

FCC Part 15C Measurement and Test Report

For

DewertOkin GmbH

Weststr. 1, 32278 Kirchlingern, Germany

FCC ID: O3YRF308A

FCC Rule(s): FCC Part 15.249

Product Description: RF-Liteline

Tested Model: RF308A

Report No.: STR17128271I

Sample Receipt Date: 2017-12-22

Tested Date: 2017-12-23 to 2018-01-15

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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
1.6 MEASUREMENT UNCERTAINTY	5
1.7 TEST EQUIPMENT LIST AND DETAILS	6
2. SUMMARY OF TEST RESULTS	7
3. ANTENNA REQUIREMENTS.....	8
3.1 STANDARD APPLICABLE.....	8
3.2 TEST RESULT.....	8
4. RADIATED EMISSIONS.....	9
4.1 STANDARD APPLICABLE.....	9
4.2 TEST PROCEDURE.....	9
4.3 CORRECTED AMPLITUDE & MARGIN CALCULATION.....	11
4.4 ENVIRONMENTAL CONDITIONS	11
4.5 SUMMARY OF TEST RESULTS/PLOTS	11
5. OUT OF BAND EMISSIONS.....	20
5.1 STANDARD APPLICABLE.....	20
5.2 TEST PROCEDURE.....	20
5.3 ENVIRONMENTAL CONDITIONS	20
5.4 SUMMARY OF TEST RESULTS/PLOTS	20
6. EMISSION BANDWIDTH.....	23
6.1 STANDARD APPLICABLE.....	23
6.2 TEST PROCEDURE.....	23
6.3 ENVIRONMENTAL CONDITIONS	23
6.4 SUMMARY OF TEST RESULTS/PLOTS	23

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: DewertOkin GmbH
Address of applicant: Weststr. 1, 32278 Kirchlengern, Germany

Manufacturer: DewertOkin GmbH
Address of manufacturer: Weststr. 1, 32278 Kirchlengern, Germany

General Description of EUT	
Product Name:	RF-Liteline
Brand Name:	/
Model No.:	RF308A
Adding Model(s):	/
Rated Voltage:	Battery: DC4.5V
Software Version:	R2
Hardware Version:	V1.1
Note: The test data is gathered from a production sample, provided by the manufacturer.	

Technical Characteristics of EUT	
Frequency Range:	2403MHz-2480MHz
Max. Field Strength:	93.36dBuV/m (3m)
Data Rate:	/
Modulation:	GFSK
Antenna Type:	PCB Antenna
Antenna Gain:	1.1dBi
Lowest Internal Frequency of EUT:	16MHz

1.2 Test Standards

The following report is prepared on behalf of the DewertOkin GmbH 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	2403MHz
TM2	Middle Channel	2440MHz
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	$\pm 0.42\text{dB}$
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	2018-06-07
SEMT-1042	Horn Antenna	ETS	3117	00086197	2017-06-08	2018-06-07
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2017-06-08	2018-06-07
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-08	2018-06-07
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	2017-03-09	2018-03-08

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

N/A: not applicable

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.

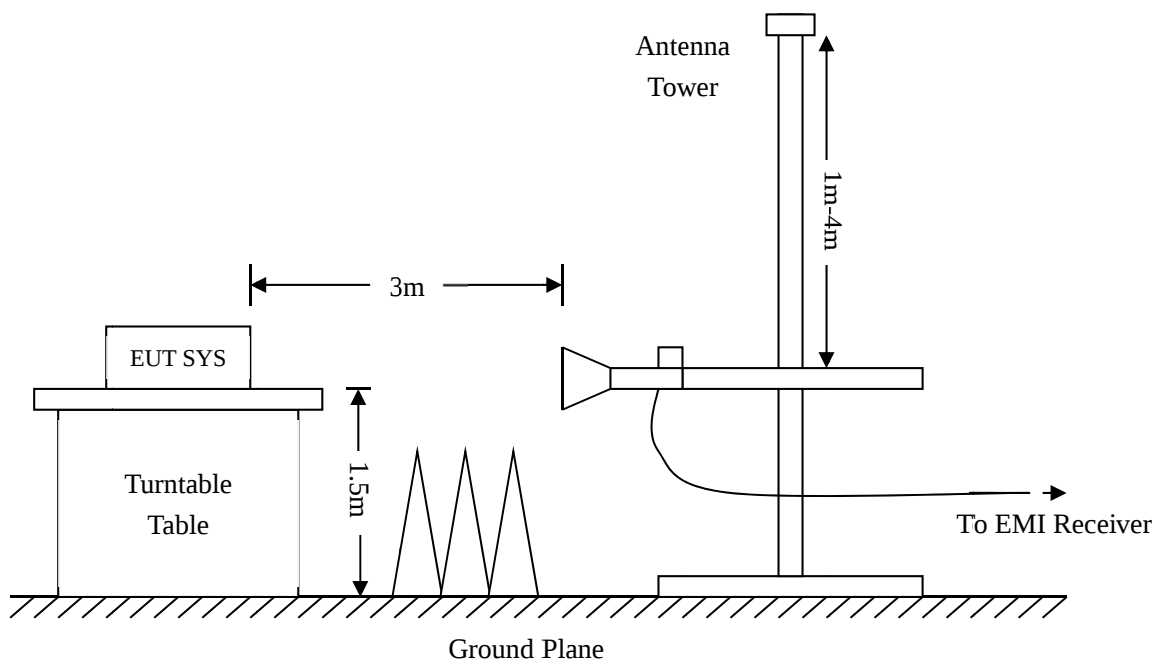
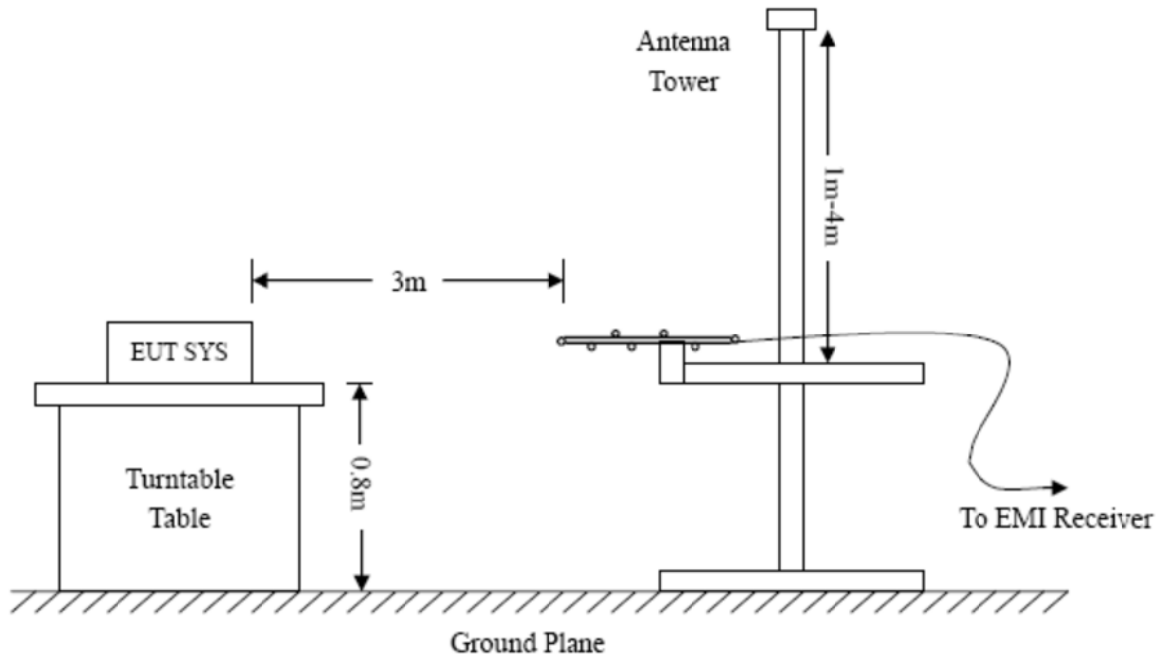
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

