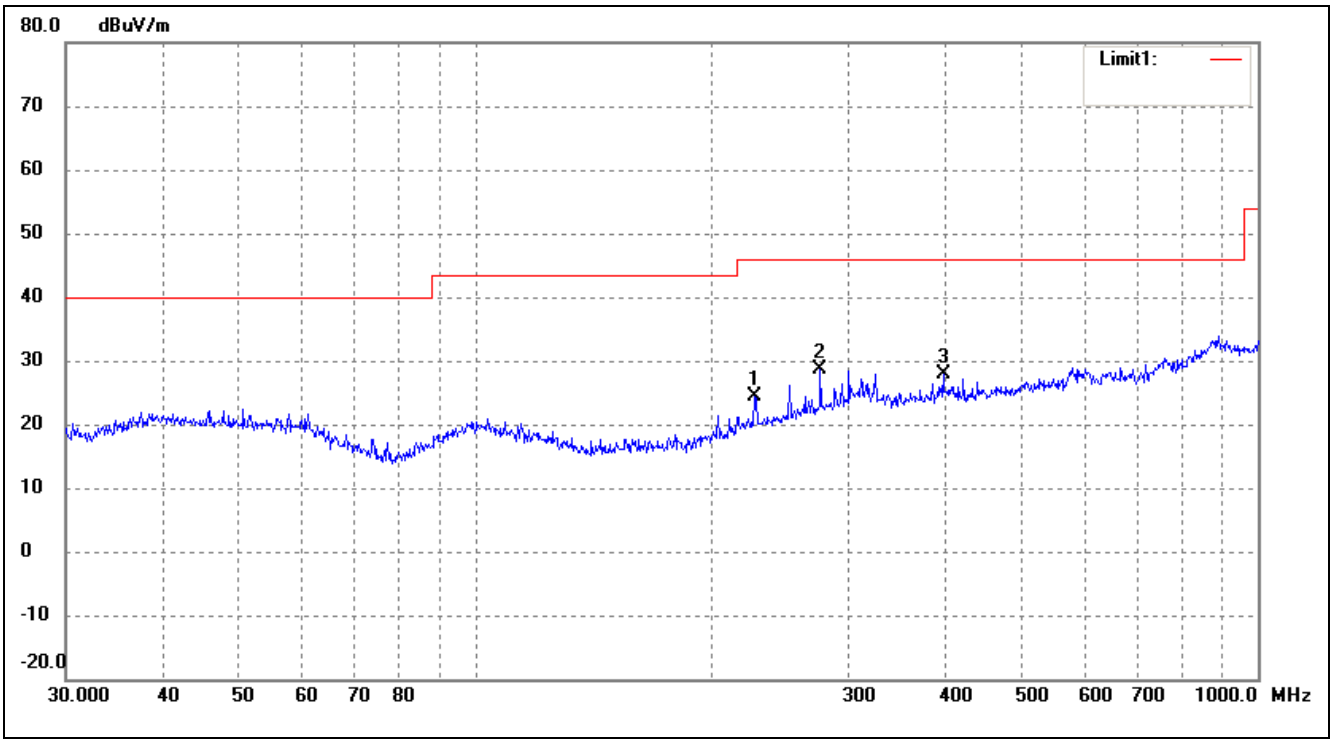
Test Specification: *Vertical*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	100.9340	15.66	6.03	21.69	43.50	-21.81	290	100	peak
2	321.0608	16.32	9.26	25.58	46.00	-20.42	138	100	peak
3	758.0408	16.19	14.74	30.93	46.00	-15.07	201	100	peak

