

# FCC Part 15C Measurement and Test Report

For

**DewertOkin GmbH**

Weststr. 1, 32278 Kirchlingern, Germany

**FCC ID: O3YAPL18**

<b>FCC Rule(s):</b>	<u>FCC Part 15.249</u>
<b>Product Description:</b>	<u>RF-APLINE</u>
<b>Tested Model:</b>	<u>APL18</u>
<b>Report No.:</b>	<u>STR18078099I</u>
<b>Sample Receipt Date:</b>	<u>2018-06-14</u>
<b>Tested Date:</b>	<u>2018-06-15 to 2018-08-20</u>
<b>Issued Date:</b>	<u>2018-08-21</u>
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<b>Prepared By:</b>	



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## 1. GENERAL INFORMATION

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### 1.1 Product Description for Equipment Under Test (EUT)

#### Client Information

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

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

General Description of EUT	
Product Name:	RF-APLINE
Trade Name:	/
Model No.:	APL18
Adding Model(s):	/
Rated Voltage:	DC 4.5V (3xBattery AAA/LR03 1.5V)
Power Adapter Model:	/
<i>Note: The test data is gathered from a production sample, provided by the manufacturer.</i>	

Technical Characteristics of EUT	
Frequency Range:	2410MHz-2473MHz
Max. Field Strength:	94.59dBuV/m
Modulation:	GFSK
Antenna Type:	PCB Antenna
Antenna Gain:	1.09dBi

## 1.2 Test Standards

The tests were performed according to following standards:

**FCC Rules Part 15.249:** Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz.

**ANSI C63.10-2013:** American National Standard for Testing Unlicensed Wireless Devices.

**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, The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted accordingly in reference to the Operating Instructions.

## 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	2410MHz
TM2	Middle Channel	2440MHz
TM3	High Channel	2473MHz

Test Conditions	
Temperature:	23 °C
Relative humidity	55 %.
ATM Pressure:	1019 mbar

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

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	2018-05-22	2019-05-21
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2018-05-22	2019-05-21
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2018-05-22	2019-05-21
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2018-05-22	2019-05-21
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2018-05-22	2019-05-21
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	2018-05-22	2019-05-21
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2018-05-22	2019-05-21
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2018-05-22	2019-05-21
SEMT-1168	Pre-amplifier	Direction Systems Inc.	PAP-0126	14141-12838	2018-05-22	2019-05-21
SEMT-1169	Pre-amplifier	Direction Systems Inc.	PAP-2640	14145-14153	2018-05-22	2019-05-21
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2018-05-22	2019-05-21
SEMT-1170	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2018-03-19	2021-03-18
SEMT-1166	Power Limiter	Agilent	N9356B	MY45450376	2018-05-22	2019-05-21
SEMT-1048	RF Limiter	ATTEN	AT-BSF-2400~2500	/	2018-05-22	2019-05-21
SEMT-1076	RF Switcher	Top Precision	RCS03-A2	/	2018-05-22	2019-05-21
SEMT-C001	Cable	Zheng DI	LL142-07-07-10M(A)	/	2018-03-19	2019-03-18
SEMT-C002	Cable	Zheng DI	ZT40-2.92J-2.92J-6M	/	2018-03-19	2019-03-18
SEMT-C003	Cable	Zheng DI	ZT40-2.92J-2.92J-2.5M	/	2018-03-19	2019-03-18
SEMT-C004	Cable	Zheng DI	2M0RFC	/	2018-03-19	2019-03-18
SEMT-C005	Cable	Zheng DI	1M0RFC	/	2018-03-19	2019-03-18
SEMT-C006	Cable	Zheng DI	1M0RFC	/	2018-03-19	2019-03-18

## 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

N/A Means' not application

### **3. Antenna Requirements**

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#### **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 a PCB antenna, fulfill the requirement of this section.



## 4. Radiated Emissions

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### 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.