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 -6dB μ V means the emission is 6dB μ 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:

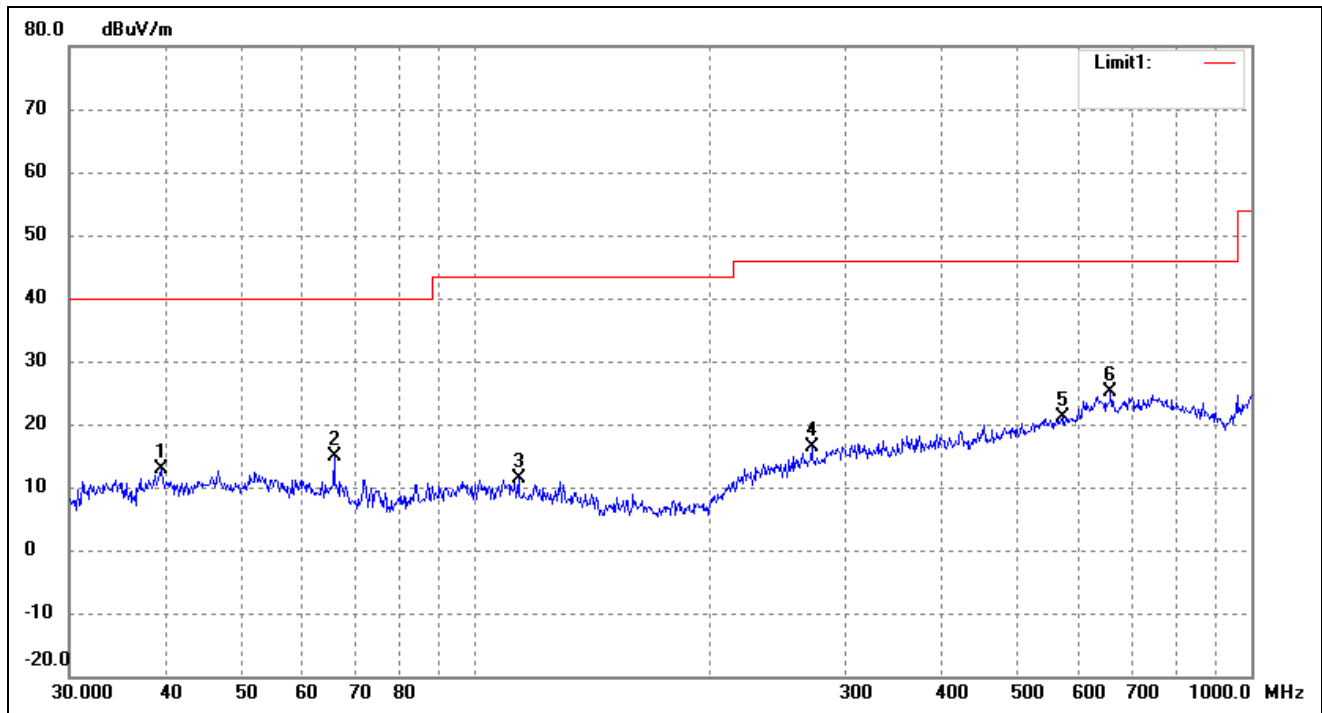
-14.35 dB at 72.0843 MHz in the Vertical polarization, Lowest Channel, 9 kHz to 25 GHz, 3Meters

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)

