FCC PART 18

TEST REPORT

For

Whirlpool Microwave Products Development Limited.

16/F, Paliburg Plaza 68 Yee Woo Street, Causeway Bay, Hong Kong

FCC ID: PR4RED199X1

Report Type:	Product Type:
Class II Permissive Change	Microwave oven

Report Number: SZ2211019-53569E-EM

Report Date: 2021-11-04

Reviewed By: Candy Li, RF Engineer

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Microwave oven
Tested Model	WMH31017
Trademark	Whirlpool
Voltage Range	AC 120V/60Hz
Highest operating frequency	2450 MHz
Microwave Output power	1000W
Microwave Input power	1800W
Date of Test	2021-10-22 to 2021-10-30
Sample serial number	SZ2211019-53569E-EM-S1 (Assigned by ATC)
Received date	2021-10-19
Sample/EUT Status	Good condition

Objective

This report is in accordance with Part 2-Subpart J, and Part 18-Subparts A, B and C of the Federal Communication Commissions rules and regulations.

The objective of the manufacturer is to determine compliance with FCC Part 18 limits.

This is a CIIPC application of the device; the differences between the original device and the current one are as follows:

1. Change the magnetron.
2. Change the Control Board
3. Change the motor start capacitor

Based on above differences, it's will affect all the test of item, so all the items were performed, we will updated the test data and EUT photos.

Test Methodology

All measurements contained in this report were conducted with MP-5, FCC Methods of Measurements of Radio Noise Emissions from ISM Equipment, February 1986. All measurements were performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters. Each test item follows test standards and with no deviation.

Measurement Uncertainty

Parameter		Uncertainty
RF Frequency		$0.082*10^{-7}$
AC Power Lines Conducted Emissions		2.72dB
Emissions, Radiated	30MHz - 1GHz	4.28dB
	1GHz - 18GHz	4.98dB
	18GHz - 26.5GHz	5.06dB
Temperature		1℃
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISEDC), the Registration Number is 5077A.

OPERATING CONDITION/TEST CONFIGURATION

Justification

The EUT was operated at maximum (continuous) RF output power. The loads consisted of water in a glass beaker in the amounts specified in the test procedure.

EUT Exercise Software

No exercise software was used.

Special Accessories

No special accessory was used.

Equipment Modifications

No modifications were made to the EUT tested.

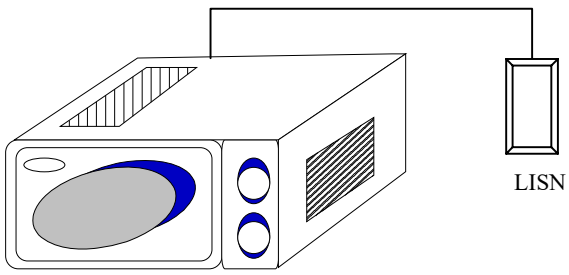
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
/	Glass beaker	/	/

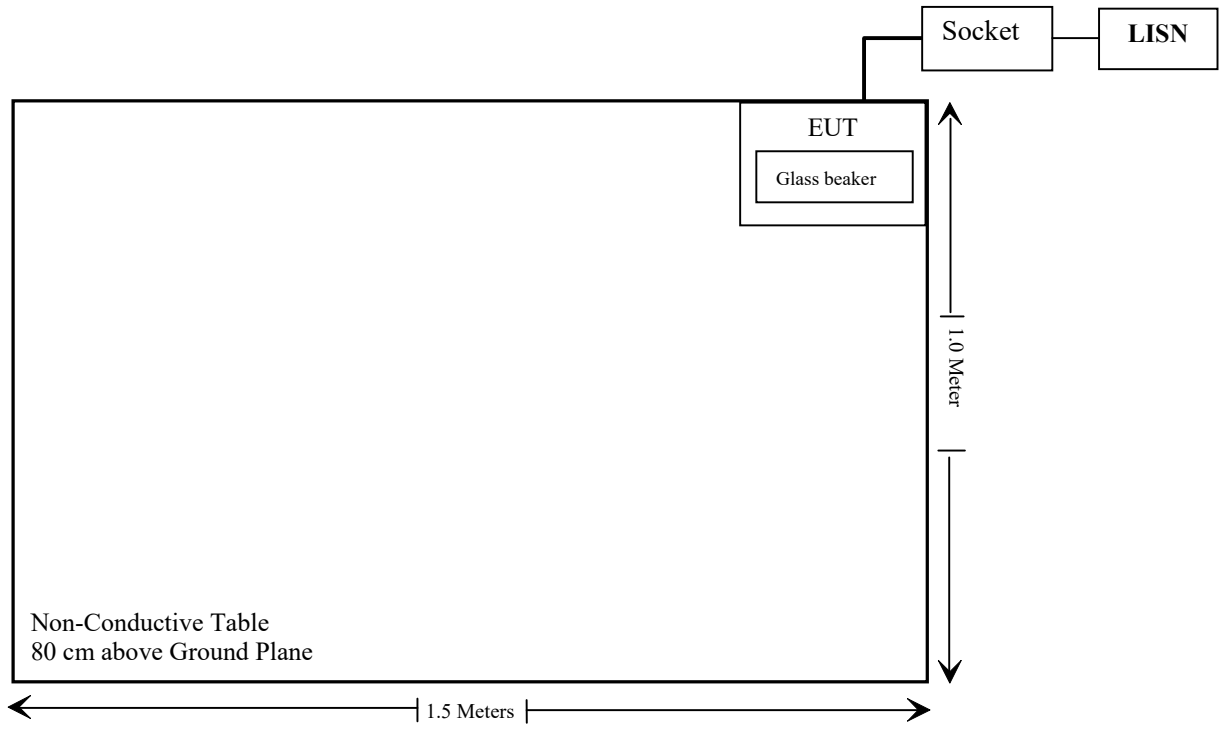
External Cable List and Details

Cable Description	Length (m)	From/Port	To
Unshielded un-detachable AC cable	1.0	LISN	Socket
Unshielded un-detachable AC cable	0.9	Socket	EUT

