



# **TEST REPORT**

# FCC PART 15 SUBPART C 15.247

Test report
On Behalf of
SUNVALLEYTEK INTERNATIONAL, INC.
For
4K UST Laser Projector

Model No.: VA-LT002

FCC ID: 2AFDGVA-LT002

Prepared for: SUNVALLEYTEK INTERNATIONAL, INC.

46724 Lakeview Blvd, Fremont, CA 94538

Prepared By: Shenzhen HUAK Testing Technology Co., Ltd.

1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Date of Test: Jan. 15, 2019 to Jan. 21, 2019

Date of Report: Jan. 21, 2019
Report Number: HK1901210165E



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# **TEST RESULT CERTIFICATION**

Applicant's name	SUNVALLEYTEK INTERNATIONAL, INC.
Address	46724 Lakeview Blvd, Fremont, CA 94538
Manufacture's Name	Shenzhen NearbyExpress Technology Development Company Limited
Address	333 Bulong Road, Jialianda Industrial Park, Building 1,Bantian, Longgang District, Shenzhen, China
Factory's Name	Shenzhen NearbyExpress Technology Development Company Limited
Address	333 Bulong Road, Jialianda Industrial Park, Building 1,Bantian, Longgang District, Shenzhen, China
Product description	
Trade Mark:	VAVA
Product name	4K UST Laser Projector
Model and/or type reference	VA-LT002
Standards	47 CFR FCC Part 15 Subpart C 15.247
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Date of Test	:
Date (s) of performance of tests	: Jan. 15, 2019 to Jan. 21, 2019
Date of Issue	: Jan. 21, 2019
Test Result	: Pass

Testing Engineer : Gon To

(Gary Qian)

Technical Manager :

Eden Hu

Authorized Signatory:

(Jason Zhou)



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# 1.SUMMARY

# **1.1 TEST STANDARDS**

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

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

# **1.2 TEST DESCRIPTION**

	DESCRIPTION OF TEST	RESULT
	Peak Output Power	Compliant
	6 dB Bandwidth	Compliant
FCC PART 15.247	Conducted Spurious Emission and Band Edges	Compliant
	Maximum Conducted Output Power Density	Compliant
	Radiated Emission	Compliant
	Line Conduction Emission	Compliant



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#### 1.3 TEST FACILITY

#### 1.3.1 ADDRESS OF THE TEST LABORATORY

Shenzhen HUAK Testing Technology Co., Ltd.

Add.:1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Heping Community, Fuhai Street, Bao'an District, Shenzhen, China

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 32/EN 55032 requirements.

1.3.2 LABORATORY ACCREDITATION

The test facility is recognized, certified, or accredited by the following organizations:

## IC Registration No.: 21210

The 3m alternate test site of Shenzhen HUAK Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 21210 on May 24, 2016.

FCC Registration No.: CN1229

Test Firm Registration Number: 616276

#### 1.4 STATEMENT OF THE MEASUREMENT UNCERTAINTY

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the Shenzhen HUAK Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for HUAK laboratory is reported:

Test	Measurement Uncertainty	Notes
Transmitter power conducted	±0.57 dB	(1)
Transmitter power Radiated	±2.20 dB	(1)
Conducted spurious emission 9KHz-40 GHz	±2.20 dB	(1)
Occupied Bandwidth	±0.01ppm	(1)
Radiated Emission 30~1000MHz	±4.10dB	(1)
Radiated Emission Above 1GHz	±4.32dB	(1)
Conducted Disturbance0.15~30MHz	±3.20dB	(1)

<sup>(1)</sup> This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.



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## **2.GENERAL INFORMATION**

# 2.1 ENVIRONMENTAL CONDITIONS

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101 kPa

# 2.2 GENERAL DESCRIPTION OF EUT

Product Name:	4K UST Laser Projector
Model/Type reference:	VA-LT002
Power supply:	100-240VAC
Version:	V4.2
Modulation:	GFSK(BLE)
Operation frequency:	2402MHz~2480MHz
Channel number:	40
Channel separation:	2MHz
Antenna type:	PFC Antenna
Antenna gain:	3.45dBi
Hardware Version:	LT002-TV-PCB-VERB1 V02
Software Version:	VAVA_V1.00_20180905.183616

Note: For more details, refer to the user's manual of the EUT.