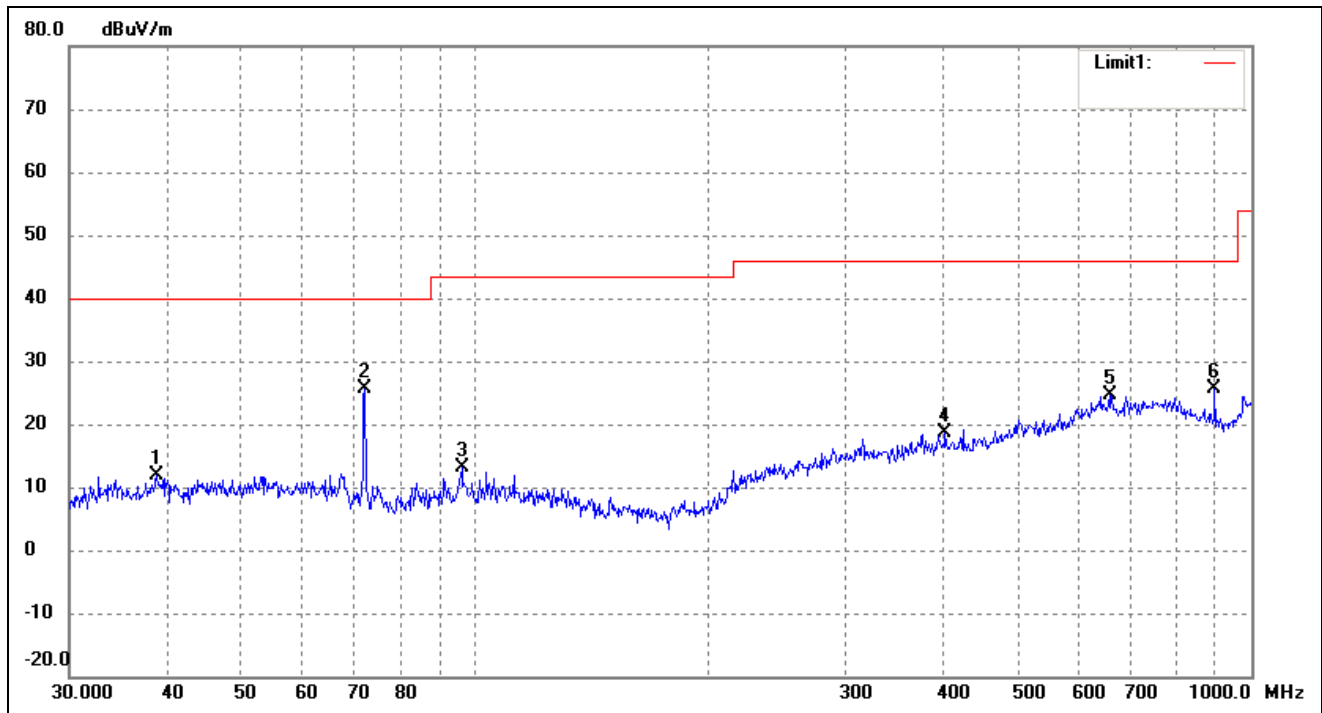
EUT: RF-Liteline
Tested Model: RF308A
Operating Condition: Transmitting Low Channel (2403MHz)
Comment: DC 4.5V

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	39.4372	29.48	-16.62	12.86	40.00	-27.14	215	100	peak
2	65.8031	32.56	-17.77	14.79	40.00	-25.21	98	100	peak
3	113.7143	27.93	-16.63	11.30	43.50	-32.20	131	100	peak
4	271.3246	27.36	-10.98	16.38	46.00	-29.62	107	100	peak
5	570.6100	25.65	-4.44	21.21	46.00	-24.79	306	100	peak
6	658.8362	26.63	-1.47	25.16	46.00	-20.84	149	100	peak

