



FCC PART 18

# **TEST REPORT**

For

# Guangdong Midea Kitchen Appliances Manufacturing Co.,Ltd

No.6, Yong An Road, Beijiao, Shunde, Foshan, Guangdong China 528311

# FCC ID: VG8XM031MYY

Report Type:		Product Type:
Class II Permissive Change		Microwave Oven
Report Number:	RSZ191211550-00	)
Report Date:	2019-12-27	
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# **TABLE OF CONTENTS**

GENERAL INFORMATION	
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	
OBJECTIVE	
RELATED SUBMITTAL(S)/GRANT(S)	
Test Methodology	
MEASUREMENT UNCERTAINTY	4
TEST FACILITY	
OPERATING CONDITION/TEST CONFIGURATION	
JUSTIFICATION	5
EUT EXERCISE SOFTWARE	
SPECIAL ACCESSORIES	
EQUIPMENT MODIFICATIONS	5
SUPPORT EQUIPMENT LIST AND DETAILS	
EXTERNAL CABLE LIST AND DETAILS CONFIGURATION OF TEST SETUP	
BLOCK DIAGRAM OF TEST SETUP	
SUMMARY OF TEST RESULT	
TEST EQUIPMENT LIST	8
CONDUCTED EMISSIONS	10
APPLICABLE STANDARD	
EUT SETUP	
EMI TEST RECEIVER SETUP	
TEST PROCEDURE	
TEST RESULTS SUMMARY	
TEST DATA	
RADIATION HAZARD MEASUREMENT	
APPLICABLE STANDARD	
Environmental Conditions	
RADIATION HAZARD MEASUREMENT Input Power	
INPUT POWER Load for Microwave Ovens	
RF OUTPUT POWER MEASUREMENT	
OPERATING FREQUENCY MEASUREMENT	
RADIATED EMISSIONS	
Applicable Standard	
EUT SETUP	
EMI TEST RECEIVER SETUP AND SPECTRUM ANALYZER SETUP	
Test Procedure	
CORRECTED AMPLITUDE & MARGIN CALCULATION	
TEST RESULTS SUMMARY	
TEST DATA AND PLOTS	

# **GENERAL INFORMATION**

Product	Microwave Oven
Tested Model	EM031M2HH
Multiple Model	EM031MYY-X, EM031MYYY-X, EM031M2ZC-X, EM031MYY, EM031MYYY, ML2-EM31PA(SS), NN- S#5#LS
Voltage Range	AC 120V/60Hz
Highest operating frequency	2450 MHz
Microwave output power	1000 W
Input power	1500 W
Date of Test	2019-12-19~2019-12-21
Sample serial number	RSZ191211550 (Assigned by Shenzhen BACL)
Received date	2019-12-11
Sample/EUT Status	Good condition

### **Product Description for Equipment under Test (EUT)**

Notes: This series products model: EM031MYY-X, EM031MYYY-X, EM031M2ZC-X, EM031MYY, EM031MYYY, ML2-EM31PA(SS), NN-S#5#LS (X,YY and YYY indicate different appearance, X or  $Y = 0 \sim 9$  or  $A \sim Z$ . The first '#' is 'B' or 'G' or "C" or "U", 'stands for United States or Canada. The second '#' is number from '1' to '9' which stands for different cosmetic model) and EM031M2HH are identical schematics. Model EM031M2HH was selected for fully testing, the detailed information can be referred to the declaration which was stated and guaranteed by the applicant.

# Objective

This report is prepared on behalf of *Guangdong Midea Kitchen Appliances Manufacturing Co.,Ltd* 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 base on the report STS1804228E01 with FCC ID: VG8XM031MYY which was granted on 2018-05-11, the details as below:

1. Changing the high voltage transformer to "MD-103ATR-1";

2. Adding the relay in the computer board;

3. Changing the appearance color and shape;

4. Changing the model number to "EM031M2HH, EM031MYY-X, EM031MYYY-X, EM031M2ZC-X, EM031MYY, EM031MYYY, ML2-EM31PA(SS), NN-S#5#LS (X,YY and YYY indicate different appearance,X or  $Y = 0 \sim 9$  or  $A \sim Z$ . The first '#' is 'B' or 'G' or "C" or "U", 'stands for United States or Canada. The second '#' is number from '1' to '9' which stands for different cosmetic model)". For the changes are made to the device, all the test items were performed.