# 2.3 DESCRIPTION OF TEST MODES AND TEST FREQUENCY

Frequency Band	Channel Number	Frequency
2400~2483.5MHZ	0	2402MHZ
	1	2404MHZ
	:	:
	38	2478MHZ
	39	2480MHZ

NO.	TEST MODE DESCRIPTION	
1	Low channel TX	
2	Middle channel TX	
3	High channel TX	

Note:

Only the result of the worst case was recorded in the report, if no other cases. The EUT has been set to operate continuously on the lowest, middle and highest operation frequency Individually, and the eut is operating at its maximum duty cycle>or equal 98%



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# 2.4 DESCRIPTION OF TEST SETUP

Configure	:
	EUT

# 2.5 RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended to comply with Section 15.247 of the FCC Part 15, Subpart C Rules and RSS-247.

# 2.6 MODIFICATIONS

No modifications were implemented to meet testing criteria.

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# 2.7 EQUIPMENT USED

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	R&S	ENV216	HKE-002	Dec. 27, 2018	1 Year
2.	Receiver	R&S	ESCI 7	HKE-010	Dec. 27, 2018	1 Year
3.	RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 27, 2018	1 Year
4.	Spectrum analyzer	R&S	FSP40	HKE-025	Dec. 27, 2018	1 Year
5.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 27, 2018	1 Year
6.	Preamplifier	Schwarzbeck	BBV 9743	HKE-006	Dec. 27, 2018	1 Year
7.	EMI Test Receiver	Rohde & Schwarz	ESCI 7	HKE-010	Dec. 27, 2018	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	Dec. 27, 2018	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 27, 2018	1 Year
10.	Horn Antenna	Schewarzbeck	9120D	HKE-013	Dec. 27, 2018	1 Year
11.	Pre-amplifier	EMCI	EMC051845 SE	HKE-015	Dec. 27, 2018	1 Year
12.	Pre-amplifier	Agilent	83051A	HKE-016	Dec. 27, 2018	1 Year
13.	EMI Test Software EZ-EMC	Tonscend	JS1120-B Version	HKE-083	Dec. 27, 2018	N/A
14.	Power Sensor	Agilent	E9300A	HKE-086	Dec. 27, 2018	1 Year
15.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 27, 2018	1 Year
16.	Signal generator	Agilent	N5182A	HKE-029	Dec. 27, 2018	1 Year
17.	Signal Generator	Agilent	83630A	HKE-028	Dec. 27, 2018	1 Year
18.	Shielded room	Shiel Hong	4*3*3	HKE-039	Dec. 27, 2018	3 Year

The calibration interval was one year



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# 3. PEAK OUTPUT POWER

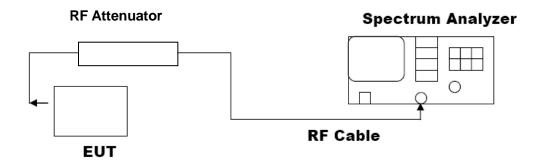
# 3.1. MEASUREMENT PROCEDURE

For peak power test:

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2. RBW ≥ DTS bandwidth
- 3. VBW≥3\*RBW.
- 4. SPAN≥VBW.
- 5. Sweep: Auto.
- 6. Detector function: Peak.
- 7. Trace: Max hold.

Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

# 3.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) PEAK POWER TEST SETUP







# 3.3. LIMITS AND MEASUREMENT RESULT

	1001122.11			
	PEAK OUTPUT POWER MEASUREMENT RESULT			
	FOR GFSK MOUDULAT	ION		
Frequency Peak Power Applicable Limits (GHz) (dBm) Pass or Fail				
	F 007	,	-	
2.402	5.927	30	Pass	
2.440	7.426	30	Pass	
2.480	6.138	30	Pass	



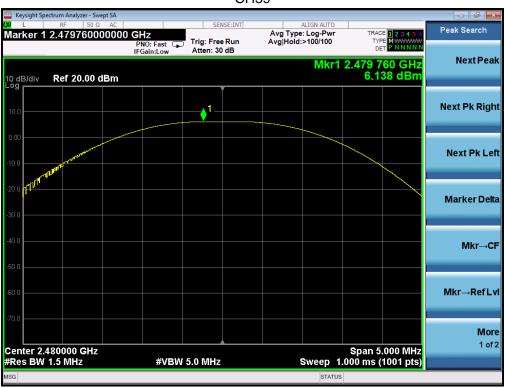








# **CH39**



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## 4. 6 DB BANDWIDTH

## **4.1. MEASUREMENT PROCEDURE**

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- 3. Set SPA Centre Frequency = Operation Frequency, RBW= 100 KHz, VBW ≥ 3×RBW.
- 4. Set SPA Trace 1 Max hold, then View.