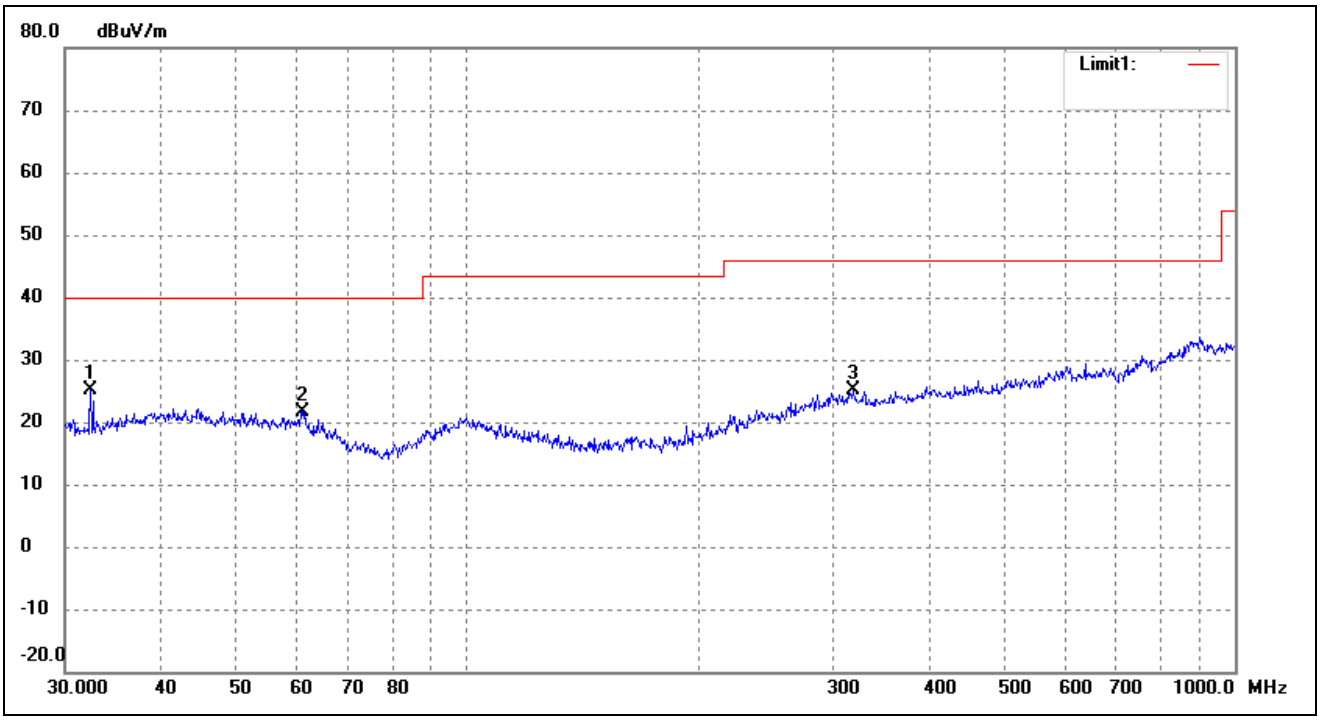
Operating Condition: *Transmitting High Channel (2476MHz)*
Comment: *Transmitter*