# **Related Submittal(s)/Grant(s)**

No related submittal(s).

### **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 Bay Area Compliance Laboratory Corporation. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

### **Measurement Uncertainty**

Parameter		uncertainty		
Conducted Emissions		±1.95dB		
Radiated	Below 1GHz	±4.75dB		
Emissions	Above 1GHz	±4.88dB		

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 Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, 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.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

# **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.

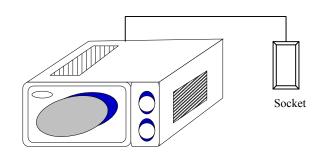
# **Support Equipment List and Details**

Manufacturer	anufacturer Description Model		Serial Number
BULL	Socket	GN-606D	N/A
N/A	Glass beaker	N/A	N/A

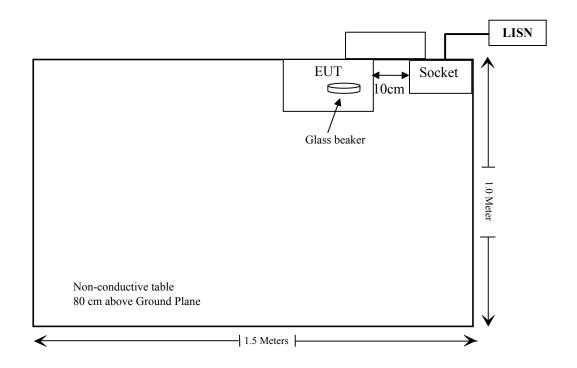
# **External Cable List and Details**

Cable Description	Length (m)	From/Port	То
Un-shielding Un-detachable AC Cable	1.0	Socket	EUT
Un-shielding Un-detachable AC Cable	1.0	LISN	Socket

# **Configuration of Test Setup**



# **Block Diagram of Test Setup**



FCC Part 18

Page 6 of 23

# SUMMARY OF TEST RESULT

FCC Rules	Description of Test	Results
§18.307	AC Line Conducted Emissions	Compliance
FCC/OST MP-5 FCC §18.301	Radiation Hazard Measurement	Compliance
§18.305	Field Strength	Compliance

### Report No.: RSZ191211550-00

# **TEST EQUIPMENT LIST**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date			
	CONDUCTED EMISSIONS							
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2019/7/9	2020/7/8			
Rohde & Schwarz	LISN	ENV216	101613	2019/1/25	2020/1/24			
Rohde & Schwarz	Transient Limitor	ESH3Z2	DE25985	2019/11/29	2020/11/28			
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR			
N/A	Conducted emission CABLE	78652	UF A210B-1- 0720-504504	2019/11/12	2020/11/12			
	RADIATIO	N HAZARD MEAS	SUREMENT	•				
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2019/7/22	2020/07/21			
GW Instek	Power Meter	GPM 8212	CL110045	2019/10/14	2020/10/13			
GW Instek	Power Meter	GPM 8212	CL110034	2019/10/14	2020/10/13			
MC	Thermometer	Unknown	Unknown	2019/11/1	2020/11/1			
ETS	Horn Antenna	3115	27188	NCR	NCR			
ETS	ETS Microwave Survery Meter		N/A	NCR	NCR			
N/A	N/A Electronic Weighed		N/A	NCR	NCR			
Ducommun technologies	Signal Cable	UFA210A-1- 4724-30050U	MFR64369 223410-001	2019/11/12	2020/11/12			
Ducommun technologies	Signal Cable	104PEA	218124002	2019/11/12	2020/11/12			

