

Test Report

FCC ID: 2A2CG-LSC3

Applicant: Dongguan Qiangde Electronics Technology Co.,Ltd.

Address: Room 201, building 7, No.2, middle 2nd commercial street, puxinhu, Tangxia Town, Dongguan City, Guangdong Province

Manufacturer: Dongguan Qiangde Electronics Technology Co.,Ltd.

Address: Room 201, building 7, No.2, middle 2nd commercial street, puxinhu, Tangxia Town, Dongguan City, Guangdong Province

Product: Light Stream Controller



Test Model(s): V-20671

Series Model(s): N/A

Test Date: May 13, 2021 ~ May 28, 2021

Issued By: Hwa-Hsing (Dongguan) Testing Co., Ltd.

Address: No.101, Bld N1, Yuyuan 2Rd, Yuyuan Industrial Park, HuangJiang Town, Dongguan, China

FCC Designation No.: CN1255

Standards: ANSI C63.10-2013
FCC Part 15, Subpart C (Section 15.249)

The above equipment has been tested by **Hwa-Hsing (Dongguan) Testing Co., Ltd.**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared By :



Date: June 03, 2021

Scott He/ Project Engineer

Approved By :



Date: June 16, 2021

Harry Li/ Technical Director

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Release
Ver. 1.1

Table of Contents

Release Control Record	3
1. Summary of Test Results	4
1.1 Measurement Uncertainty	4
1.2 Modification Record	4
2. General Information	5
2.1 General Description of EUT	5
2.2 Description of Test Channels	6
2.3 Description of Support Units	6
2.4 Configuration of System under Test	6
3. Test Types and Results	7
3.1 Conducted Emissions at Mains Ports	7
3.1.1 Limits	7
3.1.2 Test Instruments	7
3.1.3 Test Procedure	8
3.1.4 Test setup	8
3.1.5 Test Results	9
3.2 Radiated Emission and Band-edge Measurement	11
3.2.1 Limits of radiated emission and band-edge measurement	11
3.2.2 Test Instruments	12
3.2.3 Test Procedures	13
3.2.4 Deviation from Test Standard	13
3.2.5 Test Setup	14
3.2.6 EUT Operating Conditions	15
3.2.7 Test Results	16
3.3 20dB Bandwidth Measurement	20
3.3.1 Limits of 20dB Bandwidth Measurement	20
3.3.2 Test Setup	20
3.3.3 Test Instruments	20
3.3.4 Test Procedure	20
3.3.5 Deviation from Test Standard	20
3.3.6 EUT Operating Conditions	20
3.3.7 Test Result	21
4. Pictures of Test Arrangements	22
5. Appendix – Information on The Testing Laboratories	23

Release Control Record

Issue No.	Description	Date Issued
210325EL31-RF-US-01	Original Release	June 16, 2021

**HWA-HSING**

Test Report No.: 210325EL31-RF-US-01

1. Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.249) ANSI C63.10: 2013			
Clause	Test Item	Result	Remarks
§15.203	Antenna Requirement	Pass	Meet the requirement of limit.
§15.207 (a)	Conducted Emission	Pass	Meet the requirement of limit.
§15.205	Restricted Band of Operation	Pass	Meet the requirement of limit.
§15.209 §15.249(a)	Radiated Emission	Pass	Meet the requirement of limit.
§15.215(c)	20dB Bandwidth Test	Pass	Meet the requirement of limit.

1.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

The listed uncertainties are the worst cases uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	Frequency	Expended Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.66 dB
Radiated Emissions up to 1 GHz	9KHz ~ 30MHz	2.90dB
	30MHz ~ 1000MHz	3.47 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	4.84 dB
	18GHz ~ 40GHz	4.62 dB

1.2 Modification Record

There were no modifications required for compliance.



2. General Information

2.1 General Description of EUT

Product	Light Stream Controller
Brand	
Test Model(s)	V-20671
Series Model(s)	N/A
FCC ID:	2A2CG -LSC3
Status of EUT	Engineering prototype
Power Supply Rating	AC 120V 50/60Hz 5A (Max.)
Modulation Type	GFSK
Transfer Rate	1 Mbps
Operating Frequency	2477MHz
Number of Channel	1
Maximum Output Power	0.783mW
Antenna Type	Dipole antenna
Antenna Gain (Max.)	3.0dBi Peak
Antenna Connector	Dipole
Accessory Device	AC Line: Un-shielding 15cm
Data Cable Supplied	N/A

Note:

1. Please refer to the EUT photo document (Reference No.: 210325EL31) for detailed product photo.
2. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.
3. The EUT has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (SDoC).
The test report has been issued separately.



2.2 Description of Test Channels

1 channel was provided to this EUT:

Channel	Frequency (MHz)	Modulation Type	Transfer Rate
1	2477	GFSK	1 Mbps

Test Condition:

Applicable test items	Environmental Conditions	Power supply	Tested by
Conducted Emission	25 deg. C, 65 %RH	AC120V/60Hz	Tank Tan
Radiated Emission	25 deg. C, 65 %RH	AC120V/60Hz	Tank Tan
20dB Bandwidth Test	25 deg. C, 65 %RH	AC120V/60Hz	Tank Tan

2.3 Description of Support Units

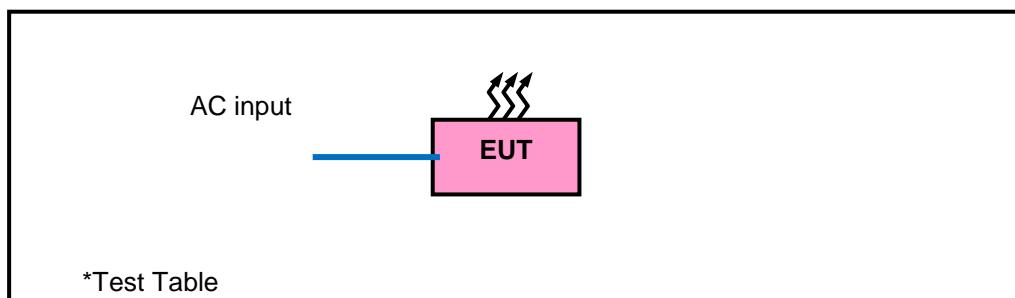
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	N/A	N/A	N/A	N/A	N/A

Insert Cable Connections to/from EUT provided by test team.