Configuration of Test Setup



Block Diagram of Test Setup



SUMMARY OF TEST RESULT

FCC Rules	Description of Test	Results
FCC §18.313, §1.1310, §2.1091	Maximum Permissible Exposure	Compliant
FCC §18.307	AC Line Conducted Emissions	Compliant
FCC/OST MP-5 FCC §18.301	Radiation Hazard Measurement	Compliant
FCC §18.305	Field Strength	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde& Schwarz	Test Receiver	ESPI3	100396	2020/12/24	2021/12/23
R & S	L.I.S.N.	ENV216	101314	2020/12/25	2021/12/24
Anritsu Corp	50Ω Coaxial Switch	MP59B	6200506474	2020/12/25	2021/12/24
Unknown	CE Cable	CE Cable	Unknown	2020/12/26	2021/12/25
Conducted Emission Test Software: ES-K1 V1.71					
Radiated Emissions Test					
Rohde&Schwarz	Test Receiver	ESR	101817	2020/12/24	2021/12/23
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2020/12/24	2021/12/23
A.H. Systems, inc.	Preamplifier	PAM-0118P	531	2021/07/08	2022/07/07
SONOMA INSTRUMENT	Amplifier	310 N	186131	2020/12/25	2021/12/24
Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2020/12/25	2021/12/24
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2020/01/04	2023/01/03
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2020/01/05	2023/01/04
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2020/11/28	2021/11/27
Unknown	RF Coaxial Cable	N-5m	No.3	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-5m	No.4	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-1m	No.5	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-1m	No.6	2020/12/25	2021/12/24
Radiated Emission Test Software: e3 19821b(V9)					

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiation Hazard Measurement					
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2020/12/24	2021/12/23
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Unknown	RF Coaxial Cable	N-5m	No.4	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-1m	No.6	2020/12/25	2021/12/24
Qingzhi	Digital Power Meter	8716C	870307126	2020/12/25	2021/12/24
OHAUS	Electronic Scale	R2000-6	8339220237	2020/12/25	2021/12/24
ETS	Microwave Survery Meter	1501	123654	2021/3/12	2022/3/12
MC	Thermometer	Unknown	Unknown	2021/10/31	2022/10/30

*** Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §18.313, §1.1310, §2.1091- MAXIMUM PERMISSIBLE EXPOSURE

Applicable Standard

According to subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

Measurement

Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Amy Cao on 2021-10-22.

Radiation leakage was measured in the as-received condition with the oven door closed using a microwave leakage meter.

A 275 mL water load was placed in the center of the oven and the oven was operated at maximum output power.

☒ There was no microwave leakage exceeding a power level of 0.1mW/cm2 observed at any point 5 cm or more from the external surface of the oven.

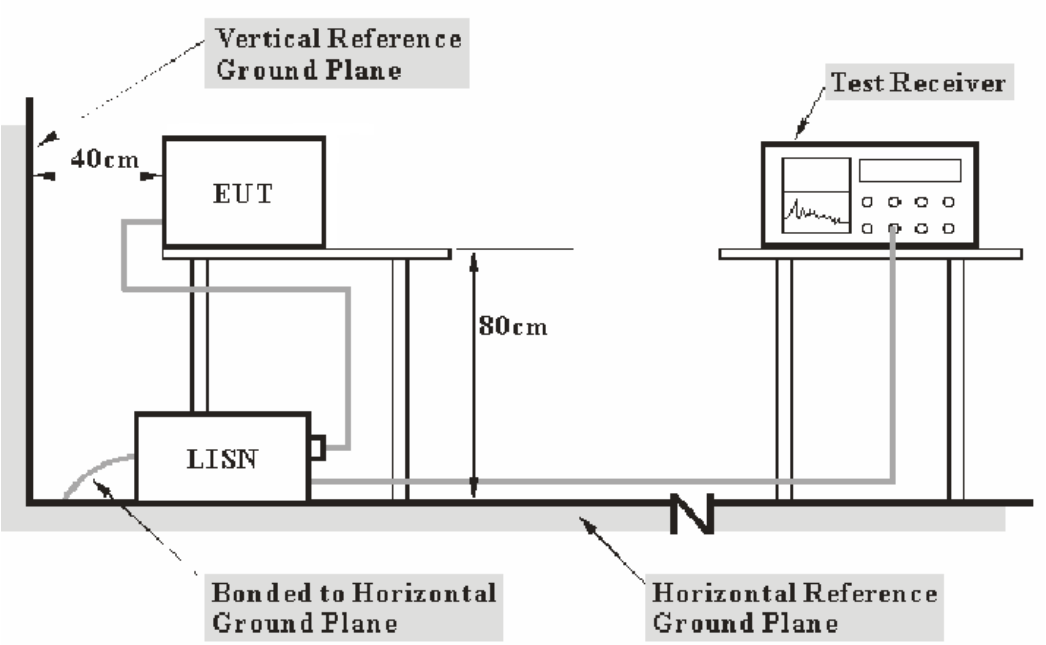
A maximum of 1.0 mW/cm^2 is allowed in accordance with the applicable Federal Standards. Hence, microwave leakage in the as-received condition with the oven door closed was below the maximum allowed.