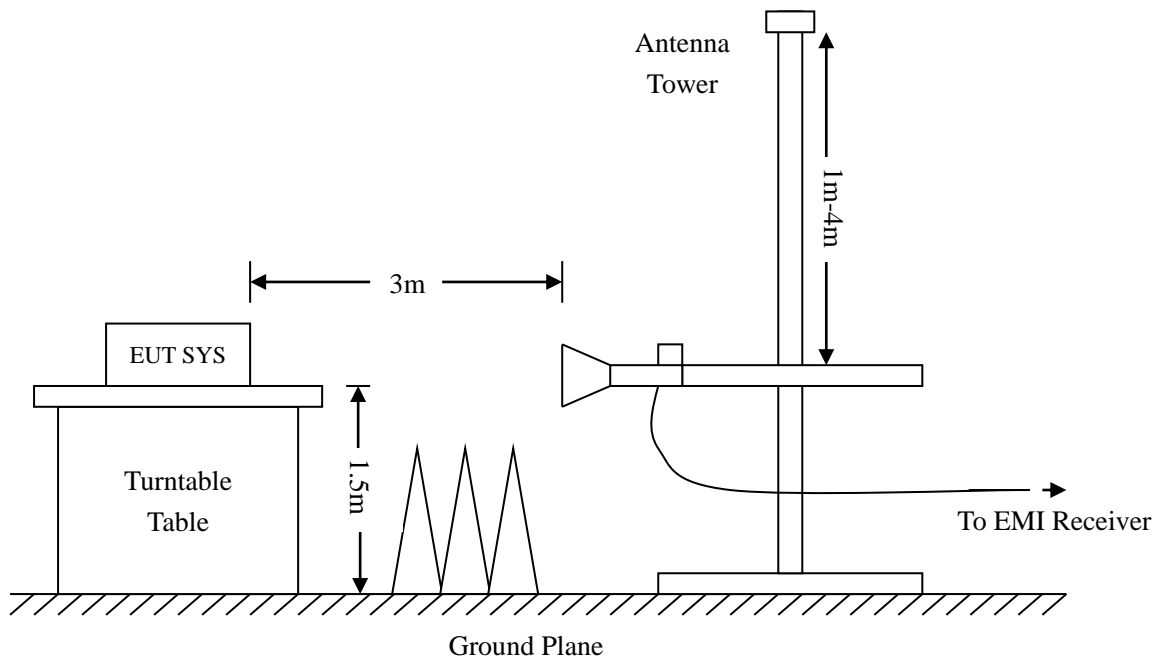
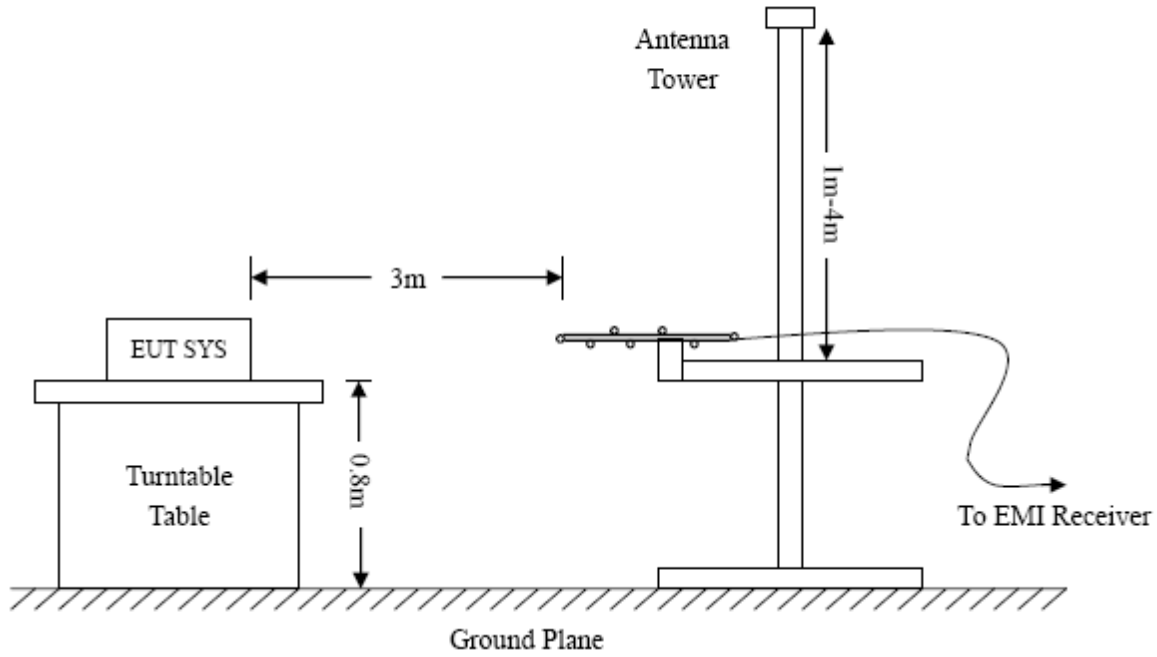
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

### 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:

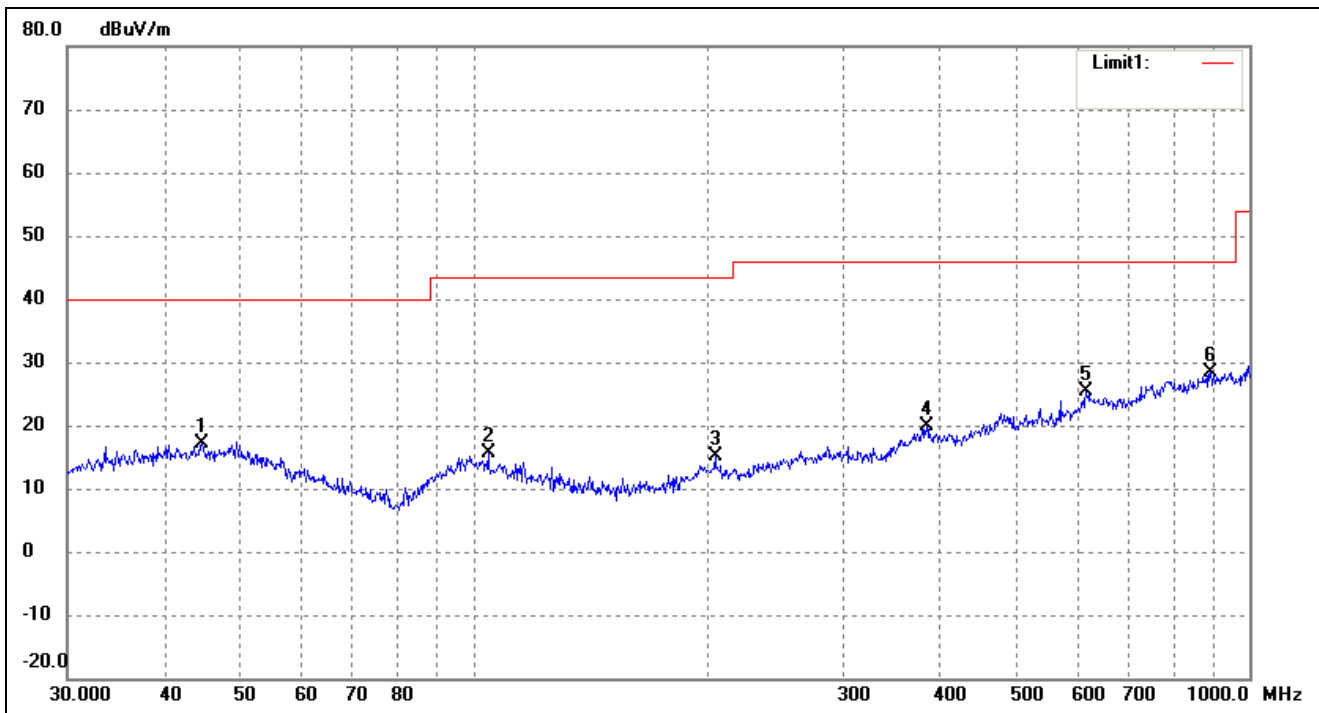
$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15C Limit}$$

