



SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch

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Report No.: GZEM181100357401

Page: 1 of 20

TEST REPORT

Application No.: GZEM1811003574CR
Applicant: Varjo Technologies Oy
Address of Applicant: Aleksanterinkatu 21H, 00100 Helsinki, Finland
Manufacturer: Varjo Technologies Oy
Address of Manufacturer: Aleksanterinkatu 21H, 00100 Helsinki, Finland
Factory: Flextronics Manufacturing (Zhuhai) Co., Ltd.
Address of Factory: Xin Qing Science & Technology Industrial Park, Jing An, Doumen, Zhuhai, Guangdong, 519180, PRC

Equipment Under Test (EUT):
EUT Name: Varjo VR-1
Model No.: LB-1
Trade Mark: Varjo
Standard(s) : 47 CFR Part 15, Subpart B
Date of Receipt: 2018-11-20
Date of Test: 2018-11-26 to 2018-11-30
Date of Issue: 2019-03-01

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.



Kobe Jian
Lab Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.



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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2019-03-01		Original

Authorized for issue by:			
Tested By			2018-11-26 to 2018-11-30
	Curry_Wu /Project Engineer		Date
Checked By			2019-03-01
	Ricky_Liu /Reviewer		Date



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2 Test Summary

Emission Part				
Item	Standard	Method	Requirement	Result
Conducted Emissions at Mains Terminals (150kHz-30MHz)	47 CFR Part 15, Subpart B	ANSI C63.4:2014	N/A	Pass
Radiated Emissions (30MHz-1GHz)	47 CFR Part 15, Subpart B	ANSI C63.4:2014	N/A	Pass
Radiated Emissions (above 1GHz)	47 CFR Part 15, Subpart B	ANSI C63.4:2014	N/A	Pass

N/A: Not applicable

Internal Source	Upper Frequency
Below 1.705MHz	30MHz
1.705MHz to 108MHz	1GHz
108MHz to 500MHz	2GHz
500MHz to 1GHz	5GHz
Above 1GHz	5th harmonic of the highest frequency or 40GHz, whichever is lower



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4 General Information

4.1 Details of E.U.T.

Power Supply:	Power Supply Unit MODEL: S51A00 INPUT: AC 100-240V, 50~60Hz, 1.3A OUTPUT: DC5V 3A / DC9V 3A / DC15V 3A / DC20 3A
Test Voltage:	AC 120V 60Hz
Cable:	0.5m unscreened DP cable x 2 0.5m unscreened USB cable x1 0.8m unscreened USB type C cable x1 0.5m x 2 wires unscreened AC mains cable x1
Internal Source Frequency	<1GHz

4.2 Description of Support Units

The EUT has been tested with corresponding accessories as below:

Supplied by client:

Description	Manufacturer	Model No.	SN/Certificate NO
Laptop	Acer	N17Q7	NHQ2LED008747120397600
DP to type C converter	Kanex	K181-1016-WT8I	N/A



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4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Conducted Disturbance Voltage at Mains Terminals	±3.63dB (9kHz to 150kHz)
		±3.22dB (150kHz to 30MHz)
2	Disturbance Power	±3.78dB
3	Radiated Emissions	±5.0dB (30MHz-1GHz)
		±5.0dB (1GHz-6GHz)
4	Radiated Immunity	±2.18dB(80MHz-3GHz)
5	Conducted Immunity	±3.5dB(150kHz-230MHz)
6	Electrostatic Discharge	±6 %
7	EFT (Electrical Fast Transients)	±4 %
8	Surge Immunity	±6%
9	Voltage Dips and Interruptions	±4 %
10	CISPR 20 Immunity	±1.5dB
11	Temperature	±0.4 °C
12	Humidity	±1.3%
13	DC power	±0.5 %

4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou Branch EMC Laboratory,
198 Kezhu Road, Sciencetech Park, Guangzhou Economic & Technology Development District,
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No tests were sub-contracted.



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4.5 Test Facility

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

● **NVLAP (Lab Code: 200611-0)**

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 200611-0.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

● **ACMA**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our NVLAP accreditation.

● **SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO**

Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

● **CNAS (Lab Code: L0167)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been assessed and in compliance with CNAS-CL01:2006 accreditation criteria for testing laboratories (identical to

ISO/IEC 17025:2005 General Requirements) for the Competence of Testing Laboratories.

● **FCC Recognized 2.948 Listed Test Firm(Registration No.: 282399)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 282399, May 31, 2002.

● **FCC Recognized Accredited Test Firm(Registration No.: 486818)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation Number: CN5016, Test Firm Registration Number: 486818, Jul 13, 2017.

● **Industry Canada (Registration No.: 4620B-1)**

The 3m/10m Alternate Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd., has been registered by Certification and Engineering of Industry Canada for radio equipment testing with Registration No. 4620B-1.

● **VCCI (Registration No.: R-2460, C-2584, G-449 and T-1179)**

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-2460, C-2584, G-449 and T-1179 respectively.

● **CBTL (Lab Code: TL129)**

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2005, the Basic Rules, IECEE 01 and Rules of procedure IECEE 02, and the relevant IECEE CB-Scheme Operational documents.