**Note:** The EUT was tested according to ANSI C63.10 for compliance to FCC PART 15.247 requirements.

# 4.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 7.2.

#### 4.3. LIMITS AND MEASUREMENT RESULTS

LIMITS AND MEASUREMENT RESULT			
Applicable Limits			
Applicable Limits	Test Data (kHz)		Criteria
>500KHZ	Low Channel	716.6	PASS
	Middle Channel	719.4	PASS
	High Channel	714.4	PASS

## TEST PLOT OF BANDWIDTH FOR LOW CHANNEL





# TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

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#### TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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# 5. CONDUCTED SPURIOUS EMISSION

# **5.1. MEASUREMENT PROCEDURE**

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2, Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- 3. Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to ANSI C63.10 for compliance to FCC PART 15.247 requirements.

# 5.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 7.2.

## **5.3. MEASUREMENT EQUIPMENT USED**

The same as described in section 6.

# **5.4. LIMITS AND MEASUREMENT RESULT**

LIMITS AND MEASUREMENT RESULT					
	Measurement Result				
Applicable Limits	Test Data	Criteria			
In any 100 KHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power.	At least -20dBc than the reference level	PASS PASS			



TEST RESULT FOR ENTIRE FREQUENCY RANGE

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GFSK MODULATION IN LOW CHANNEL





# GFSK MODULATION IN MIDDLE CHANNEL

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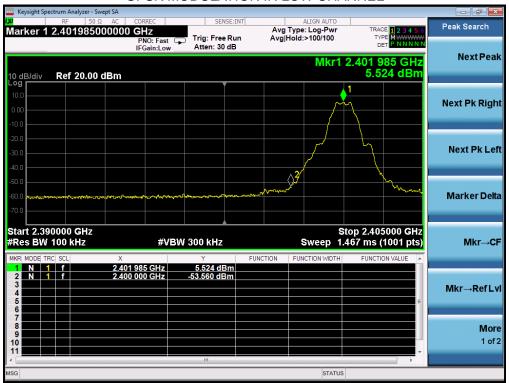


Note: The peak emissions without marker on the above plots are fundamental wave and need not to compare with the limit.

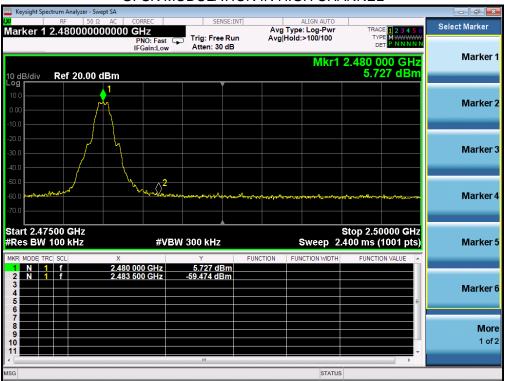


## **TEST RESULT FOR BAND EDGE**

# GFSK MODULATION IN LOW CHANNEL



## GFSK MODULATION IN HIGH CHANNEL



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## 6. MAXIMUM CONDUCTED OUTPUT POWER SPECTRAL DENSITY

## **6.1 MEASUREMENT PROCEDURE**

- (1). Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- (2). Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- (3). Set SPA Trace 1 Max hold, then View.

Note: The method of PKPSD in the KDB 558074 item 10.2 was used in this testing.

# 6.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

Refer To Section 7.2.

#### **6.3 MEASUREMENT EQUIPMENT USED**

Refer To Section 6.

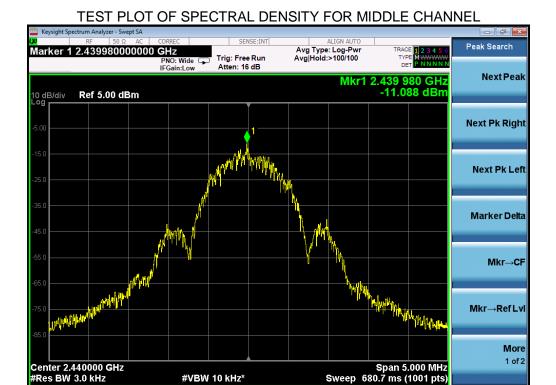
## **6.4 LIMITS AND MEASUREMENT RESULT**

