



Test report No. : 4788494033-US-R0-V0  
Page : 1 of 50  
Issued date : June 5, 2018  
FCC ID : 2ADKC-TVS

## **RADIO TEST REPORT**

**Product** : **TV Streamer**

**Model Name** : **Kairos BLE TV Streamer**

**FCC ID** : **2ADKC-TVS**

**Test Regulation** : **FCC 47 CFR Part 15 Subpart C (Section 15.249)**

**Received Date** : **May 28, 2018**

**Test Date** : **May 30, 2018 ~ May 31, 2018**

**Issued Date** : **June 5, 2018**

**Applicant** : **Clarity, LLC**  
**8408 S. Delaware Avenue, Tulsa,**  
**OK 74137, USA**

**Issued By** : **Underwriters Laboratories Taiwan Co., Ltd.**  
**Building B and Building E, No. 372-7, Sec. 4,**  
**Zhongxing Rd., Zhudong Township, Hsinchu**  
**County, Taiwan**



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Doc No: 17-EM-F0877 / 1.0



Test report No. : 4788494033-US-R0-V0  
Page : 2 of 50  
Issued date : June 5, 2018  
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## REVISION HISTORY

**Original Test Report No.: 4788494033-US-R0-V0**

[illegible]

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## Table Of Contents

<b>1. Attestation of Test Results .....</b>	<b>4</b>
<b>2. Summary of Test Results .....</b>	<b>5</b>
<b>3. Test Methodology .....</b>	<b>5</b>
<b>4. Facilities and Accreditation .....</b>	<b>5</b>
<b>5. Measurement Uncertainty .....</b>	<b>6</b>
<b>6. Equipment under Test .....</b>	<b>7</b>
6.1. Description of EUT .....	7
6.2. Test Condition .....	7
6.3. Channel List .....	8
6.4. Duty Cycle .....	8
6.5. Description Of Available Antennas .....	9
6.6. Operating Mode and Worst Case of EUT .....	9
<b>7. Test Equipment.....</b>	<b>10</b>
<b>8. Description of Test Setup.....</b>	<b>12</b>
<b>9. Test Result .....</b>	<b>13</b>
9.1. Radiated Spurious Emission .....	13
9.2. AC Power Line Conducted Emission .....	38
9.3. 20 dB Bandwidth .....	44
<b>10. Antenna Requirement .....</b>	<b>46</b>
<b>11. Radiated Measurement Setup Configuration .....</b>	<b>47</b>
<b>12. Conducted Emission Measurement Setup Configurations .....</b>	<b>49</b>

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Page : 4 of 50  
Issued date : June 5, 2018  
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## 1. Attestation of Test Results

**APPLICANT:** Clarity, LLC  
8408 S. Delaware Avenue, Tulsa,  
OK 74137, USA

**EUT DESCRIPTION:** TV Streamer

**BRAND:** ListenClear

**MODEL:** Kairos BLE TV Streamer

**SAMPLE STAGE:** Engineering Sample

**DATE of TESTED:** May 30, 2018 ~ May 31, 2018

APPLICABLE STANDARDS	
STANDARD	Test Results
FCC 47 CFR PART 15 Subpart C (Section 15.249)	PASS

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:

Evelyn Lee  
Project Handler

Date : June 5, 2018

Approve By:

John Cheng  
Project Engineer

Date : June 5, 2018

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## 2. Summary of Test Results

FCC Clause	Test Item	Result
15.203	Antenna requirement	PASS
15.207	AC Power Conducted Emission	PASS
15.215 (c)	20dB Bandwidth	PASS
15.209 15.249 15.249 (d)	Radiated Emission Test Band Edge Measurement Limit: 50dB less than the peak value of fundamental frequency or meet radiated emission limit in section 15.209	PASS

## 3. Test Methodology

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, KDB414788 D01 Radiated Test Site v01, ANSI C63.10-2013.

## 4. Facilities and Accreditation

Test Location	Underwriters Laboratories Taiwan Co., Ltd.
Address	Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
Accreditation Certificate	Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398. The full scope of accreditation can be viewed at <a href="http://accreditation.taftw.org.tw/taf/public/basic/viewApplyItems.action?unitNo=3398">http://accreditation.taftw.org.tw/taf/public/basic/viewApplyItems.action?unitNo=3398</a>

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## 5. Measurement Uncertainty

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor  $k=2$ .

Test Item	Measurement Frequency Range	K	U(dB)
Conducted disturbance at mains terminals ports	0.15MHz ~ 30MHz	2	2.6
RF Conducted	9 kHz - 40GHz	2	1.0
Radiated disturbance below 30MHz	9 kHz - 30 MHz	2	2.4
Radiated disturbance below 1 GHz	30MHz ~ 1GHz	2	5.5
Radiated disturbance above 1GHz	1GHz ~ 40GHz	2	5.0

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## 6. Equipment under Test

### 6.1. Description of EUT

<b>Product</b>	TV Streamer
<b>Brand Name</b>	ListenClear
<b>Model Name</b>	Kairos BLE TV Streamer
<b>Operating Frequency</b>	2408 ~ 2474 MHz
<b>Modulation</b>	GFSK
<b>Normal Voltage</b>	5.0 Vdc (Adapter)
<b>Field Strength (dBuV/m)</b>	102.43 dBuV/m

### 6.2. Test Condition

<b>Test Item</b>	<b>Test Site No.</b>	<b>Relative Humidity</b>	<b>Temperature</b>	<b>Voltage</b>	<b>Test Engineer</b>
20dB Bandwidth	966-2	60%	26°C	120 Vac/ 60 Hz	Will Chen
Radiated Spurious Emission	966-2	60%	26°C	120 Vac/ 60 Hz	Will Chen
AC power Line Conducted Emission	SR1	54%	26°C	120 Vac/ 60 Hz	Will Chen

FCC Test Firm Registration Number: 498077

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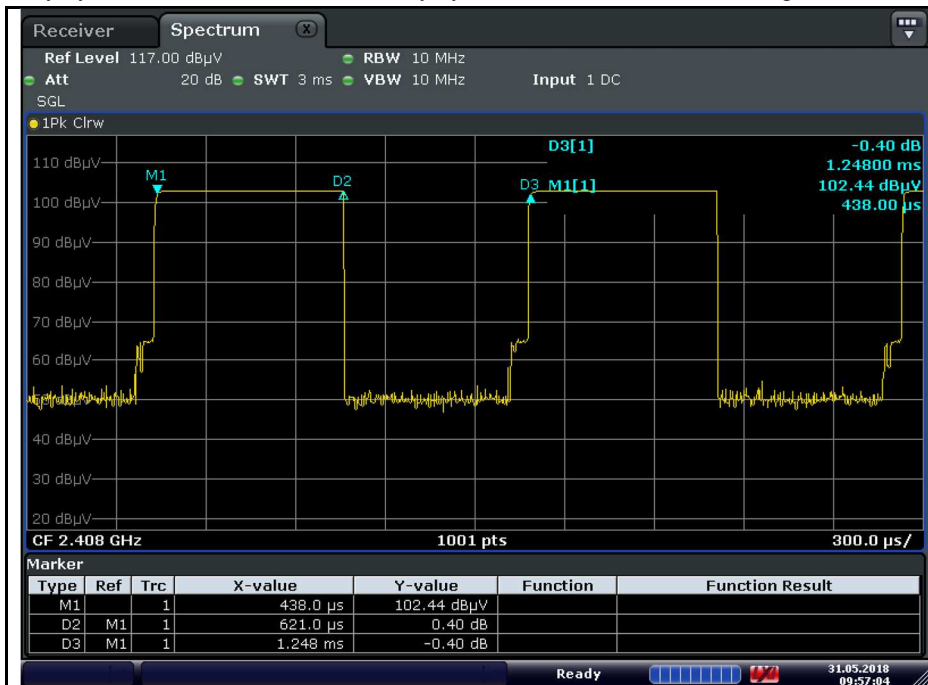
### 6.3. Channel List

7 channels are provided to this EUT:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2408	5	2450
2	2420	6	2468
3	2432	7	2474
4	2444		

### 6.4. Duty Cycle

Duty cycle =  $0.621/1.248 = 0.498$ , Duty cycle correction factor =  $20 * \log(0.498) = -6.06$



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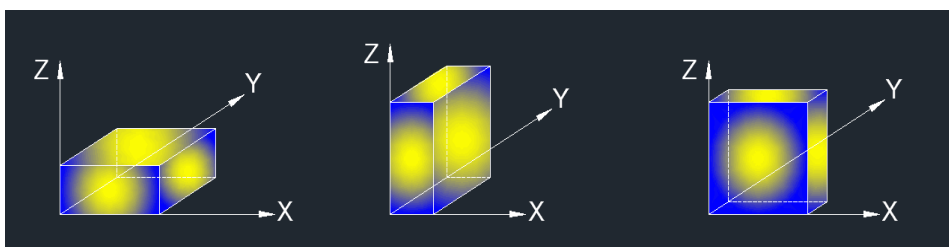
## 6.5. Description Of Available Antennas

Antenna	Brand Name	Model Name	Antenna Type	Connector Type	Antenna Gain(dBi)
Chain(0)	N/A	N/A	PCB Antenna	N/A	3.57

## 6.6. Operating Mode and Worst Case of EUT

For below 1GHz radiated emission and AC power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case.

X axis, Y axis, Z axis positions:



The fundamental of the EUT was investigated in three orthogonal axes X/Y/Z, it was determined that X axis were worst-case . Therefore, all final radiated testing was performed with the EUT in X axis.