Test Specification: Vertical

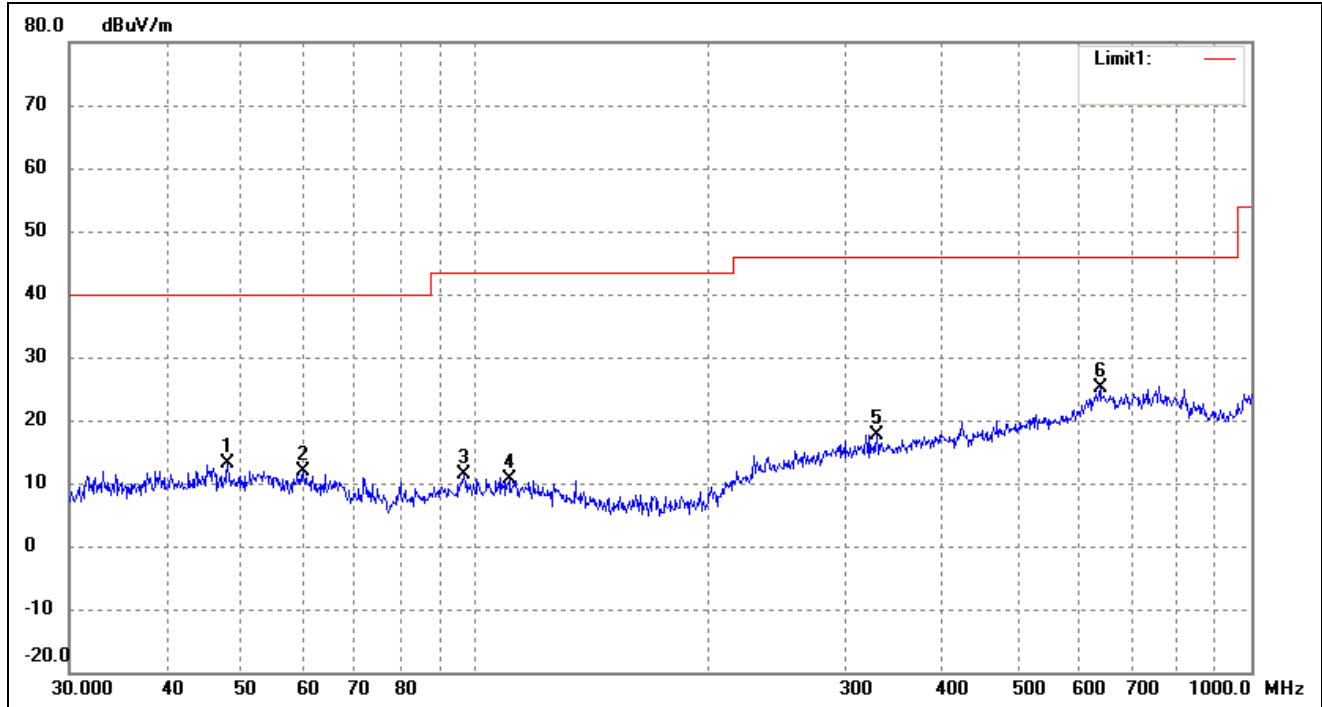


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	38.8879	28.50	-16.71	11.79	40.00	-28.21	319	100	peak
2	72.0843	44.62	-18.97	25.65	40.00	-14.35	94	100	peak
3	96.0986	30.18	-17.14	13.04	43.50	-30.46	295	100	peak
4	403.2500	26.54	-7.88	18.66	46.00	-27.34	118	100	peak
5	656.5300	26.12	-1.41	24.71	46.00	-21.29	228	100	peak
6	896.9965	28.58	-2.86	25.72	46.00	-20.28	318	100	peak

Operating Condition: Transmitting Middle Channel (2440MHz)

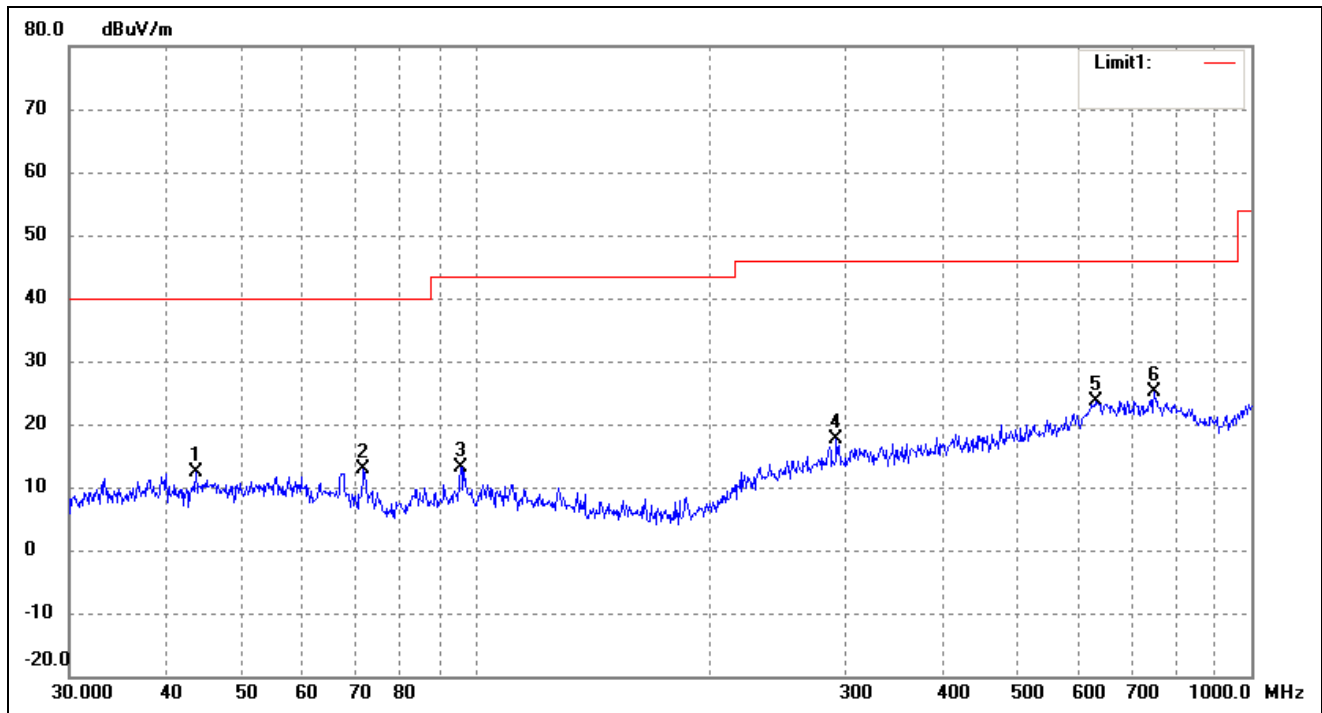
Comment: DC 4.5V

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	47.9940	29.74	-16.53	13.21	40.00	-26.79	302	100	peak
2	60.0691	28.34	-16.52	11.82	40.00	-28.18	119	100	peak
3	96.7749	28.49	-17.03	11.46	43.50	-32.04	98	100	peak
4	110.5687	27.25	-16.62	10.63	43.50	-32.87	268	100	peak
5	329.0390	27.25	-9.50	17.75	46.00	-28.25	107	100	peak
6	638.3686	26.12	-1.06	25.06	46.00	-20.94	131	100	peak