Channel No.	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low Channel	-12.813	8	Pass
Middle Channel	-11.088	8	Pass
High Channel	-12.310	8	Pass











**#VBW 10 kHz\*** 



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## 7. RADIATED EMISSION

#### 7.1. MEASUREMENT PROCEDURE

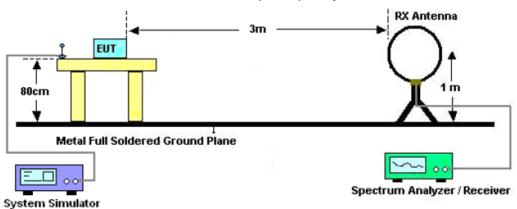
1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.

- 2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
- 3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
- 4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
- 5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
- 6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- 7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
- 8.If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
- 9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- 10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High Low scan is not required in this case.

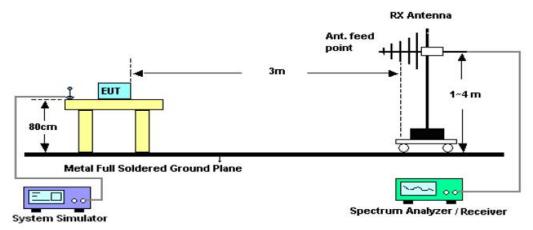


## 7.2. TEST SETUP

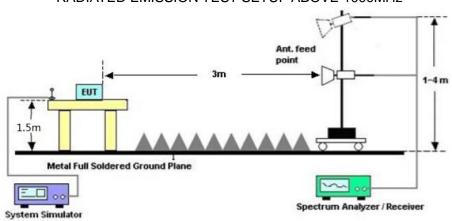
# Radiated Emission Test-Setup Frequency Below 30MHz



# RADIATED EMISSION TEST SETUP 30MHz-1000MHz



# RADIATED EMISSION TEST SETUP ABOVE 1000MHz





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# 7.3. LIMITS AND MEASUREMENT RESULT

15.209 Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (micorvolts/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: All modes were tested For restricted band radiated emission,

the test records reported below are the worst result compared to other modes.

# 7.4. TEST RESULT

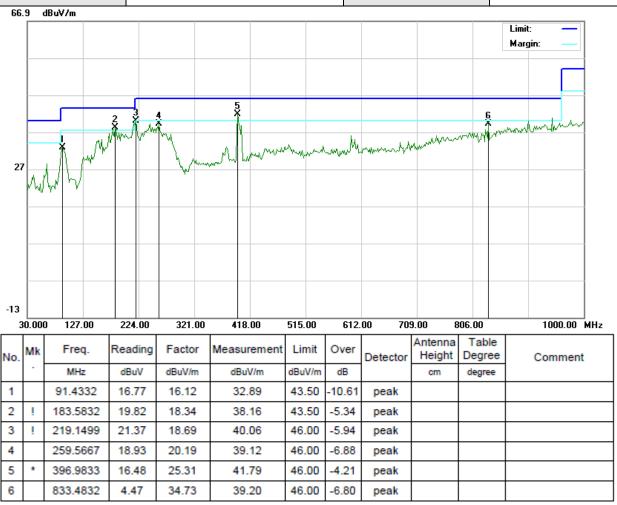
# **RADIATED EMISSION BELOW 30MHZ**

No emission found between lowest internal used/generated frequencies to 30MHz.

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## **RADIATED EMISSION BELOW 1GHZ**

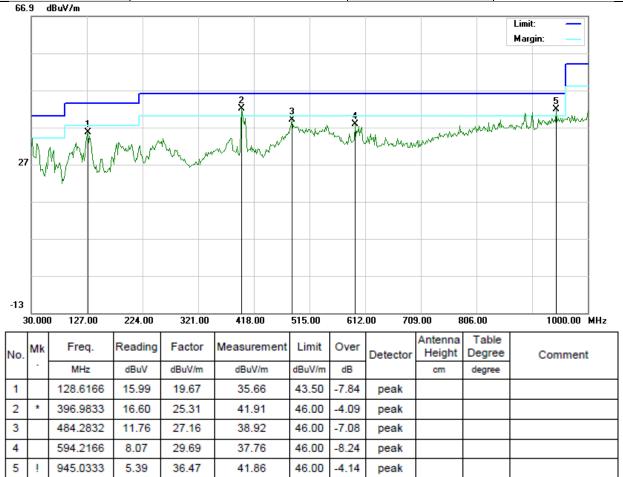
EUT	4K UST Laser Projector	Model Name	VA-LT002
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal



**RESULT: PASS** 

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EUT	4K UST Laser Projector	Model Name	VA-LT002
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical



# **RESULT: PASS**

## Note:

- 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.
- 2. All test modes had been tested. The mode 1 is the worst case and recorded in the report.

