

LG Electronics USA

EMC TEST REPORT

Report Type:

FCC Part 18 EMC report

Model:

MS1595###

REPORT NUMBER:

220502139SHA-001

ISSUE DATE:

June 1, 2022

DOCUMENT CONTROL NUMBER:

TTRF18_V1 © 2018 Intertek



TEST REPORT

Applicant: LG Electronics USA
111 Sylvan Avenue, Englewood Cliffs, New Jersey, United States

Manufacturing Site: LG Electronics Tianjin Appliances Co., Ltd.
No.9 Jinwei Road, Bei Chen Dist., Tianjin 300402, People’s Republic of China

Product Name: Microwave oven

Type/Model: MS1595###
("#" on model/type reference represents A to Z or blank, according to exterior design, color, cooking utensil or market)

FCC ID: BEJS159FZ

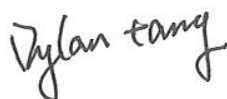
SUMMARY:

The equipment complies with the requirements according to the following standard(s) or Specification:

47CFR Part 18 (2018): Industrial, Scientific, and Medical Equipment

FCC/OET MP-5 (1986): FCC methods of Measurements of Radio Noise Emissions From Industrial, Scientific, and Medical Equipment

PREPARED BY:



Project Engineer
Dylan Tang

REVIEWED BY:



Reviewer
Wakeyou Wang

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TEST REPORT

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Revision History

Report No.	Version	Description	Issued Date
220502139SHA-001	Rev. 01	Initial issue of report	June 1, 2022

Measurement result summary

TEST ITEM	FCC REFERANCE	RESULT
Conducted Emission (150 kHz to 30 MHz)	18.307(b)	Pass
Radiated Emission (9 kHz to 30 MHz)	18.305(b)	Pass
Radiated Emission (30 MHz to1 GHz)	18.305(b)	Pass
Radiated Emission (1 GHz to 25 GHz)	18.305(b)	Pass
Operating Frequency	Clause 4.5	Pass
RF Output Power Measurement	Clause 4.3	Pass

Notes: 1: NA =Not Applicable

2. Determination of the test conclusion is based on IEC Guide 115 in consideration of measurement uncertainty.

3: Additions, Deviations and Exclusions from Standards: None.

TEST REPORT

1 GENERAL INFORMATION

1.1 Description of Equipment Under Test (EUT)

Product name:	Microwave oven
Type/Model:	MS1595### ("#" on model/type reference represents A to Z or blank, according to exterior design, color, cooking utensil or market)
Brand Name:	LG
Description of EUT:	The EUT is a Microwave oven which have series models, and they are electric identical. The model LMC1575BD were chosen to testing.
Rating:	AC 120V 60Hz Output: 1250W
Frequency:	2450MHz
EUT type:	<input checked="" type="checkbox"/> Table top <input type="checkbox"/> Floor standing
Software Version:	/
Hardware Version:	/
Sample received date:	May 14, 2022
Date of test:	May 14, 2022 ~ May 30 , 2022

1.2 Description of Test Facility

Name:	Intertek Testing Services Shanghai
Address:	Building 86, No. 1198 Qinzhou Road(North), Shanghai 200233, P.R. China
Telephone:	86 21 61278200
Telefax:	86 21 54262353

The test facility is recognized, certified, or accredited by these organizations:	CNAS Accreditation Lab Registration No. CNAS L0139
	FCC Accredited Lab Designation Number: CN1175
	IC Registration Lab CAB identifier.: CN0051
	VCCI Registration Lab Registration No.: R-14243, G-10845, C-14723, T-12252
	A2LA Accreditation Lab Certificate Number: 3309.02

TEST REPORT

All tests were sub-contracted.

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng Science and Technology Park, Longhua District, Shenzhen, China 518109

Telephone: +86 (0) 755 2823 0888

Fax: +86 (0) 755 2823 0886

All tests were sub-contracted at Shenzhen UnionTrust Quality and Technology Co., Ltd, and conducted by Kieron Luo

Reviewed and approved by Wakeyou Wang from Intertek Testing Services Shanghai.

The test facility is recognized, certified, or accredited by the following organizations:**CNAS-Lab Code: L9069**

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC/EN 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

IC-Registration No.: 21600-1

The 3m Semi-anechoic chamber of Shenzhen UnionTrust Quality and Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 21600-1.

A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC Accredited Lab.

Designation Number: CN1194

Test Firm Registration Number: 259480

2 TEST SPECIFICATIONS

2.1 Standards or specification

47CFR Part 18 (2018)
FCC/OET MP-5 (1986)

2.2 Mode of operation during the test

Within this test report, EUT was tested under all available operation modes and tested under its rating voltage and frequency. Other voltage and frequency are specified if used.

Worst test mode: Working mode with full power.