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4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None



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5 Equipment List

Conducted Emissions at Mains Terminals (150kHz-30MHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	Zhong Yu	8m x 3m x 3.8m	EMC0306	N/A	N/A
Two-Line V-Netwok	R&S	ENV216	EMC0118	2018-01-19	2019-01-18
LISN	R&S	ENV216	EMC2135	2018-09-21	2019-09-20
EMI Test Receiver	Rohde & Schwarz	ESCS30	EMC0506	2018-11-19	2019-11-18
Coaxial Cable	HangTianXing	2m	EMC0107	2017-07-23	2019-07-22
Voltage Probe	SGS	N/A	EMC0106	2018-04-04	2020-04-03
Conical Metal Housing	SGS-EMC	N/A	EMC0167	2018-04-19	2020-04-18
Test Software E3c	Audix	Ver. 5.4.1221b	GZE100-62	N/A	N/A



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Radiated Emissions (30MHz-1GHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EMI Test Receiver	Rohde & Schwarz	ESIB26	EMC0522	2018-01-19	2019-01-18
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC0056	2018-01-19	2019-01-18
Chamber cable	HangTianXing	N/A	EMC0542	2017-06-30	2019-06-30
Trilog Broadband Antenna 30MHz-1GHz	SCHWARZBECKME SS-ELEKTRONIK	VULB 9160	EMC2025	2016-09-08	2019-09-07
Trilog Broadband Antenna 30MHz-1GHz	SCHWARZBECKME SS-ELEKTRONIK	VULB 9168	SEM003-18	2016-06-29	2019-06-28
Bi-log Type Antenna	Schaffner -Chase	CBL6112B	EMC0524	2016-09-08	2019-09-07
Bi-log Type Antenna	Schaffner -Chase	CBL6143	EMC0519	2017-05-04	2020-05-03
Horn Antenna 1GHz-18GHz	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2016-09-09	2019-09-08
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2018-01-08	2019-01-07
Amplifier	HP	8447F	EMC2065	2018-06-01	2019-05-31
Pre-Amplifier MH648A	ANRITSU CORP	MH648A	EMC2086	2018-11-19	2019-11-18
Active Loop Antenna	EMCO	6502	EMC0523	2018-02-24	2019-02-23
High Pass Filter(915MHz)	FSY MICROWAVE	HM1465-9SS	EMC2079	2018-01-19	2019-01-18
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2018-01-08	2019-01-07
10m Semi-Anechoic Chamber	ETS	N/A	EMC0530	2017-06-18	2019-06-18
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2017-12-19	2019-12-18
MXE EMI Receiver	Keysight	N9038A	EMC2139	2018-11-19	2019-11-18
EXA Signal Analyzer	Keysight	N9010A	EMC2138	2018-11-19	2019-11-18
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A



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Radiated Emissions (above 1GHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EMI Test Receiver	Rohde & Schwarz	ESIB26	EMC0522	2018-01-19	2019-01-18
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC0056	2018-01-19	2019-01-18
Chamber cable	HangTianXing	N/A	EMC0542	2017-06-30	2019-06-30
Trilog Broadband Antenna 30MHz-1GHz	SCHWARZBECKME SS-ELEKTRONIK	VULB 9160	EMC2025	2016-09-08	2019-09-07
Bi-log Type Antenna	Schaffner -Chase	CBL6112B	EMC0524	2016-09-08	2019-09-07
Bi-log Type Antenna	Schaffner -Chase	CBL6143	EMC0519	2017-05-04	2020-05-03
Horn Antenna 1GHz-18GHz	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2016-09-09	2019-09-08
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2018-01-08	2019-01-07
Amplifier	HP	8447F	EMC2065	2018-06-01	2019-05-31
Pre-Amplifier MH648A	ANRITSU CORP	MH648A	EMC2086	2018-11-19	2019-11-18
Active Loop Antenna	EMCO	6502	EMC0523	2018-02-24	2019-02-23
High Pass Filter(915MHz)	FSY MICROWAVE	HM1465-9SS	EMC2079	2018-01-19	2019-01-18
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2018-01-08	2019-01-07
10m Semi-Anechoic Chamber	ETS	N/A	EMC0530	2017-06-18	2019-06-18
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2017-12-19	2019-12-18
MXE EMI Receiver	Keysight	N9038A	EMC2139	2018-11-19	2019-11-18
EXA Signal Analyzer	Keysight	N9010A	EMC2138	2018-11-19	2019-11-18
Trilog Broadband Antenna 30MHz-1GHz	SCHWARZBECKME SS-ELEKTRONIK	VULB 9168	SEM003-18	2016-06-29	2019-06-28
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A

General used equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
DMM	Fluke	73	EMC0006	2018-07-20	2019-07-19
DMM	Fluke	73	EMC0007	2018-07-19	2019-07-18



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6 Emission Test Results

6.1 Conducted Emissions at Mains Terminals (150kHz-30MHz)

Test Requirement: 47 CFR Part 15, Subpart B

Test Method: ANSI C63.4:2014

Frequency Range: 150kHz to 30MHz

6.1.1 E.U.T. Operation

Operating Environment:

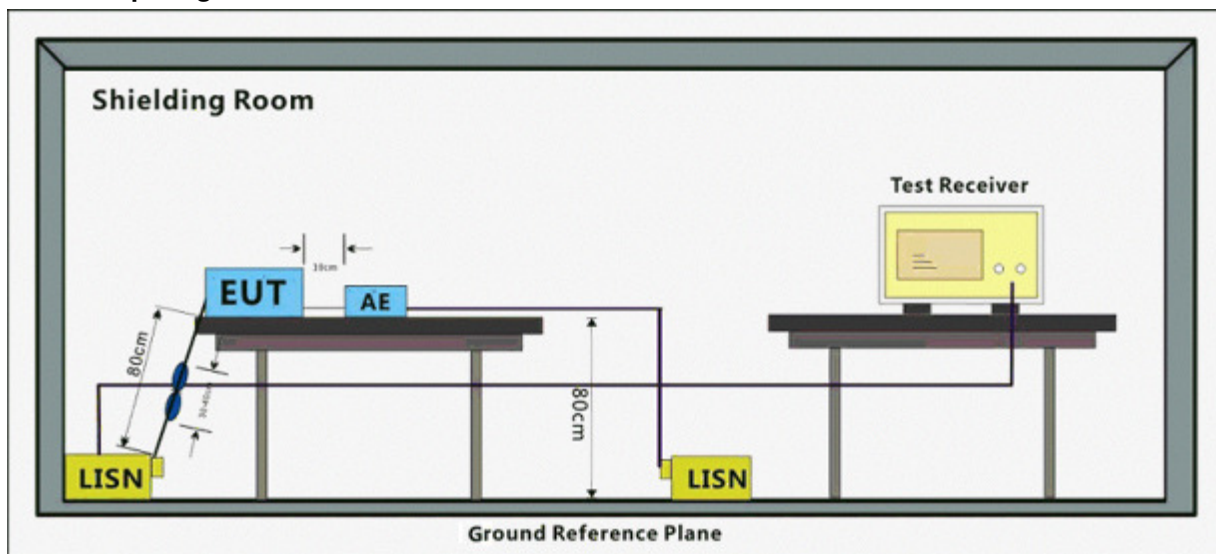
Temperature: 25.4 °C Humidity: 58.7 % RH Atmospheric Pressure: 1020 mbar

Pretest these b: Normal working_Keep the EUT communicate with other auxiliary devices.

modes to find c: Idle_Keep the EUT standby.
the worst case:

The worst case b: Normal working_Keep the EUT communicate with other auxiliary devices.
for final test:

6.1.2 Test Setup Diagram

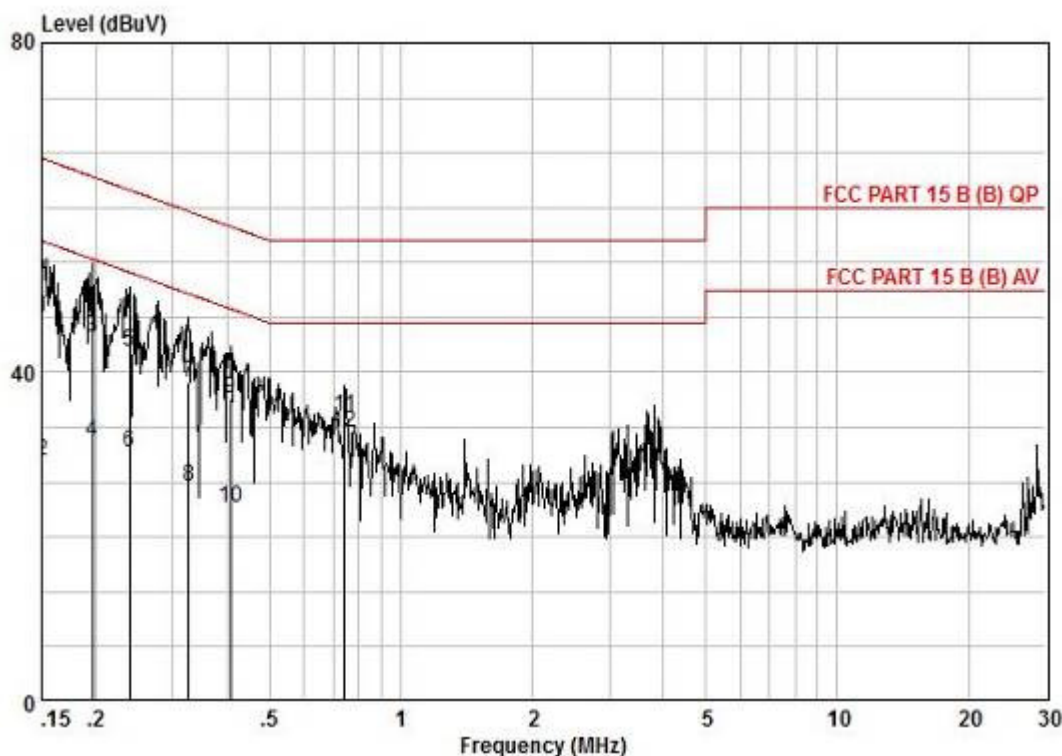


6.1.3 Measurement Data

An initial pre-scan was performed with peak detector. Quasi-Peak or Average measurement were performed at the frequencies with maximized peak emission were detected.

Measured Level = Read level + Cable Loss + LISN Factor

Mode:a; Line:Live Line



Pol	: LIVE
No	:
Model	:

Frequency MHz	read level dBuV	Cable Loss dB	LISN Factor dB	Measured level dBuV	Limit Line dBuV	Over limit dB	Remark
0,15	36,86	0,10	9,67	46,63	66,00	-19,37	QP
0,15	19,40	0,10	9,67	29,17	56,00	-26,83	AVERAGE
0,20	34,44	0,10	9,66	44,20	63,76	-19,56	QP
0,20	21,90	0,10	9,66	31,66	53,76	-22,10	AVERAGE
0,24	32,82	0,12	9,67	42,61	62,13	-19,52	QP
0,24	20,44	0,12	9,67	30,23	52,13	-21,90	AVERAGE
0,33	29,05	0,15	9,66	38,87	59,53	-20,66	QP
0,33	16,30	0,15	9,66	26,12	49,53	-23,41	AVERAGE
0,41	27,09	0,18	9,66	36,93	57,73	-20,80	QP
0,41	13,73	0,18	9,66	23,57	47,73	-24,16	AVERAGE
0,74	24,62	0,26	9,67	34,55	56,00	-21,45	QP
0,74	22,82	0,26	9,67	32,75	46,00	-13,25	AVERAGE