No.	Signal Cable Description Of The Above Support Units
1.	N/A

2.4 Configuration of System under Test





3. Test Types and Results

3.1 Conducted Emissions at Mains Ports

3.1.1 Limits

Frequency (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 - 56	56 - 46
0.50 - 5.0	73	60	56	46
5.0 - 30.0	73	60	60	50

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

3.1.2 Test Instruments

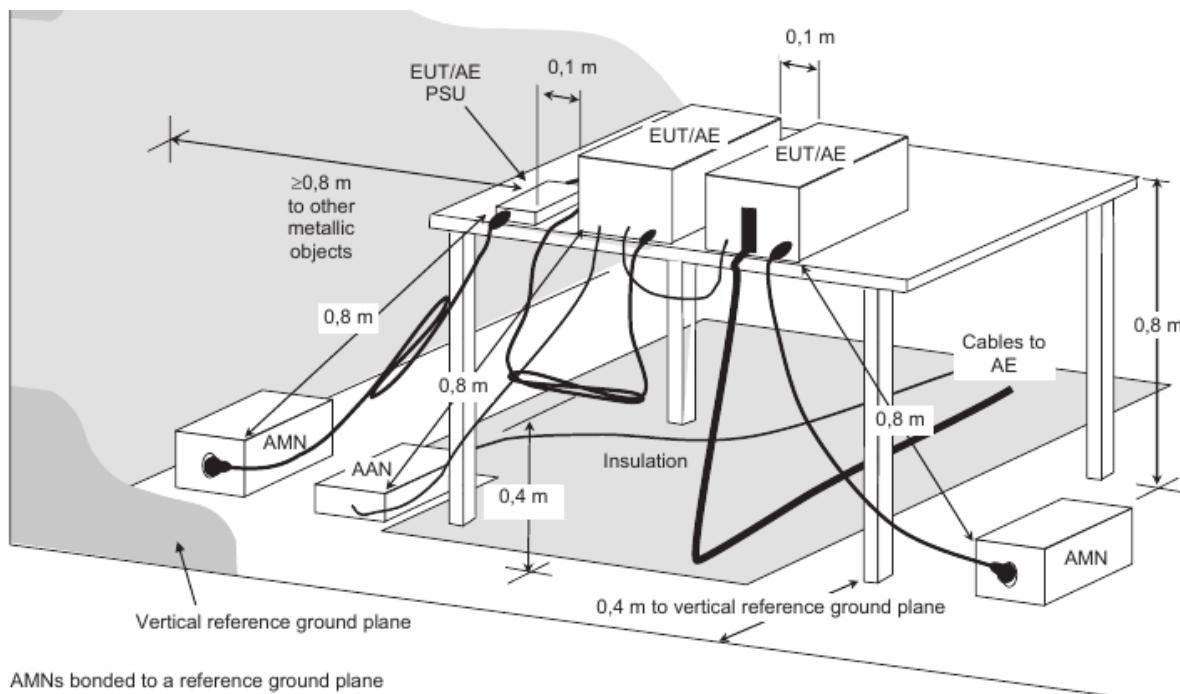
Description & Manufacturer	Model No.	Serial No.	Next Cal. Date
EMI Test Receiver Rohde&Schwarz	ESCI3	101418	2021/09/05
Artificial Mains Network Rohde&Schwarz	ENV216	3560.6550.15	2021/09/16
Test software FARAD	EZ_EMCA V1.1.4.2	N/A	N/A

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA.
2. The test was performed in Shielded Room

3.1.3 Test Procedure

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. The test results of conducted emissions at mains ports are recorded of six worst margins for quasi-peak and average values against the limits at the frequencies of interest unless the margin is 20 dB or greater

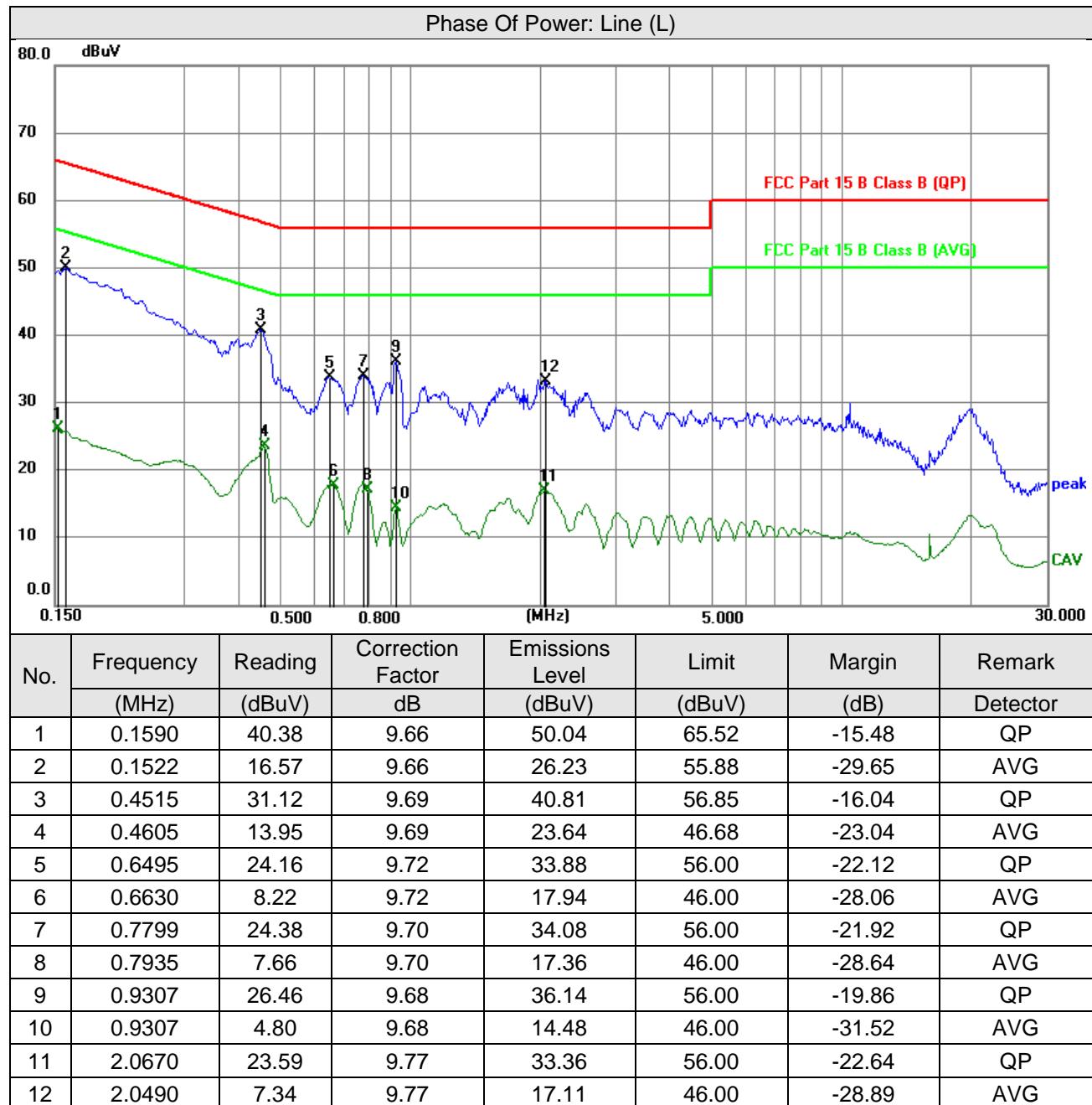
3.1.4 Test setup





3.1.5 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Power Supply	120Vac, 60Hz	Environmental Conditions	22°C, 46%RH
Tested by	Benson	Test Date	2021/05/24