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## 7. Test Equipment

Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
Radiated Spurious Emission					
Spectrum Analyzer	Keysight	N9010A	MY56070821	Nov. 28, 2017	1 year
Loop Antenna	ETS lindgren	6502	00213440	Dec. 7, 2017	1 year
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck & EMCI	VULB 9168 & N-6-05	VULB 9168-773 & AT-N0539	Feb. 12, 2018	1 year
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	BBHA 9120D-01686	Jan. 23, 2018	1 year
Horn Antenna(18-40 GHz)	Schwarzbeck	BBHA 9170	BBHA9170750	Jan.12, 2018	1 year
Preamplifier (30-1000 MHz)	EMCI	RMC330E	980404	Jan. 9, 2018	1 year
Preamplifier (1-18 GHz)	EMCI	EMC051835B E	980407	Jan. 10, 2018	1 year
Preamplifier (18-40GHz)	EMCI	EMC184040S EE	980408	Mar. 13, 2018	1 year
RF Cable (9 KHz~18 GHz)	UltraPhase & EMC Instrument	A1K50-UP0358-A1K50-1500&EMC106-NM-SM-2500/8000	170111-3&170104/170223	Feb. 1, 2018	1 year
RF Cable (18 GHz~40 GHz)	UltraPhase	K1K50-UP0264-K1K50-500/2500/4000	170214-3/170214-3/170214-1	Feb. 1, 2018	1 year

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Test report No. : 4788494033-US-R0-V0  
Page : 11 of 50  
Issued date : June 5, 2018  
FCC ID : 2ADKC-TVS

Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
AC power Line Conducted Emission					
EMI Test Receiver	Rohde & Schwarz	ESR7	101753	Nov. 28, 2017	1 year
Two-Line V-Network	Rohde & Schwarz	ENV216	102136	Aug. 2, 2017	1 year
Impuls-Begrenzer Pulse Limiter	Rohde & Schwarz	ESH3-Z2	102219-Qt	July 31, 2017	1 year
Cables	Huber+Suhner	RG 214/U	FCC-BCICF-4_RF	Feb. 1, 2018	1 year
UL Software					
Description			Name		Version
Radiated measurement			EMC-RI		1.0.0.0
AC power Line Conducted Emission			EZ_EMG		1.1.4.2

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## 8. Description of Test Setup

### Support Equipment

Item	Equipment	Brand Name	Model Name	P/N
N/A	N/A	N/A	N/A	N/A

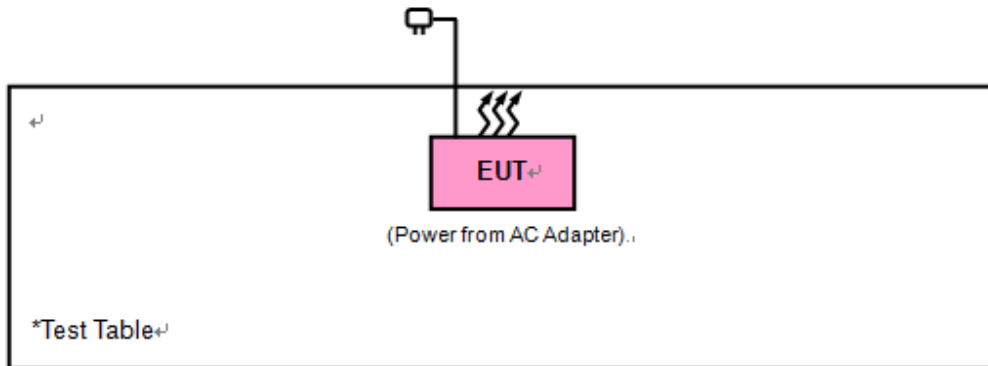
### Accessory

Item	Accessory	Brand Name	Model Name	Description
1	Adapter	AC ADAPTER	MYX-0500500US	I/P: 100-240V~, 50/60Hz, 0.3A max O/P: 5.0V,  500mA
2	Fiber Cable	Jiangsu TX	TX-TP-001	1.2 Meter, non-shielded
3	Audio Cable	YC	YCM0157R	1.2 Meter, non-shielded

### Test Setup

The EUT was worked in engineering mode to transmit signal.

### Setup Diagram for Test



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## 9. Test Result

### 9.1. Radiated Spurious Emission

#### Requirements

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following

Fundamental Frequency (MHz)	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902 ~ 928 MHz	50	500
2400 ~ 2483.5 MHz	50	500
5725 ~ 5875 MHz	50	500
24 ~ 24.25 GHz	250	2500

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 as below table, whichever is the lesser attenuation

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Note :

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

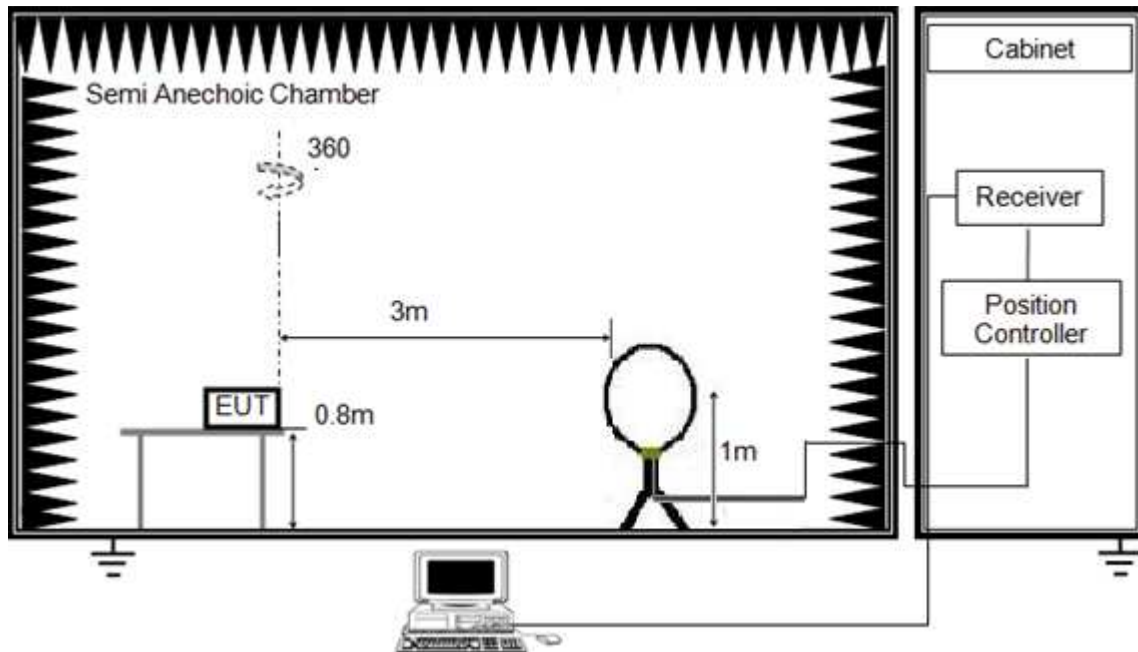
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## Test Procedures

[For 9 kHz ~ 30 MHz]



The setting of the spectrum analyzer

<b>RBW</b>	9 KHz
<b>VBW</b>	9 KHz
<b>Sweep</b>	Auto
<b>Detector</b>	Peak/QP/Average
<b>Trace</b>	Max hold

### **Note:**

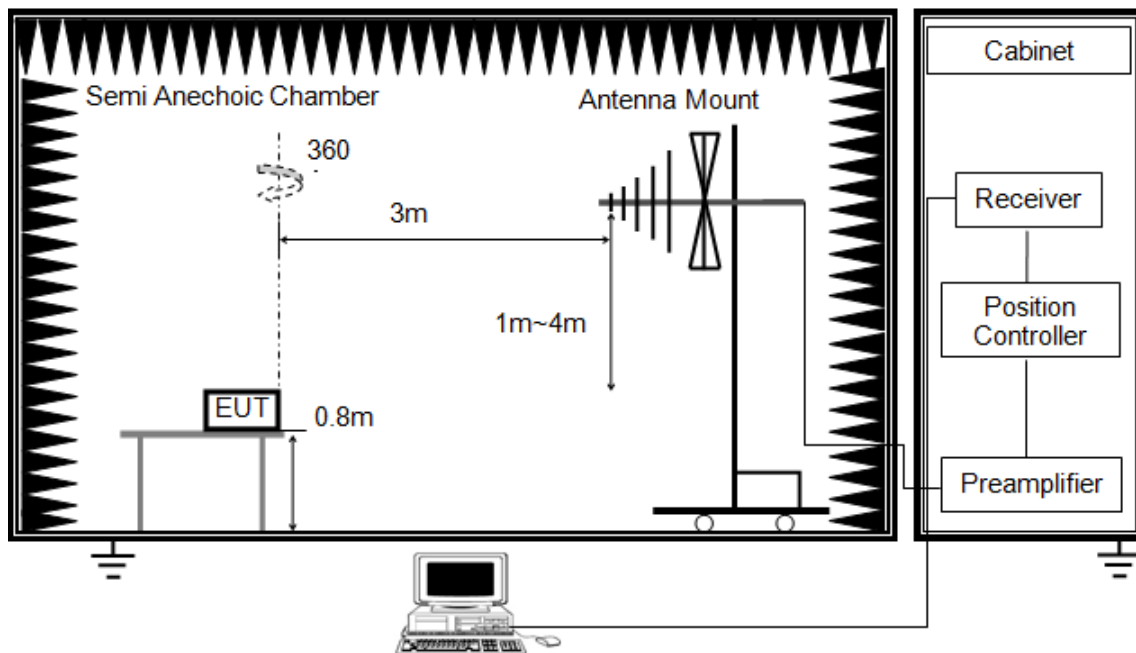
- The testing follows the guidelines in ANSI C63.10-2013
- The EUT was arranged to its worst case and then turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- The EUT was placed on a turntable with 0.8 meter above ground.
- The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

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- e. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
- f. The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

[For below 1 GHz]



The setting of the spectrum analyzer:

<b>RBW</b>	120K
<b>VBW</b>	360K
<b>Sweep</b>	Auto
<b>Detector</b>	Peak/QP
<b>Trace</b>	Max hold

Note :

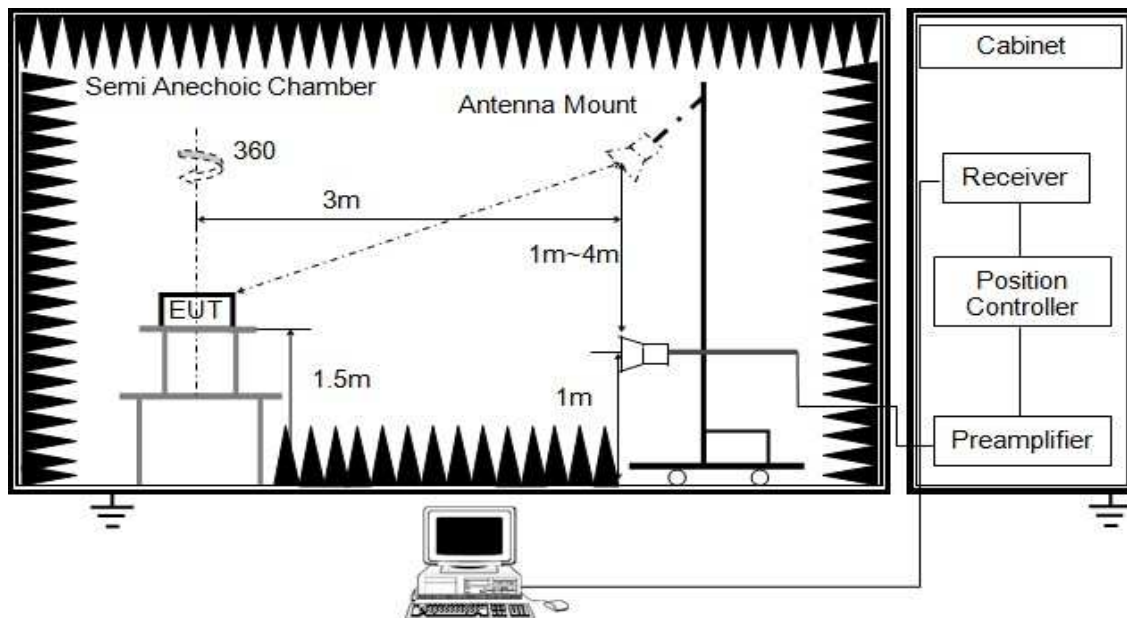
- a. The testing follows the guidelines in ANSI C63.10-2013.