### 4.4 Summary of Test Results/Plots

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

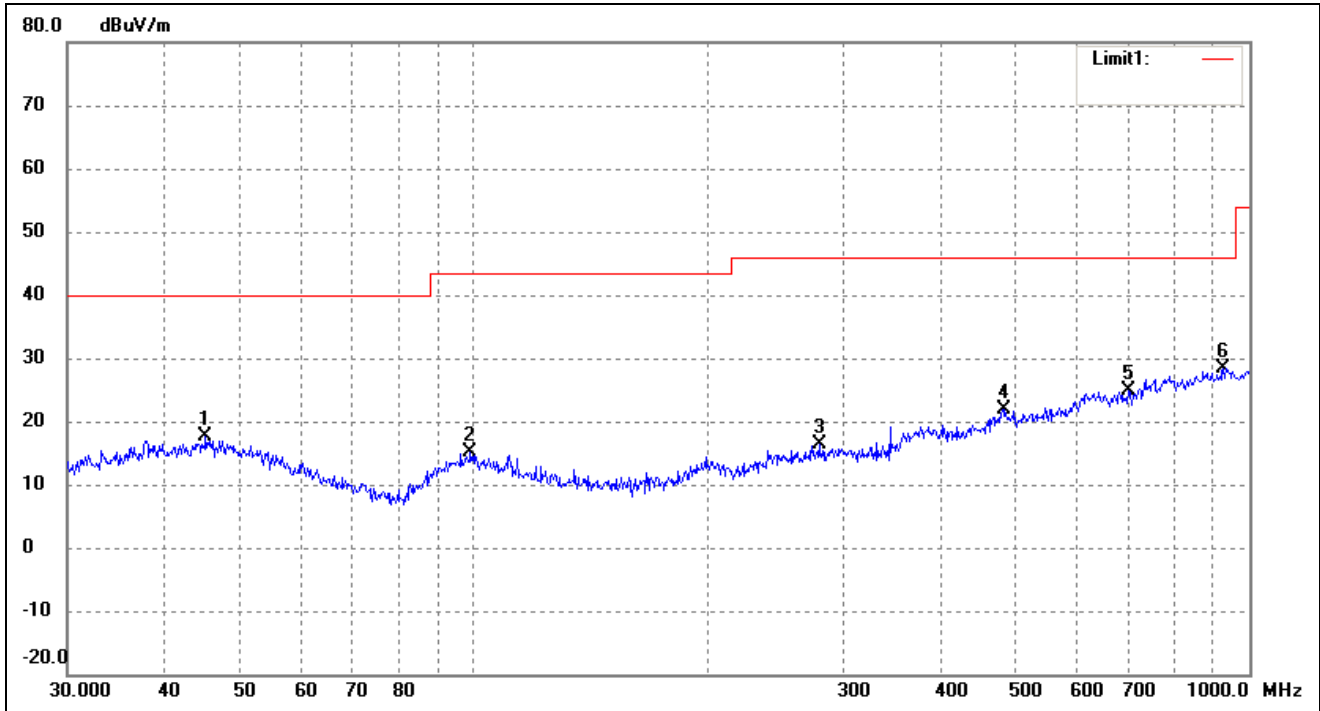
## ➤ Spurious Emissions Below 1GHz

Test Channel	Low	Polarity:	Horizontal
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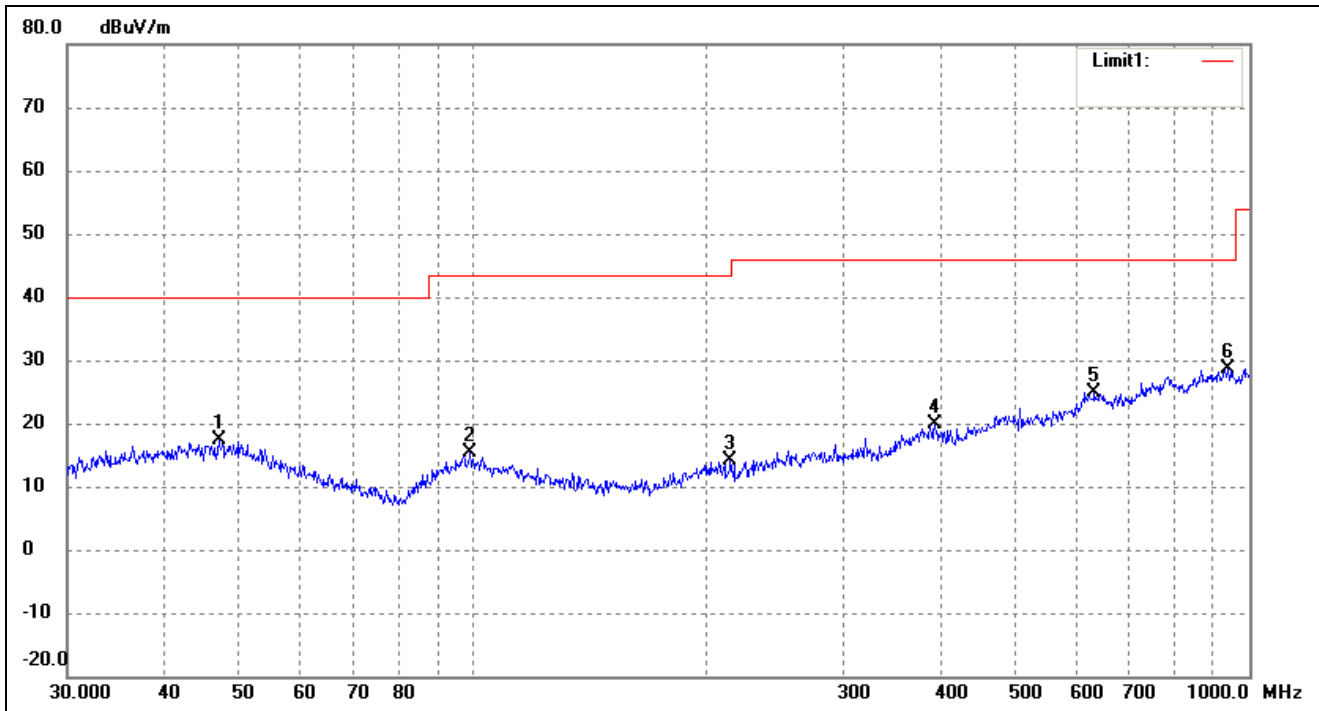
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	44.7434	27.61	-10.59	17.02	40.00	-22.98	84	100	peak
2	104.5361	27.52	-11.92	15.60	43.50	-27.90	152	100	peak
3	204.9551	26.88	-11.82	15.06	43.50	-28.44	80	100	peak
4	383.9318	26.95	-7.12	19.83	46.00	-26.17	120	100	peak
5	616.3718	28.41	-3.07	25.34	46.00	-20.66	118	100	peak
6	890.7278	27.04	1.43	28.47	46.00	-17.53	313	100	peak