Test Specification: Vertical

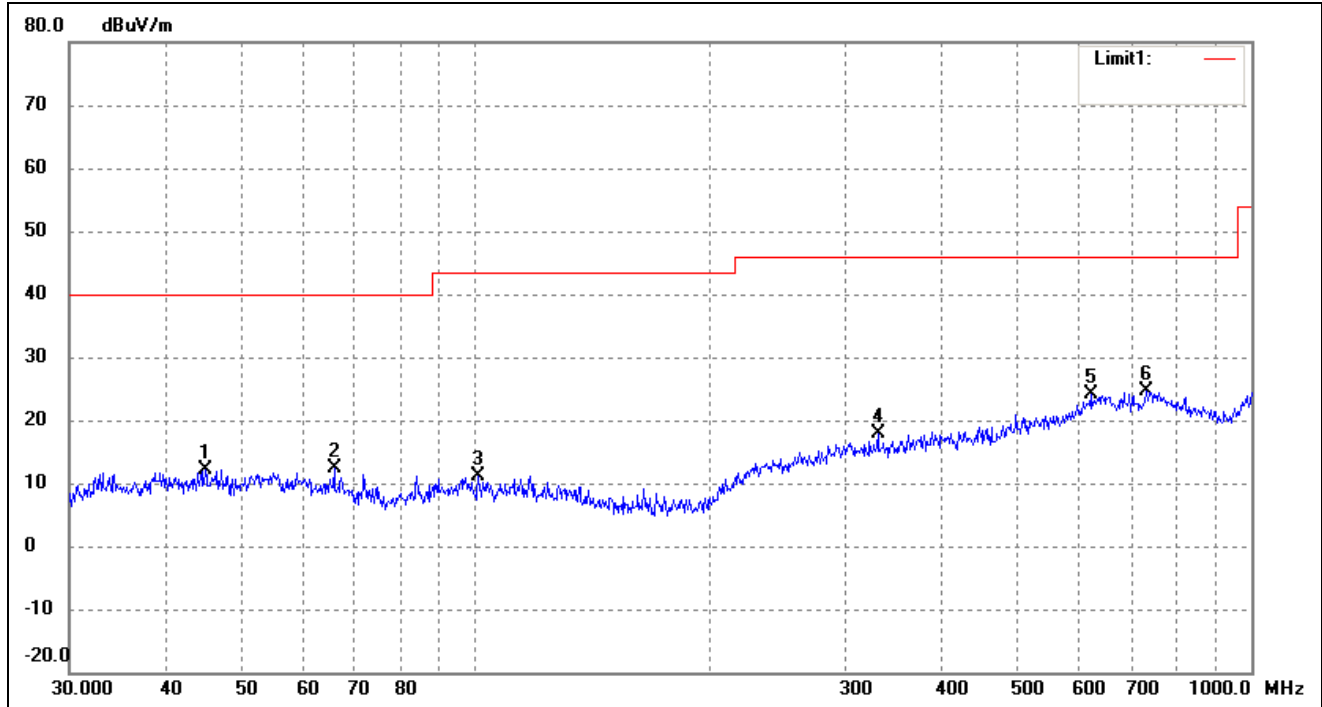


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	43.6585	28.95	-16.49	12.46	40.00	-27.54	224	100	peak
2	71.8320	31.73	-18.94	12.79	40.00	-27.21	247	100	peak
3	95.7622	30.33	-17.19	13.14	43.50	-30.36	52	100	peak
4	292.0583	27.57	-9.87	17.70	46.00	-28.30	199	100	peak
5	629.4772	24.96	-1.36	23.60	46.00	-22.40	67	100	peak
6	750.1083	25.46	-0.23	25.23	46.00	-20.77	291	100	peak

Operating Condition: Transmitting High Channel (2480MHz)