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- b. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- c. The EUT was placed on a turntable with 0.8 meter above ground.
- d. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- e. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
- f. For the actual test configuration, please refer to the related item in this test report (Photographs of the Test Configuration)

[For above 1 GHz]







The setting of the spectrum analyzer:

<b>RBW</b>	1M
<b>VBW</b>	PEAK: 3M AVG: see note f
<b>Sweep</b>	Auto
<b>Detector</b>	Peak
<b>Trace</b>	Max hold

Note :

- The testing follows the guidelines in ANSI C63.10-2013.
- The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- The EUT was placed on a turntable with 1.5m above ground.
- The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- For measurement above 1GHz, the emission measurement will be measured by the peak detector. This peak level, once corrected, must comply with the limit specified in Section 15.209.
- For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector. The EUT is configured to transmit with  $D \geq 98\%$ , then set  $VBW \leq RBW / 100$ , but not less than 10 Hz.
- For the actual test configuration, please refer to the related item in this test report (Photographs of the Test Configuration)

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## Test Data

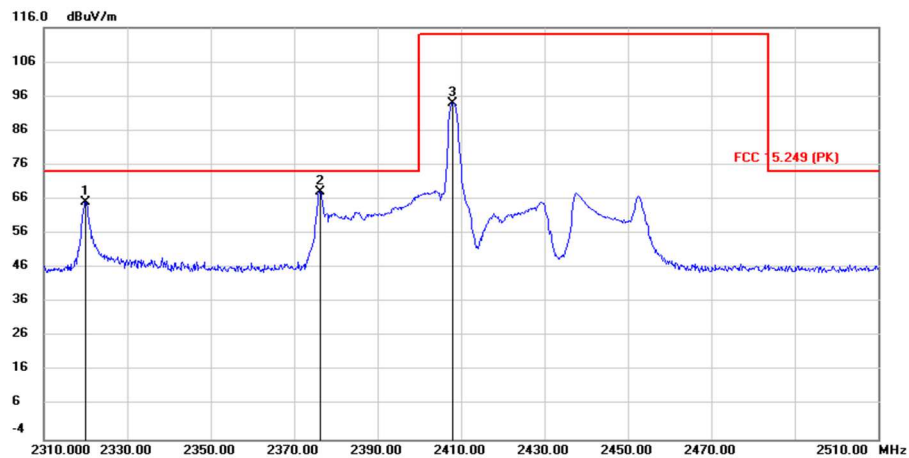
### Above 1 GHz DATA:

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	1 GHz ~ 25 GHz

### Band Edge

### Peak

### Horizontal

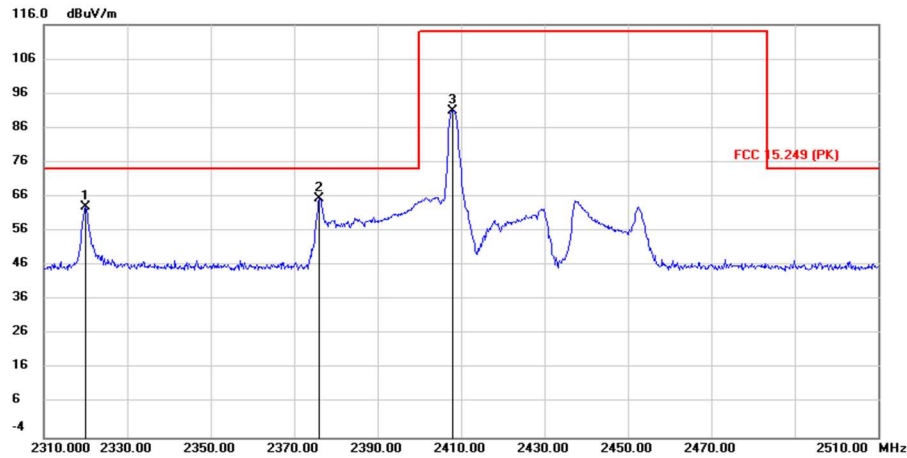


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## Vertical



Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2320.000	73.60	-8.41	65.19	74.00	-8.81	peak
2	2376.200	76.53	-8.46	68.07	74.00	-5.93	peak
3	@2408.000	102.34	-8.48	93.86	114.00	-20.14	peak
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2320.000	71.32	-8.41	62.91	74.00	-11.09	peak
2	2376.000	73.81	-8.46	65.35	74.00	-8.65	peak
3	@2408.000	99.53	-8.48	91.05	114.00	-22.95	peak

### Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. "#": The radiated frequency is out of the restricted band.
6. The other emission levels were very low against the limit.

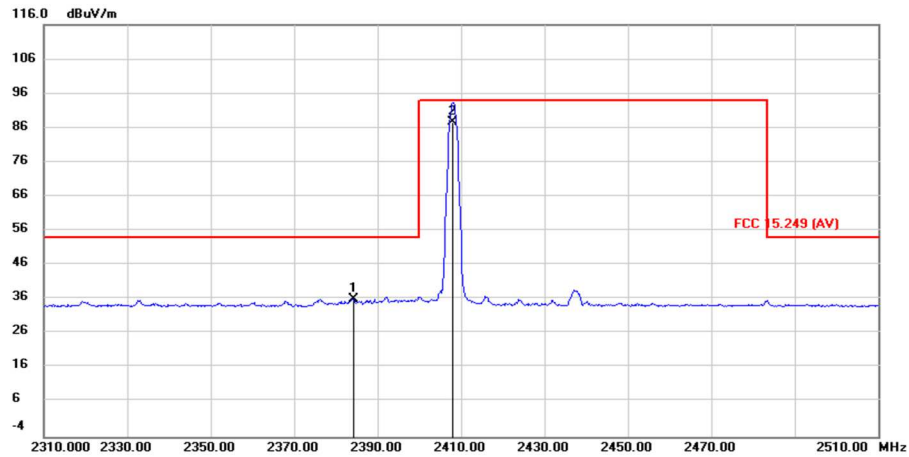
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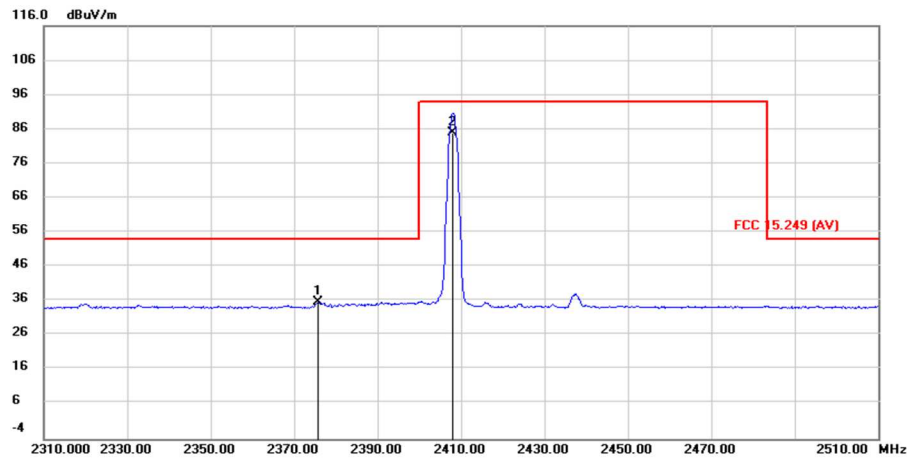


## Average

### Horizontal



### Vertical



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Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2384.200	44.52	-8.46	36.06	54.00	-17.94	AVG
2	@2408.000	96.28	-8.48	87.80	94.00	-6.20	AVG
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2375.600	44.25	-8.46	35.79	54.00	-18.21	AVG
2	@2408.000	93.47	-8.48	84.99	94.00	-9.01	AVG

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. "#": The radiated frequency is out of the restricted band.
6. The other emission levels were very low against the limit.
7. The average value of fundamental frequency is :

Average value = Peak value + Duty cycle correction factor

The duty cycle correction factor is calculated from formula :

$$20 \log (\text{Duty cycle}) = 20 \log (0.621 \text{ ms} / 1.248 \text{ ms}) = -6.06 \text{ dB}$$

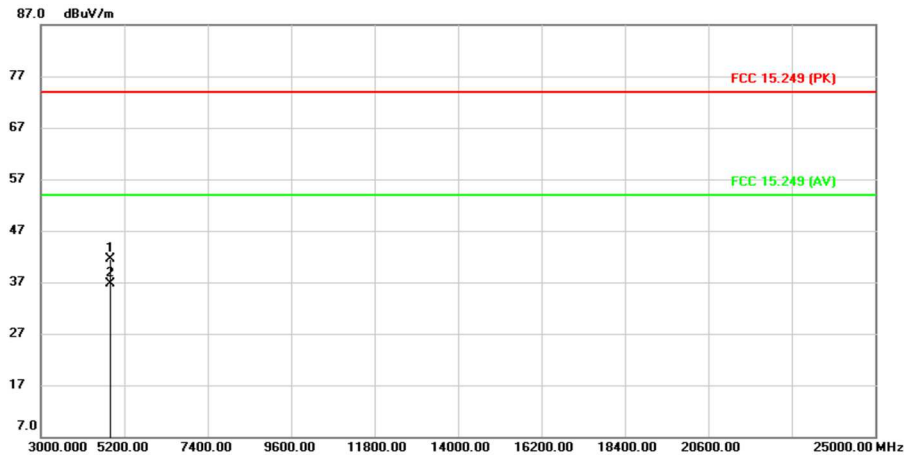
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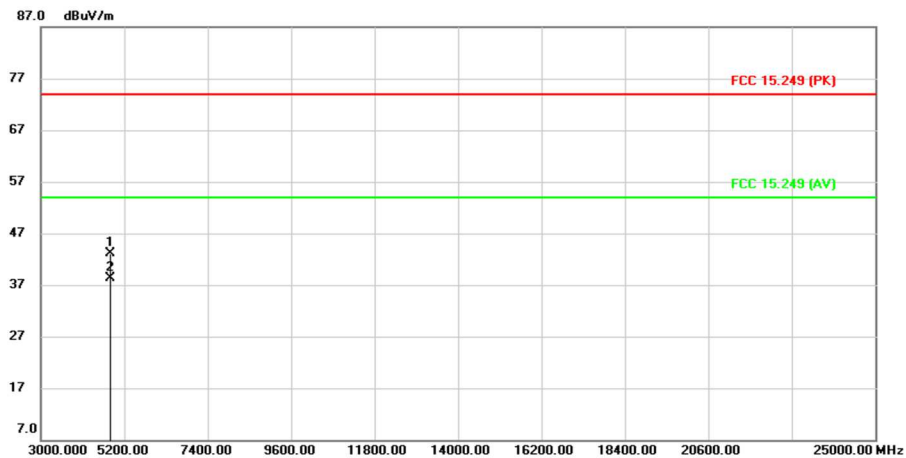


## Spurious Emission

### Horizontal



### Vertical



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Test report No. : 4788494033-US-R0-V0  
Page : 23 of 50  
Issued date : June 5, 2018  
FCC ID : 2ADKC-TVS

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	4816.000	45.86	-4.36	41.50	74.00	-32.50	peak
2	4816.000	40.97	-4.36	36.61	54.00	-17.39	AVG
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	4816.000	47.54	-4.36	43.18	74.00	-30.82	peak
2	4816.000	42.67	-4.36	38.31	54.00	-15.69	AVG

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. " # ": The radiated frequency is out of the restricted band.
5. The other emission levels were very low against the limit.