Remarks:

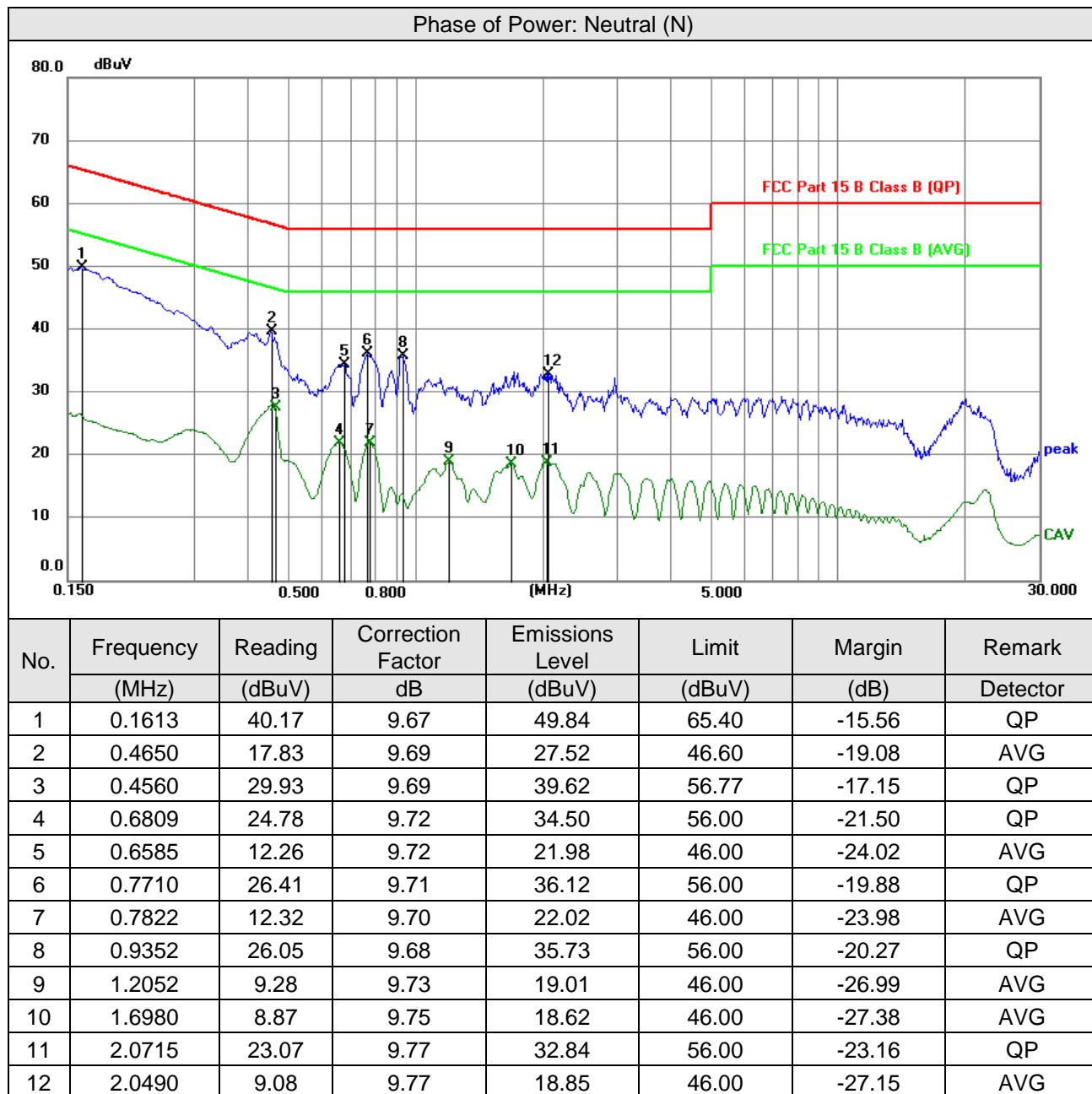
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



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Test Report No.: 210325EL31-RF-US-01

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Power Supply	120Vac, 60Hz	Environmental Conditions	22°C, 46%RH
Tested by	Benson	Test Date	2021/05/24



Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

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3.2 Radiated Emission and Band-edge Measurement

3.2.1 Limits of radiated emission and band-edge measurement

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

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

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

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.

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, 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.



3.2.2 Test Instruments

For radiated emission test (9kHz-30MHz)

Equipment	Manufacturer	Model No.	Serial No.	Next Cal. Date
EMI Test Receiver (10kHz~7GHz)	Rohde&Schwarz	ESCI 7	100962	2022/05/13
Loop antenna (9kHz-30MHz)	TESEQ	HLA 6121	56735	2022/04/15
3m Semi-anechoic Chamber	MAORUI	9m*6m*6m	NSEMC003	2022/04/14
Attenuator	R&S	TS2GA-6dB	18101101	N/A
Test software	EZ	EZ_EMC V1.1.4.2	N/A	N/A

For radiated emission test (30MHz-1GHz)

Equipment	Manufacturer	Model No.	Serial No.	Next Cal. Date
EMI Test Receiver (10kHz~7GHz)	Rohde&Schwarz	ESCI 7	100962	2022/05/13
Broadband antenna (25MHz~2500MHz)	Schwarzbeck	VULB 9168	00937	2022/04/15
3m Semi-anechoic Chamber	MAORUI	9m*6m*6m	NSEMC003	2022/04/14
Signal Amplifier (30MHz-1000MHz)	Com-power	PAM-103	18020051	2022/04/15
Attenuator	R&S	TS2GA-6dB	18101101	N/A
Test software	EZ	EZ_EMC V1.1.4.2	N/A	N/A

For radiated emission test (1GHz-40GHz)

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.Date
Horn Antenna (1GHz-18GHz)	Schwarzbeck	BBHA 9170	01959	2022/04/15
Broadband Coaxial Preamplifier (1GHz-18GHz)	Schwarzbeck	BBV 9718	00025	2022/04/15
Spectrum Analyzer	Rohde&Schwarz	FSV-40N	10783	2022/04/15
Horn Antenna (18GHz-40GHz)	Schwarzbeck	BBHA 9170	BBHA9170242	2022/04/15
Pre-Amplifier (18GHz-40GHz)	EMCI	EMC 184045	980102	2022/04/15
High pass filter	Micro-Tronics	HPM50107	G050	2021/09/16
High pass filter	Micro-Tronics	HPM50117	G007	2021/09/16
Test software	EZ	EZ_EMC V1.1.4.2	N/A	N/A
Spectrum (10kHz~26.5GHz)	Keysight	N9020A	MY51240612	2021/09/16

Note: 1. The calibration interval of the above test instruments is 12/24months and the calibrations are traceable to CEPREI/CHINA.
 2. The test was performed in 966.