2.3 Test software list

Test Items	Software	Manufacturer	Version
Conducted emission	ESxS-K1	R&S	V2.1.0
Radiated emission	ES-K1	R&S	V1.71

2.4 Test peripherals list

Item No.	Name	Band and Model	Description
1	Beaker	NA	1000/700/300mL

2.5 Test Load Description

Load for power output measurement, frequency measurement, radiation hazard test: 1000 milliliters of water in the beaker located in the center of the oven;
Load for measurement of radiation on second and third harmonic: Two loads, one of 700 and the other of 300 milliliters, of water are used. Each load is tested both with the beaker located in the center of the oven and with it in the right front corner.
Load for all other measurements: 700 milliliters of water, with the beaker located in the center of the oven.

TEST REPORT**2.6 Test environment condition:**

Test items	Temperature	Humidity
Radiated Emissions	22°C	55% RH
Conducted Emission	21°C	52% RH

2.7 Instrument list

Radiated Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
<input checked="" type="checkbox"/>	3m Chamber SAC	ETS-LINDGREN	3m	NA	2024-01-21
<input checked="" type="checkbox"/>	Receiver	R&S	ESIB26	100114	2022-11-04
<input checked="" type="checkbox"/>	Broadband Antenna (Pre-amplifier)	ETS-Lindgren	3142E-PA	00201891	2023-04-29
<input checked="" type="checkbox"/>	6dB Attenuator	Talent	RA6A5-N-18	18103001	2023-11-10
<input checked="" type="checkbox"/>	Preamplifier	HP	8447F	2805A02960	2022-11-04
<input checked="" type="checkbox"/>	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-Lindgren	3117-PA	00201541	2023-04-29
<input checked="" type="checkbox"/>	Pre-amplifier	ETS-Lindgren	00118385	00201874	2022-11-05
<input checked="" type="checkbox"/>	Loop Antenna	ETS-Lindgren	6502	00202525	2023-11-10
<input checked="" type="checkbox"/>	Band Reject Filter(2400MHz~2500MHz)	Micro-Tronics	BRM50702	G248	2022-11-05
<input checked="" type="checkbox"/>	Test Software	Audix	e3	Software Version: 9.160323	
Conducted Emission Test Equipment List					
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. Due date (mm dd, yyyy)
<input checked="" type="checkbox"/>	Receiver	R&S	ESR7	1316.3003K07-101181-K3	Nov. 04, 2022
<input checked="" type="checkbox"/>	Pulse Limiter	R&S	ESH3-Z2	0357.8810.54	Nov. 04, 2022
<input checked="" type="checkbox"/>	LISN	R&S	ESH2-Z5	860014/024	Nov. 04, 2022

2.8 Measurement uncertainty

The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Test item	Measurement uncertainty
Radiated Emissions in restricted frequency bands below 1GHz	± 4.90dB
Radiated Emissions in restricted frequency bands above 1GHz	± 5.02dB
Power line conducted emission	± 3.19dB

3 Operating Frequency

Test result: Pass

3.1 Limit

ISM equipment may be operated on any frequency above 9 kHz. And the frequency band 2400-2500MHz is allocated for use by ISM equipment. (§18.301)

ISM frequency	Tolerance
6.78 MHz	±15.0 kHz
13.56 MHz	±7.0 kHz
27.12 MHz	±163.0 kHz
40.68 MHz	±20.0 kHz
915 MHz	±13.0 MHz
2,450 MHz	±50.0 MHz
5,800 MHz	±75.0 MHz
24,125 MHz	±125.0 MHz
61.25 GHz	±250.0 MHz
122.50 GHz	±500.0 MHz
245.00 GHz	±1.0 GHz

3.2 Measurement Procedure

a) Frequency for Normal Voltage

The operating frequency was measured using a spectrum analyzer. Starting with the EUT at room temperature, a 1000mL water load was placed in the center of the oven and the oven was operated at maximum output power. The fundamental operating frequency was monitored until the water load was reduced to 20 percent of the original load.

b) Frequency for Line Voltage

The EUT was operated / warmed by at least 10 minutes of use with a 1000 mL water load at room temperature at the beginning of the test. Then the operating frequency was monitored as the input voltage was varied between 80 and 125 percent of the nominal rating.

3.3 Test Results

Item	START Frequency (MHz)	STOP Frequency (MHz)
Frequency for Normal Voltage	2401.86	2476.25
Frequency for Line Voltage	2402.05	2478.68

4 RF Output Power Measurement

Test result: Pass

4.1 Limit

NA

4.2 Measurement Procedure

The EUT in microwave mode with full power.

Formula:

$$P = \frac{4,187 \cdot m_w(T_2 - T_1) + 0,55 \cdot m_c(T_2 - T_0)}{t}$$

NOTE:

P is the microwave power output (W)

m_w is the mass of the water (g)

m_c is the mass of the container (g)

T₀ is the ambient temperature (°C)

T₁ is the initial temperature of the water (°C)

T₂ is the final temperature of the water (°C)

t is the heating time (s), excluding the magnetron filament heating-up time (s).

4.3 Test Results

Quantity of Water [ml]	Mass of the container [g]	Ambient temperature [°C]	Initial temperature [°C]	Final temperature [°C]	Heating time [s]	Power output [W]
1 000	390	22.6	21.7	50.3	120	1082

5 Radiation Hazard Measurement

Test result: Pass

5.1 Limit

A maximum of 1.0mW/cm² is allowed in accordance with the applicable FCC standards. Hence, microwave leakage in the as-received condition with the oven door closed was below the maximum allowed.