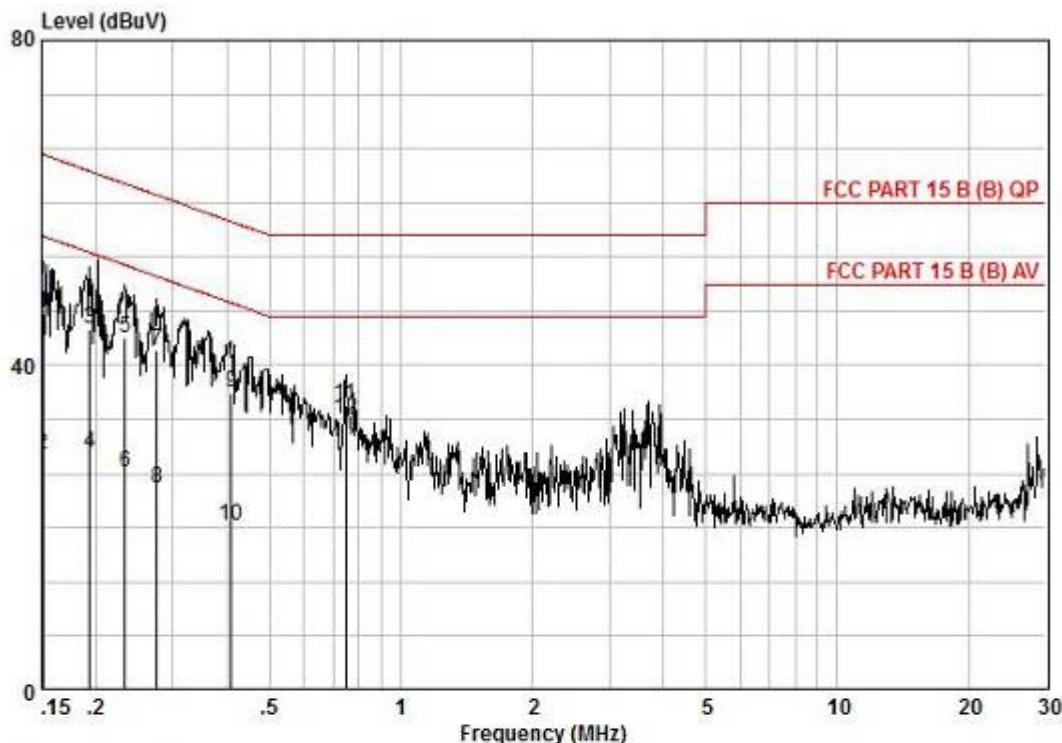


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Mode:a; Line:Neutral Line



Pol : NEUTRAL
No :
Model :

Frequency MHz	read level dBUV	Cable Loss dB	LISN Factor dB	Measured level dBUV	Limit Line dBUV	Over limit dB	Remark
0.15	36.67	0.10	9.58	46.35	65.96	-19.61	QP
0.15	19.34	0.10	9.58	29.02	55.96	-26.94	AVERAGE
0.19	34.78	0.10	9.60	44.48	63.89	-19.41	QP
0.19	19.55	0.10	9.60	29.25	53.89	-24.64	AVERAGE
0.23	33.60	0.12	9.59	43.31	62.35	-19.04	QP
0.23	17.10	0.12	9.59	26.81	52.35	-25.54	AVERAGE
0.28	32.13	0.14	9.59	41.86	60.94	-19.08	QP
0.28	15.08	0.14	9.59	24.81	50.94	-26.13	AVERAGE
0.41	26.79	0.18	9.59	36.56	57.68	-21.12	QP
0.41	10.48	0.18	9.59	20.25	47.68	-27.43	AVERAGE
0.75	25.22	0.26	9.61	35.08	56.00	-20.92	QP
0.75	23.45	0.26	9.61	33.31	46.00	-12.69	AVERAGE



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6.2 Radiated Emissions (30MHz-1GHz)

Test Requirement: 47 CFR Part 15, Subpart B
Test Method: ANSI C63.4:2014
Frequency Range: 30MHz to 1GHz
Measurement Distance: 3m