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# **RADIATED EMISSION ABOVE 1GHZ**

EUT	4K UST Laser Projector	Model Name	VA-LT002
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4804.011	45.34	7.12	52.46	74	-21.54	peak
4804.011	40.52	7.12	47.64	54	-6.36	AVG
7206.022	43.14	9.84	52.98	74	-21.02	peak
7206.022	37.36	9.84	47.2	54	-6.8	AVG
Remark:						
	enna Factor + Ca	able Loss – F	Pre-amplifier.			

EUT	4K UST Laser Projector	Model Name	VA-LT002
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

(dBµV)				Margin	Value Type
(ubh v)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
44.75	7.12	51.87	74	-22.13	peak
40.26	7.12	47.38	54	-6.62	AVG
42.84	9.84	52.68	74	-21.32	peak
38.34	9.84	48.18	54	-5.82	AVG
	40.26 42.84	40.26     7.12       42.84     9.84	40.26     7.12     47.38       42.84     9.84     52.68	40.26     7.12     47.38     54       42.84     9.84     52.68     74	40.26     7.12     47.38     54     -6.62       42.84     9.84     52.68     74     -21.32

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

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EUT	4K UST Laser Projector	Model Name	VA-LT002
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4880.005	46.24	7.12	53.36	74	-20.64	peak
4880.005	42.38	7.12	49.5	54	-4.5	AVG
7320.140	43.29	9.84	53.13	74	-20.87	peak
7320.140	38.51	9.84	48.35	54	-5.65	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	4K UST Laser Projector	Model Name	VA-LT002
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	
4880.050	44.31	7.12	51.43	74	-22.57	peak
4880.050	40.16	7.12	47.28	54	-6.72	AVG
7320.080	43.74	9.84	53.58	74	-20.42	peak
7320.080	39.19	9.84	49.03	54	-4.97	AVG
Remark:						

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

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EUT	4K UST Laser Projector	Model Name	VA-LT002
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4960.012	46.24	7.12	53.36	74	-20.64	peak
4960.012	42.38	7.12	49.5	54	-4.5	AVG
7440.027	43.17	9.84	53.01	74	-20.99	peak
7440.027	38.79	9.84	48.63	54	-5.37	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	4K UST Laser Projector	Model Name	VA-LT002
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4960.013	44.59	7.12	51.71	74	-22.29	peak
4960.013	40.27	7.12	47.39	54	-6.61	AVG
7440.027	42.92	9.84	52.76	74	-21.24	peak
7440.027	38.15	9.84	47.99	54	-6.01	AVG
emark:						

# RESULT: PASS

# Note:

Other emissions from 1G to 25 GHz are considered as ambient noise. No recording in the test report.

Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

The "Factor" value can be calculated automatically by software of measurement system.

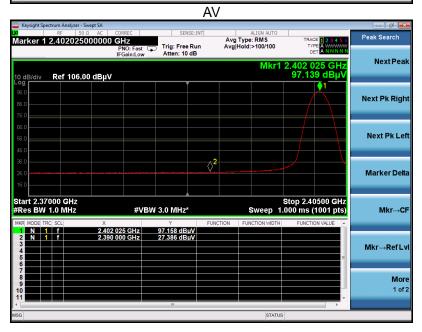


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# TEST RESULT FOR RESTRICTED BANDS REQUIREMENTS

EUT	4K UST Laser Projector	Model Name	VA-LT002
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal





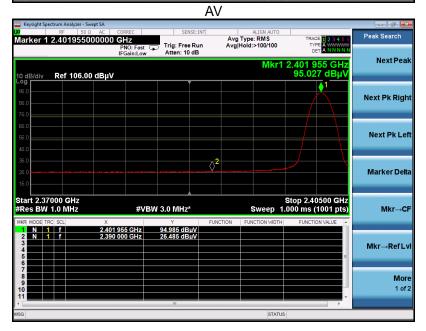
**RESULT: PASS** 



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EUT	4K UST Laser Projector	Model Name	VA-LT002
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical





**RESULT: PASS**