### Report No.: RSZ191211550-00

Manufacturer	nufacturer Description Model		Serial Number	Calibration Date	Calibration Due Date	
RADIATED EMISSIONS						
R&S	EMI Test Receiver	ESR3	102455	2019/7/9	2020/7/8	
Sonoma instrument	Pre-amplifier	310 N	186238	2019/4/20	2020/4/20	
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017/12/22	2020/12/21	
ETS	Passive Loop Antenna	6512	29604	2018/7/14	2021/7/13	
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2019/7/22	2020/07/21	
COM-POWER	Pre-amplifier	PA-122	181919	2019/11/29	2020/11/28	
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017/12/22	2020/12/21	
the electro- Mechanics Co	Horn Antenna	3116	9510-2270	2019/10/13	2022/10/12	
Agilent	Spectrum Analyzer	8564E	3943A01781	2019/3/2	2020/3/2	
Ducommun technologies	Powerling Surge Coupling Decoupling Network	2PS-1401-2760- 2ps	3	2019/11/12	2020/11/12	
Ducommun technologies	Signal Cable	UFA210A-1- 4724-30050U	MFR64369 223410-001	2019/11/12	2020/11/12	
Ducommun technologies	Signal Cable	104PEA	218124002	2019/11/12	2020/11/12	
COM-POWER	Amplifier	QLW-18405536- J0	15964001002	2019/11/29	2020/11/28	
R&S	Auto test Software	EMC32	V9.10	NCR	NCR	

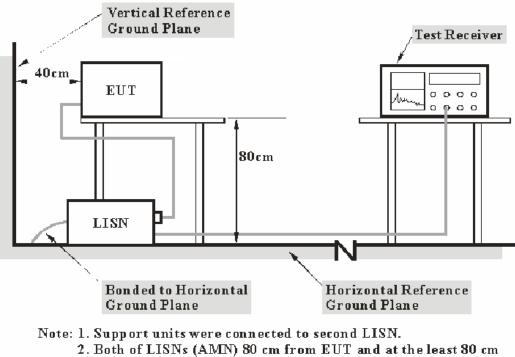
\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

# **CONDUCTED EMISSIONS**

# Applicable Standard

FCC §18.307

# **EUT Setup**



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.

# **Test Results Summary**

According to the EUT complied with the FCC PART 18,

# **Test Data**

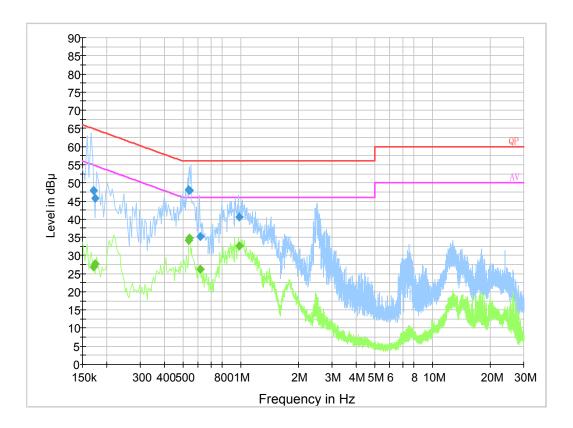
### **Environmental Conditions**

Temperature:	25 °C	
<b>Relative Humidity:</b>	50 %	
ATM Pressure:	101.0 kPa	

The testing was performed by Haiguo Li on 2019-12-19.

EUT operation mode: 1000mL Water in center of microwave oven with Maximum Power on