Test Channel	Low	Polarity:	Vertical
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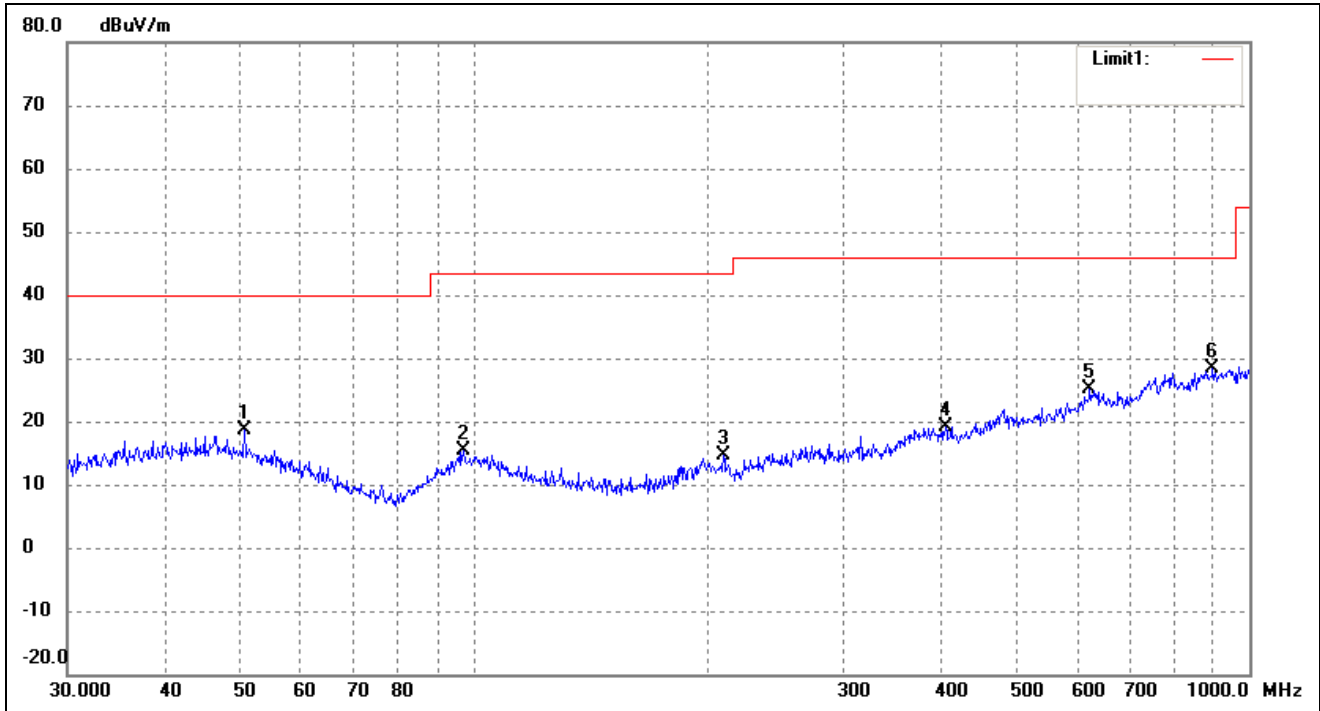
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	45.2166	28.02	-10.45	17.57	40.00	-22.43	134	100	peak
2	99.1797	26.66	-11.58	15.08	43.50	-28.42	285	100	peak
3	279.0436	25.96	-9.53	16.43	46.00	-29.57	86	100	peak
4	482.2156	27.27	-5.44	21.83	46.00	-24.17	162	100	peak
5	699.3046	28.34	-3.40	24.94	46.00	-21.06	55	100	peak
6	925.7563	26.54	1.90	28.44	46.00	-17.56	269	100	peak