CONDUCTED EMISSIONS

Applicable Standard

FCC §18.307

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with MP-5: 1986 measurement procedure. Specification used was with the FCC Part 18.

The socket was connected to a 120 VAC/ 60Hz power source.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Transd Factor & Margin Calculation

The Transd factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Transd Factor = LISN VDF + Cable Loss

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – level
Level= reading level+ Transd Factor

Test Data

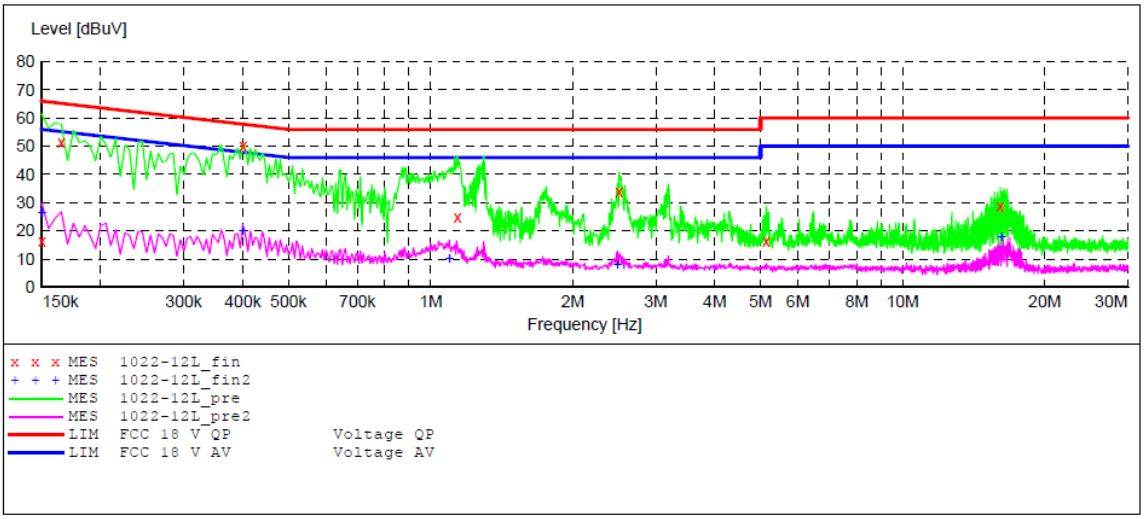
Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Amy Cao on 2021-10-22.

Test mode：Microwave

AC 120V/60 Hz, Line



MEASUREMENT RESULT: "1022-12L_fin"

2021-10-22 05:46

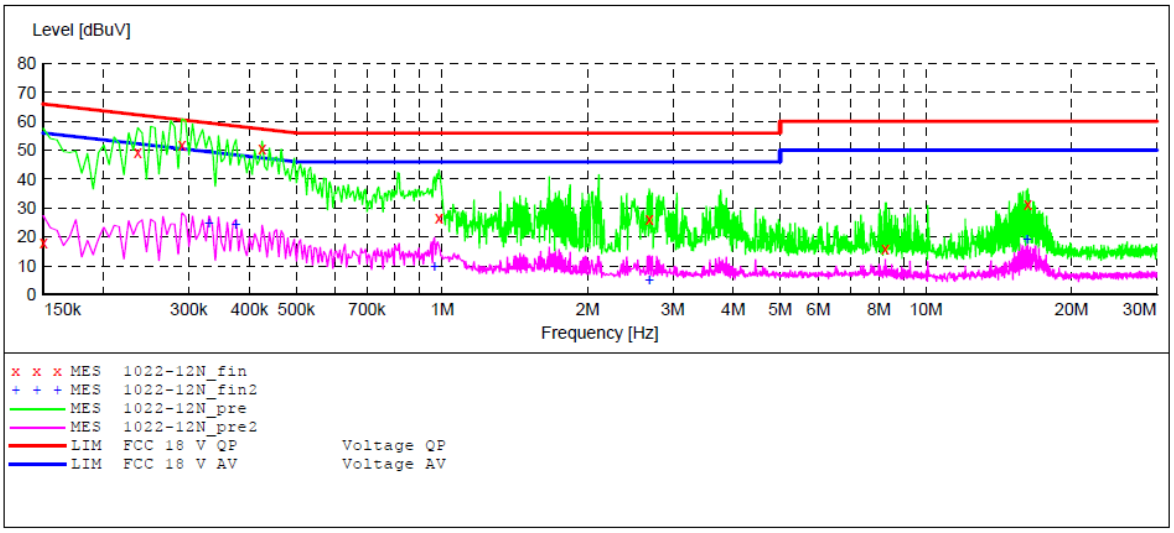
Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.150000	16.40	10.8	66	49.6	QP	L1	GND
0.165000	51.20	10.8	65	13.8	QP	L1	GND
0.400000	50.10	11.0	58	7.9	QP	L1	GND
1.140000	24.70	11.2	56	31.3	QP	L1	GND
2.510000	33.90	11.3	56	22.1	QP	L1	GND
5.140000	16.20	11.4	60	43.8	QP	L1	GND
16.125000	28.60	11.7	60	31.4	QP	L1	GND