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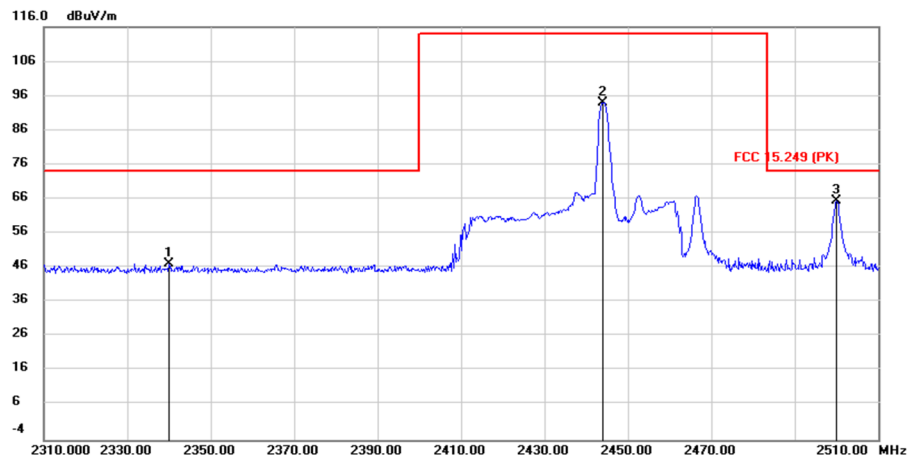


EUT Test Condition		Measurement Detail	
Channel	Channel 4	Frequency Range	1 GHz ~ 25 GHz

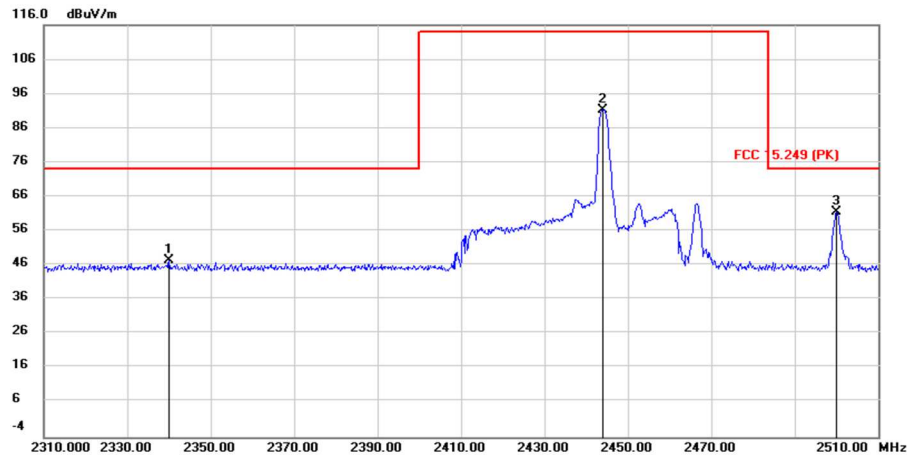
## Band Edge

### Peak

### Horizontal



### Vertical



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Test report No. : 4788494033-US-R0-V0  
Page : 25 of 50  
Issued date : June 5, 2018  
FCC ID : 2ADKC-TVS

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2340.000	55.72	-8.44	47.28	74.00	-26.72	peak
2	@2444.000	102.43	-8.51	93.92	114.00	-20.08	peak
3	2500.000	73.93	-8.55	65.38	74.00	-8.62	peak
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2340.000	55.79	-8.44	47.35	74.00	-26.65	peak
2	@2444.000	99.88	-8.51	91.37	114.00	-22.63	peak
3	2500.000	70.15	-8.55	61.60	74.00	-12.40	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. "#": The radiated frequency is out of the restricted band.
6. The other emission levels were very low against the limit.

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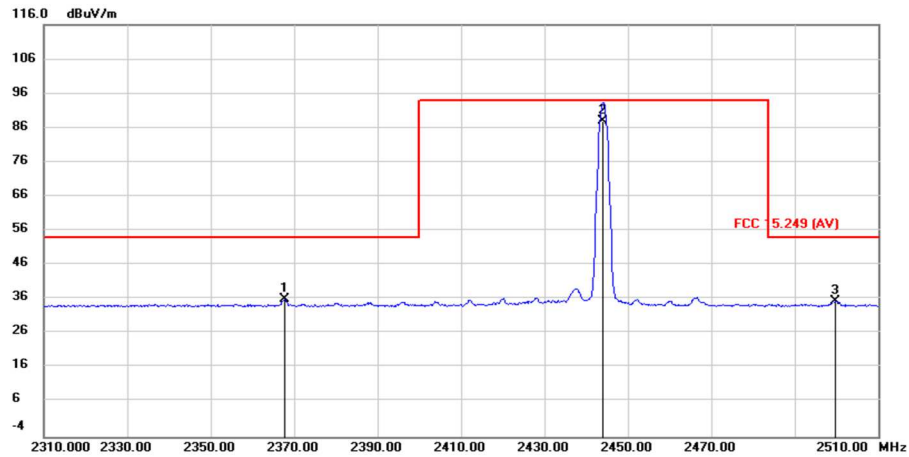
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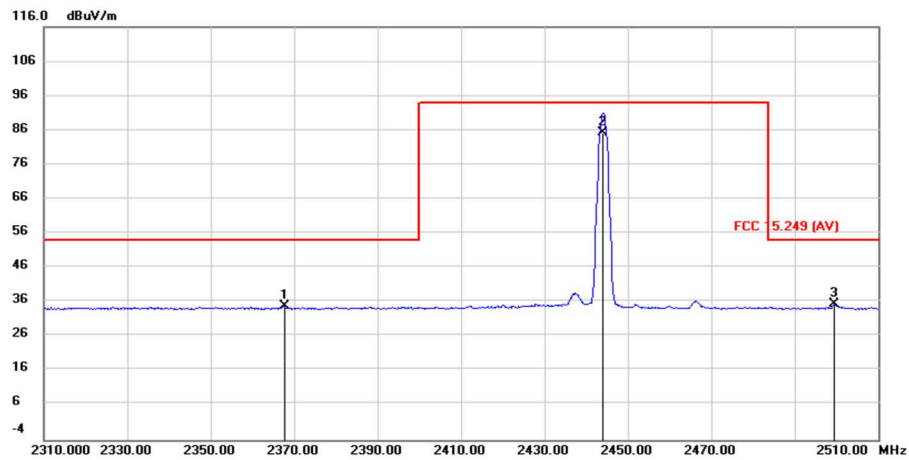


## Average

### Horizontal



### Vertical



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Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2367.600	44.57	-8.45	36.12	54.00	-17.88	AVG
2	@2444.000	96.37	-8.51	87.86	94.00	-6.14	AVG
3	2499.600	43.95	-8.55	35.40	54.00	-18.60	AVG
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2367.600	43.25	-8.45	34.80	54.00	-19.20	AVG
2	@2444.000	93.82	-8.51	85.31	94.00	-8.69	AVG
3	2499.400	44.08	-8.55	35.53	54.00	-18.47	AVG

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency. AVG = Peak – Duty cycle correction factor.
5. "#": The radiated frequency is out of the restricted band.
6. The other emission levels were very low against the limit.
7. The average value of fundamental frequency is :

Average value = Peak value + Duty cycle correction factor

The duty cycle correction factor is calculated from formula :

$$20 \log (\text{Duty cycle}) = 20 \log (0.621 \text{ ms} / 1.248 \text{ ms}) = -6.06 \text{ dB}$$

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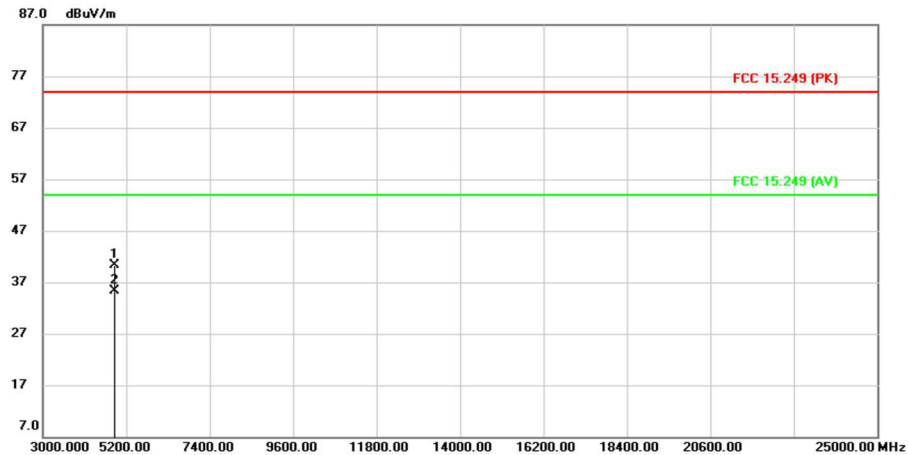
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Doc No: 17-EM-F0877 / 1.0