Test Specification: *Horizontal*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(°)	(cm)	
1	227.6906	18.75	5.57	24.32	46.00	-21.68	136	100	peak
2	276.1236	20.56	8.14	28.70	46.00	-17.30	109	100	peak
3	396.2415	18.05	9.95	28.00	46.00	-18.00	98	200	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	32.4059	17.23	8.00	25.23	40.00	-14.77	66	100	peak
2	61.1316	16.69	5.02	21.71	40.00	-18.29	91	100	peak
3	318.8170	15.86	9.28	25.14	46.00	-20.86	136	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-2406MHz							
2406	86.36	-3.49	82.87	114.00	-31.13	H	PK
2406	75.36	-3.49	71.87	94.00	-22.13	H	AV
4812	33.31	0.55	33.86	54.00	-20.14	H	PK
4812	44.64	0.55	45.19	74.00	-28.81	H	AV
7218	23.97	3.65	27.62	54.00	-26.38	H	PK
7218	36.61	3.67	40.28	74.00	-33.72	H	AV
2406	81.06	-3.49	77.57	114.00	-36.43	V	PK
2406	70.06	-3.49	66.57	94.00	-27.43	V	AV
4812	33.03	0.55	33.58	54.00	-20.42	V	PK
4812	42.80	0.55	43.35	74.00	-30.65	V	AV
7218	23.38	3.65	27.03	54.00	-26.97	V	PK
7218	35.01	3.67	38.68	74.00	-35.32	V	AV
Middle Channel-2447MHz							
2447	85.16	-3.41	81.75	114.00	-32.25	H	PK
2447	71.62	-3.41	68.21	94.00	-25.79	H	AV
4894	45.30	0.68	45.98	74.00	-28.02	H	PK
4894	33.28	0.68	33.96	54.00	-20.04	H	AV
7341	38.83	3.77	42.60	74.00	-31.40	H	PK
7341	26.89	3.82	30.71	54.00	-23.29	H	AV
2447	85.19	-3.41	81.78	114.00	-32.22	V	PK
2447	71.68	-3.41	68.27	94.00	-25.73	V	AV
4894	48.07	0.68	48.75	74.00	-25.25	V	PK
4894	34.77	0.68	35.45	54.00	-18.55	V	AV
7341	38.30	3.77	42.07	74.00	-31.93	V	PK
7341	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-2476MHz							
2476	83.60	-3.33	80.27	114.00	-33.73	H	PK
2476	72.52	-3.33	69.19	94.00	-24-81	H	AV
4952	46.18	0.77	46.95	74.00	-27.05	H	PK
4952	33.24	0.77	34.01	54.00	-19.99	H	AV
7428	26.94	3.82	30.76	54.00	-23.24	H	PK
7428	38.28	3.84	42.12	74.00	-31.88	H	AV
2476	87.46	-3.33	84.13	114.00	-29.87	V	PK
2476	76.43	-3.33	73.10	94.00	-20.90	V	AV
4952	49.65	0.77	50.42	74.00	-23.58	V	PK
4952	35.28	0.77	36.05	54.00	-17.95	V	AV
7428	26.88	3.82	30.70	54.00	-23.30	V	PK
7428	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