MEASUREMENT RESULT: "1022-12L_fin2"

2021-10-22 05:46

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.150000	26.50	10.8	56	29.5	AV	L1	GND
0.400000	20.40	11.0	48	27.6	AV	L1	GND
1.095000	10.50	11.1	46	35.5	AV	L1	GND
2.490000	8.30	11.3	46	37.7	AV	L1	GND
10.200000	11.10	11.6	50	48.9	AV	L1	GND
16.225000	18.10	11.7	50	31.9	AV	L1	GND

AC 120V/60 Hz, Neutral



MEASUREMENT RESULT: "1022-12N_fin"

2021-10-22 05:48

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.150000	18.10	10.8	66	47.9	QP	N	GND
0.235000	49.40	10.9	62	12.6	QP	N	GND
0.290000	52.00	10.9	61	8.0	QP	N	GND
0.425000	50.70	11.0	57	6.3	QP	N	GND
0.985000	26.80	11.1	56	29.2	QP	N	GND
2.680000	26.20	11.3	56	29.8	QP	N	GND
8.250000	15.80	11.5	60	44.2	QP	N	GND
16.250000	31.30	11.7	60	28.7	QP	N	GND

MEASUREMENT RESULT: "1022-12N_fin2"

2021-10-22 05:48

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.330000	25.30	10.9	50	24.7	AV	N	GND
0.375000	24.00	10.9	48	24.0	AV	N	GND
0.965000	9.80	11.1	46	36.2	AV	N	GND
2.680000	5.40	11.3	46	40.6	AV	N	GND
8.250000	10.80	11.5	50	39.2	AV	N	GND
16.225000	19.10	11.7	50	30.9	AV	N	GND

RADIATION HAZARD MEASUREMENT

Applicable Standard

FCC §18.301 & FCC/OST MP-5

Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Amy Cao on 2021-10-30.

Input Power

Input power and current was measured using a power analyzer. A 1000 mL water load was placed in the center of the oven and the oven was operated at maximum output power. A 1000mL water load was chosen for its compatibility with the procedure commonly used by manufacturers to determine their input ratings.

Input Voltage (V_{AC}/Hz)	Input Current (Amps)	Measured Input Power (Watts)	Rated Input Power (Watts)
119.6	14.2	1698.32	1800

☒ Based on the measured input power, the EUT was found to be operating within the intended specifications.

Load for Microwave Ovens

For all measurements, the energy developed by the oven was absorbed by a dummy load consisting of a quantity of tap water in a beaker. If the oven was provided with a shelf or other utensil support, this support was in its initial normal position. For ovens rated at 1000 watts or less power output, the beaker contained quantities of water as listed in the following subparagraphs. For ovens rated at more than 1000 watts output, each quantity was increased by 50% for each 500watts or fraction thereof in excess of 1000 watts. Additional beakers were used if necessary.

● Load for power output measurement: 1000 milliliters of water in the beaker located in the center of the oven.

● Load for frequency measurement: 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.

RF Output Power Measurement

A cylindrical container of borosilicate glass is used for the test. It has a maximum thickness of 3 mm, an external diameter of approximately 190 mm and a height of approximately 90 mm. The mass of the container is determined.

At the start of the test, the oven and the empty container are at ambient temperature. Water having an initial temperature is used for the test. The water temperature is measured immediately before it is poured into the container.

A quantity of 1000 g ± 5 g of water is added to the container and its actual mass obtained. The container is then immediately placed in the centre of the oven shelf, which is in its lowest normal position. The oven is operated and the time for the water temperature to attain is measured. The oven is then switched off and the final water temperature is measured within 60 s.

m_w (g)	m_c (g)	T_0 (ºC)	T_1 (ºC)	T_2 (ºC)	t (s)
1000	380.0	25.3	9.7	20.3	45

RF Output Power = (4.187 x 1000 x (20.3–9.7) + 0.55 x 377.0 x (20.3- 25.3)) / 45= 963.23 Watts
P is the microwave power output, in watts;
m_w is the mass of the water, in grams;
m_c is the mass of the container, in grams;
T_0 is the ambient temperature, in degrees Celsius;
T_1 is the initial temperature of the water, in degrees Celsius;
T_2 is the final temperature of the water, in degrees Celsius;
t is the heating time, in seconds, excluding the magnetron filament heating-up time.

☐ The measurement output power was found to be less than 500 watts. Therefore, in accordance with Section 18.305 of Subpart-C, the measured out-of-band emissions were compared to the limit of 25μV/meter at a 300-meter measurement distance.

☒ The measured output power was found to exceed 500 watts. Therefore, in accordance with Section 18.305 of Subpart-C, the measured out-of-band emissions were compared with the limit calculated as following:

LFS = 25*SQRT (Power Output/500)

LFS = 25*SQRT (963.23/500)

LFS = 34.70

Where: LFS is the maximum allowable field strength for out-of-band emissions in μV/meter at a 300-meter measurement distance. Power Output is the measured output power in watts.