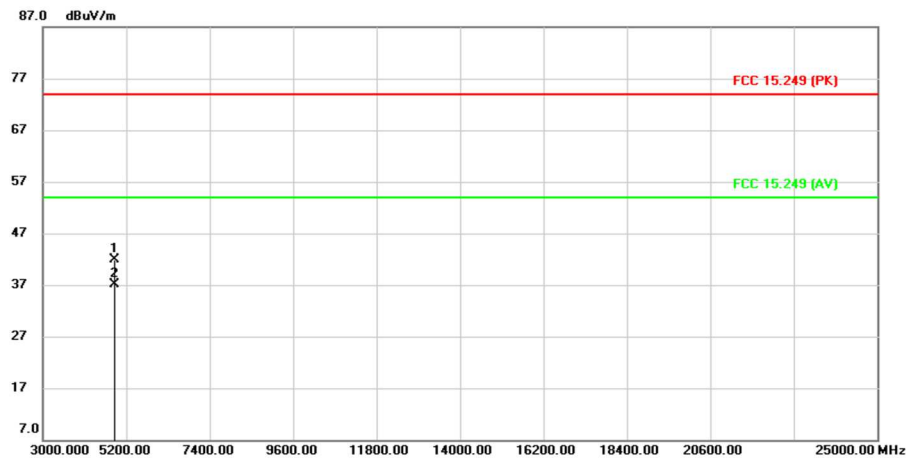


## Spurious Emission

### Horizontal



### Vertical



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Test report No. : 4788494033-US-R0-V0  
Page : 29 of 50  
Issued date : June 5, 2018  
FCC ID : 2ADKC-TVS

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	4888.000	44.60	-4.20	40.40	74.00	-33.60	peak
2	4888.000	39.55	-4.20	35.35	54.00	-18.65	AVG
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	4888.000	46.20	-4.20	42.00	74.00	-32.00	peak
2	4888.000	41.36	-4.20	37.16	54.00	-16.84	AVG

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. " # ": The radiated frequency is out of the restricted band.
5. The other emission levels were very low against the limit.

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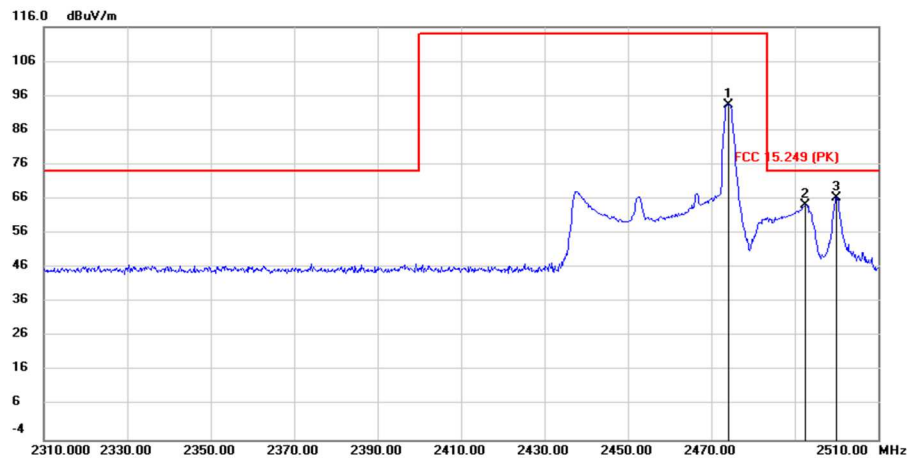


EUT Test Condition		Measurement Detail	
Channel	Channel 7	Frequency Range	1 GHz ~ 25 GHz

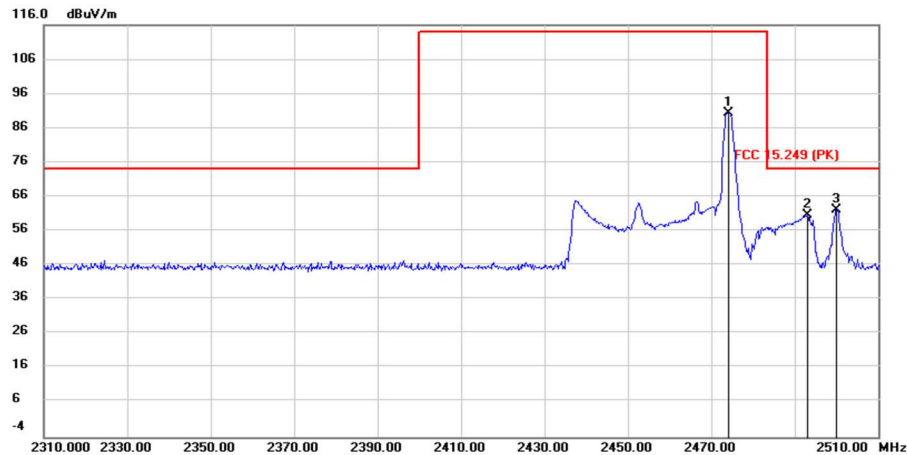
## Band Edge

### Peak

### Horizontal



### Vertical



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Test report No. : 4788494033-US-R0-V0  
Page : 31 of 50  
Issued date : June 5, 2018  
FCC ID : 2ADKC-TVS

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	@2474.000	101.91	-8.52	93.39	114.00	-20.61	peak
2	2492.400	72.86	-8.55	64.31	74.00	-9.69	peak
3	2500.000	75.00	-8.55	66.45	74.00	-7.55	peak
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	@2474.000	99.01	-8.52	90.49	114.00	-23.51	peak
2	2493.000	69.22	-8.55	60.67	74.00	-13.33	peak
3	2500.000	70.74	-8.55	62.19	74.00	-11.81	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. "#": The radiated frequency is out of the restricted band.
6. The other emission levels were very low against the limit.

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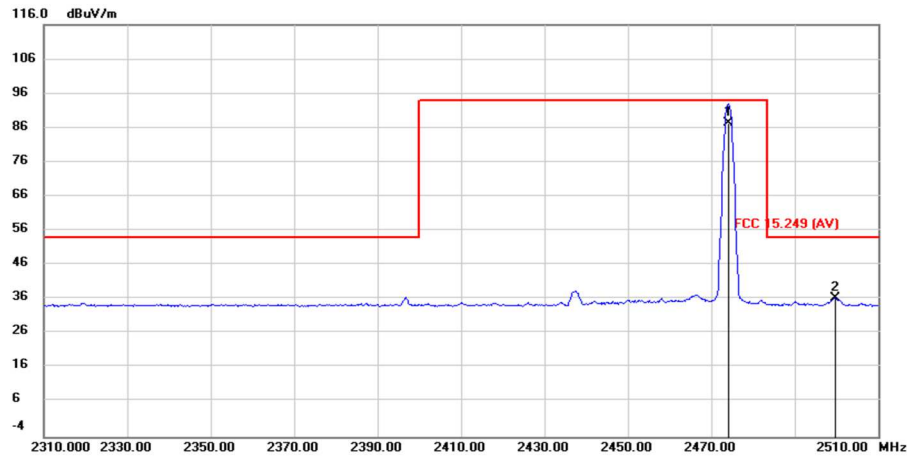
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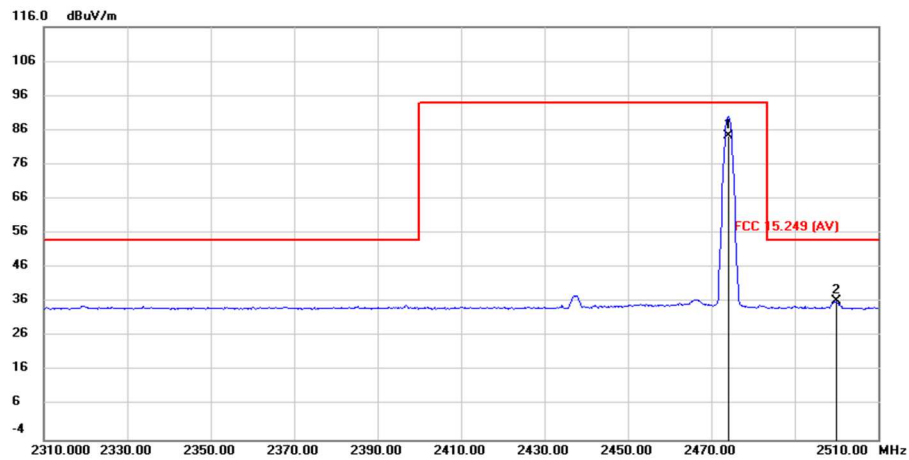


## Average

### Horizontal



### Vertical



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Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	@2474.000	95.85	-8.52	87.33	94.00	-6.67	AVG
2	2499.600	45.03	-8.55	36.48	54.00	-17.52	AVG
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	@2474.000	92.95	-8.52	84.43	94.00	-9.57	AVG
2	2500.000	44.99	-8.55	36.44	54.00	-17.56	AVG

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency. AVG = Peak – Duty cycle correction factor.
5. "#": The radiated frequency is out of the restricted band.
6. The other emission levels were very low against the limit.
7. The average value of fundamental frequency is :

Average value = Peak value + Duty cycle correction factor

The duty cycle correction factor is calculated from formula :

$$20 \log (\text{Duty cycle}) = 20 \log (0.621 \text{ ms} / 1.248 \text{ ms}) = -6.06 \text{ dB}$$

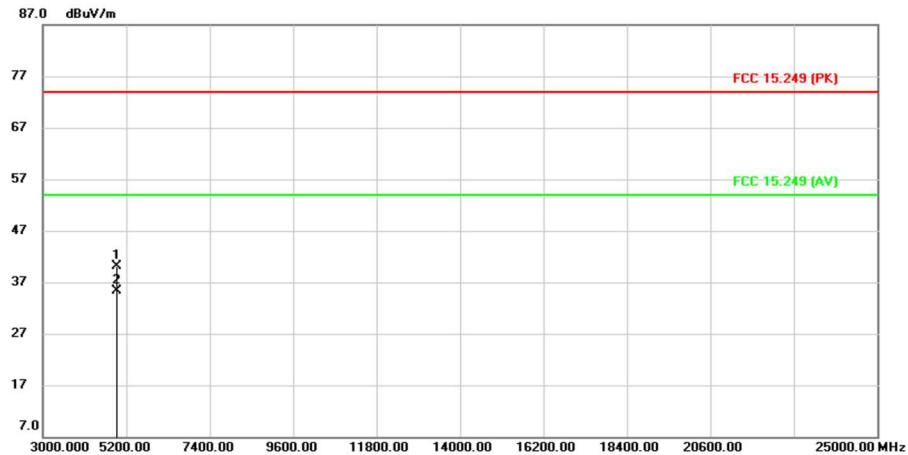
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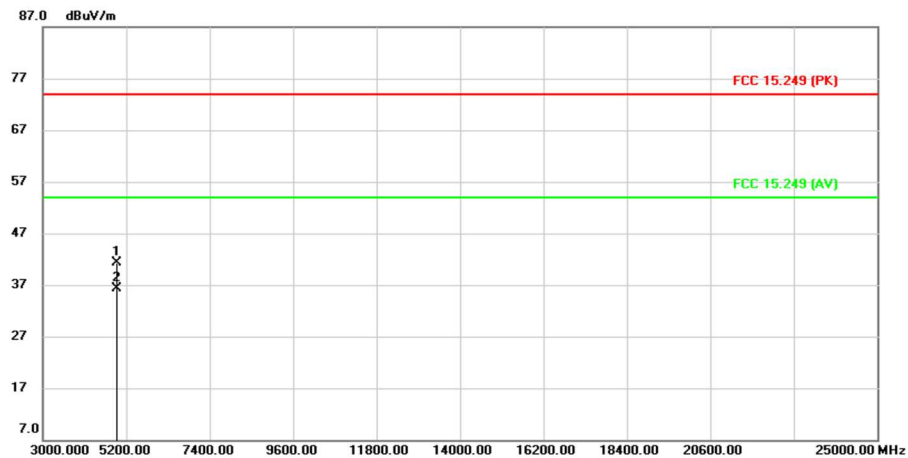