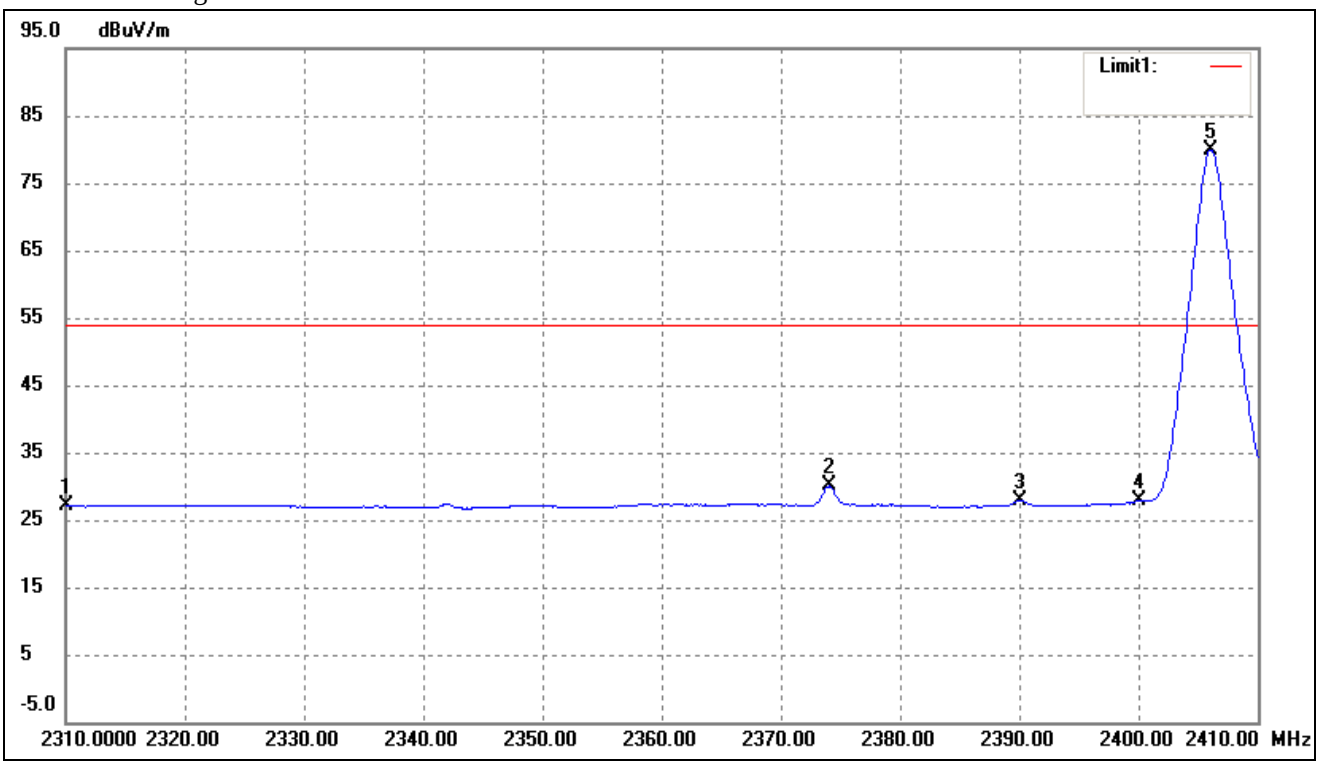
5.5 Summary of Test Results/Plots

Test mode	Frequency	Limit	Result
	MHz	dBuV / dBc	
Lowest	2310.00	<54 dBuV	Pass
	2390.00	<54 dBuV	Pass
	2400.00	>50 dBc	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.

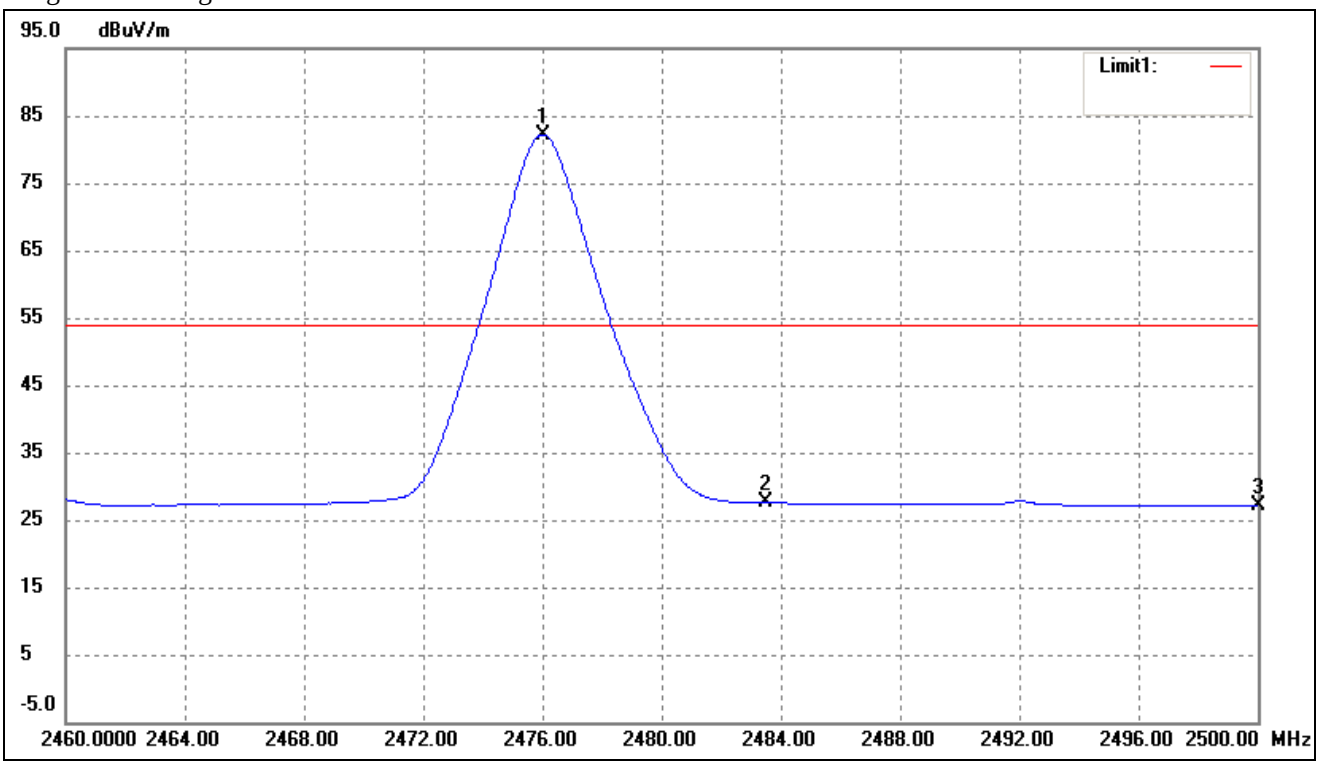
Please refer to the test plots as below.