# AC 120V/60Hz, Line

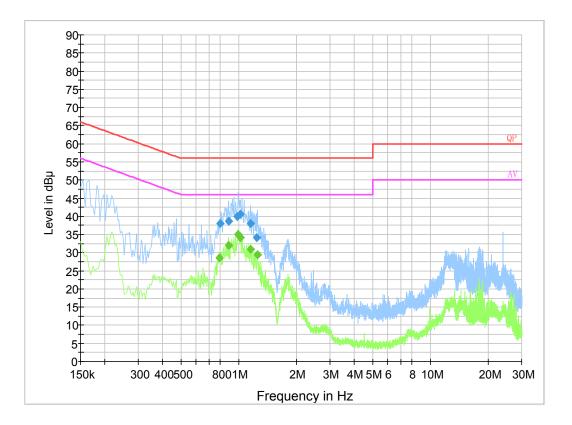


Frequency (MHz)	Corrected Amplitude (dBµV)	Corrected Factor (dB)	Limit (dBµV)	Margin (dB)	Remark (PK/QP/Ave.)
0.170501	47.8	19.9	64.9	17.1	QP
0.174500	45.7	19.9	64.7	19.0	QP
0.537950	48.2	19.8	56.0	7.8	QP
0.541750	47.8	19.8	56.0	8.2	QP
0.616850	35.3	19.8	56.0	20.7	QP
0.983390	40.6	19.9	56.0	15.4	QP
0.170501	26.9	19.9	54.9	28.0	Ave.
0.174500	27.7	19.9	54.7	27.0	Ave.
0.537950	34.1	19.8	46.0	11.9	Ave.
0.541750	34.8	19.8	46.0	11.2	Ave.
0.616850	26.2	19.8	46.0	19.8	Ave.
0.983390	32.7	19.9	46.0	13.3	Ave.

FCC Part 18

### Report No.: RSZ191211550-00

# AC 120V/60Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Corrected Factor (dB)	Factor (dBuV) (dl		Remark (PK/QP/Ave.)
0.801910	38.0	19.8	56.0	18.0	QP
0.888710	38.7	19.7	56.0	17.3	QP
0.983030	40.0	19.8	56.0	16.0	QP
1.026370	40.6	19.8	56.0	15.4	QP
1.152690	38.0	19.8	56.0	18.0	QP
1.239190	34.1	19.8	56.0	21.9	QP
0.794000	28.5	19.8	46.0	17.5	Ave.
0.886000	32.1	19.7	46.0	13.9	Ave.
0.998000	35.0	19.8	46.0	11.0	Ave.
1.022000	34.2	19.8	46.0	11.8	Ave.
1.154000	30.9	19.8	46.0	15.1	Ave.
1.254000	29.5	19.8	46.0	16.5	Ave.

#### Note:

Corrected Amplitude = Reading + Correction Factor
Correction Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

3) Margin = Limit – Corrected Amplitude

FCC Part 18

# **RADIATION HAZARD MEASUREMENT**

## **Applicable Standard**

FCC §18.301 & FCC/OST MP-5

# **Environmental Conditions**

Temperature:	25 °C
<b>Relative Humidity:</b>	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Alan He on 2019-12-21.

### **Radiation Hazard Measurement**

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  $0.1 \text{mW/cm}^2$  observed at any point 5 cm or more from the external surface of the oven.

A maximum of 1.0 mW/cm<sup>2</sup> 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.

# **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	Input Current	Measured Input Power	Rated Input Power	
(V <sub>AC</sub> /Hz)	(Amps)	(W)	(W)	
119.3	11.9	1419.67	1500	

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 of 10 °C  $\pm$  1 °C is used for the test. The water temperature is measured immediately before it is poured into the container.

A quantity of 1000 g  $\pm$  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 20 °C  $\pm$  2 °C is measured. The oven is then switched off and the final water temperature is measured within 60 s.

m <sub>w</sub>	m <sub>c</sub>	Т <sub>0</sub>	T₁	T₂	t
(g)	(g)	(°С)	(°C)	(℃)	(s)
1000	377.0	24.1	9.6	19.7	45

RF Output Power = (4.187 x 1000 x (19.7 - 9.6) + 0.55 x 377.0 x (19.7 - 24.1)) / 45 = 919.47 W

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  $25\mu$ V/meter at a 300-meter measurement distance.