6.2.1 E.U.T. Operation

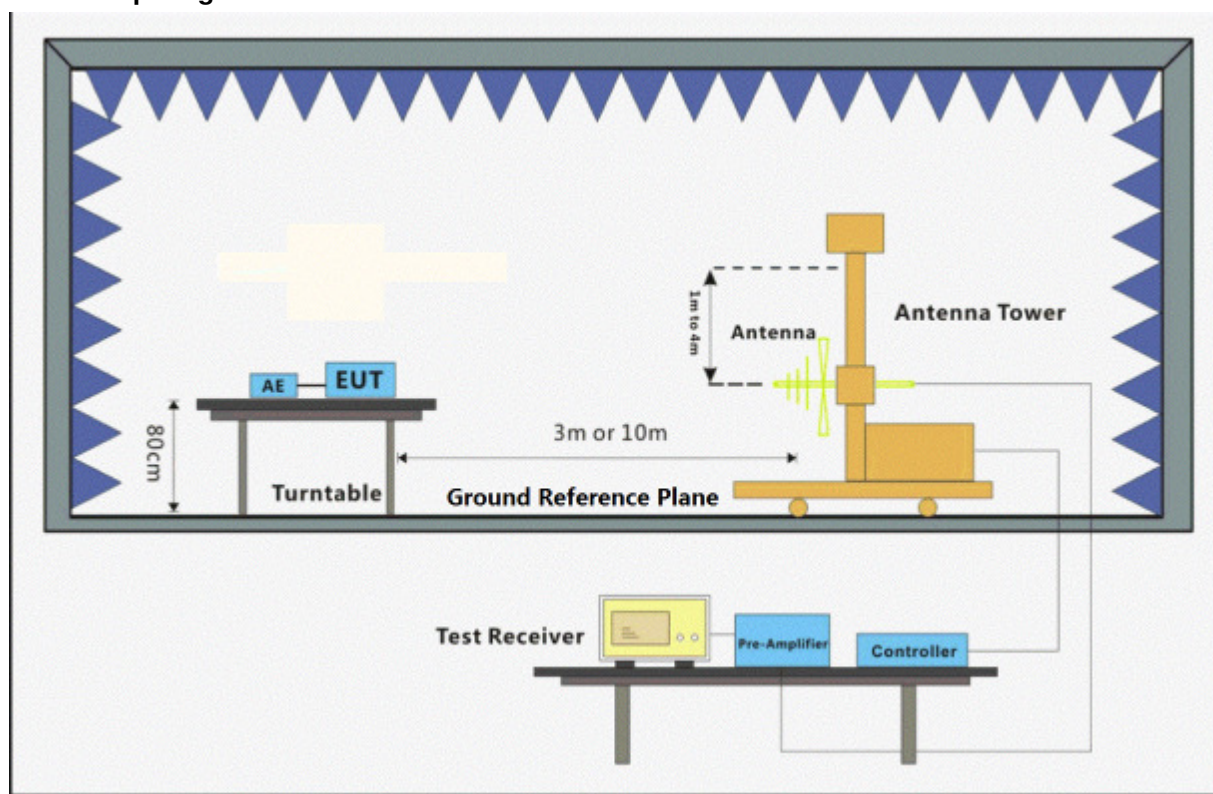
Operating Environment:

Temperature: 23.6 °C Humidity: 66.7 % RH Atmospheric Pressure: 1020 mbar

Pretest these modes to find the worst case:
b: Normal working_Keep the EUT communicate with other auxiliary devices.
c: Idle_Keep the EUT standby.

The worst case for final test: b: Normal working_Keep the EUT communicate with other auxiliary devices.

6.2.2 Test Setup Diagram

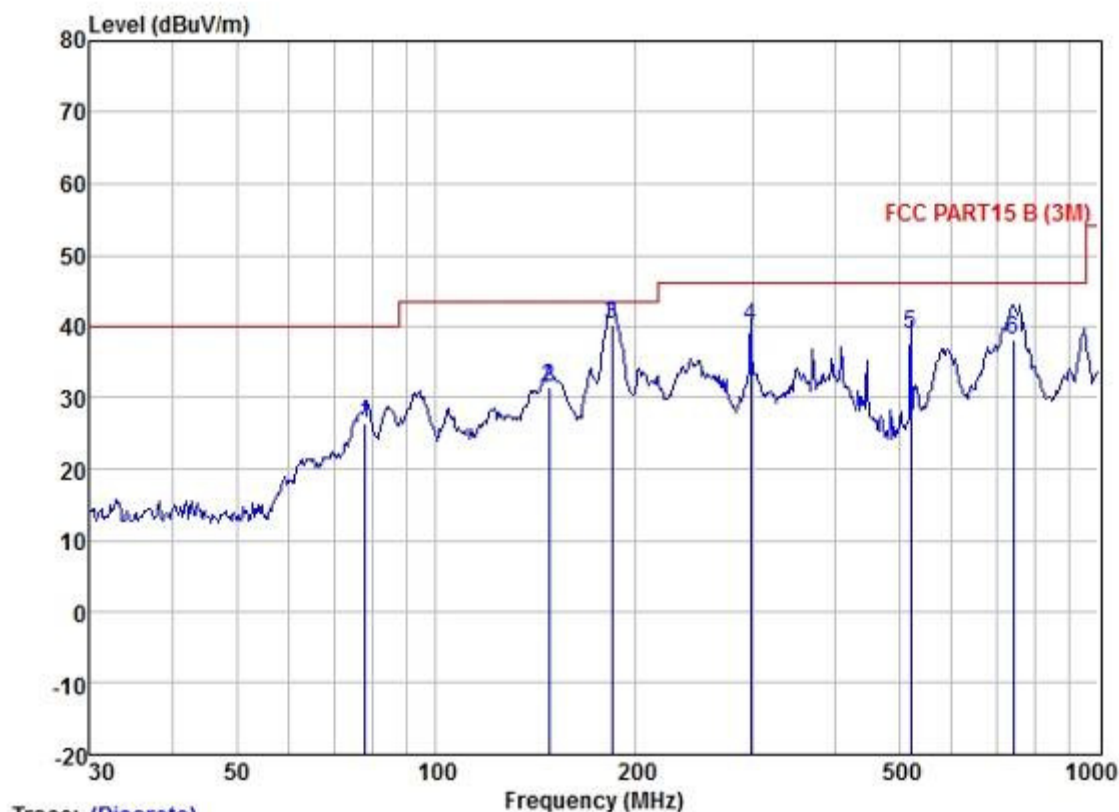


6.2.3 Measurement Data

An initial pre-scan was performed in the chamber using the spectrum analyser in peak detection mode. Quasi-peak measurements were conducted based on the peak sweep graph. The EUT was measured by BiConiLog antenna with 2 orthogonal polarities.

Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor

Mode:b; Polarization:Horizontal



Trace: (Discrete)

	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	78.139	42.45	9.49	0.97	26.42	26.49	40.00	-13.51	HORIZONTAL	QP
2	147.921	42.62	14.06	1.30	26.43	31.55	43.50	-11.95	HORIZONTAL	QP
3	183.844	54.21	11.18	1.45	26.45	40.39	43.50	-3.11	HORIZONTAL	QP
4	298.268	52.16	12.76	1.80	26.78	39.94	46.00	-6.06	HORIZONTAL	QP
5	520.888	47.00	16.91	2.42	27.46	38.87	46.00	-7.13	HORIZONTAL	QP
6	744.866	42.21	20.22	2.90	27.30	38.03	46.00	-7.97	HORIZONTAL	QP

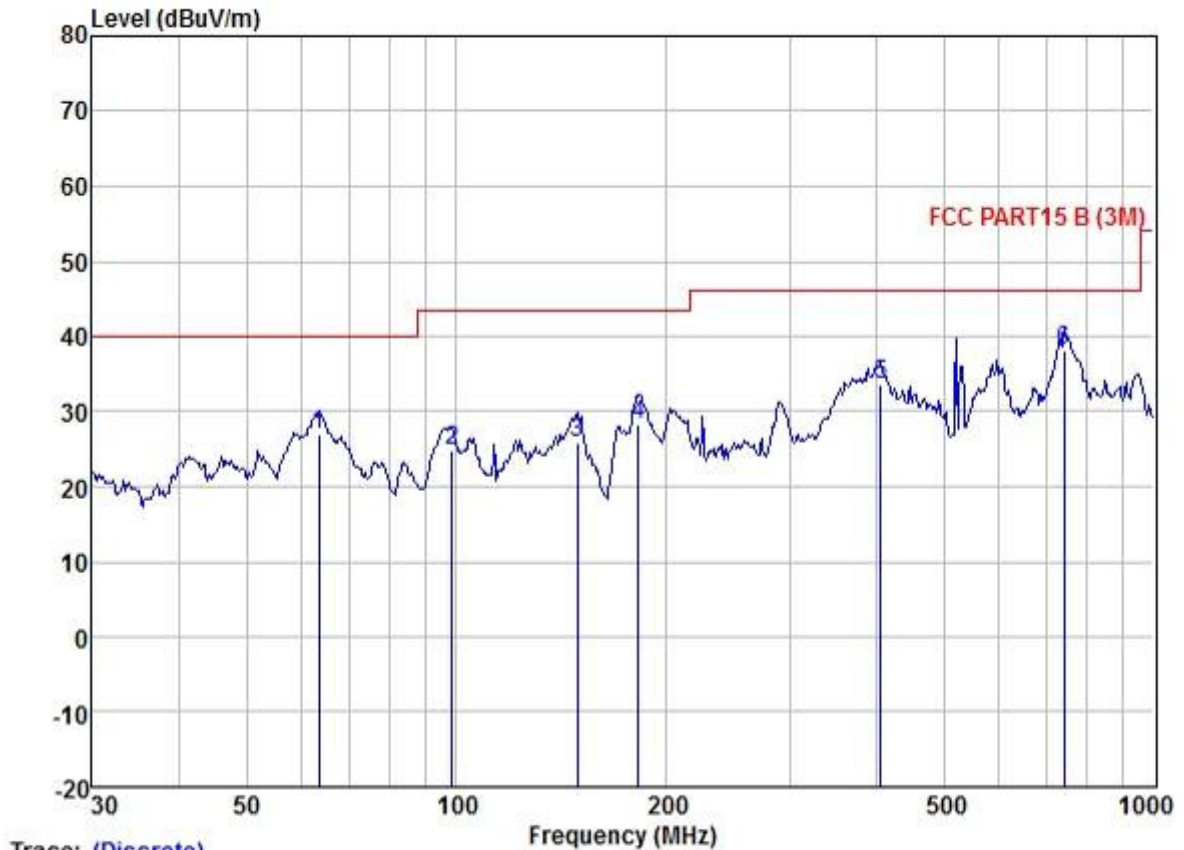


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Mode:b; Polarization:Vertical



Trace: (Discrete)

	Freq	ReadAntenna	Cable	Preamp	Limit	Over			
	MHz	Level	Loss	Factor	Line	Limit	Pol/Phase	Remark	
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	63.536	40.41	12.17	0.80	26.48	26.90	40.00	-13.10	VERTICAL QP
2	98.487	40.08	10.08	1.10	26.40	24.86	43.50	-18.64	VERTICAL QP
3	148.963	36.90	14.11	1.30	26.43	25.88	43.50	-17.62	VERTICAL QP
4	182.559	41.89	11.37	1.45	26.45	28.26	43.50	-15.24	VERTICAL QP
5	406.088	43.87	14.86	2.22	27.36	33.59	46.00	-12.41	VERTICAL QP
6	744.866	42.21	20.22	2.90	27.30	38.03	46.00	-7.97	VERTICAL QP



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6.3 Radiated Emissions (above 1GHz)

Test Requirement: 47 CFR Part 15, Subpart B
Test Method: ANSI C63.4:2014
Frequency Range: Above 1GHz
Measurement Distance: 3m