Lowest Bandedge



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	30.82	-3.71	27.11	54.00	-26.89	Ave Detector
	2310.000	44.53	-3.71	40.82	74.00	-33.18	Peak Detector
2	2374.000	33.57	-3.56	30.01	54.00	-23.99	Ave Detector
3	2390.000	31.49	-3.54	27.95	54.00	-26.05	Ave Detector
	2390.000	44.79	-3.54	41.25	74.00	-32.75	Peak Detector
4	2400.000	31.35	-3.51	27.84	Delta=52.12dBc		Ave Detector
5	2404.899	83.46	-3.50	79.96			Ave Detector

Highest Bandedge



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
2	2476.000	85.54	-3.34	82.20	/	/	Ave Detector
	2476.000	85.78	-3.34	82.44	/	/	Peak Detector
4	2483.500	Delta=58.80dBc		23.40	54.00	-30.60	Ave Detector
	2483.500			26.64	74.00	-47.36	Peak Detector
6	2500.000	30.42	-3.28	27.14	54.00	-26.86	Ave Detector
	2500.000	44.22	-3.28	40.94	74.00	-33.06	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

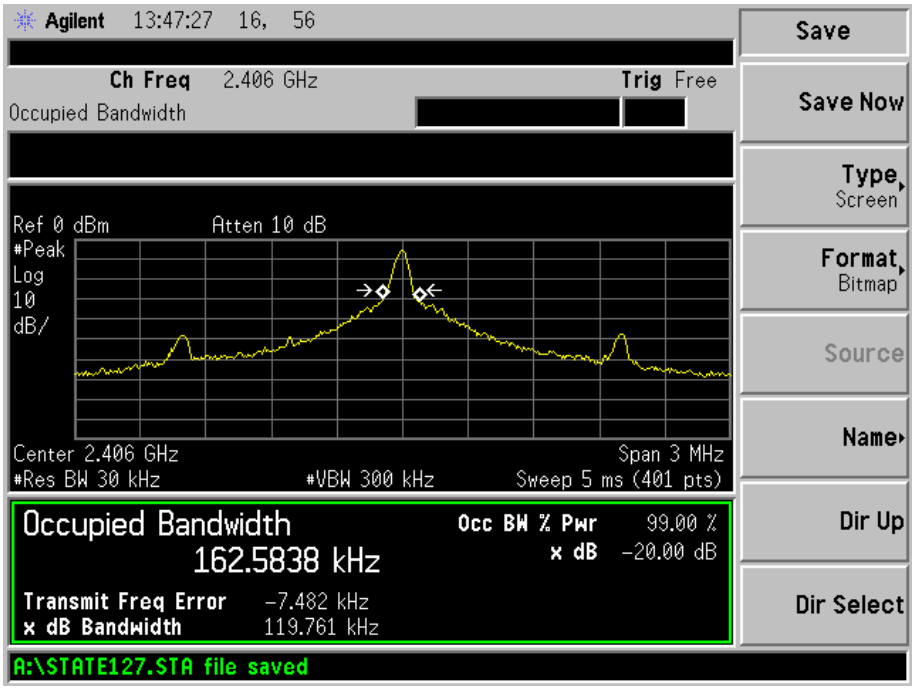
Temperature:	25 °C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