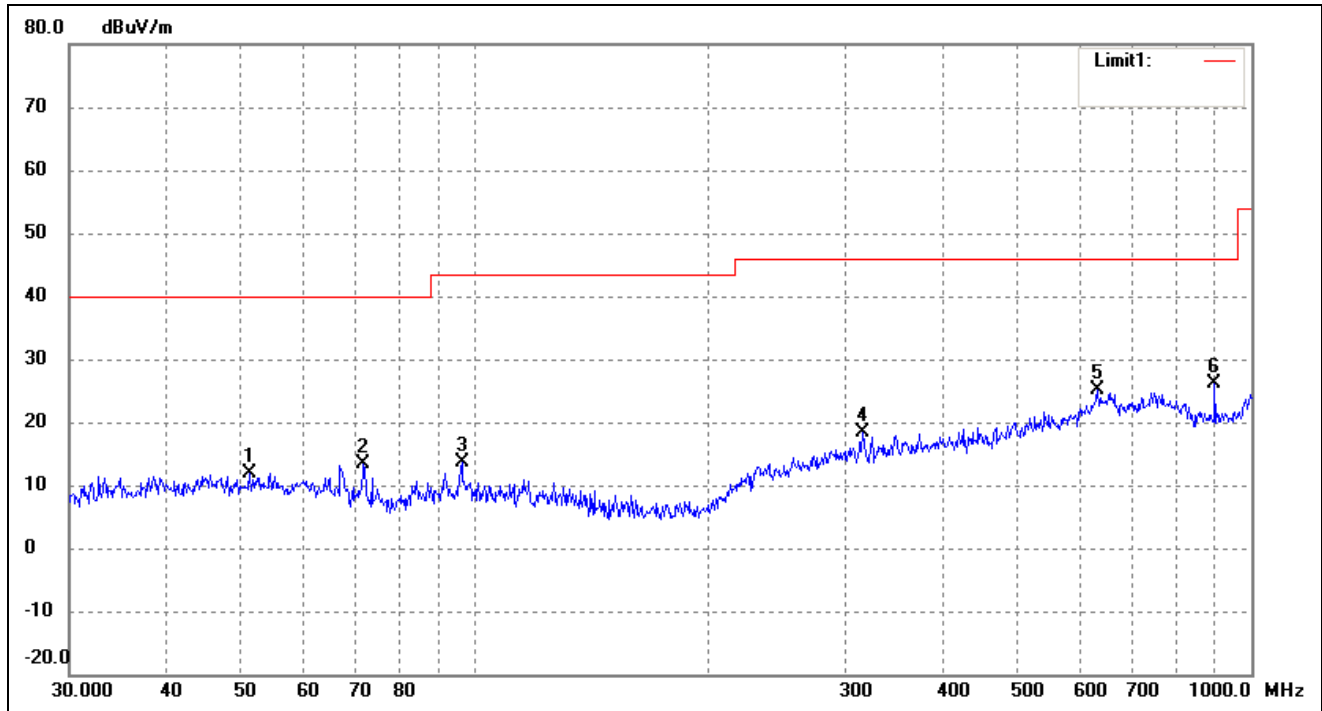
Comment: DC 4.5V

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	44.9006	28.50	-16.48	12.02	40.00	-27.98	100	100	peak
2	65.8031	30.22	-17.77	12.45	40.00	-27.55	181	100	peak
3	100.9340	27.75	-16.57	11.18	43.50	-32.32	85	100	peak
4	330.1949	27.35	-9.52	17.83	46.00	-28.17	91	100	peak
5	620.7096	25.79	-1.67	24.12	46.00	-21.88	153	100	peak
6	731.9203	25.10	-0.35	24.75	46.00	-21.25	304	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	51.1209	28.36	-16.52	11.84	40.00	-28.16	65	100	peak
2	71.8320	32.21	-18.94	13.27	40.00	-26.73	136	100	peak
3	96.0986	30.66	-17.14	13.52	43.50	-29.98	69	100	peak
4	315.4808	27.72	-9.40	18.32	46.00	-27.68	120	100	peak
5	633.9073	26.23	-1.21	25.02	46.00	-20.98	345	100	peak
6	896.9965	29.08	-2.86	26.22	46.00	-19.78	199	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-2403MHz							
2403	100.76	-7.40	93.36	114	-20.64	H	PK
2403	98.11	-7.40	90.71	94	-3.29	H	AV
4806	50.37	-6.48	43.89	74	-30.11	H	PK
4806	49.75	-6.48	43.27	54	-10.73	H	AV
7209	54.08	-8.91	45.17	74	-28.83	H	PK
7209	53.45	-8.91	44.54	54	-9.46	H	AV
2403	99.89	-7.40	92.49	114	-21.51	V	PK
2403	95.87	-7.40	88.47	94	-5.53	V	AV
4806	52.00	-6.48	45.52	74	-28.48	V	PK
4806	50.78	-6.48	44.30	54	-9.70	V	AV
7209	52.72	-8.91	43.81	74	-30.19	V	PK
7209	51.78	-8.91	42.87	54	-11.13	V	AV
Middle Channel-2440MHz							
2440	96.82	-7.36	89.46	114	-24.54	H	PK
2440	94.08	-7.36	86.72	94	-7.28	H	AV
4880	52.28	-6.02	46.26	74	-27.74	H	PK
4880	50.52	-6.02	44.50	54	-9.50	H	AV
7320	53.42	-6.88	46.54	74	-27.46	H	PK
7320	52.04	-6.88	45.16	54	-8.84	H	AV
2440	95.41	-7.36	88.05	114	-25.95	V	PK
2440	90.57	-7.36	83.21	94	-10.79	V	AV
4880	51.47	-6.02	45.45	74	-28.55	V	PK
4880	49.56	-6.02	43.54	54	-10.46	V	AV
7320	55.93	-6.88	49.05	74	-24.95	V	PK
7320	53.71	-6.88	46.83	54	-7.17	V	AV

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2480MHz							
2480	98.86	-7.28	91.58	114	-22.42	H	PK
2480	96.13	-7.28	88.85	94	-5.15	H	AV
4960	51.90	-7.03	44.87	74	-29.13	H	PK
4960	50.47	-7.03	43.44	54	-10.56	H	AV
7440	55.23	-9.47	45.76	74	-28.24	H	PK
7440	53.78	-9.47	44.31	54	-9.69	H	AV
2480	96.87	-7.28	89.59	114	-24.41	V	PK
2480	93.65	-7.28	86.37	94	-7.63	V	AV
4960	50.12	-7.03	43.09	74	-30.91	V	PK
4960	48.37	-7.03	41.34	54	-12.66	V	AV
7440	54.75	-9.47	45.28	74	-28.72	V	PK
7440	52.59	-9.47	43.12	54	-10.88	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