5.2 Measurement Procedure

The EUT was set-up according to the FCC MP-5 and FCC Part 18 for Radiation Hazard Measurement. The measurement was using a microwave leakage meter to measure the Radiation leakage in the as-received condition with the oven door closed. A 1000ml water load in a beaker was located in the center of the oven and the Microwave Oven was set to maximum power. While the oven operating, the microwave meter will check the leakage and then record the maximum leakage.

5.3 Test Results

There was no microwave leakage exceeding a power level of 0.15mW/cm² observed at any point 5cm or more from the external surface of the oven.

6 Radiated Emissions

Test result: Pass

6.1 Limit

- (a) ISM equipment operation on a frequency specified in §18.301 is permitted unlimited radiated energy in the band specified for that frequency.
- (b) The field strength levels of emissions which lie outside the bands specified in §18.301, unless otherwise indicated, shall not exceed the following:

Equipment	Operating frequency	RF Power generated by equipment (watts)	Field strength limit (uV/m)	Distance (meters)
Any type unless otherwise specified (miscellaneous)	Any ISM frequency	Below 500	25	300
		500 or more	$25 \times \text{SQRT}(\text{power}/500)$	300

RF Power = 1082W according to clause 4.3

Limit = $20\lg(25 \times \text{SQRT}(\text{power}/500)) + 20\lg(300/3) = 31.31 + 40 = 71.31\text{dBuV/m @ 3m distance.}$

6.2 Measurement Procedure

For Radiated emission below 30MHz:

- a) The EUT was placed on the top of a rotating table 1 meters above the ground at a 3 meter chamber room. 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, which was mounted on the top of a variable-height antenna tower.
- c) Both X and Y axes of the antenna are set to make the measurement.
- d) For each suspected emission, the EUT was arranged to its worst case 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.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

TEST REPORT**For Radiated emission above 30MHz:**

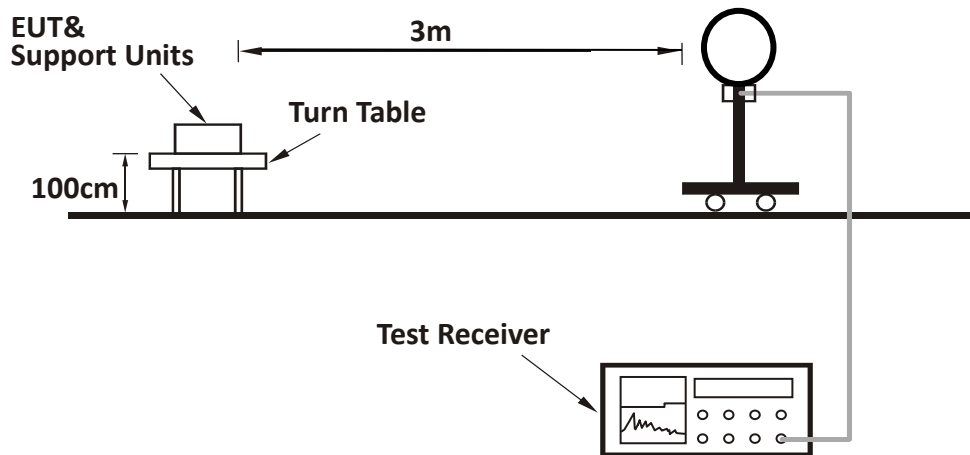
- a) The EUT was placed on the top of a rotating table 1.0 meters above the ground at 3-meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 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 detect 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:

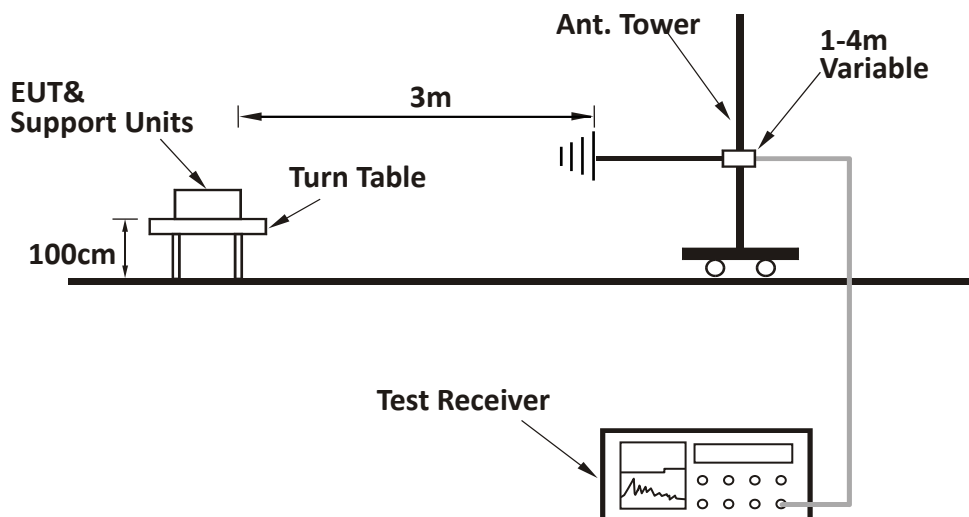
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