LFS μV/m@300m	**dBμV/m@300m**	**dBμV/m@3m**
34.70	30.8	70.8

Note: Limit (dBμV/m@3m) = Limit (dBμV/m@300m) + 40(dB)

Operating Frequency Measurement

Variation in Operating Frequency with Time

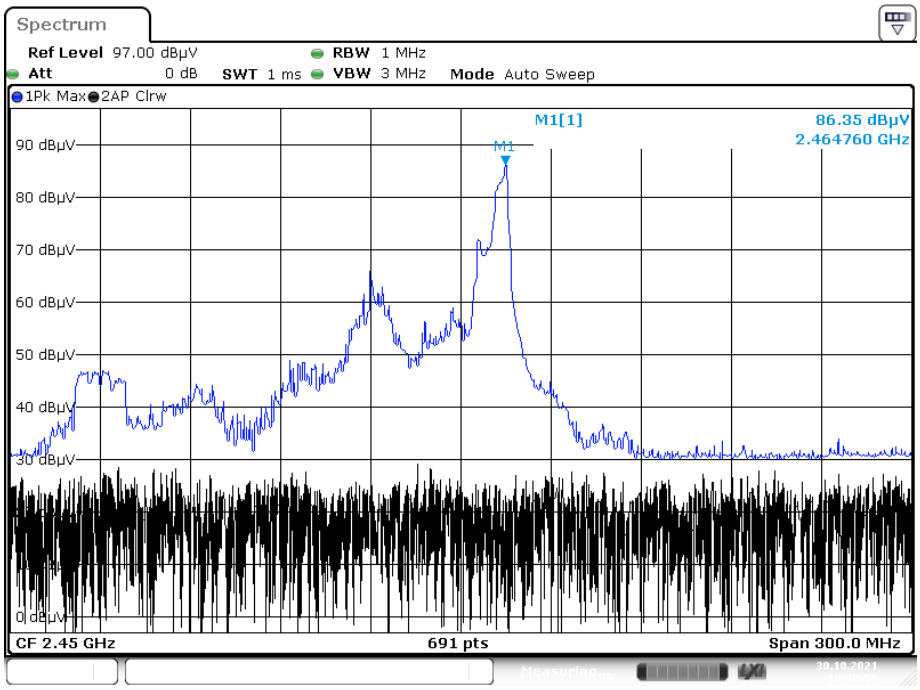
The operating frequency was measured using a spectrum analyzer. Starting with the EUT at room temperature, a 1000mL water load was placed in the center of the oven and the oven was operated at maximum output power. The fundamental operating frequency was monitored until the water load was reduced to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

The results of this test are as follows:

Frequency at Start time (MHz)	Frequency at End time (MHz)
2464.76	2466.93

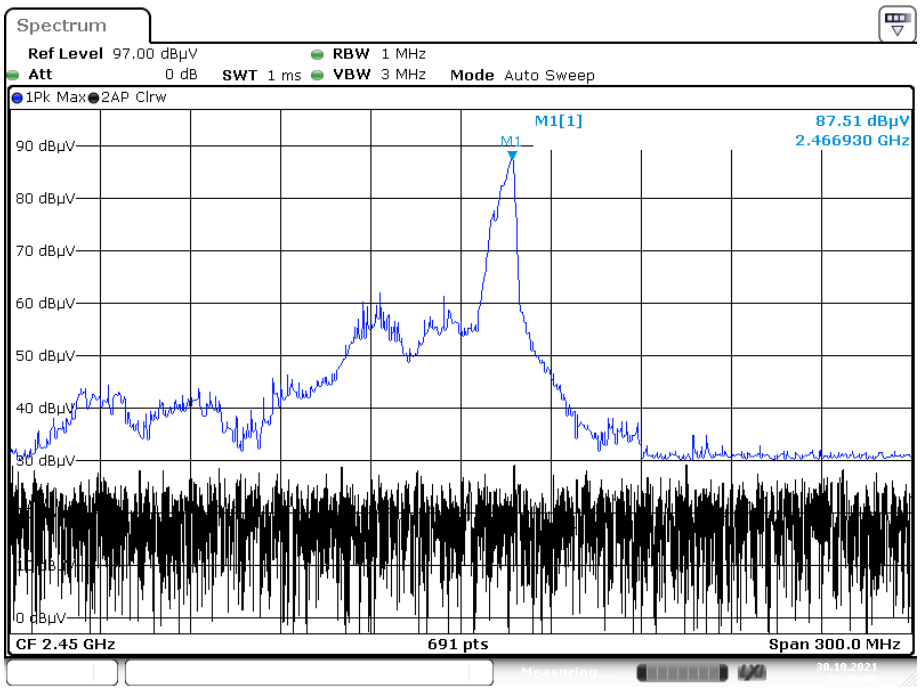
Refer to data pages for details of the variation in operating frequency with time measurement.

Start time:



Date: 30.OCT.2021 16:30:59

End time:



Date: 30.OCT.2021 16:49:00

Variation in Operating Frequency with 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.