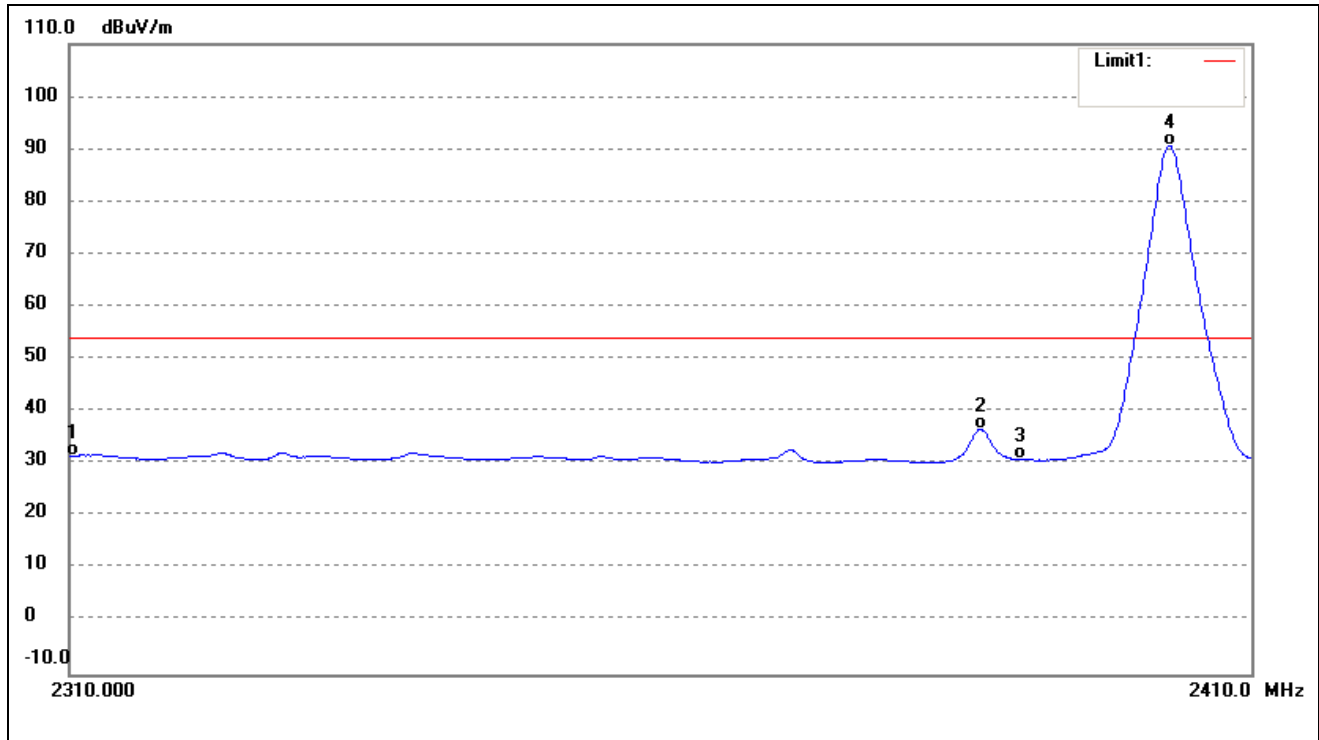
5.4 Summary of Test Results/Plots

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.

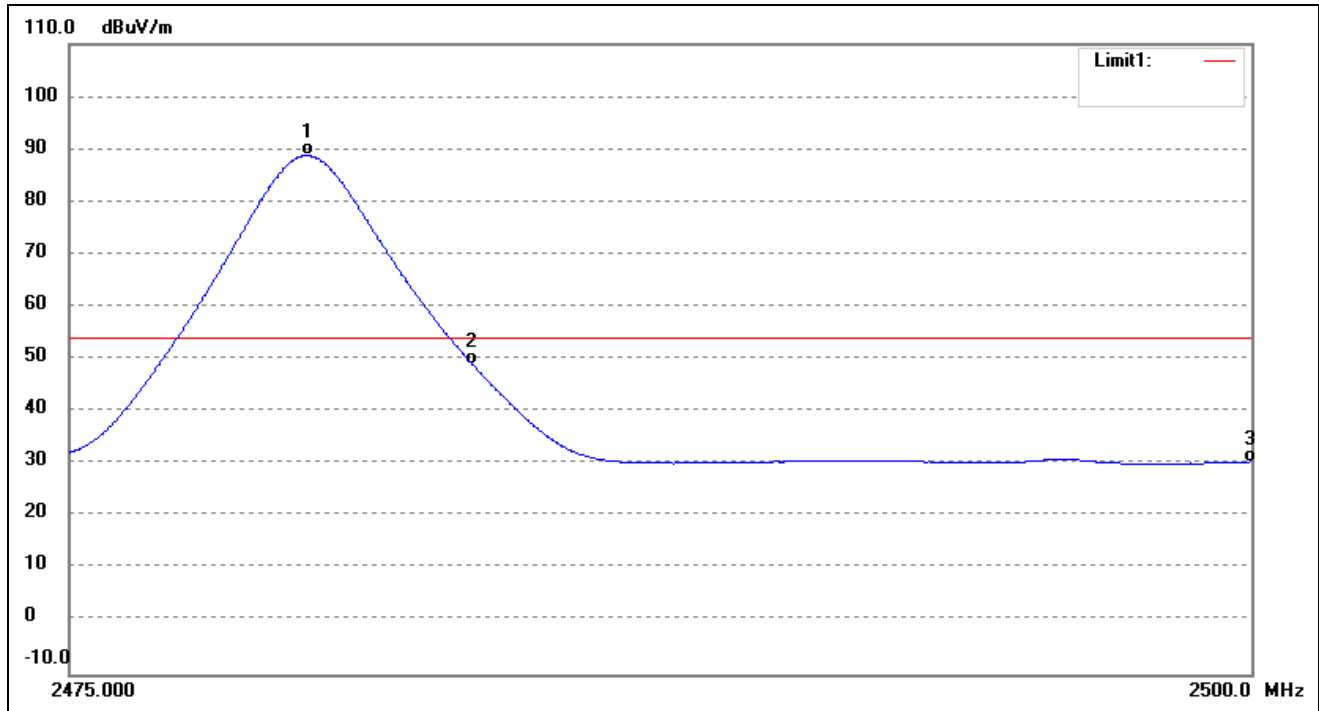
Please refer to the test plots as below.

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	37.94	-6.38	31.56	54.00	-22.44	Average Detector
	2310.00	51.61	-6.38	45.23	74.00	-28.77	Peak Detector
2	2386.72	43.84	-7.22	36.62	54.00	-17.38	Average Detector
3	2390.00	38.14	-7.26	30.88	54.00	-23.12	Average Detector
	2390.00	67.79	-7.26	60.53	74.00	-13.47	Peak Detector
4	2402.96	98.11	-7.40	90.71	/	/	Average Detector
	2403.57	100.76	-7.40	93.36	/	/	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	2480.03	96.13	-7.28	88.85	/	/	Average Detector
	2480.55	98.86	-7.28	91.58	/	/	Peak Detector
2	2483.50	56.09	-7.28	48.81	54.00	-5.19	Average Detector
	2483.50	75.03	-7.28	67.75	74.00	-6.25	Peak Detector
3	2500.00	37.75	-7.25	30.50	54.00	-23.50	Average Detector
	2500.00	59.95	-7.25	52.70	74.00	-21.30	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