Report No.: RSZ191211550-00

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 (<u>919.47</u>/500)

LFS = 33.90

Where: LFS is the maximum allowable field strength for out-of-band emissions in  $\mu$ V/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
33.90	30.60	70.60

Note: Limit  $(dB\mu V/m@3m) = Limit (dB\mu V/m@300m) + 40(dB)$ 

### **Operating Frequency Measurement**

#### Variation in Operating Frequency with Time

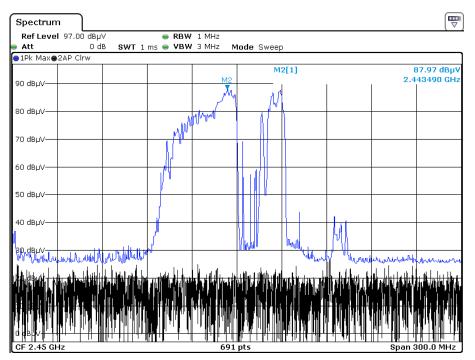
The operating frequency was measured using a spectrum analyzer. Starting with the EUT at room temperature, a 1000mL water load was placed in the center of the oven and the oven was operated at maximum output power. The fundamental operating frequency was monitored until the water load was reduced to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

The results of this test are as follows:

Frequency at Start time	Frequency at End time
(MHz)	(MHz)
2443.49	2481.26

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

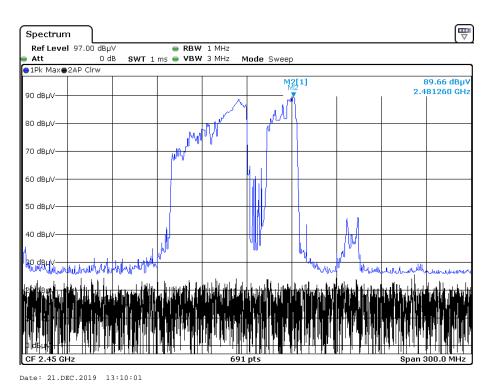
### Start time:



Date: 21.DEC.2019 13:20:46

FCC Part 18

## End time:



# 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:

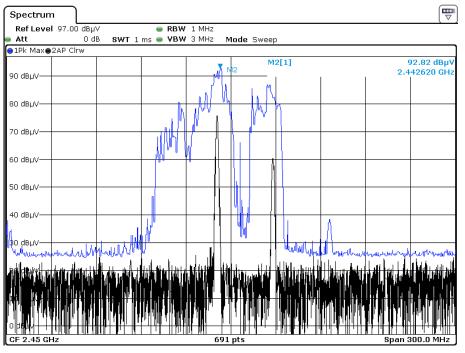
Line voltage varied from 96  $V_{AC}$  to 150  $V_{AC}$ .

(Low voltage) Frequency	(High voltage) Frequency
(MHz)	(MHz)
2442.62	2446.96

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

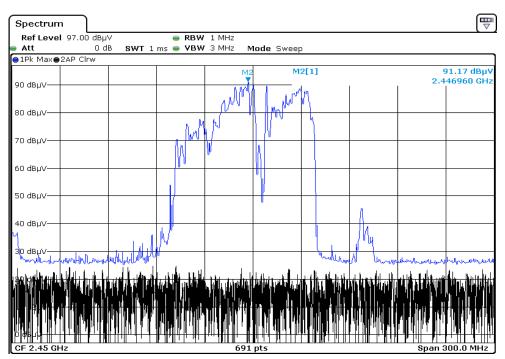
#### Report No.: RSZ191211550-00

### Low Voltage:



Date: 21.DEC.2019 12:59:04

### High Voltage:



Date: 21.DEC.2019 12:48:33

FCC Part 18

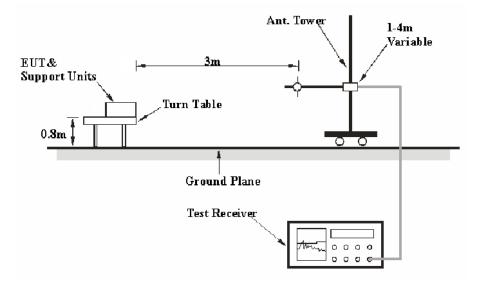
# **RADIATED EMISSIONS**

### **Applicable Standard**

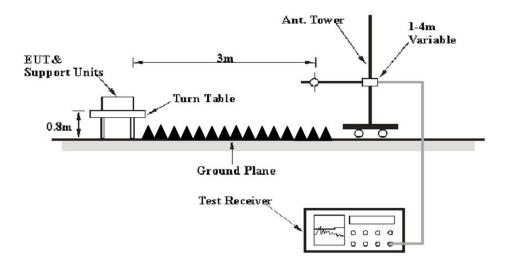
FCC §18.305 and FCC §18.309

# **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.

FCC Part 18

Page 20 of 23

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 CHr	1MHz	3 MHz	/	PK.
Above 1 GHz	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 Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