3.2.3 Test Procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters (below 1GHz) / 1.5 meters (1-18GHz) / 1.5 meters (18-40GHz) above the reference ground. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna (Below 1GHz) & (Above 1-18GHz), which was mounted on the top of a variable-height antenna tower. The EUT was set 1 meters away from the interference-receiving antenna (18-40GHz).
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

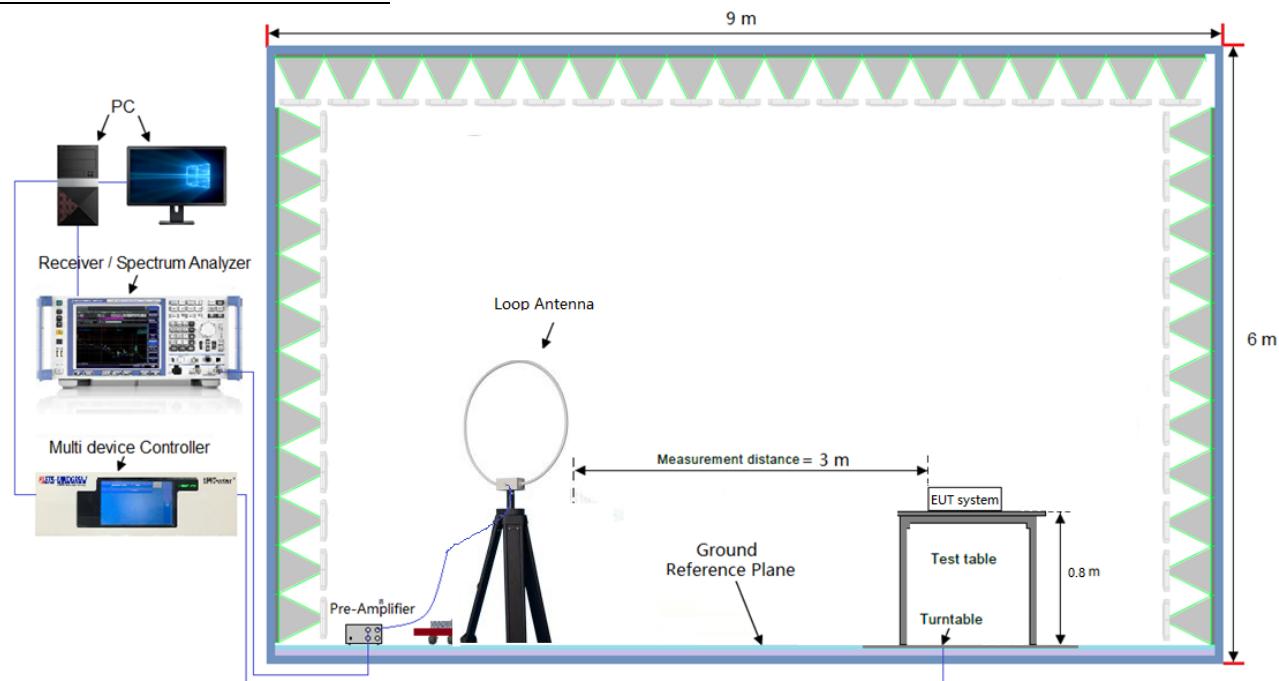
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz & 360kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 1/T for Average (Duty cycle < 98 %) detection at frequency above 1 GHz.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle \geq 98%) for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

3.2.4 Deviation from Test Standard

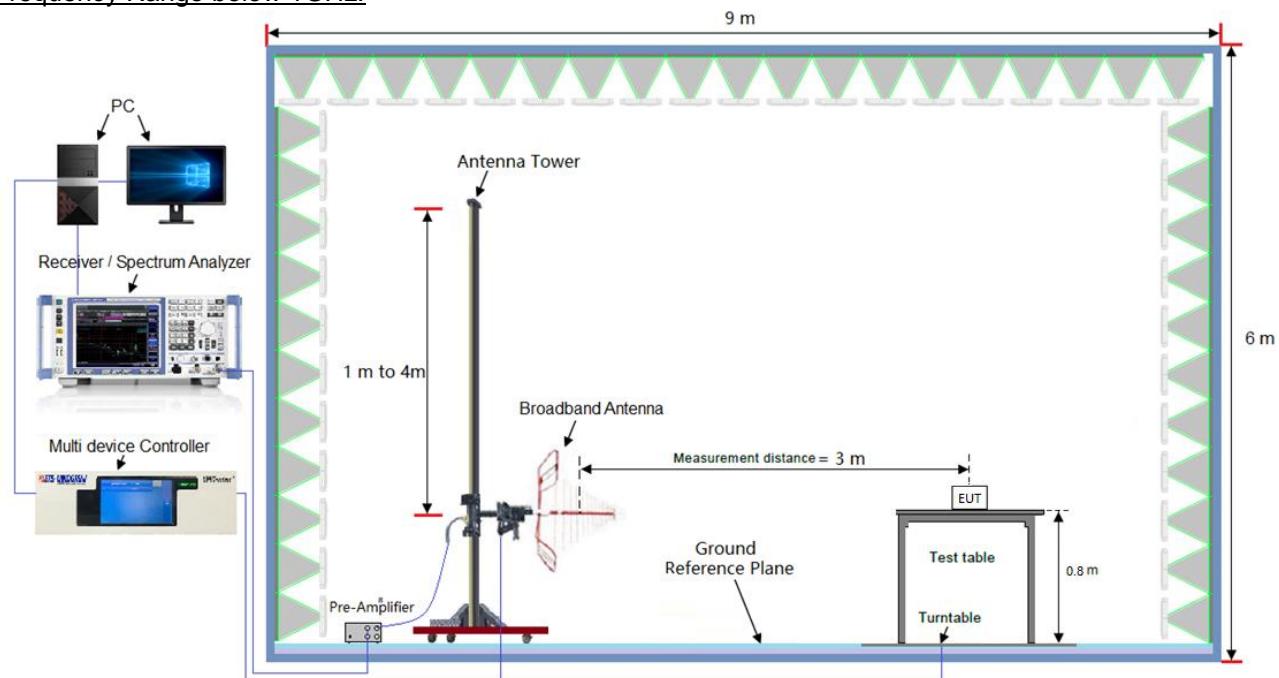
No deviation.