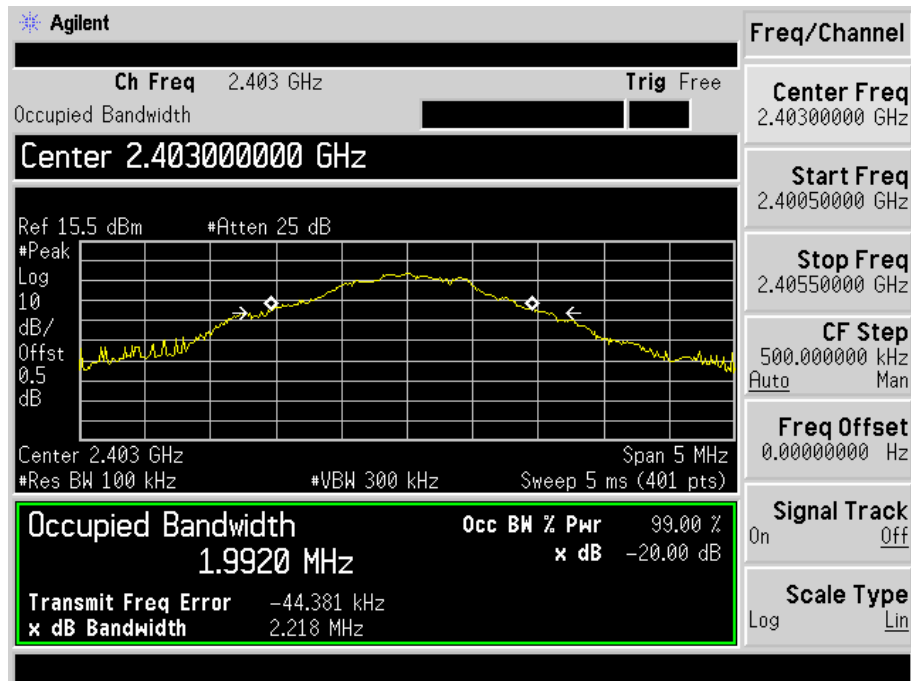
Temperature:	25 °C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

6.4 Summary of Test Results/Plots

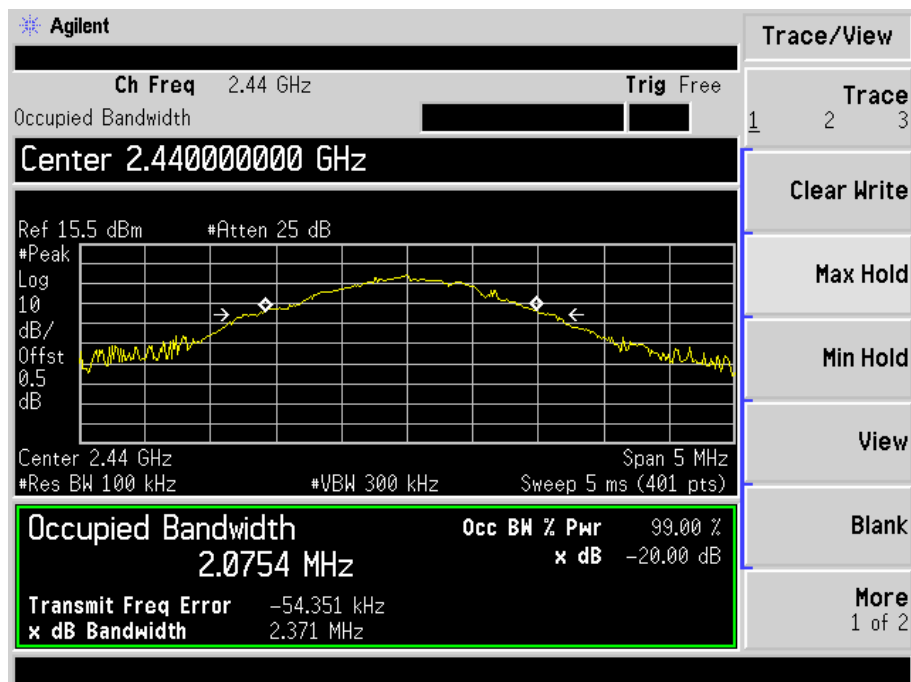
Channel	Frequency MHz	20dB Bandwidth kHz	99% Bandwidth kHz
Low Channel	2403	2218.0	1992.0
Middle Channel	2440	2371.0	2075.4
High Channel	2480	2418.0	2098.1

Please refer to the following test plots

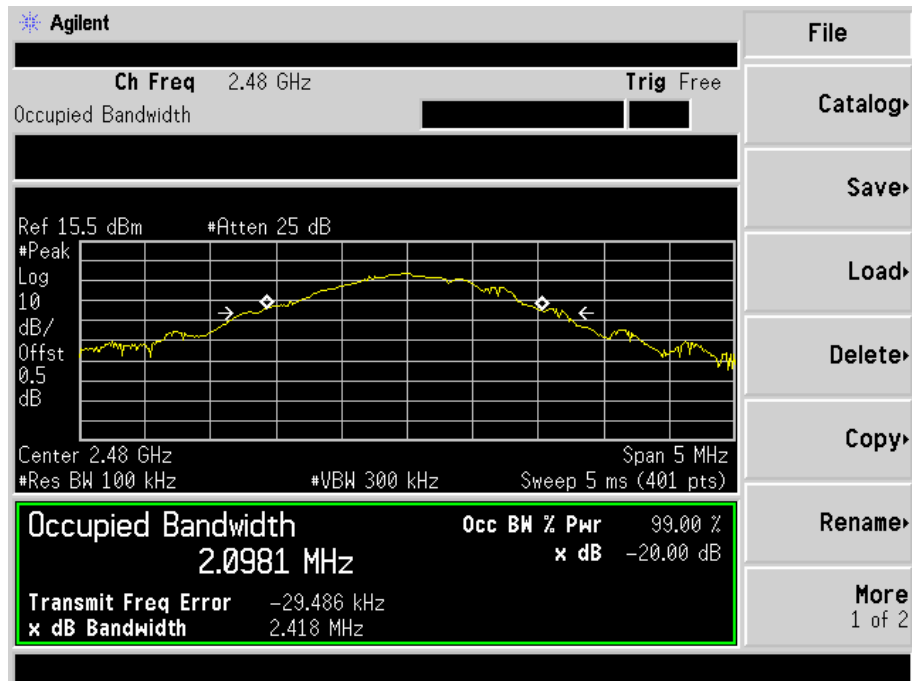
Low Channel:



Middle Channel:



High Channel:



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