## Spurious Emission

### Horizontal



### Vertical



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Test report No. : 4788494033-US-R0-V0  
Page : 35 of 50  
Issued date : June 5, 2018  
FCC ID : 2ADKC-TVS

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	4948.000	44.26	-4.07	40.19	74.00	-33.81	peak
2	4948.000	39.31	-4.07	35.24	54.00	-18.76	AVG
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	4948.000	45.29	-4.07	41.22	74.00	-32.78	peak
2	4948.000	40.42	-4.07	36.35	54.00	-17.65	AVG

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. " # ": The radiated frequency is out of the restricted band.
5. The other emission levels were very low against the limit.

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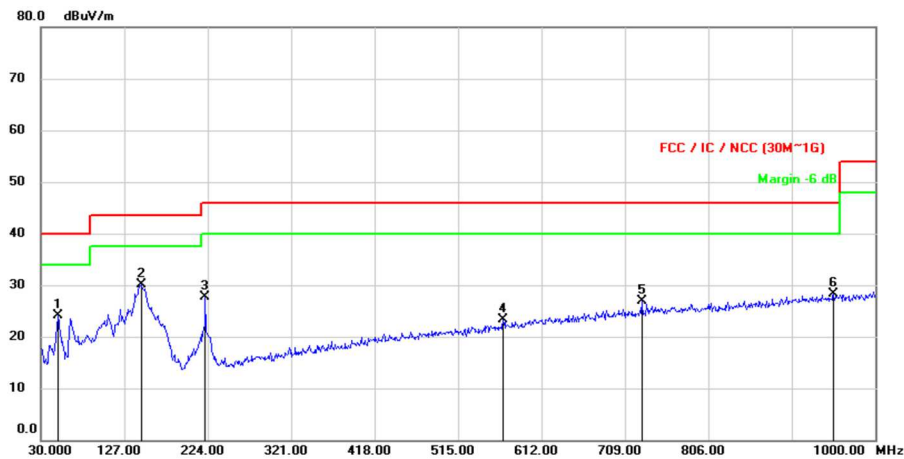
Doc No: 17-EM-F0877 / 1.0



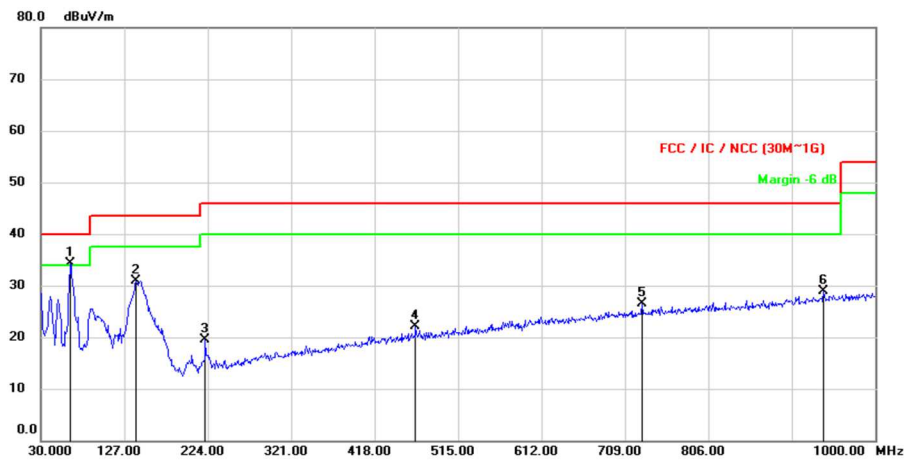
## Below 1 GHz DATA:

EUT Test Condition		Measurement Detail	
Channel	Channel 4	Frequency Range	30 MHz ~ 1 GHz

### Horizontal



### Vertical



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Test report No. : 4788494033-US-R0-V0  
Page : 37 of 50  
Issued date : June 5, 2018  
FCC ID : 2ADKC-TVS

Antenna Polarity & Test Distance: Horizontal at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	50.4669	39.42	-15.26	24.16	40.00	-15.84	peak
2	146.4000	45.64	-15.63	30.01	43.50	-13.49	peak
3	221.1870	45.62	-17.84	27.78	46.00	-18.22	peak
4	568.1560	31.57	-8.32	23.25	46.00	-22.75	peak
5	728.9820	32.13	-5.31	26.82	46.00	-19.18	peak
6	952.3407	30.36	-2.12	28.24	46.00	-17.76	peak
Antenna Polarity & Test Distance: Vertical at 3 m							
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	64.8230	51.14	-16.80	34.34	40.00	-5.66	peak
2	141.3237	46.89	-15.90	30.99	43.50	-12.51	peak
3	221.1547	37.42	-17.84	19.58	46.00	-26.42	peak
4	465.6270	32.55	-10.37	22.18	46.00	-23.82	peak
5	729.0790	31.80	-5.31	26.49	46.00	-19.51	peak
6	940.4097	31.23	-2.30	28.93	46.00	-17.07	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. The other emission levels were very low against the limit.

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## 9.2. AC Power Line Conducted Emission

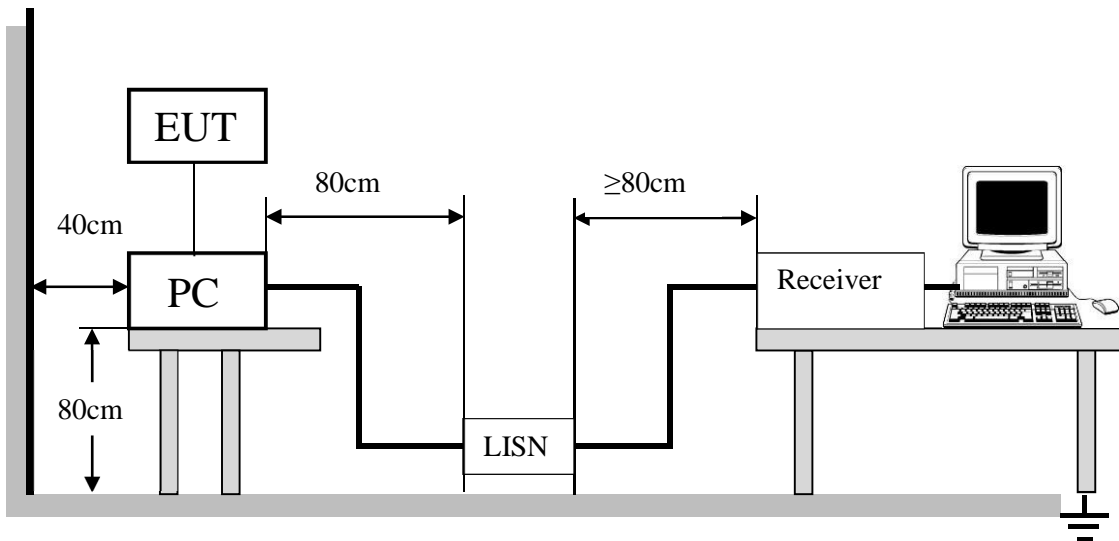
### Requirements

Frequency of Emission(MHz)	Conducted limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

Note :

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

### Test Procedures



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Doc No: 17-EM-F0877 / 1.0



Test report No. : 4788494033-US-R0-V0  
Page : 39 of 50  
Issued date : June 5, 2018  
FCC ID : 2ADKC-TVS

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The EUT was put on a table of non-conducting material that was 80cm high. The vertical conducting wall of shielding was located 40cm to the rear of the EUT. The power line of the EUT was connected to the AC mains through a Artificial Mains Network (A.M.N.). A EMI Measurement Receiver (R&S Test Receiver ESR3) was used to test the emissions from both sides of AC line. According to the requirements in Section 6.2 of ANSI C63.10 - 2013. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and average detector mode. The bandwidth of EMI test receiver was set at 9kHz.

The arrangement of the equipment was installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application.

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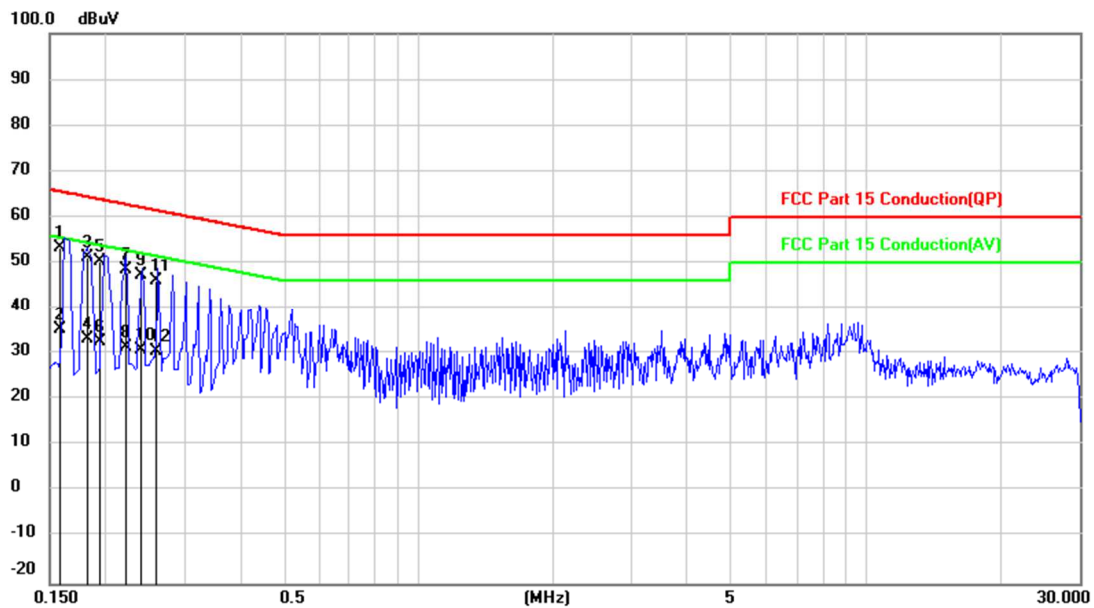
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### Test Data