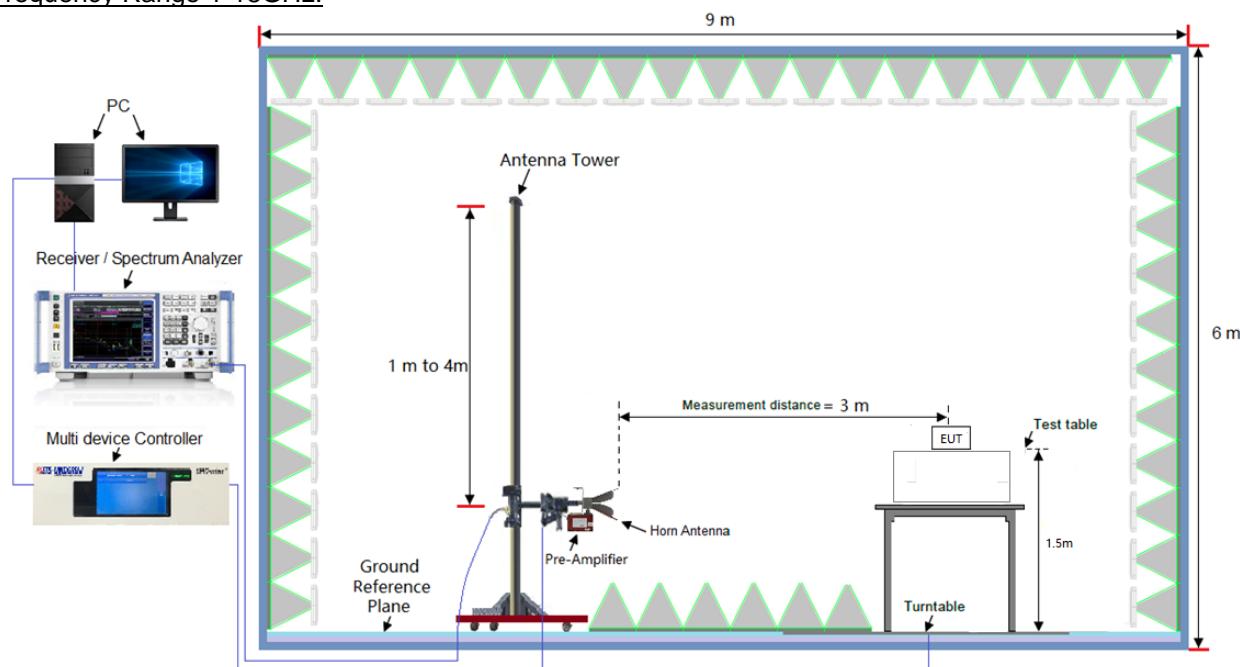
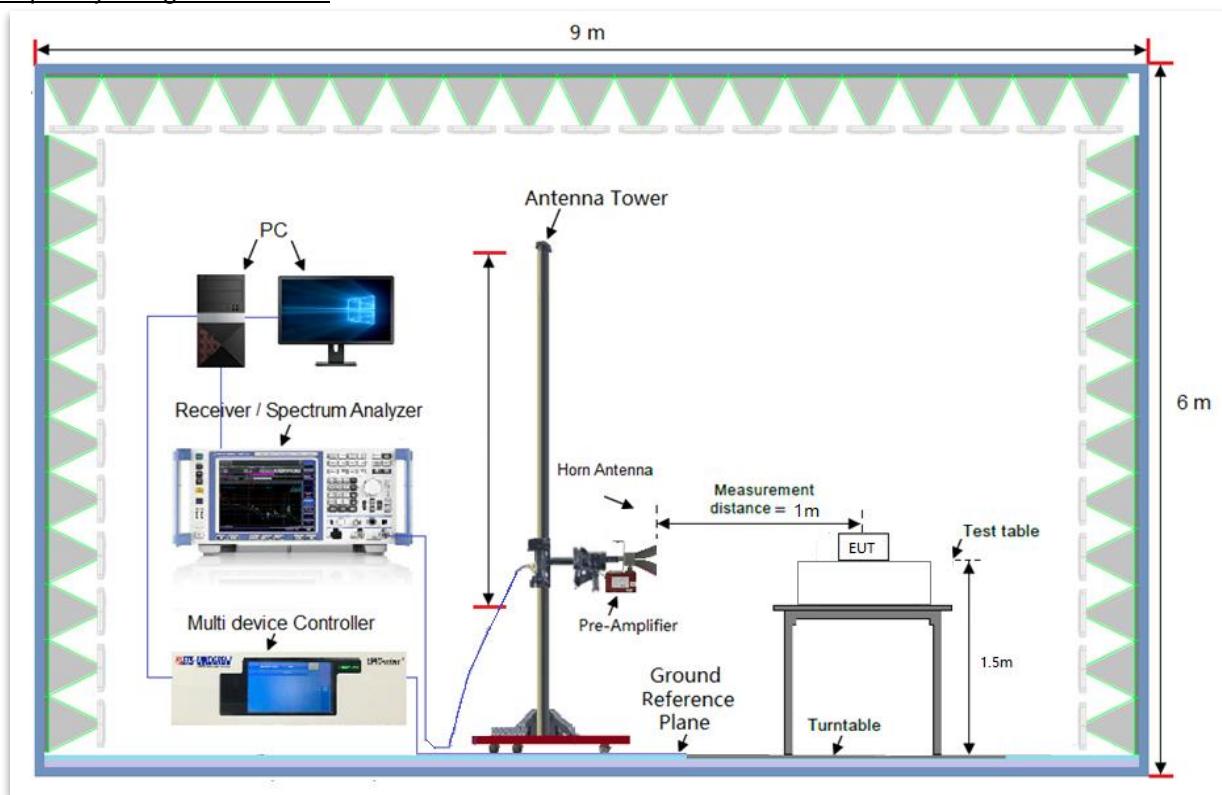
3.2.5 Test Setup

Radiated emission below 30MHz:



Frequency Range below 1GHz:



Frequency Range 1-18GHz:Frequency Range 18-40GHz:

For the actual test configuration, please refer to the attached file (Test Setup Photo).

3.2.6 EUT Operating Conditions

- Placed the EUT on the testing table.
- Set the EUT under transmission condition continuously at specific channel frequency.