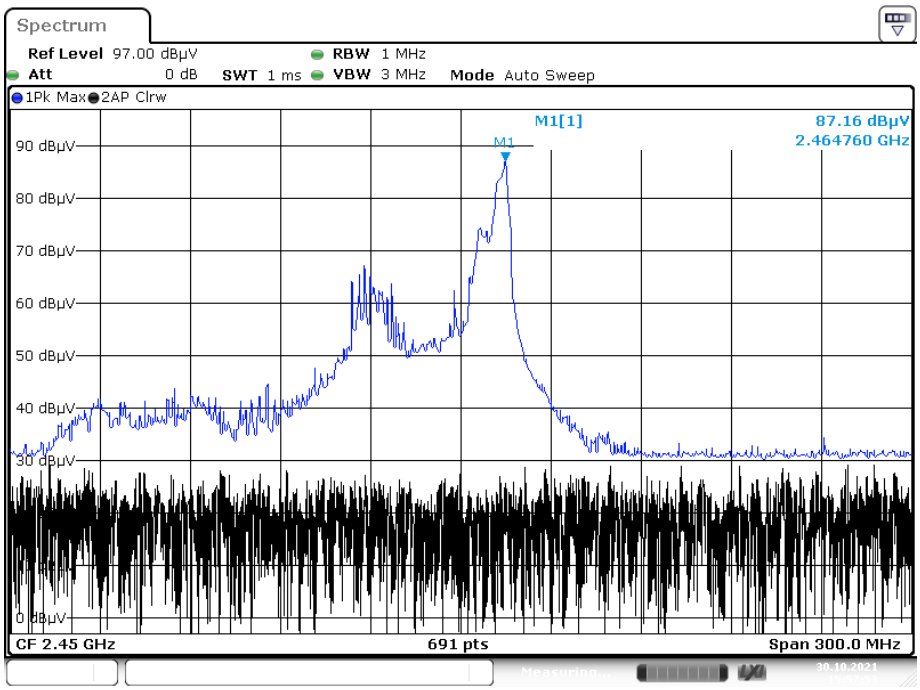
The results of this test are as follows:

Line voltage varied from 96 V_{AC} to 150 V_{AC}.

(Low voltage) Frequency (MHz)	(High voltage) Frequency (MHz)
2464.76	2464.76

Please refer to following pages for details of the variation in operating frequency with line voltage measurement.

Low Voltage:



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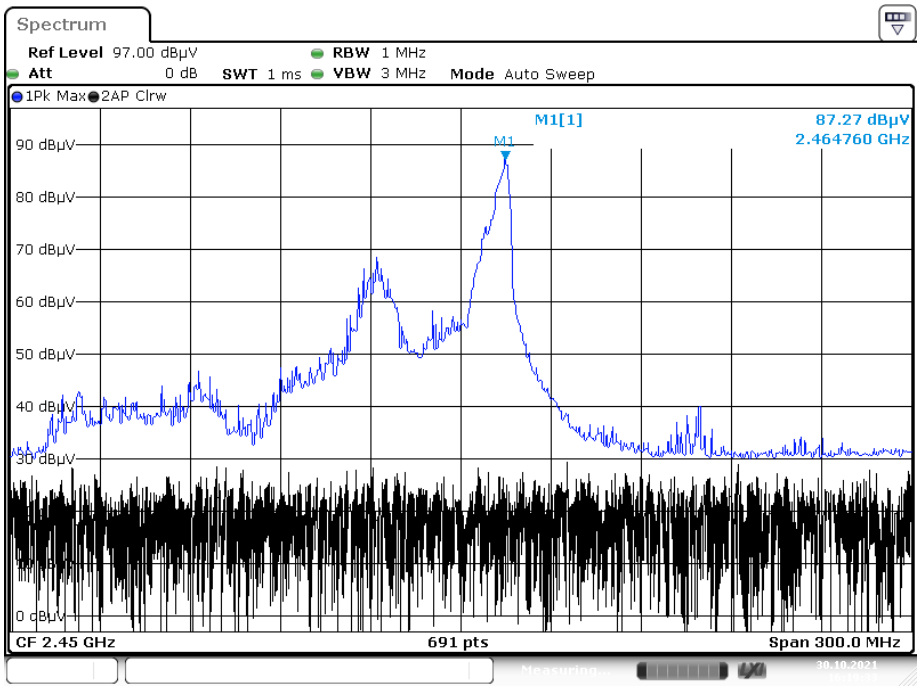
High Voltage:



Date: 30.OCT.2021 16:19:33

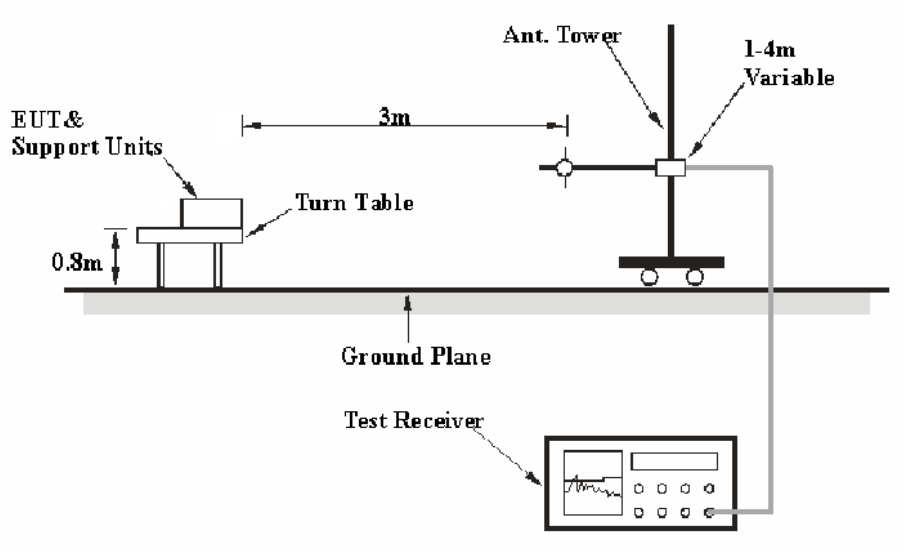
RADIATED EMISSIONS

Applicable Standard

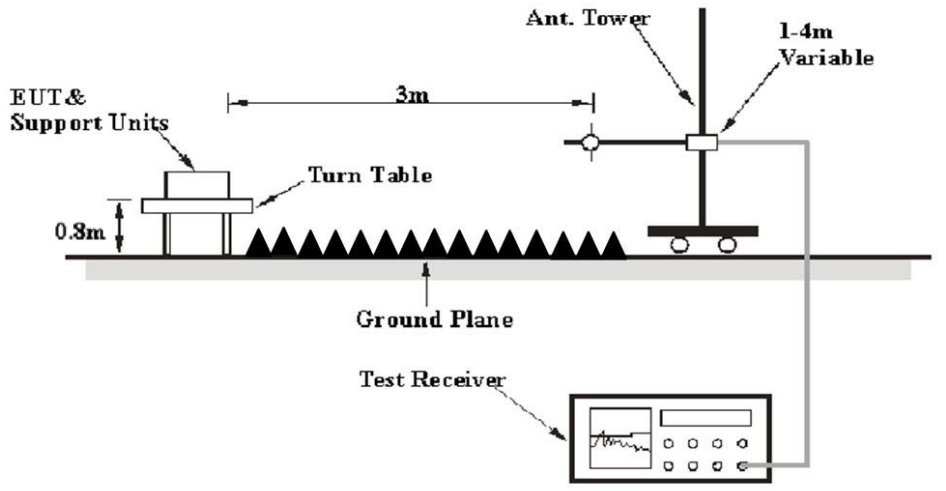
FCC §18.305 and FCC §18.309

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the FCC MP - 5. The specification used was the FCC part 18 limits.

The socket was connected to 120 VAC/60 Hz power source.

EMI Test Receiver Setup and Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver and Spectrum Analyzer were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30MHz – 1000 MHz	100 kHz	300 kHz	120kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK.
	1MHz	10 Hz	/	Ave.

Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure that the EUT complied with all installation combinations.

The EUT was in the normal (naïve) operating mode during the final qualification test to represent the worst results.

Corrected Amplitude & Margin Calculation

The Corrected Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain. The basic equation is as follows:

Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain

The "**Margin/Over limit**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin/over limit of -7dB means the emission is 7dB below the limit. The equation for calculation is as follows:

Margin = Result / Corrected Amplitude - Limit
Result / Corrected Amplitude = Reading + Factor

Test Data and Plots

Environmental Conditions

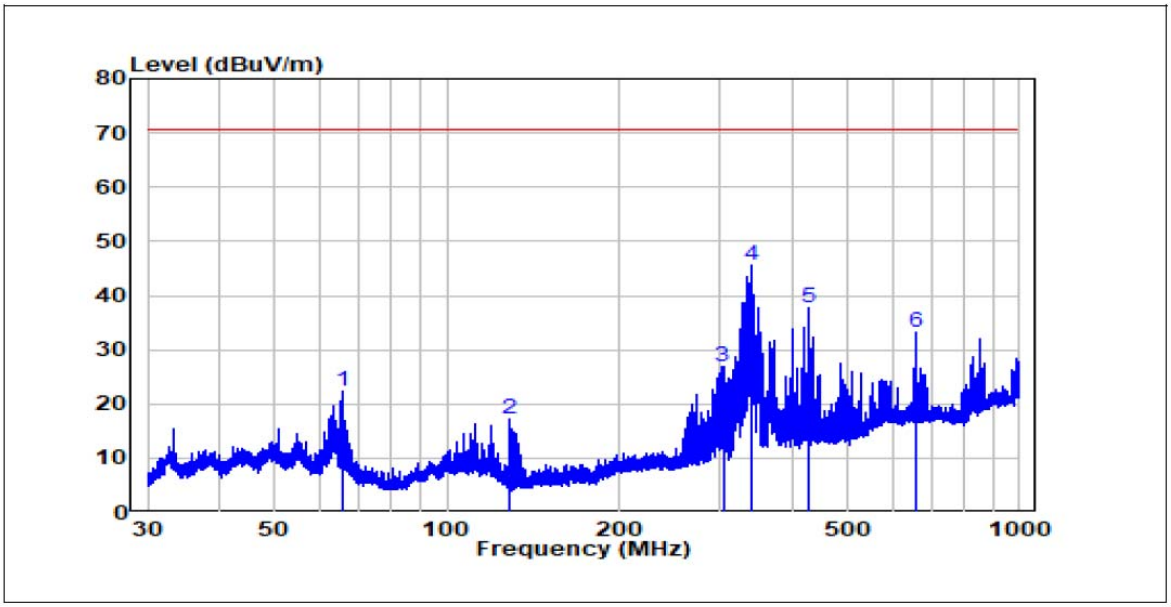
Temperature:	23-25 ℃
Relative Humidity:	51-52%
ATM Pressure:	101.0kPa

The testing was performed by Amy Cao on 2021-10-28 for below 1GHz and 2021-10-30 for above 1GHz.