Test Channel	Middle	Polarity:	Horizontal
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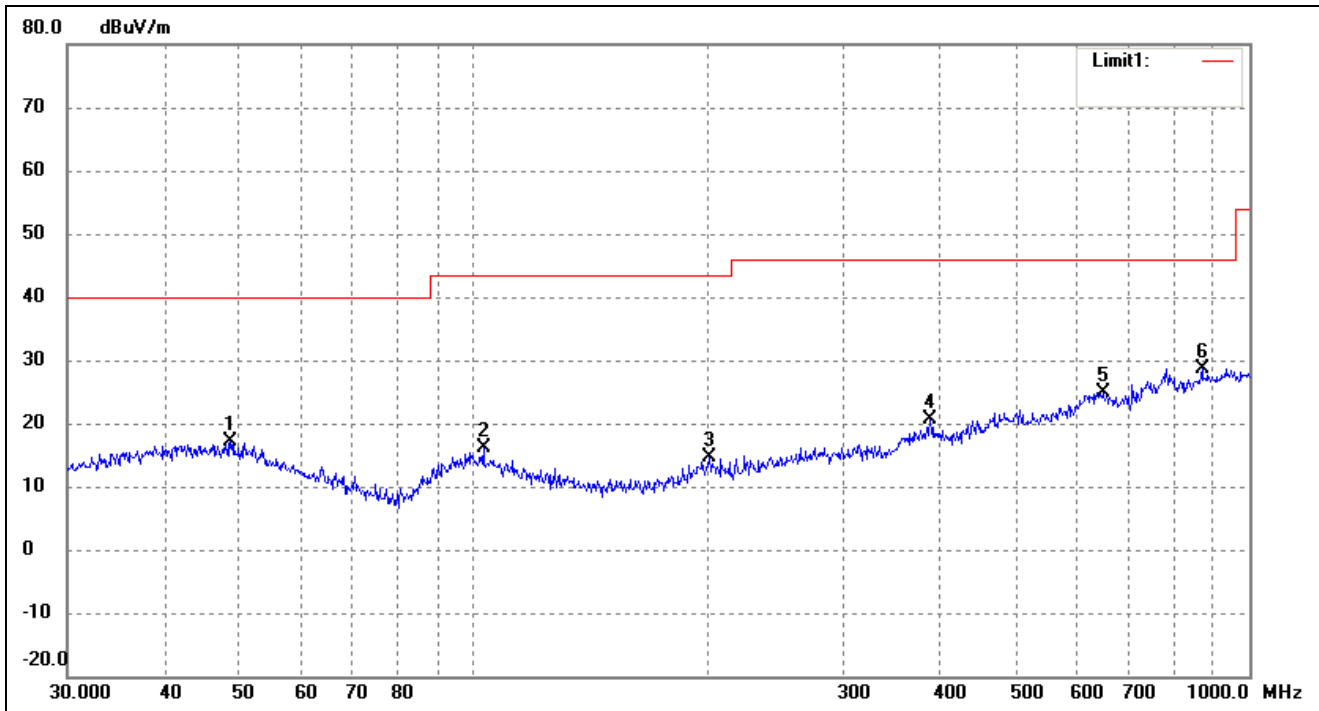
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	46.9948	28.05	-10.64	17.41	40.00	-22.59	84	100	peak
2	99.1797	27.02	-11.58	15.44	43.50	-28.06	152	100	peak
3	214.5143	26.44	-12.24	14.20	43.50	-29.30	80	100	peak
4	393.4724	27.35	-7.41	19.94	46.00	-26.06	120	100	peak
5	631.6884	27.99	-3.03	24.96	46.00	-21.04	118	100	peak
6	938.8326	26.24	2.27	28.51	46.00	-17.49	313	100	peak

Test Channel	Middle	Polarity:	Vertical
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	50.7637	29.32	-10.65	18.67	40.00	-21.33	172	100	peak
2	97.1148	27.33	-12.04	15.29	43.50	-28.21	148	100	peak
3	210.0482	26.57	-12.04	14.53	43.50	-28.97	115	100	peak
4	406.0880	26.90	-7.70	19.20	46.00	-26.80	115	100	peak
5	622.8900	27.99	-2.85	25.14	46.00	-20.86	223	100	peak
6	896.9965	27.02	1.41	28.43	46.00	-17.57	262	100	peak