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

Margin = Limit – Corrected Amplitude

### **Test Results Summary**

According to the data in the following table, the EUT complied with the FCC Part 18,

#### **Test Data and Plots**

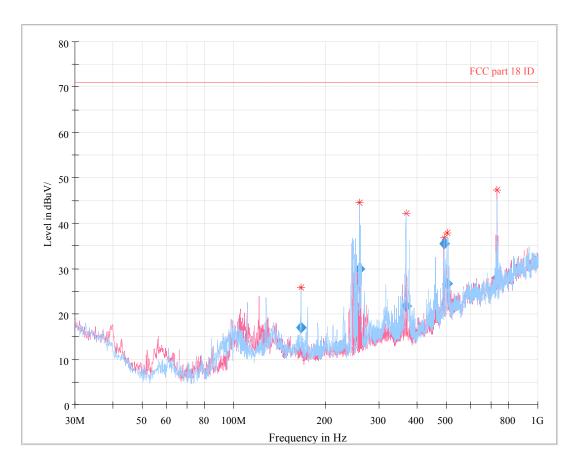
#### **Environmental Conditions**

Temperature:	23 °C
<b>Relative Humidity:</b>	65 %
ATM Pressure:	101.0 kPa

The testing was performed by Steve Lan on 2019-12-20 for below 1G and Alan He on 2019-12-21 for above 1G.

FCC Part 18

Page 21 of 23



30 MHz - 1 GHz:( 1000ml	L Water in center of microwave	oven with Maximum Power on)
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Frequency (MHz)	Corrected Amplitude (dBµV/m)	PK/QP	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
166.259500	17.02	QP	272.0	Н	240.0	-14.7	70.60	53.58
258.816250	29.98	QP	112.0	Н	152.0	-13.5	70.60	40.62
368.838125	21.64	QP	120.0	Н	200.0	-10.6	70.60	48.96
490.802500	35.52	QP	199.0	Н	346.0	-5.7	70.60	35.08
504.356000	26.57	QP	110.0	Н	235.0	-5.1	70.60	44.03
734.365250	27.96	QP	132.0	V	91.0	-0.6	70.60	42.64

# 1 -25 GHz:

For Band edge and spurious emissions:

<b>F</b>	Mea	surement	Turntable Degree	Rx An	itenna	Corrected	Corrected	FCC P	art 18
Frequency (MHz)	Reading (dBµV)	PK/QP/Ave.		Height		Factor	Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	700mL water in center								
2399.54	14.13	Ave.	212	1.1	Н	31.87	46.00	70.60	24.60
2598.48	13.95	Ave.	0	1.2	Н	32.46	46.41	70.60	24.19
8331.20	31.46	Ave.	126	2.3	V	14.92	46.38	70.60	24.22

For Second and Third Harmonics:

Frequency (MHz)	Measurement		T (II	Rx Antenna		Corrected	Corrected	FCC Part 18	
	Reading (dBµV)	PK/QP/Ave.	Turntable Degree	Height	Polar (H / V)	Factor (dB/m)	Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
700mL water in center									
4900.00	30.28	Ave.	217	1.3	V	6.43	36.71	70.60	33.89
7350.00	30.15	Ave.	145	2.0	V	12.21	42.36	70.60	28.24
300mL water in center									
4900.00	30.06	Ave.	279	2.4	V	6.43	36.49	70.60	34.11
7350.00	30.25	Ave.	22	2.0	V	12.21	42.46	70.60	28.14

#### Note:

- 1) Corrected Amplitude = Meter Reading + Correction Factor
- 2) Correction Factor = Antenna Factor + Cable Loss Amplifier Gain
- 3) Margin = Limit Corrected Amplitude
- 4) The data below 20dB to the limit was not recorded.

# \*\*\*\*\* END OF REPORT \*\*\*\*\*