6.3 Test Configuration

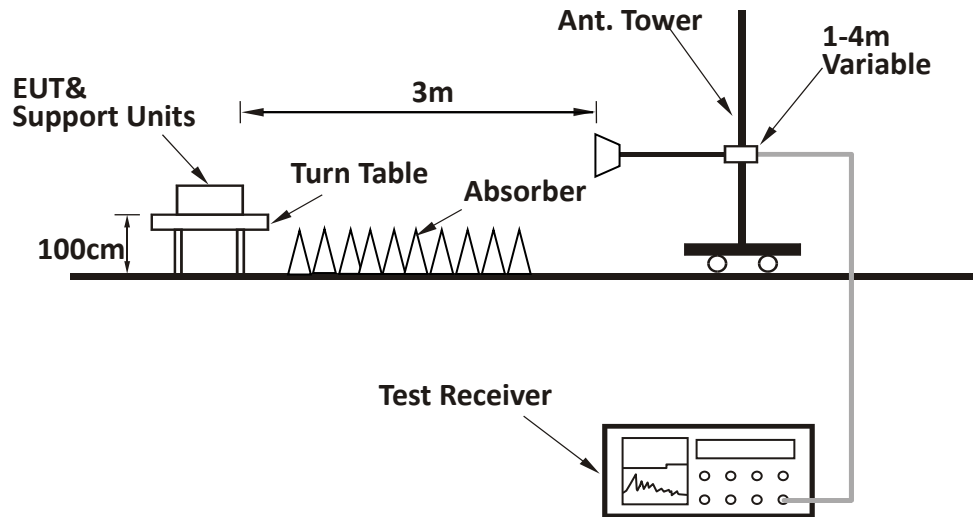
For Radiated emission below 30MHz:



For Radiated emission 30MHz to 1GHz:

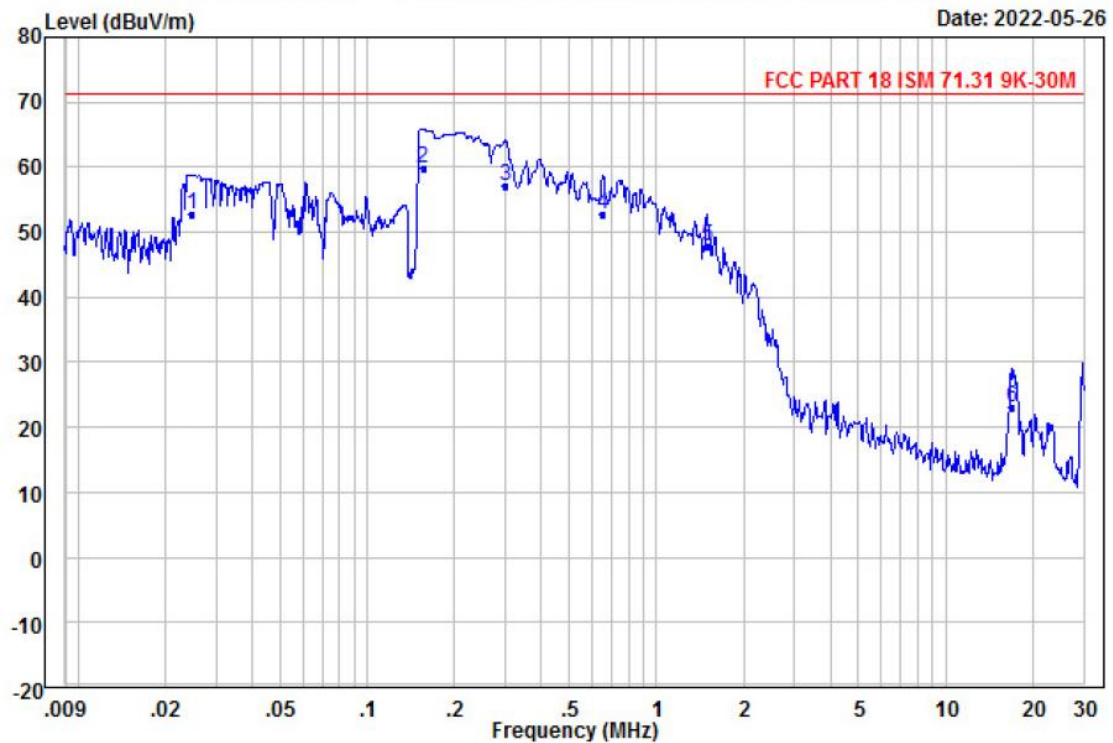


For Radiated emission above 1GHz:

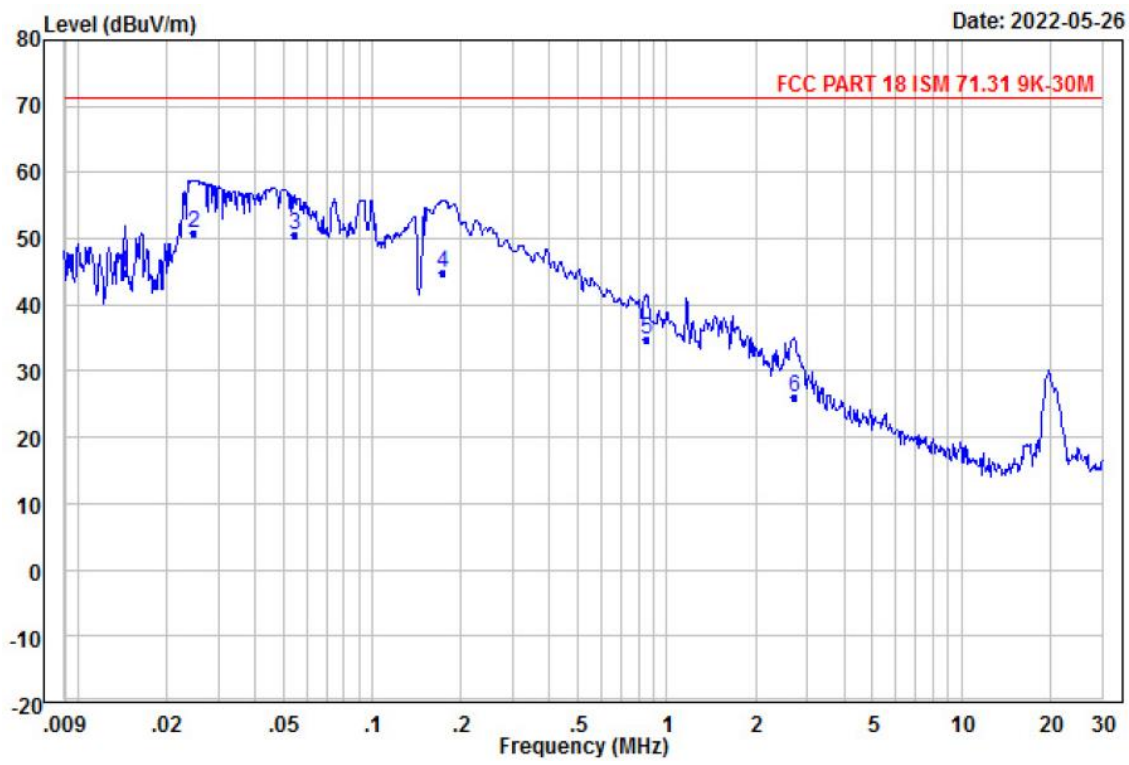


6.4 Test Results of Radiated Emissions

Test plots of 9KHz ~ 30MHz:



X



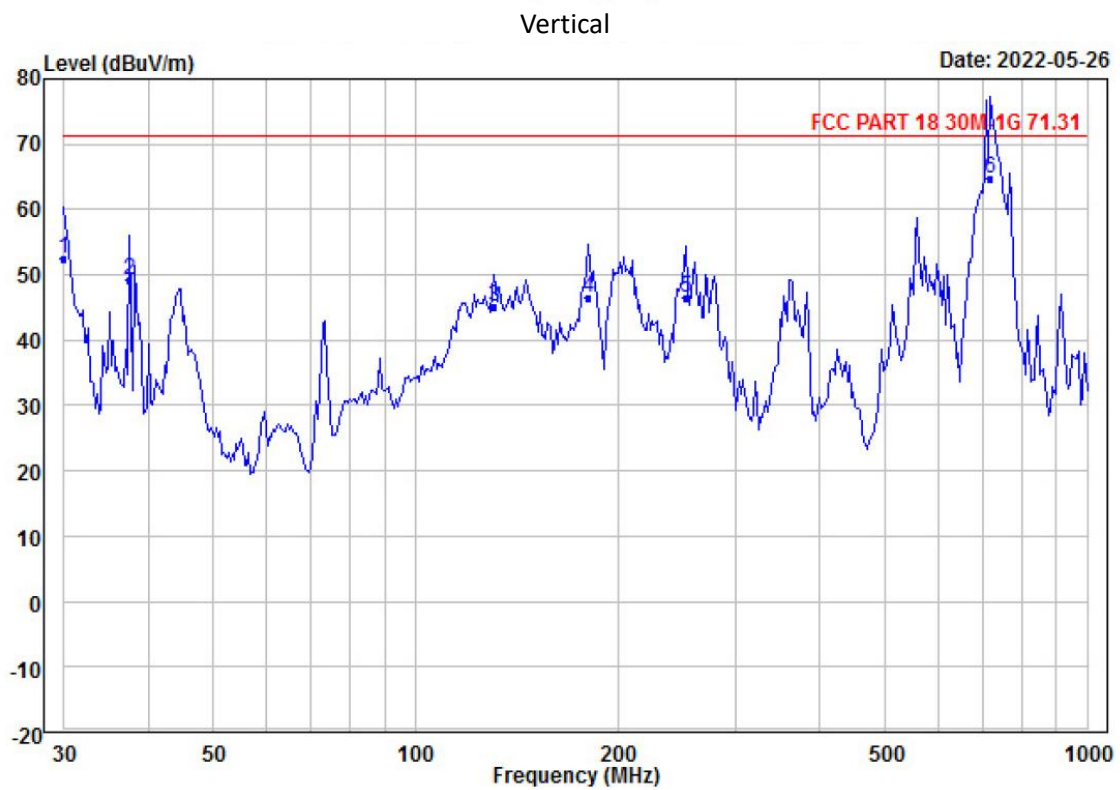
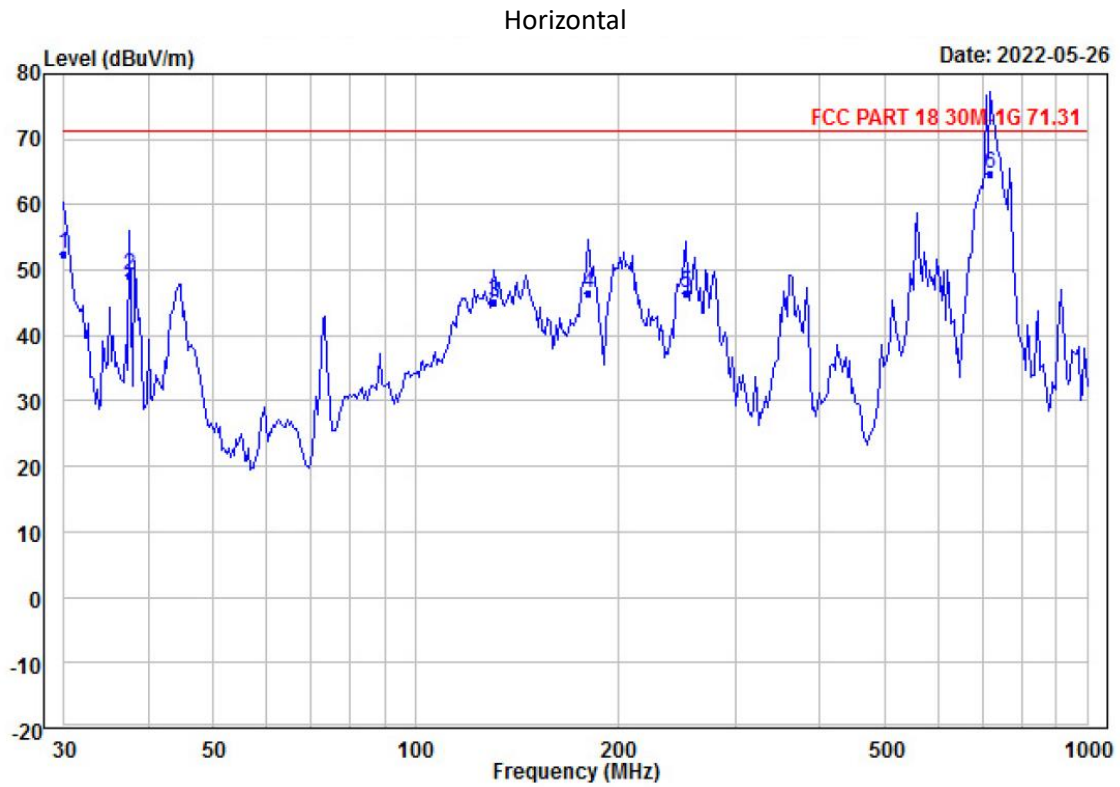
Y

TEST REPORT

Test data of 9KHz ~ 30MHz:

Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
X	0.025	52.80	71.31	18.51	AV
X	0.156	59.76	71.31	11.55	AV
X	0.300	57.11	71.31	14.20	AV
X	0.647	52.72	71.31	18.59	AV
X	1.499	47.79	71.31	23.52	AV
X	16.892	23.07	71.31	48.24	AV
Y	0.014	44.92	71.31	26.39	AV
Y	0.025	50.78	71.31	20.53	AV
Y	0.054	50.59	71.31	20.72	AV
Y	0.173	44.75	71.31	26.56	AV
Y	0.853	34.66	71.31	36.65	AV
Y	2.691	26.15	71.31	45.16	AV

Test plots of 30MHz ~ 1GHz:



TEST REPORT

Test data of 30MHz ~ 1GHz:

Polarization	Frequency (MHz)	Corrected Reading (dBuV/m)	Limits (dBuV/m)	Margin (dBuV/m)	Detector
Horizontal	30.000	52.39	71.31	18.92	AV
	37.565	49.11	71.31	22.20	AV
	131.224	44.99	71.31	26.32	AV
	181.300	46.59	71.31	24.72	AV
	252.252	46.51	71.31	24.80	AV
	718.725	64.74	71.31	6.57	AV
Vertical	30.000	43.11	71.31	28.20	AV
	46.708	40.48	71.31	30.83	AV
	118.096	39.89	71.31	31.42	AV
	178.770	32.71	71.31	38.60	AV
	246.990	38.30	71.31	33.01	AV
	723.793	57.68	71.31	13.63	AV

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Test data of 1GHz ~ 25GHz:

Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
H	1553.044	61.17	71.31	10.14	AV
H	2455.701	69.98	71.31	1.33	AV
H	4181.646	61.45	71.31	9.86	AV
H	7419.751	67.07	71.31	4.24	AV
H	8187.553	64.90	71.31	6.41	AV
H	11129.600	65.59	71.31	5.72	AV
V	1544.074	61.26	71.31	10.05	AV
V	2086.787	56.04	71.31	15.27	AV
V	2455.661	67.85	71.31	3.46	AV
V	4181.646	58.24	71.31	13.07	AV
V	7419.751	59.52	71.31	11.79	AV
V	8187.553	61.23	71.31	10.08	AV
H	19876.810	58.24	71.31	13.07	AV
H	22605.800	58.11	71.31	13.2	AV
H	23173.910	58.28	71.31	13.03	AV
V	19978.260	58.55	71.31	12.76	AV
V	22575.360	58.05	71.31	13.26	AV
V	24259.420	56.37	71.31	14.94	AV

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz), the value was added to Original Receiver Reading by the software automatically.

2. Corrected Reading = Original Receiver Reading + Correct Factor

3. Margin = Limit - Corrected Reading

4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
 Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBuV,
 Limit = 40.00dBuV/m.
 Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m;
 Corrected Reading = 10dBuV + 0.20dB/m = 10.20dBuV/m;
 Margin = 40.00dBuV/m - 10.20dBuV/m = 29.80dB.

7 Conducted Emission

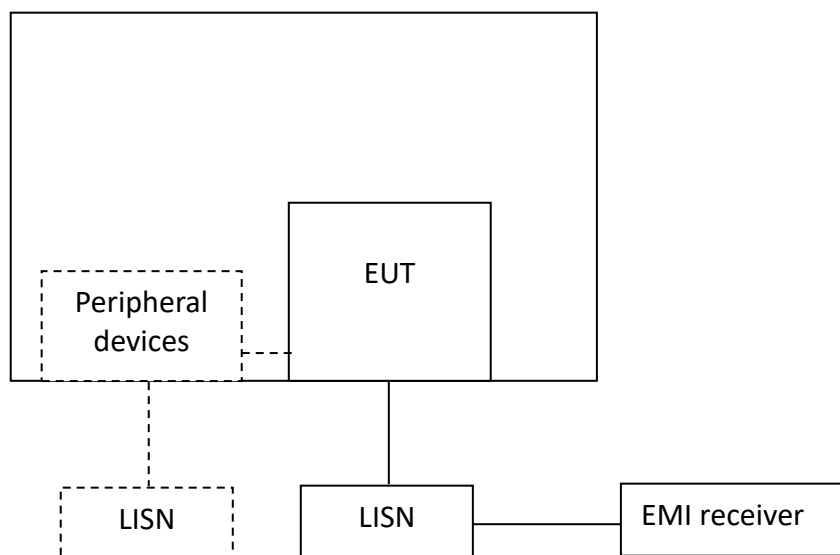
Test result: Pass

7.1 Limit

Frequency range (MHz)	Limits dB(μV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 ~ 56 *	56 ~ 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

Note: 1. * Means the limit decreasing linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz
 2. If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the equipment under test shall be deemed to meet both limits and the measurement using the receiver with an average detector need not be carried out.

7.2 Test Configuration



TEST REPORT**7.3 Measurement Procedure**

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having 50 Ω input impedance. All other ports are terminated in 50 Ω loads.

Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

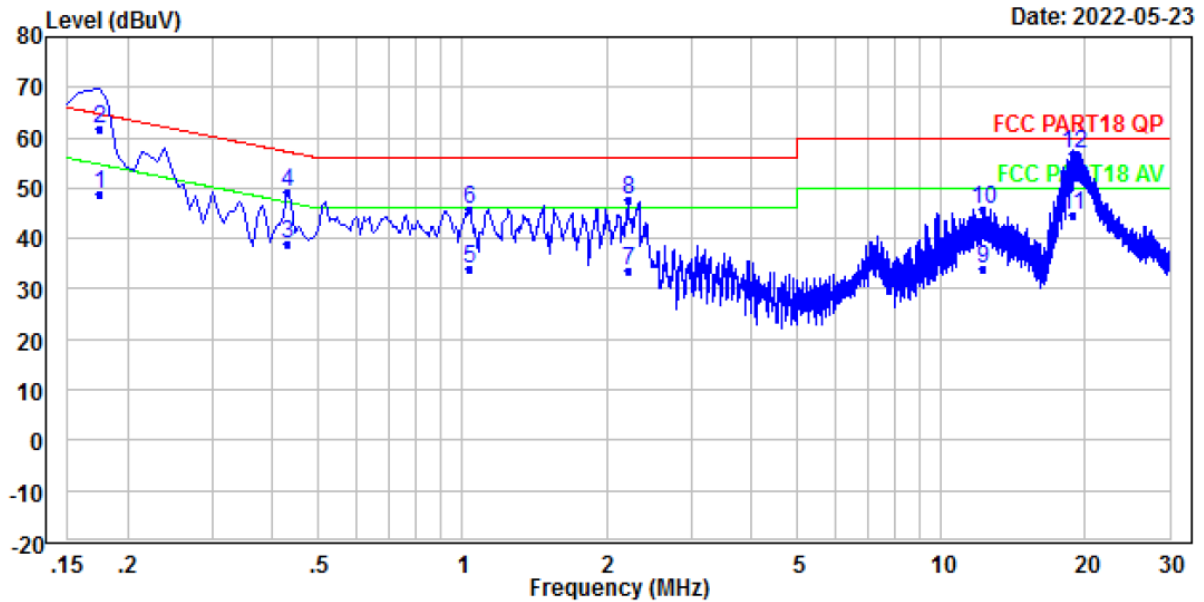
The bandwidth of the test receiver is set at 9 kHz.