Test mode：Microwave

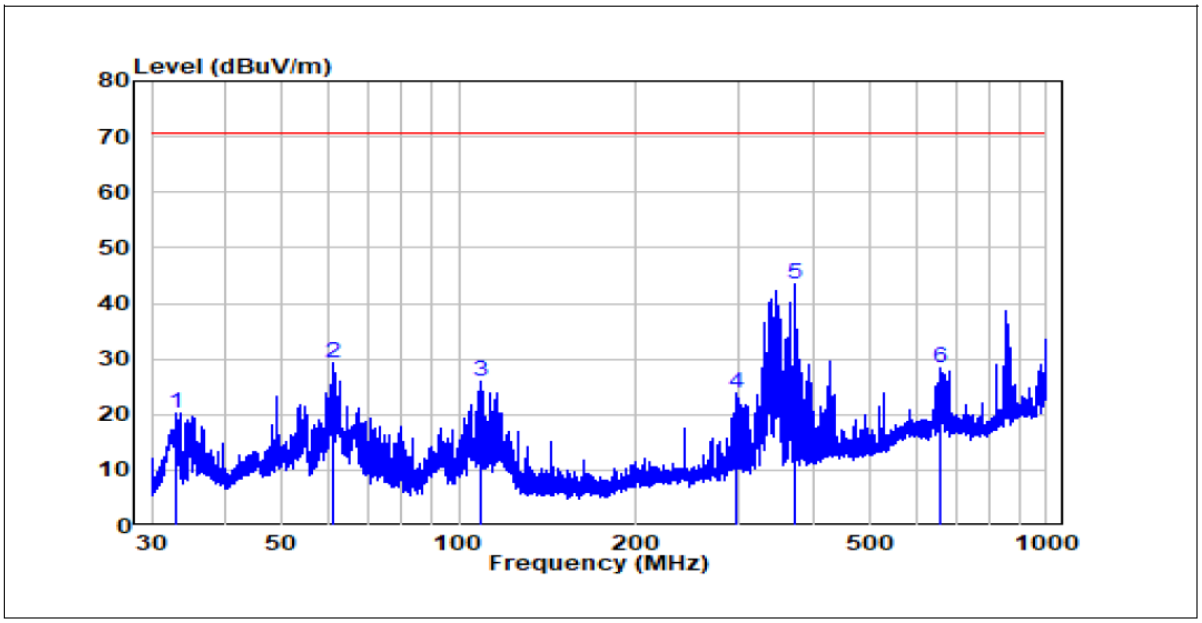
30 MHz – 1 GHz

Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Over Limit	Remark	Phase
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)		
1	65.573	42.92	-20.51	22.42	70.8	-48.38	PK	Horizontal
2	128.507	39.80	-22.64	17.15	70.8	-53.65	PK	Horizontal
3	303.411	43.43	-16.62	26.82	70.8	-43.98	PK	Horizontal
4	340.931	61.96	-16.34	45.63	70.8	-25.17	PK	Horizontal
5	429.523	52.05	-14.38	37.68	70.8	-33.12	PK	Horizontal
6	660.861	44.45	-11.39	33.06	70.8	-37.74	PK	Horizontal

Vertical



No.	Frequency	Reading	Correct	Result	Limit	Over Limit	Remark	Phase
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)		
1	33.051	40.18	-19.88	20.30	70.8	-50.5	PK	Vertical
2	61.319	48.94	-19.75	29.19	70.8	-41.61	PK	Vertical
3	108.742	45.07	-19.18	25.88	70.8	-44.92	PK	Vertical
4	297.224	40.45	-16.75	23.70	70.8	-47.10	PK	Vertical
5	374.623	59.06	-15.71	43.35	70.8	-27.45	PK	Vertical
6	661.440	39.65	-11.41	28.25	70.8	-42.55	PK	Vertical

1 -25 GHz:

Frequency (MHz)	Measurement		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 18	
	Reading (dBμV)	PK/QP/AV		Height (m)	Polar (H / V)			Limit (dBμV/m)	Margin (dB)
2397.58	45.14	AV	229	1.6	H	0.79	45.93	70.8	-24.87
2397.58	45.41	AV	178	1.1	V	0.79	46.2	70.8	-24.6
2505.63	45.1	AV	66	1.1	H	1.34	46.44	70.8	-24.36
2505.63	45.29	AV	190	1.8	V	1.34	46.63	70.8	-24.17
4250.23	32.32	AV	26	2.0	H	7.54	39.86	70.8	-30.94
4250.23	33.13	AV	205	1.0	V	7.54	40.67	70.8	-30.13
700ml water									
4945.08	36.03	AV	196	2.0	V	9.41	45.44	70.8	-25.36
4945.08	38.66	AV	285	1.7	H	9.41	48.07	70.8	-22.73
7348.12	33.04	AV	245	1.9	V	13.93	46.97	70.8	-23.83
7348.12	34.99	AV	159	1.9	H	13.93	48.92	70.8	-21.88
300ml water									
4942.15	34.64	AV	201	1.9	H	9.41	44.05	70.8	-26.75
4942.15	36.59	AV	294	2.1	V	9.41	46.00	70.8	-24.8
7351.23	32.29	AV	253	1.3	H	13.94	46.23	70.8	-24.57
7351.23	34.74	AV	161	1.9	V	13.94	48.68	70.8	-22.12

******* END OF REPORT *******