EUT Test Condition		Measurement Detail	
Channel	Channel 4	Frequency Range	150 kHz ~ 30 MHz

### Phase of Power : Line (L)



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Test report No. : 4788494033-US-R0-V0  
Page : 41 of 50  
Issued date : June 5, 2018  
FCC ID : 2ADKC-TVS

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	dB	(dBuV)	(dBuV)	(dB)	
1	0.1581	33.90	19.57	53.47	65.56	-12.09	QP
2	0.1581	15.72	19.57	35.29	55.56	-20.27	AVG
3	0.1830	31.58	19.58	51.16	64.35	-13.19	QP
4	0.1830	13.59	19.58	33.17	54.35	-21.18	AVG
5	0.1942	30.84	19.58	50.42	63.85	-13.43	QP
6	0.1942	12.94	19.58	32.52	53.85	-21.33	AVG
7	0.2219	29.09	19.59	48.68	62.75	-14.07	QP
8	0.2219	11.79	19.59	31.38	52.75	-21.37	AVG
9	0.2388	27.86	19.59	47.45	62.14	-14.69	QP
10	0.2388	11.26	19.59	30.85	52.14	-21.29	AVG
11	0.2584	26.56	19.60	46.16	61.48	-15.32	QP
12	0.2584	10.97	19.60	30.57	51.48	-20.91	AVG

Remarks:

1. Result value (dBuV) = Reading value (dBuV) + Correction Factor (dB)
2. Margin(dB) = Result value (dBuV) - Limit value (dBuV)
3. Correction Factor(dB) = Insertion loss(dB) + Cable loss(dB)
4. The other emission levels were very low against the limit.

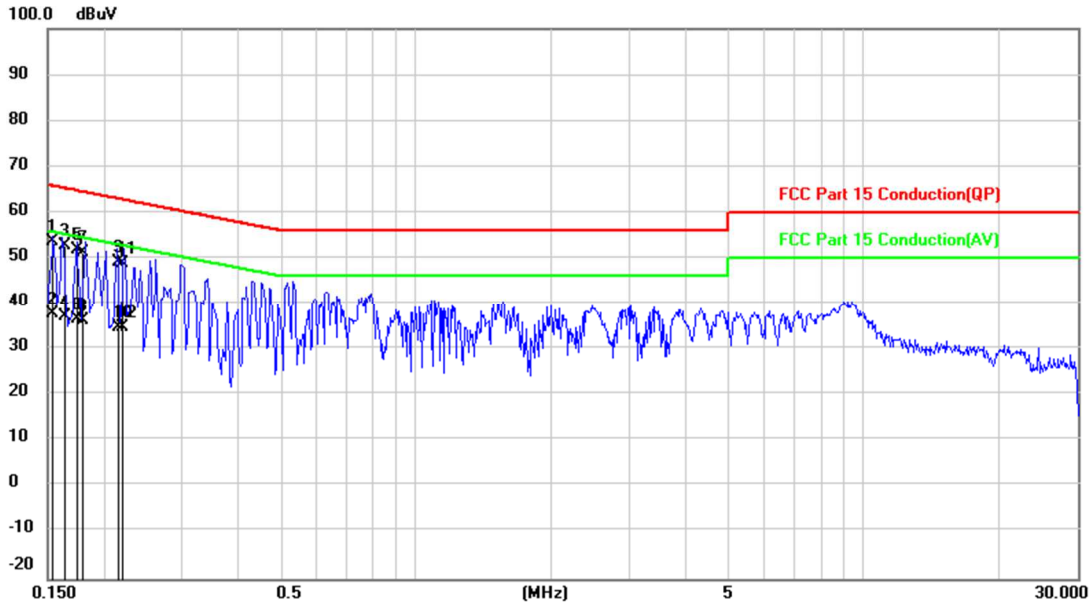
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### Phase of Power : Neutral (N)



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Test report No. : 4788494033-US-R0-V0  
Page : 43 of 50  
Issued date : June 5, 2018  
FCC ID : 2ADKC-TVS

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	dB	(dBuV)	(dBuV)	(dB)	
1	0.1532	34.05	19.59	53.64	65.82	-12.18	QP
2	0.1532	18.15	19.59	37.74	55.82	-18.08	AVG
3	0.1640	33.24	19.59	52.83	65.26	-12.43	QP
4	0.1640	17.68	19.59	37.27	55.26	-17.99	AVG
5	0.1737	32.17	19.59	51.76	64.78	-13.02	QP
6	0.1737	16.94	19.59	36.53	54.78	-18.25	AVG
7	0.1792	31.68	19.59	51.27	64.52	-13.25	QP
8	0.1792	16.64	19.59	36.23	54.52	-18.29	AVG
9	0.2169	29.41	19.60	49.01	62.94	-13.93	QP
10	0.2169	15.22	19.60	34.82	52.94	-18.12	AVG
11	0.2187	29.35	19.60	48.95	62.87	-13.92	QP
12	0.2187	15.11	19.60	34.71	52.87	-18.16	AVG

Remarks:

1. Result value (dBuV) = Reading value (dBuV) + Correction Factor (dB)
2. Margin(dB) = Result value (dBuV) - Limit value (dBuV)
3. Correction Factor(dB) = Insertion loss(dB) + Cable loss(dB)
4. The other emission levels were very low against the limit.

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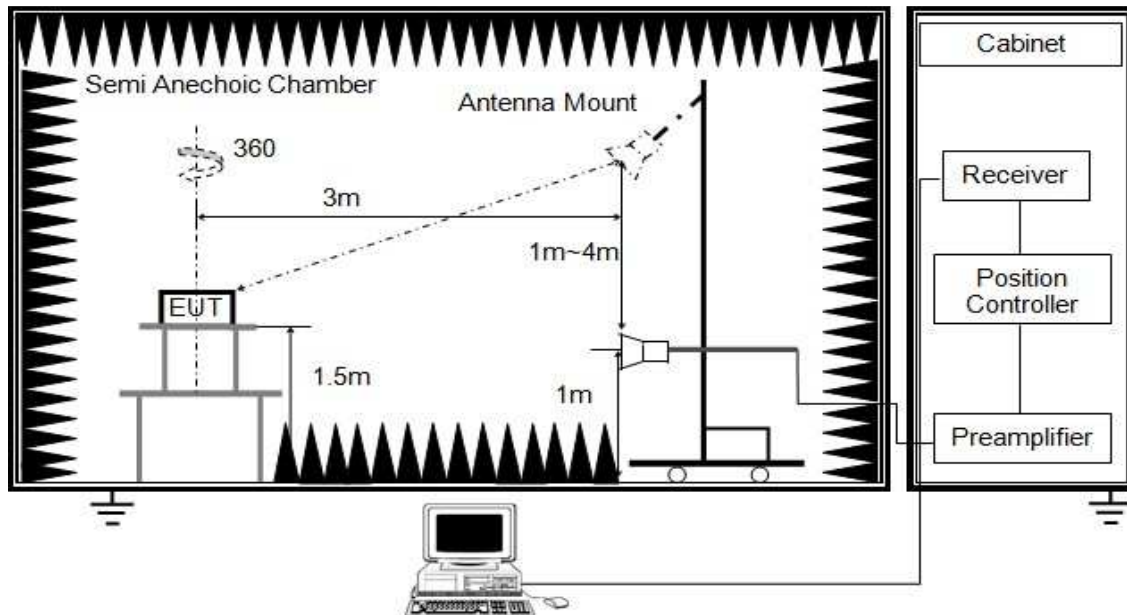
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### 9.3. 20 dB Bandwidth

#### Requirements

The 20 dB bandwidth shall be specified in operating frequency band.

#### Test Setup



#### Test Procedures

- The testing follows the guidelines in ANSI C63.10-2013.
- The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- The EUT was placed on a turntable with 1.5m above ground.
- The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- The bandwidth of the fundamental frequency was measured by spectrum analyzer with 300 kHz RBW and 1 MHz VBW. The 20 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20 dB.

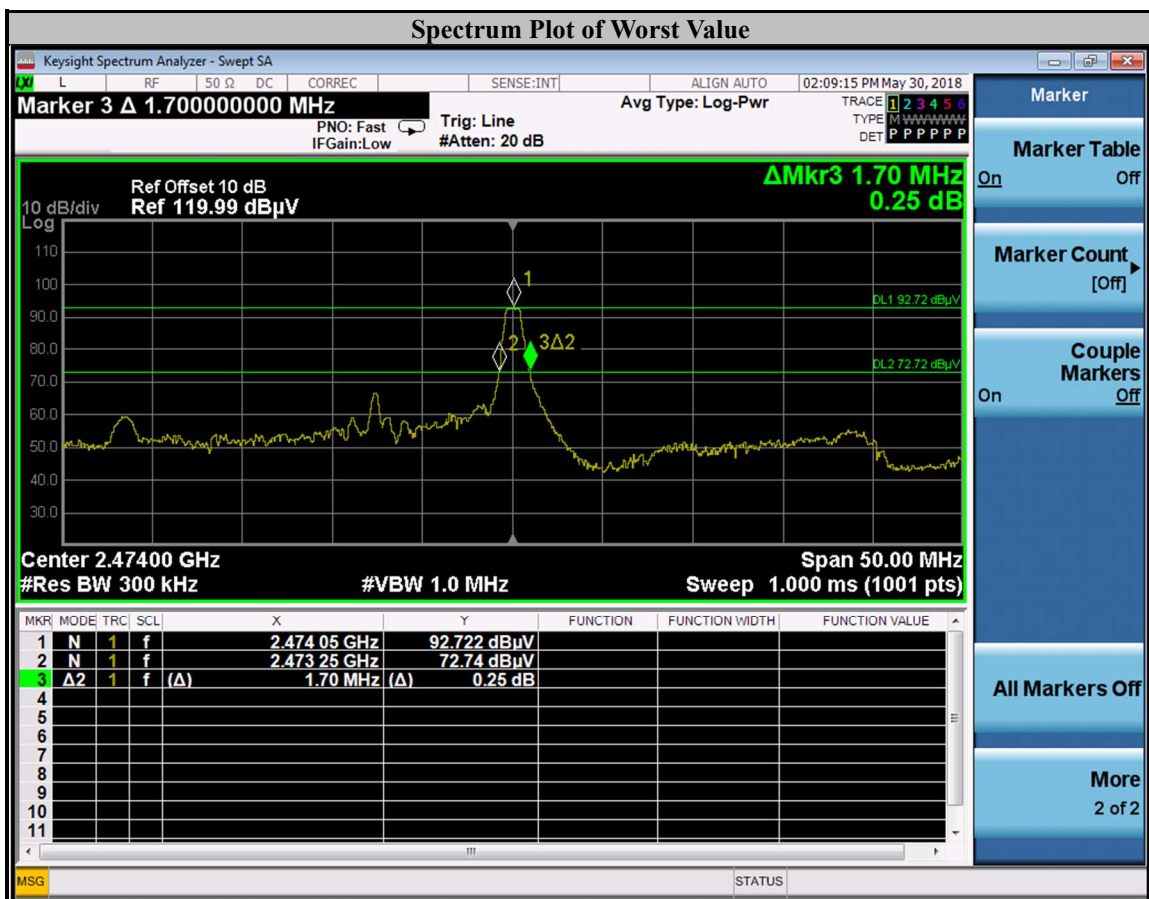
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### Test Data

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
		GFSK
1	2408	1.65MHz
4	2444	1.65MHz
7	2474	1.70MHz



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## **10. Antenna Requirement**

### **Requirements**

15.203 requirement: For intentional device, according to 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.