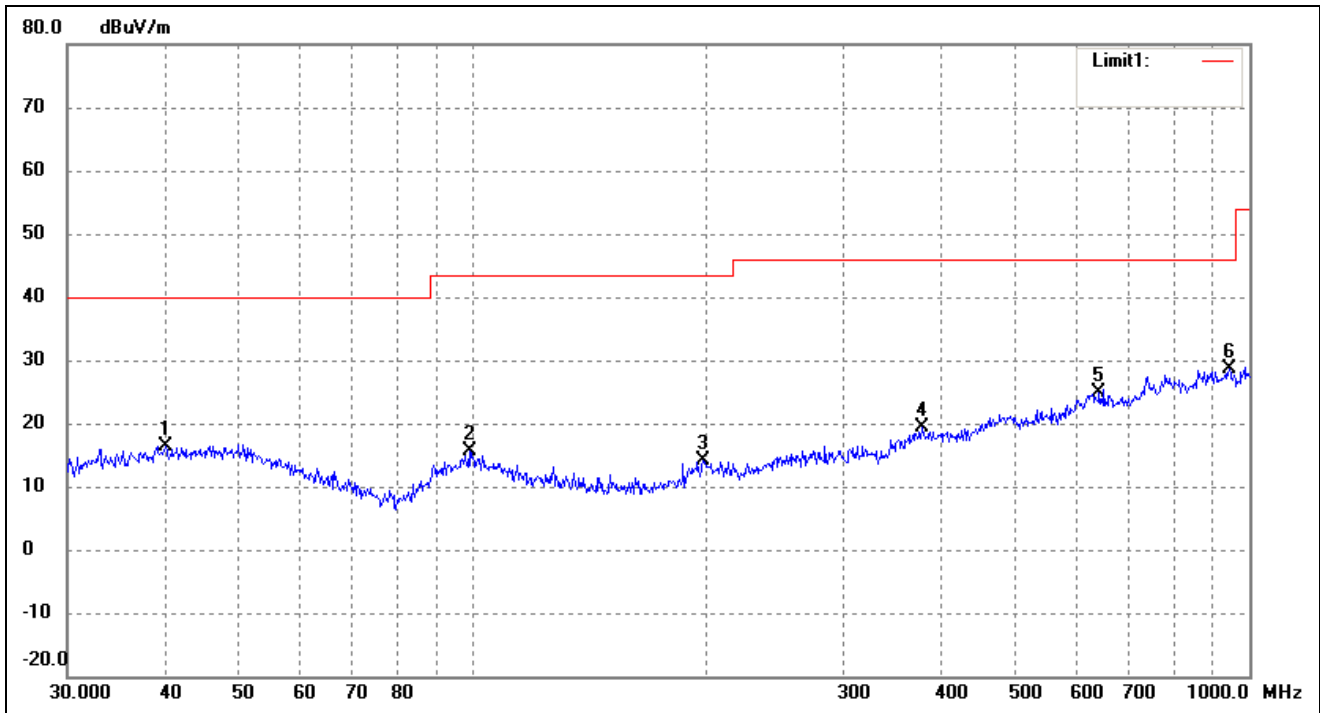
Test Channel	High	Polarity:	Horizontal
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	48.6719	27.84	-10.68	17.16	40.00	-22.84	300	100	peak
2	103.0800	27.86	-11.75	16.11	43.50	-27.39	230	100	peak
3	201.3930	26.38	-11.66	14.72	43.50	-28.78	67	100	peak
4	387.9920	27.76	-7.24	20.52	46.00	-25.48	294	100	peak
5	647.3856	28.25	-3.39	24.86	46.00	-21.14	291	100	peak
6	869.1302	27.48	1.26	28.74	46.00	-17.26	326	100	peak



Test Channel	High	Polarity:	Vertical
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	40.1347	26.90	-10.40	16.50	40.00	-23.50	274	100	peak
2	98.8326	27.35	-11.66	15.69	43.50	-27.81	94	100	peak
3	197.8928	26.07	-11.87	14.20	43.50	-29.30	198	100	peak
4	378.5843	26.42	-7.06	19.36	46.00	-26.64	91	100	peak
5	640.6110	27.99	-3.22	24.77	46.00	-21.23	252	100	peak
6	942.1305	26.51	2.21	28.72	46.00	-17.28	277	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-2410MHz							
2410.00	97.87	-3.59	94.28	114.00	-19.72	H	PK
2410.00	83.65	-3.59	80.06	94.00	-13.94	H	AV
4820.00	49.12	-3.59	45.53	74.00	-28.47	H	PK
4820.00	42.54	-3.59	38.95	54.00	-15.05	H	AV
7230.00	46.14	-0.52	45.62	74.00	-28.38	H	PK
7230.00	40.53	-0.52	40.01	54.00	-13.99	H	AV
2410.00	92.18	-3.59	88.59	114.00	-25.41	V	PK
2410.00	78.22	-3.59	74.63	94.00	-19.37	V	AV
4820.00	48.80	-3.59	45.21	74.00	-28.79	V	PK
4820.00	43.59	-3.59	40.00	54.00	-14.00	V	AV
7230.00	46.77	-0.52	46.25	74.00	-27.75	V	PK
7230.00	40.71	-0.52	40.19	54.00	-13.81	V	AV
Middle Channel-2440MHz							
2440.00	97.90	-3.59	94.31	114.00	-19.69	H	PK
2440.00	83.41	-3.59	79.82	94.00	-14.18	H	AV
4880.00	48.84	-3.49	45.35	74.00	-28.65	H	PK
4880.00	43.37	-3.49	39.88	54.00	-14.12	H	AV
7320.00	45.90	-0.47	45.43	74.00	-28.57	H	PK
7320.00	39.23	-0.47	38.76	54.00	-15.24	H	AV
2440.00	92.84	-3.59	89.25	114.00	-24.75	V	PK
2440.00	78.22	-3.59	74.63	94.00	-19.37	V	AV
4880.00	49.59	-3.49	46.10	74.00	-27.90	V	PK
4880.00	42.23	-3.49	38.74	54.00	-15.26	V	AV
7320.00	47.00	-0.47	46.53	74.00	-27.47	V	PK
7320.00	39.07	-0.47	38.60	54.00	-15.40	V	AV

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2473MHz							
2473.00	98.18	-3.59	94.59	114.00	-19.41	H	PK
2473.00	83.11	-3.59	79.52	94.00	-14.48	H	AV
4946.00	49.94	-3.41	46.53	74.00	-27.47	H	PK
4946.00	42.82	-3.41	39.41	54.00	-14.59	H	AV
7419.00	46.24	-0.42	45.82	74.00	-28.18	H	PK
7419.00	38.52	-0.42	38.10	54.00	-15.90	H	AV
2473.00	93.00	-3.59	89.41	114.00	-24.59	V	PK
2473.00	80.12	-3.59	76.53	94.00	-17.47	V	AV
4946.00	48.35	-3.41	44.94	74.00	-29.06	V	PK
4946.00	41.83	-3.41	38.42	54.00	-15.58	V	AV
7419.00	46.79	-0.42	46.37	74.00	-27.63	V	PK
7419.00	38.91	-0.42	38.49	54.00	-15.51	V	AV

*Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 5<sup>th</sup> 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

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### 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.