6.3.1 E.U.T. Operation

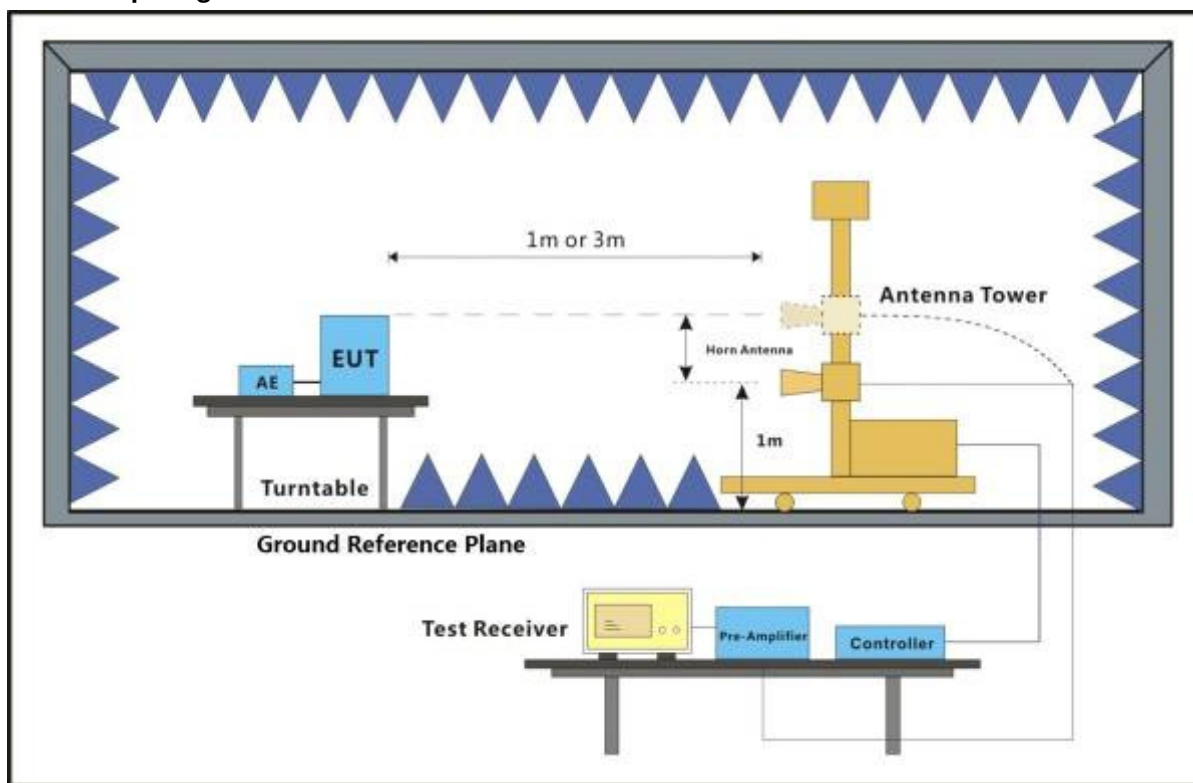
Operating Environment:

Temperature: 23.6 °C Humidity: 66.7 % RH Atmospheric Pressure: 1020 mbar

Pretest these modes to find the worst case:
b: Normal working_Keep the EUT communicate with other auxiliary devices.
c: Idle_Keep the EUT standby.

The worst case for final test:
b: Normal working_Keep the EUT communicate with other auxiliary devices.

6.3.2 Test Setup Diagram

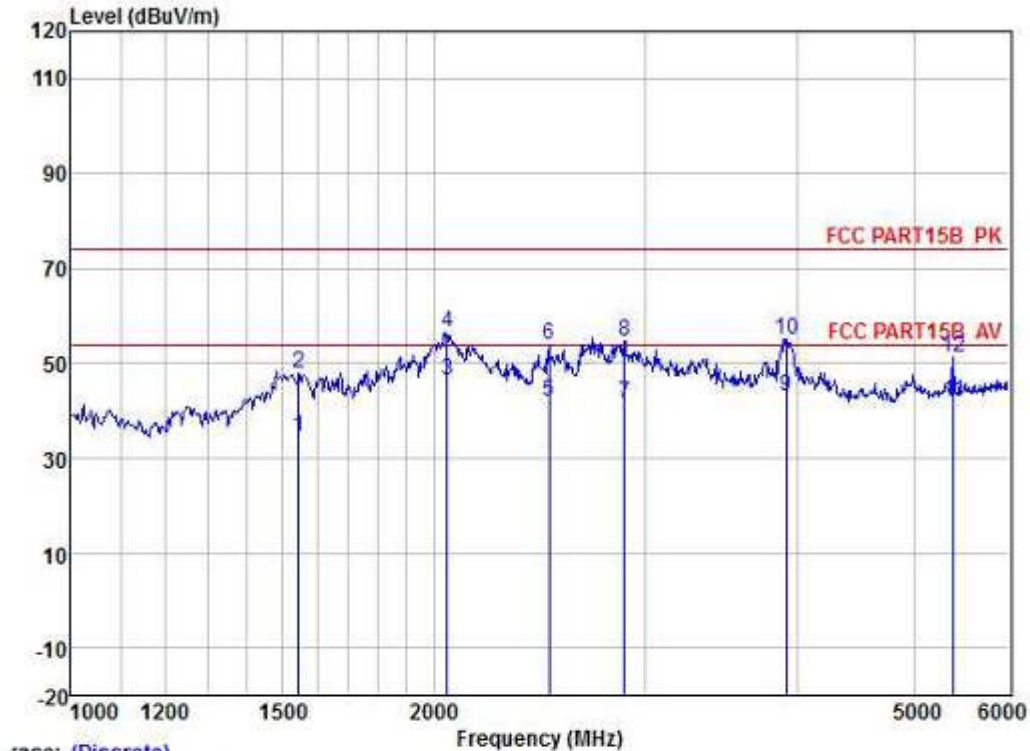


6.3.3 Measurement Data

An initial pre-scan was performed in the chamber using the spectrum analyser in peak detection mode. Average measurements were conducted based on the peak sweep graph. The EUT was measured by Horn antenna with 2 orthogonal polarities.

Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor

Mode:b; Polarization:Horizontal



Trace: (Discrete)

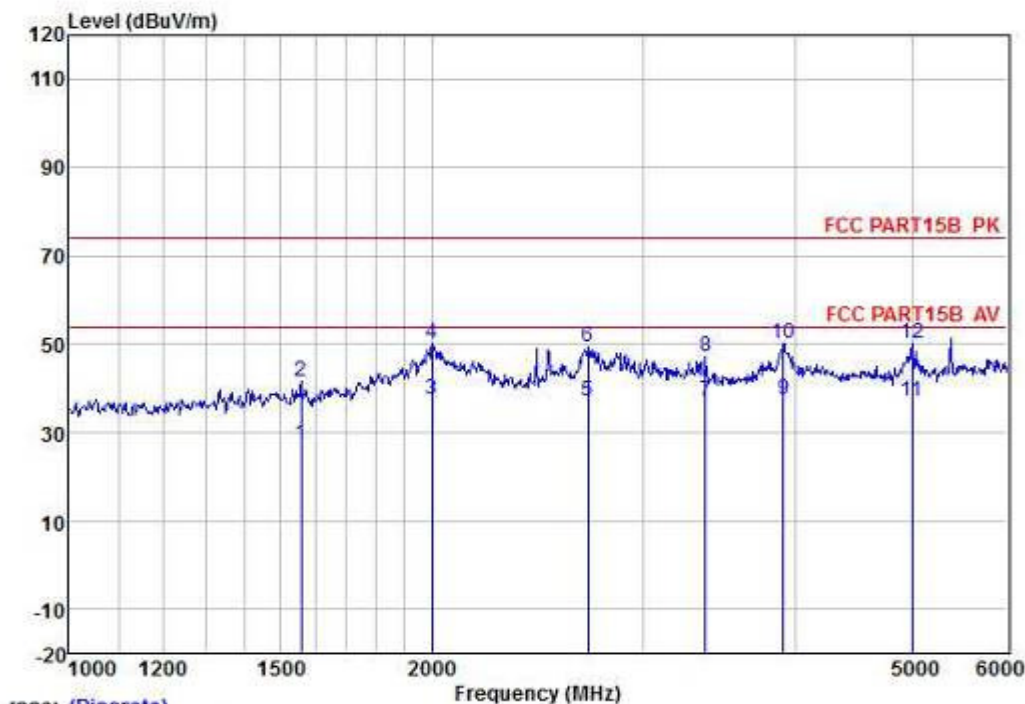
	Freq	ReadAntenna	Cable Preamp	Limit	Over					
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1545.577	44.20	25.01	3.13	37.68	34.66	54.00	-19.34	HORIZONTAL	Average
2	1545.577	57.61	25.01	3.13	37.68	48.07	74.00	-25.93	HORIZONTAL	Peak
3	2054.200	48.48	25.29	10.25	37.49	46.53	54.00	-7.47	HORIZONTAL	Average
4	2054.200	58.65	25.29	10.25	37.49	56.70	74.00	-17.30	HORIZONTAL	Peak
5	2493.774	47.81	26.59	5.09	37.39	42.10	54.00	-11.90	HORIZONTAL	Average
6	2493.774	59.58	26.59	5.09	37.39	53.87	74.00	-20.13	HORIZONTAL	Peak
7	2878.122	46.11	27.72	4.84	37.15	41.52	54.00	-12.48	HORIZONTAL	Average
8	2878.122	59.43	27.72	4.84	37.15	54.84	74.00	-19.16	HORIZONTAL	Peak
9	3924.004	43.04	29.35	7.47	36.91	42.95	54.00	-11.05	HORIZONTAL	Average
10	3924.004	55.24	29.35	7.47	36.91	55.15	74.00	-18.85	HORIZONTAL	Peak
11	5398.093	39.81	31.77	7.45	36.98	42.05	54.00	-11.95	HORIZONTAL	Average
12	5398.093	49.10	31.77	7.45	36.98	51.34	74.00	-22.66	HORIZONTAL	Peak



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Mode:b; Polarization:Vertical



Trace: (Discrete)

	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
	Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1559.486	37.03	25.01	3.18	37.67	27.55	54.00	-26.45	VERTICAL	Average
2	1559.486	51.18	25.01	3.18	37.67	41.70	74.00	-32.30	VERTICAL	Peak
3	2000.528	38.81	25.20	11.08	37.50	37.59	54.00	-16.41	VERTICAL	Average
4	2000.528	51.57	25.20	11.08	37.50	50.35	74.00	-23.65	VERTICAL	Peak
5	2693.504	42.43	27.06	4.86	37.31	37.04	54.00	-16.96	VERTICAL	Average
6	2693.504	54.90	27.06	4.86	37.31	49.51	74.00	-24.49	VERTICAL	Peak
7	3375.707	40.56	27.90	5.51	36.97	37.00	54.00	-17.00	VERTICAL	Average
8	3375.707	50.84	27.90	5.51	36.97	47.28	74.00	-26.72	VERTICAL	Peak
9	3916.979	37.47	29.32	7.51	36.91	37.39	54.00	-16.61	VERTICAL	Average
10	3916.979	50.44	29.32	7.51	36.91	50.36	74.00	-23.64	VERTICAL	Peak
11	5006.774	34.84	31.10	8.28	36.96	37.26	54.00	-16.74	VERTICAL	Average
12	5006.774	47.68	31.10	8.28	36.96	50.10	74.00	-23.90	VERTICAL	Peak

--End of Report--



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