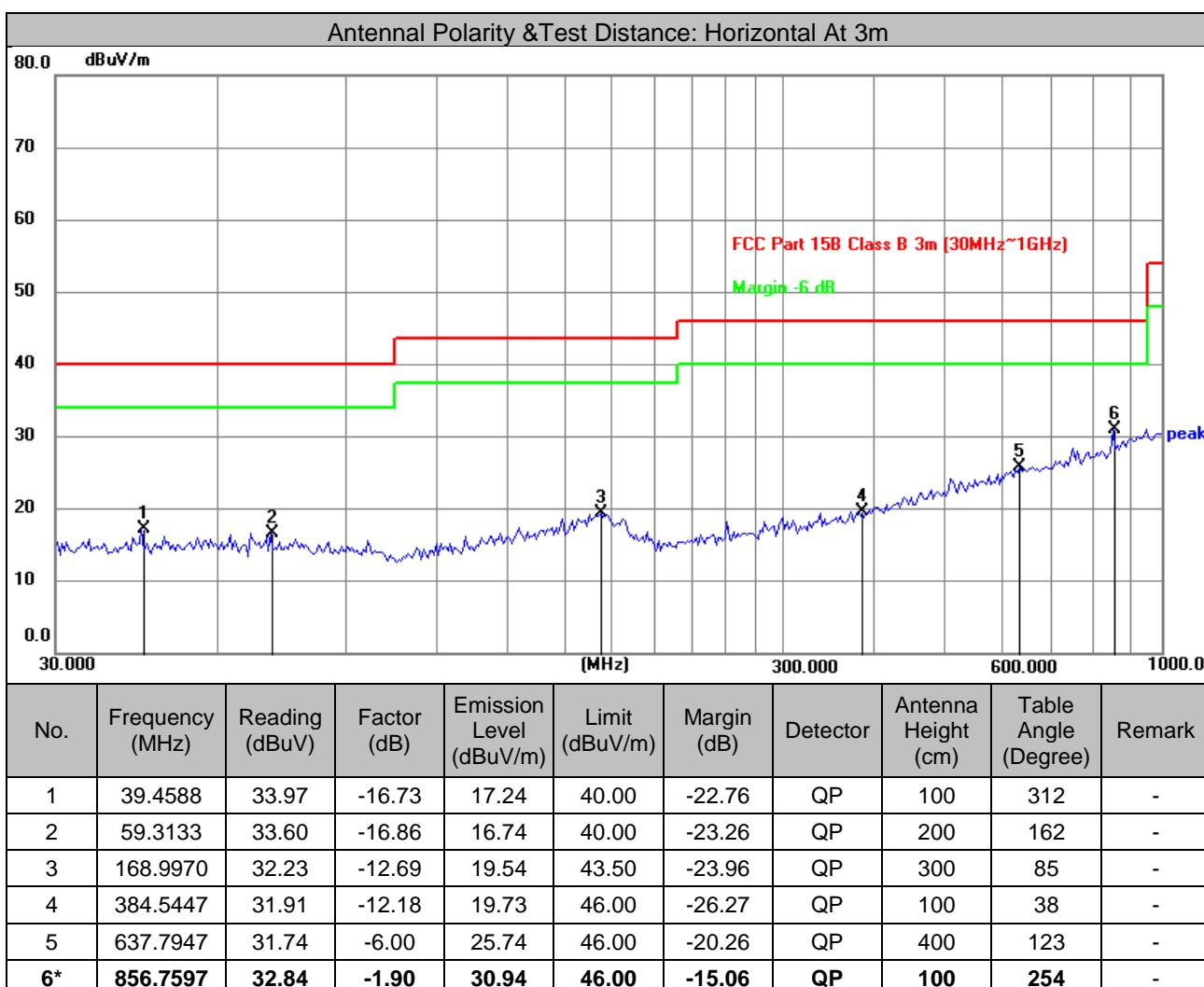
3.2.7 Test Results

9kHz ~ 30MHz:

The amplitude of spurious emissions attenuated more than 20dB below the permissible value is not required to be report.

30MHz ~ 1GHz:

Test Channel	Channel 1	Frequency Range	30MHz ~ 1GHz
Power supply	AC120V 60Hz	Detector Function	Peak (PK) Quasi-peak (QP)
Environmental Conditions	24deg. C, 57%RH	Tested By	Tank Tan



Remarks:

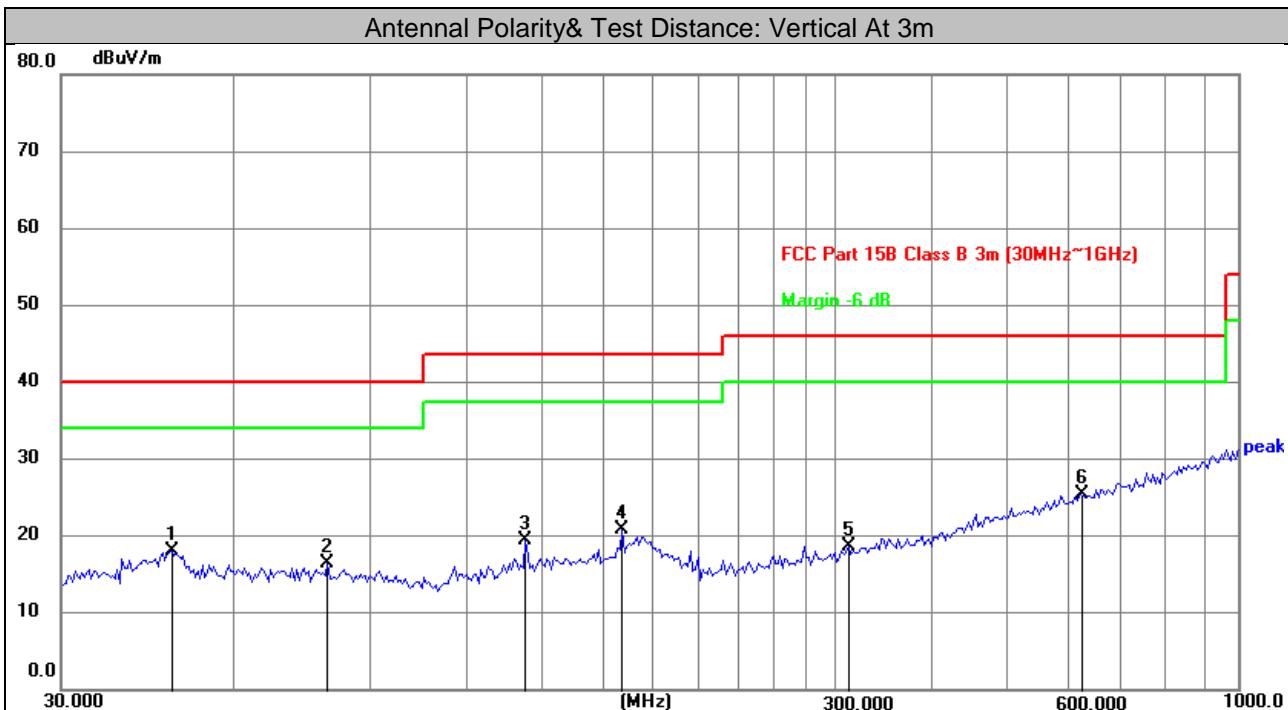
1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value



HWA-HSING

Test Report No.: 210325EL31-RF-US-01

Channel	Channel 1	Frequency Range	30MHz ~ 1GHz
Power supply	AC120V 60Hz	Detector Function	Peak (PK) Quasi-peak (QP)
Environmental Conditions	24deg. C, 57%RH	Tested By	Tank Tan



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)	Remark
1	41.7406	34.78	-16.73	18.05	40.00	-21.95	QP	100	78	-
2	66.3714	33.44	-16.99	16.45	40.00	-23.55	QP	100	175	-
3	119.7672	35.54	-16.10	19.44	43.50	-24.06	QP	200	65	-
4	159.7586	33.93	-13.04	20.89	43.50	-22.61	QP	100	350	-
5	313.6482	32.45	-13.80	18.65	46.00	-27.35	QP	400	124	-
6	624.4897	31.74	-6.29	25.45	46.00	-20.55	QP	300	258	-