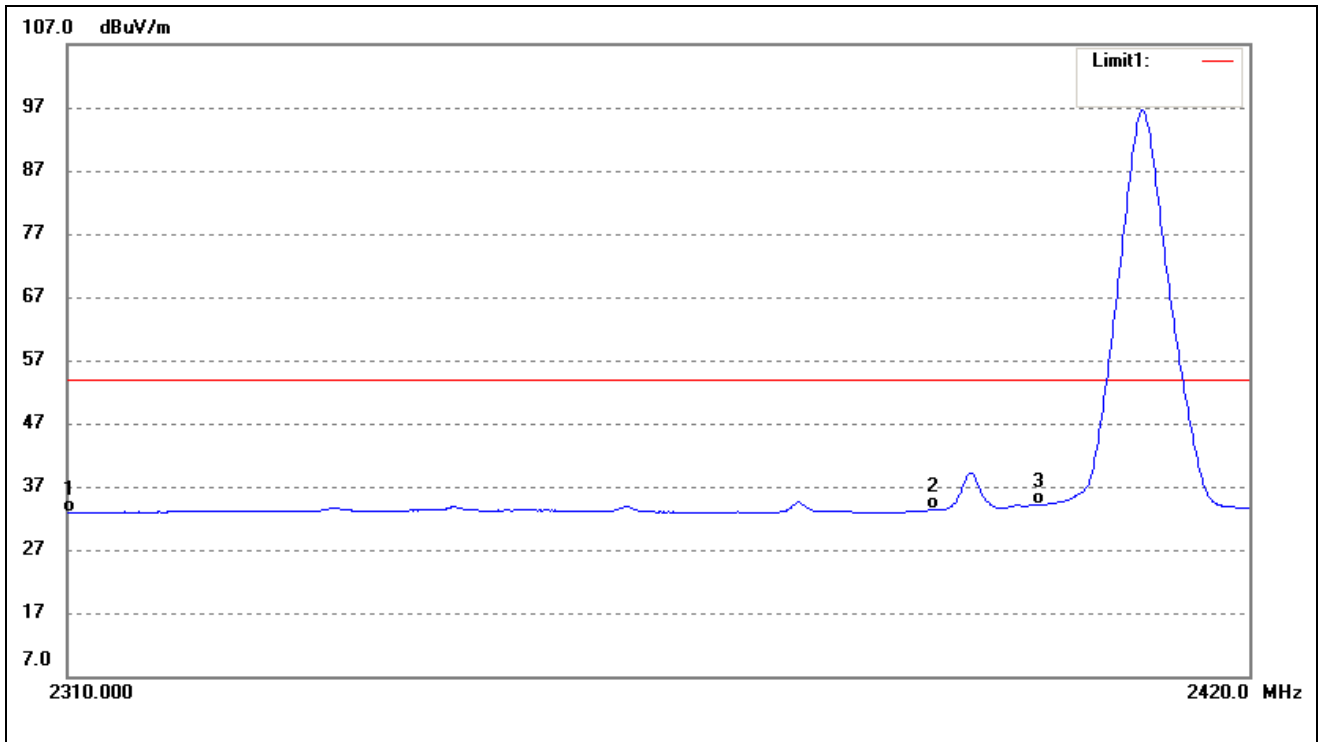
### 5.3 Summary of Test Results/Plots

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.

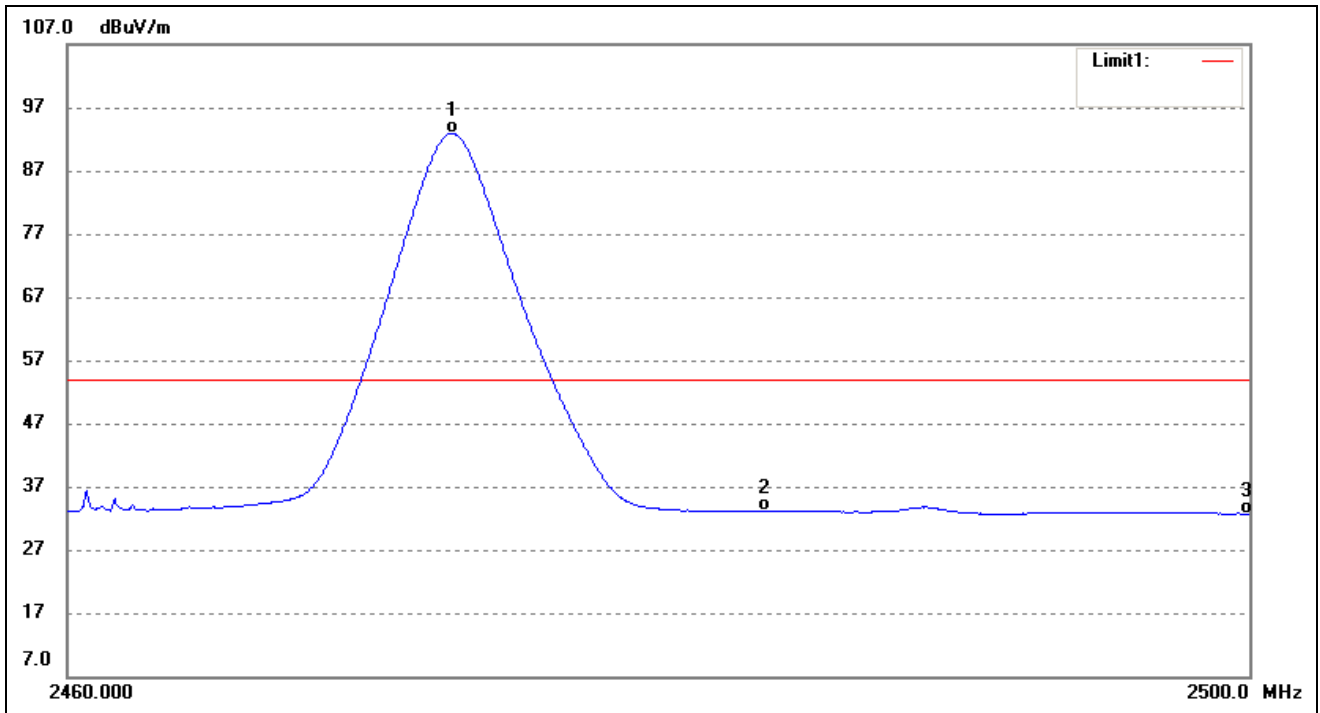
Please refer to the test plots as below.