6.5 Summary of Test Results/Plots

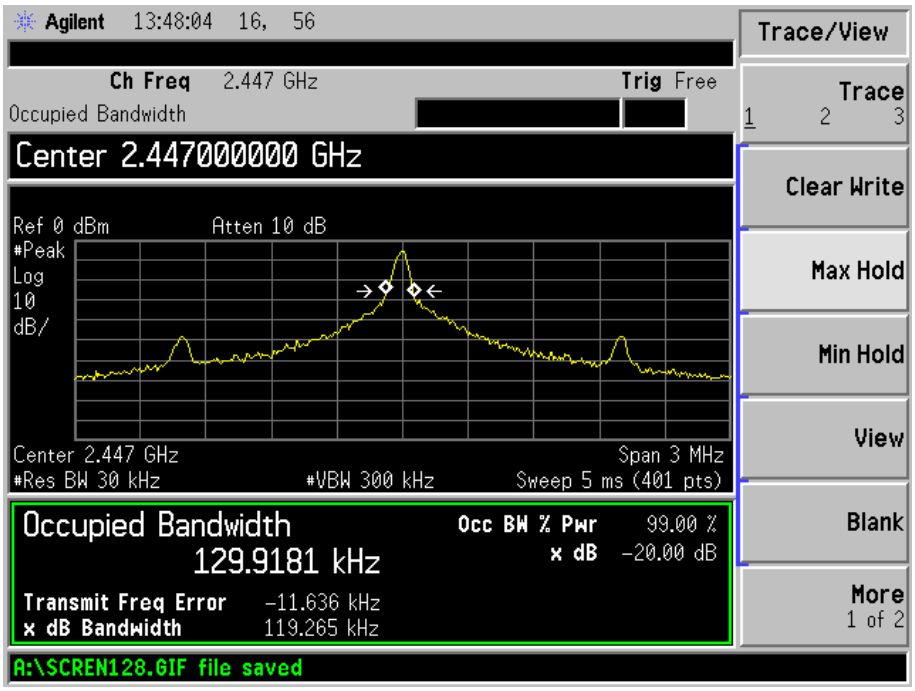
Channel	Frequency MHz	20dB Bandwidth kHz	99% Bandwidth kHz
Low Channel	2406	119.761	162.5838
Middle Channel	2447	119.265	129.9181
High Channel	2476	118.352	145.3783

Please refer to the following test plots

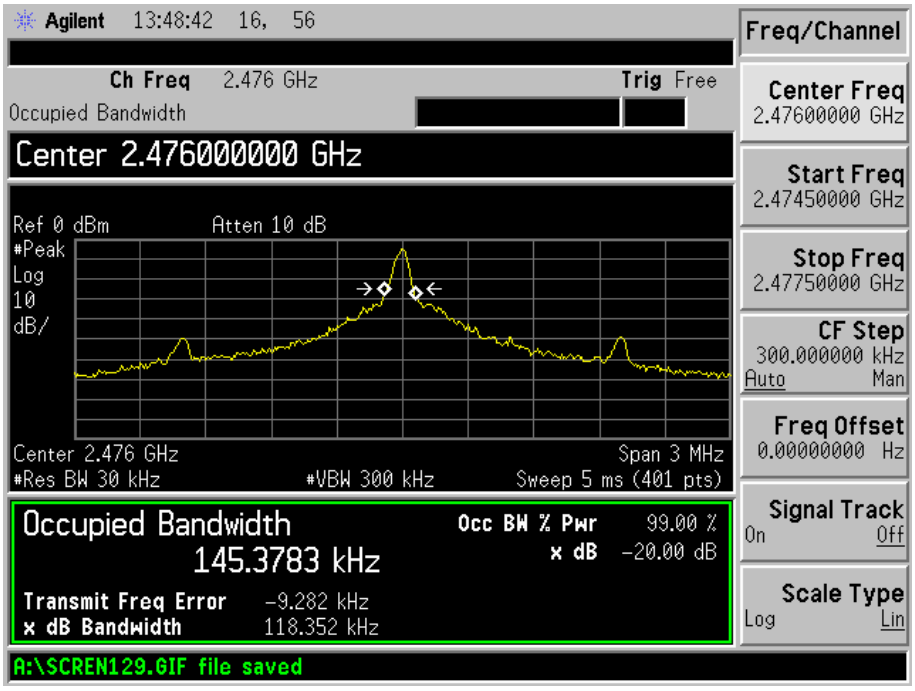
Low Channel:



Middle Channel:



High Channel:



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