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value

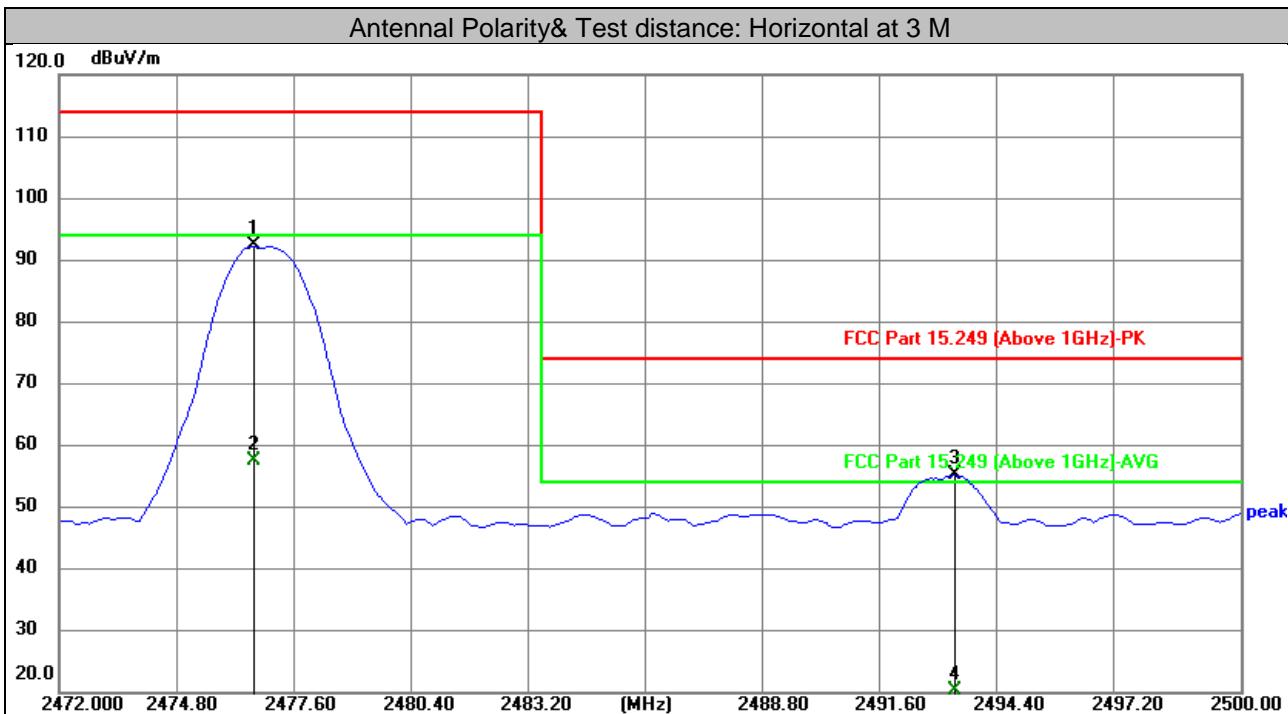


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Test Report No.: 210325EL31-RF-US-01

Above 1GHz Data:

Test Channel	Channel 1	Frequency Range	1GHz ~ 25GHz
Power supply	AC120V 60Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	24deg. C, 57%RH	Tested By	Tank Tan



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)	Remark
1	2476.601	93.58	-1.26	92.32	114.00	-21.68	peak	130	217	#
2	2476.601	58.89	-1.26	57.63	94.00	-36.37	AVG	130	217	#
3	2493.210	56.42	-1.24	55.18	74.00	-18.82	peak	240	179	
4	2493.210	21.73	-1.24	20.49	54.00	-33.51	AVG	240	179	
5	4954.000	58.41	4.88	63.29	74.00	-10.71	peak	139	267	
6	4954.000	23.72	4.88	28.60	54.00	-25.40	AVG	139	267	
7	7431.000	46.62	9.38	56.00	74.00	-18.00	peak	120	314	
8	7431.000	11.93	9.38	21.31	54.00	-32.69	AVG	120	314	

Remarks:

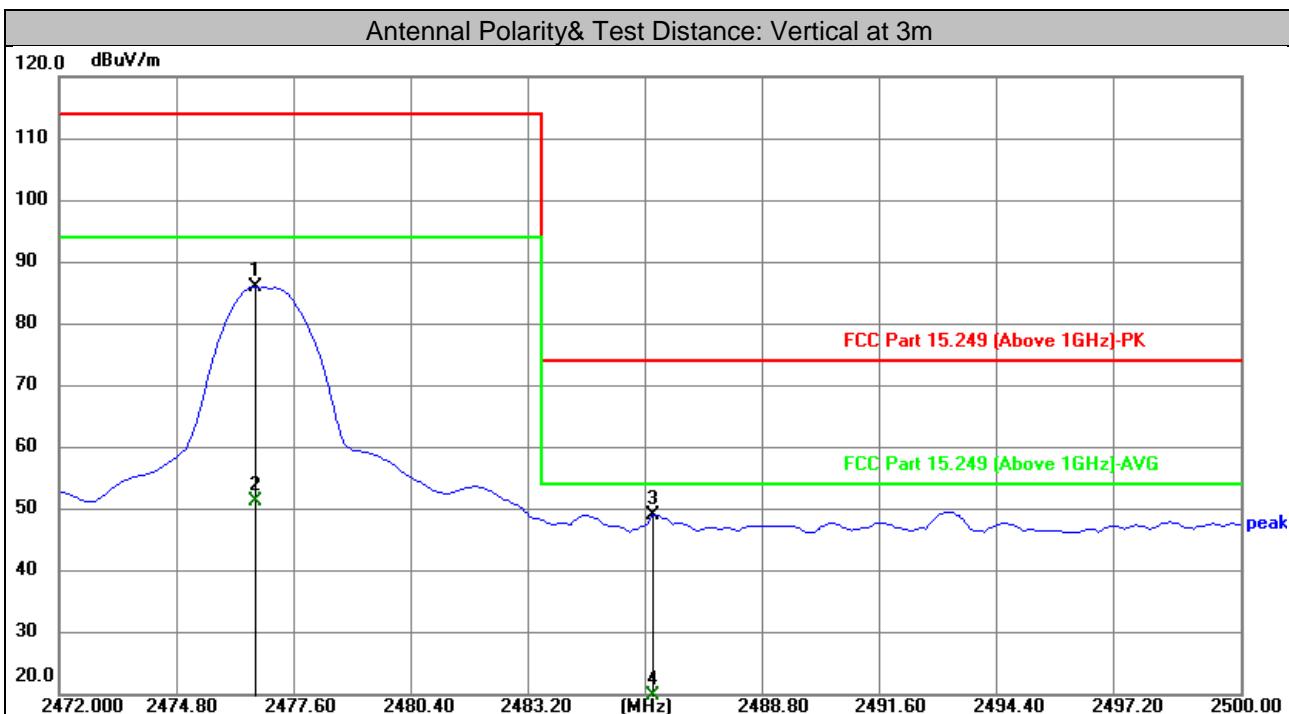
1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value
3. 2476.601MHz: Fundamental frequency.