Test Channel	Low	Polarity:	Vertical(worst case)
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	40.66	-7.78	32.88	54.00	-21.12	Ave Detector
	2310.000	53.21	-7.78	45.43	74.00	-28.57	Peak Detector
2	2390.000	40.60	-7.32	33.28	54.00	-20.72	Ave Detector
	2390.000	67.31	-7.32	59.99	74.00	-14.01	Peak Detector
3	2400.000	41.46	-7.26	34.20	54.00	-19.80	Ave Detector
	2400.000	74.49	-7.26	67.23	74.00	-6.77	Peak Detector
4	2409.889	103.77	-7.19	96.58	/	/	Ave Detector
	2409.777	105.69	-7.19	98.50	/	/	Peak Detector

Test Channel	High	Polarity:	Vertical(worst case)
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2472.929	99.74	-6.83	92.91	/	/	Ave Detector
	2472.132	101.64	-6.83	94.81	/	/	Peak Detector
2	2483.500	39.85	-6.77	33.08	54.00	-20.92	Ave Detector
	2483.500	66.55	-6.77	59.78	74.00	-14.22	Peak Detector
3	2500.000	39.40	-6.67	32.73	54.00	-21.27	Ave Detector
	2500.000	57.49	-6.67	50.82	74.00	-23.18	Peak Detector

## 6. Emission Bandwidth

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### 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

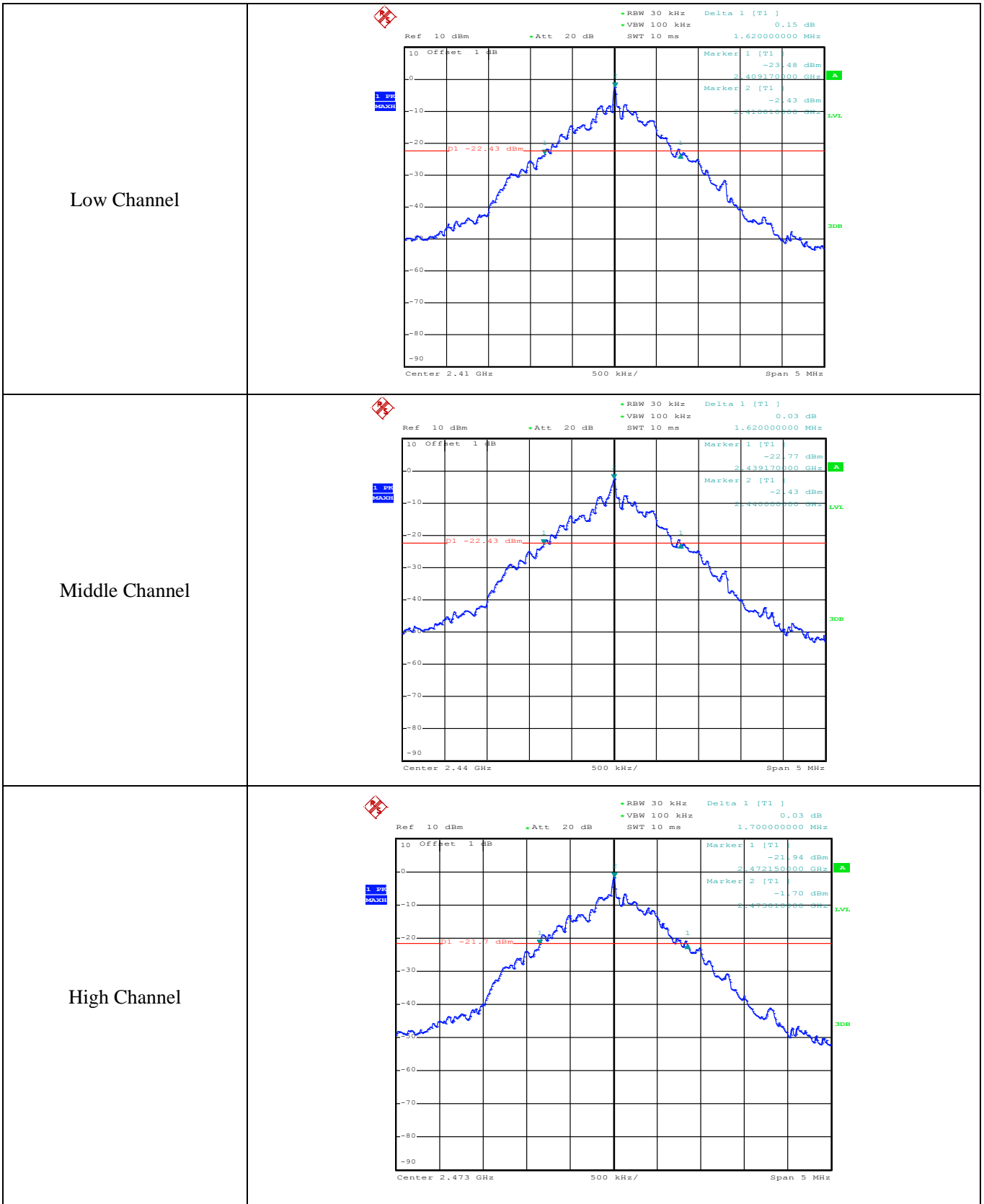
Trace = max hold

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 Summary of Test Results/Plots

Test Channel	20dB Bandwidth(kHz)
Low Channel	1620
Middle Channel	1620
High Channel	1700

*Please refer to the following test plots*



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