TEST REPORT

7.4 Test Results of Power line conducted emission

Test Curve:

L Line



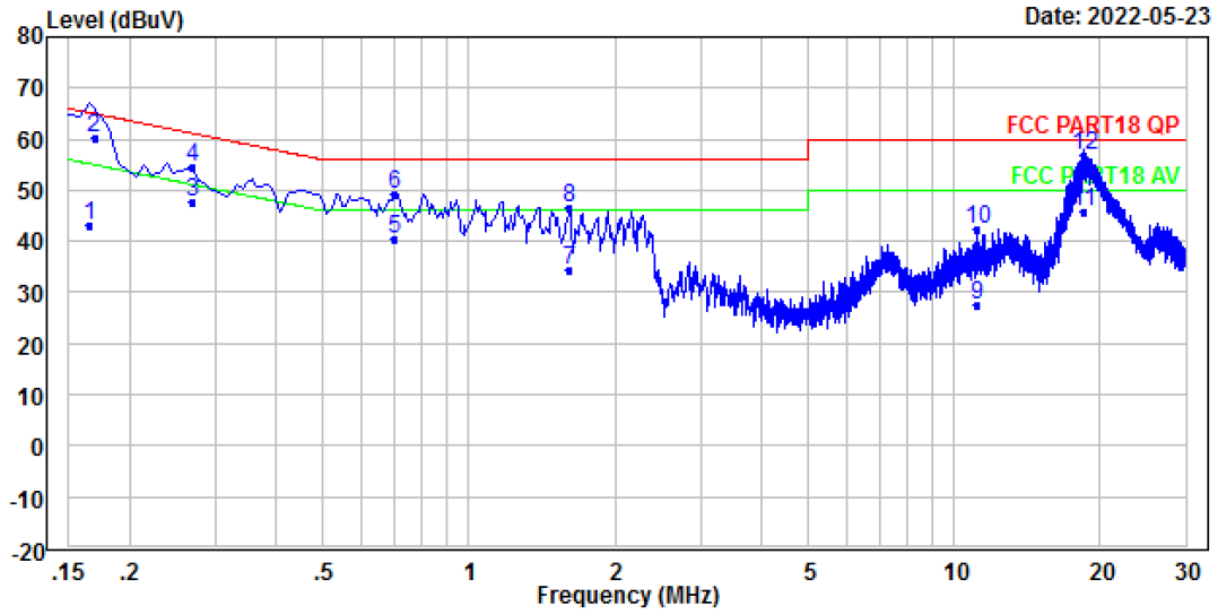
Test Data:

Frequency	Level dBuV	Limit dBuV	Margin dB	Detector	Frequency	Level dBuV	Limit dBuV	Margin dB	Detector
0.174	61.59	64.77	3.18	QP	0.174	48.79	54.77	5.98	AV
0.430	49.06	57.25	8.19	QP	0.430	39.06	47.25	8.19	AV
1.038	45.92	56.00	10.08	QP	1.038	33.92	46.00	12.08	AV
2.222	47.50	56.00	8.50	QP	2.222	33.50	46.00	12.50	AV
12.188	45.91	60.00	14.09	QP	12.188	33.91	50.00	16.09	AV
18.794	56.75	60.00	3.25	QP	18.794	44.75	50.00	5.25	AV

TEST REPORT

Test Curve:

N Line



Test Data:

Frequency	Level dBuV	Limit dBuV	Margin dB	Detector	Frequency	Level dBuV	Limit dBuV	Margin dB	Detector
0.166	60.11	65.00	4.89	QP	0.166	42.98	55.16	12.18	AV
0.270	54.51	61.12	6.61	QP	0.270	47.51	51.12	3.61	AV
0.702	49.30	56.00	6.70	QP	0.702	40.30	46.00	5.70	AV
1.614	46.38	56.00	9.62	QP	1.614	34.38	46.00	11.62	AV
11.164	42.40	60.00	17.6	QP	11.164	27.40	50.00	22.6	AV
18.458	56.78	60.00	3.22	QP	18.458	45.78	50.00	4.22	AV

Remark: 1. Margin = Limit - Level

2. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

Appendix I: Photograph of test setup

Refer to Test set up photos.

Appendix II: Photograph of equipment under test

Refer to EUT External photos and Internal photos.

***** END *****