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Test Report No.: 210325EL31-RF-US-01

Test Channel	Channel 1	Frequency Range	1GHz ~ 25GHz
Power supply	AC120V 60Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	24deg. C, 57%RH	Tested By	Tank Tan



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Height (cm)	Table Angle (Degree)	Remark
1	2476.657	87.20	-1.26	85.94	114.00	-28.06	peak	170	188	
2	2476.657	52.51	-1.26	51.25	94.00	-42.75	AVG	170	188	
3	2486.084	50.31	-1.24	49.07	74.00	-24.93	peak	170	188	#
4	2486.084	15.62	-1.24	14.38	54.00	-39.62	AVG	170	188	#
5	4954.000	60.92	4.88	65.80	74.00	-8.20	peak	160	152	
6	4954.000	26.23	4.88	31.11	54.00	-22.89	AVG	160	152	
7	7431.000	45.92	9.38	55.30	74.00	-18.70	peak	167	176	
8	7431.000	11.23	9.38	20.61	54.00	-33.39	AVG	167	176	

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value
3. 2476.657MHz: Fundamental frequency.

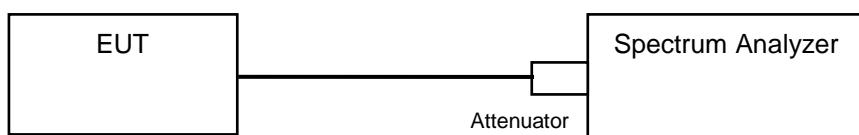


3.3 20dB Bandwidth Measurement

3.3.1 Limits of 20dB Bandwidth Measurement

According to FCC 15.215(c), must be designed to ensure that the 20dB 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.

3.3.2 Test Setup



3.3.3 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Next Cal. date
Spectrum Keysight	N9020A	MY51240612	2021/09/16
Spectrum Analyzer Rohde&Schwarz	FSV-40N	101783	2021/09/16

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA.
2. The test was performed in Chamber 1.

3.3.4 Test Procedure

- a). Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b). Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- c). Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
- d). Repeat above procedures until all frequencies measured were complete.

3.3.5 Deviation from Test Standard

No deviation.

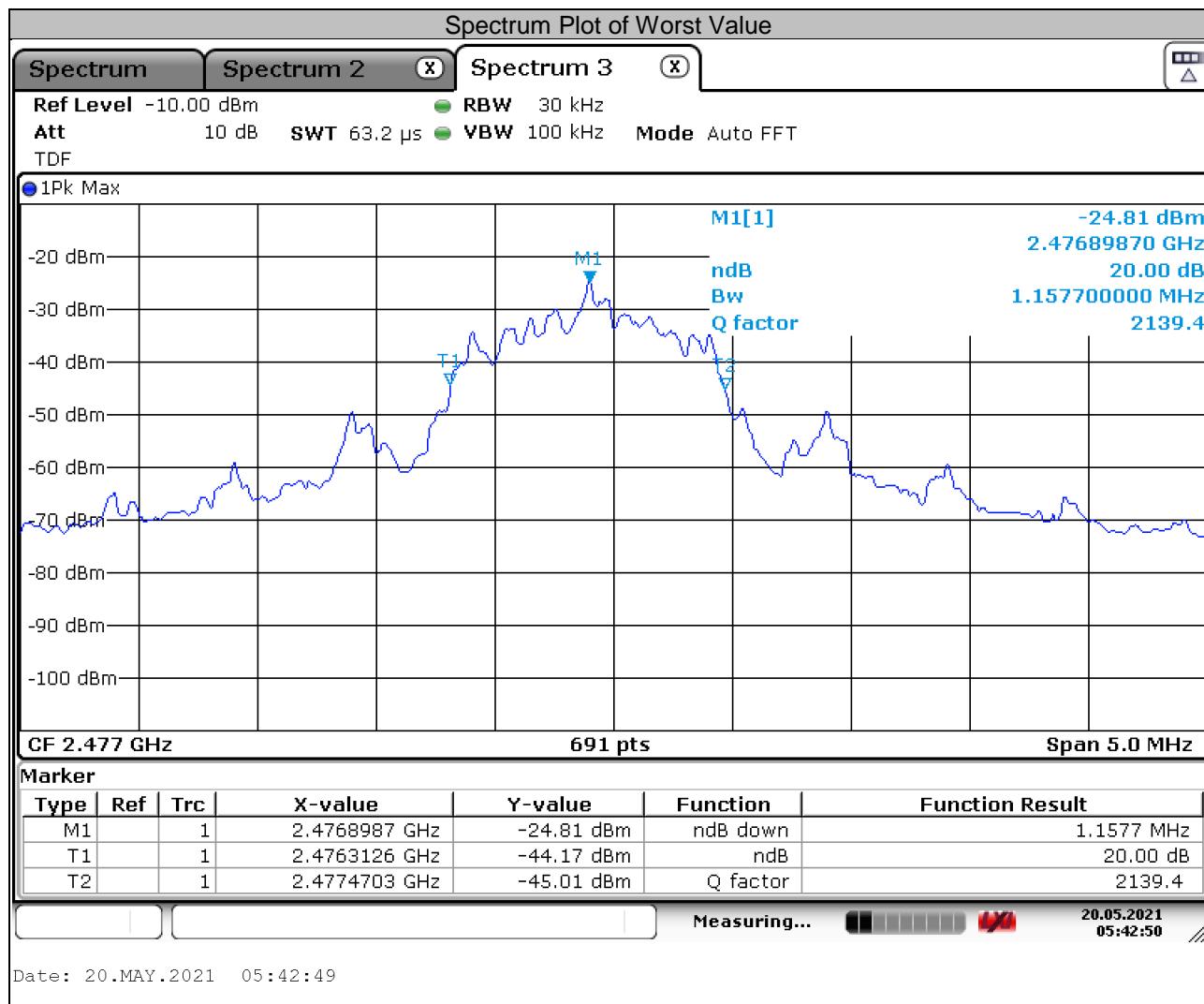
3.3.6 EUT Operating Conditions

- a). Turned on the power of all equipment.
- b). EUT was operated according to the type used was description in manufacturer's specifications or the User's Manual.



3.3.7 Test Result

Frequency (MHz)	20dB Bandwidth (MHz)	FL& FH (MHz)	Limit (MHz)	Pass / Fail
2477	1.1577	2476.312	2400~2483.5	Pass
		2477.470		





4. Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).



5. Appendix – Information on The Testing Laboratories

We, [Hwa-Hsing \(Dongguan\) Co., Ltd.](#), A global provider of TESTING and CERTIFICATION services for consumer products, electronic products and wireless information technology products. Adhering to the core values “HONEST and TRUSTWORTHY, OBJECTIVE and IMPARTIALITY, RIGOROUS and AFFICIENT”, commitment to provide professional, perfect and efficient comprehensive ONE-STOP solution of TESTING and CERTIFICATION services for Manufacturers, Buyers, Traders, Brands, Retailers. Assist client to better manage risk, protect their brands, reduce costs and cut time to over 150 markets in global. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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