### **EUT Antenna**

The EUT antenna is the permanent integral antenna. It comply with the standard requirement.

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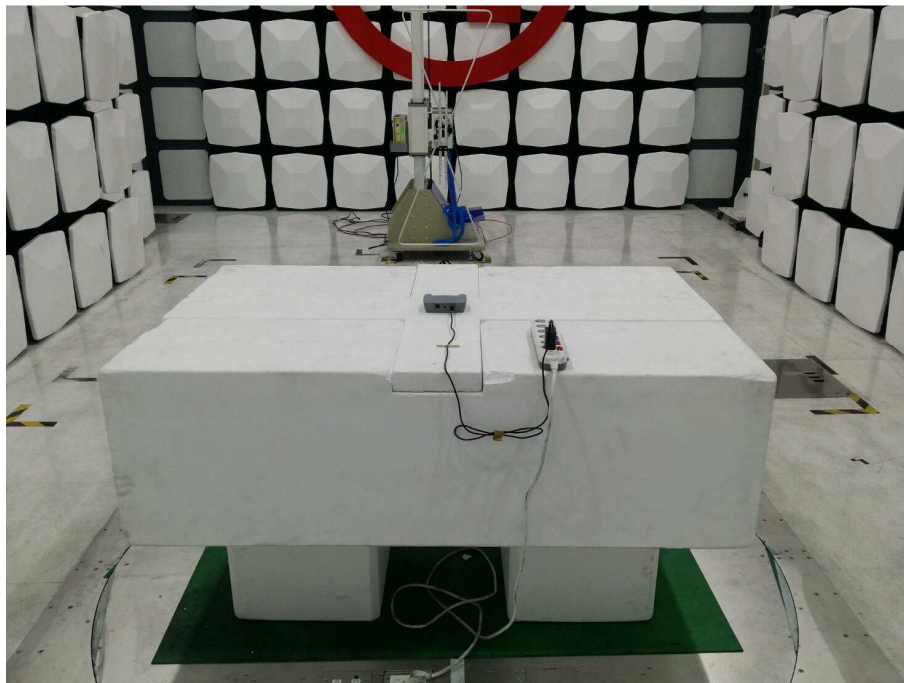
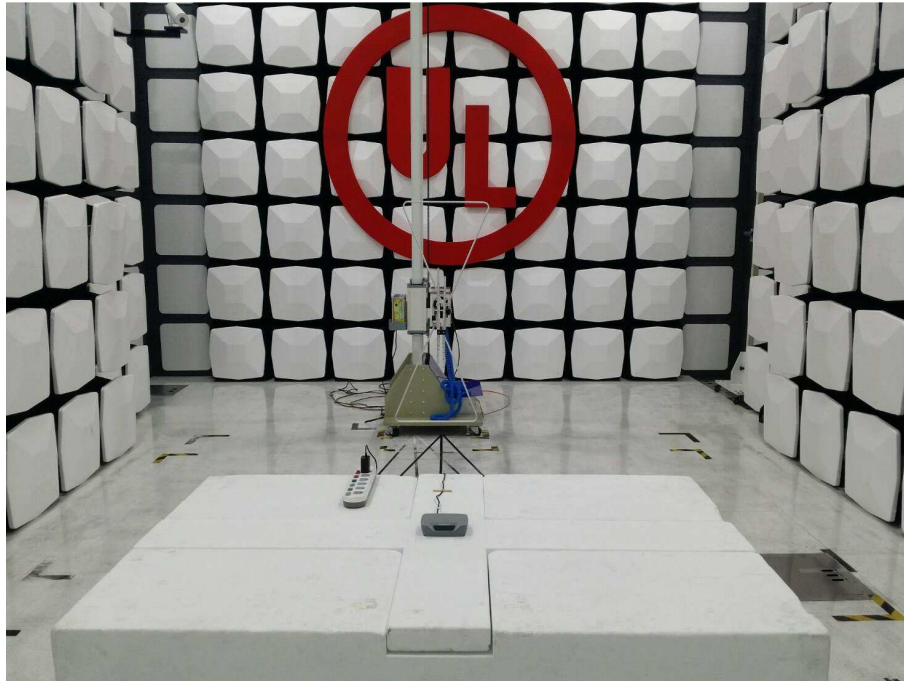
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Test report No. : 4788494033-US-R0-V0  
Page : 47 of 50  
Issued date : June 5, 2018  
FCC ID : 2ADKC-TVS

## 11. Radiated Measurement Setup Configuration

Below 1 GHz



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Doc No: 17-EM-F0877 / 1.0





Test report No. : 4788494033-US-R0-V0  
Page : 48 of 50  
Issued date : June 5, 2018  
FCC ID : 2ADKC-TVS

Above 1 GHz



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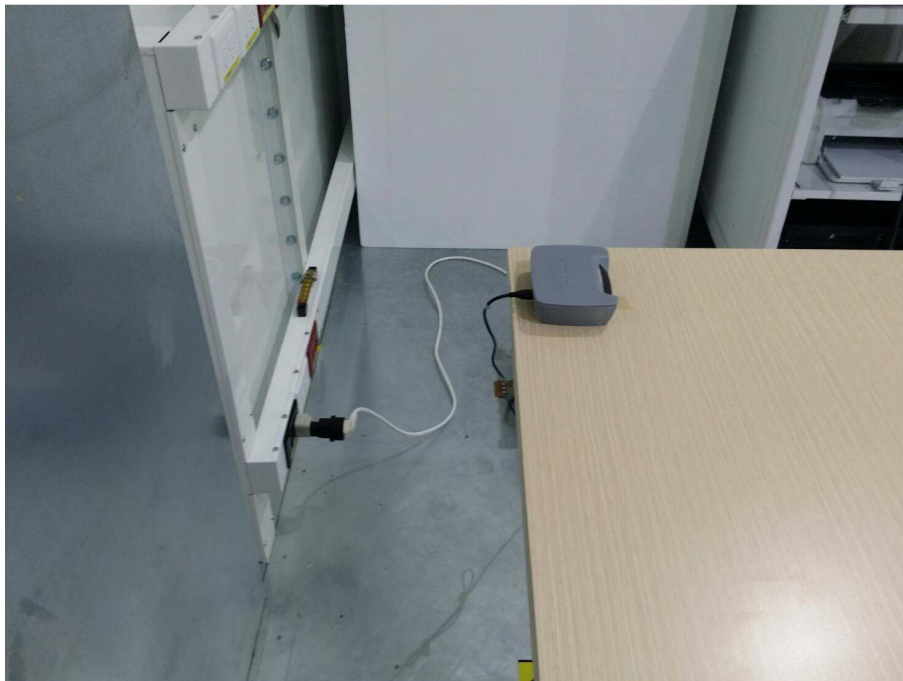
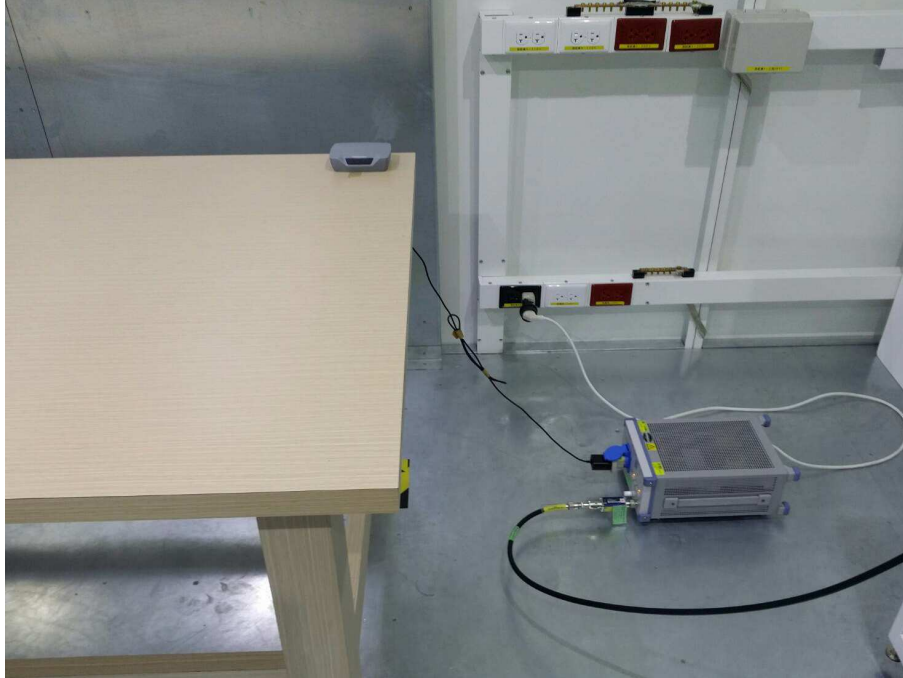
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Test report No. : 4788494033-US-R0-V0  
Page : 49 of 50  
Issued date : June 5, 2018  
FCC ID : 2ADKC-TVS

## 12. Conducted Emission Measurement Setup Configurations



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Doc No: 17-EM-F0877 / 1.0



Test report No. : 4788494033-US-R0-V0  
Page : 50 of 50  
Issued date : June 5, 2018  
FCC ID : 2ADKC-TVS

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Doc No: 17-EM-F0877 / 1.0