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:	RSZ160918550-00
Report Date:	2016-09-30
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Approved By:	Sula Huang RF Leader
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.(Dongguan). This report may contain data or test methods that are not covered by the NVLAP accreditation scope and shall be marked with an asterisk "*" and noted.

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Whirlpool Microwave Products Development Limited.'*s product, model number: *WMH31017 (FCC ID: PR4RED199X1)* or the "EUT" in this report is a *Microwave Oven ,* which was measured approximately: 75.5 cm (L) x 41.0 cm (W) x 44.0 cm (H), the input power is AC 120V/60Hz. The center frequency is 2450 MHz.

**All measurement and test data in this report was gathered from production sample serial number: 160918550. (Assigned by BACL, Dongguan). The EUT supplied by the applicant was received on 2016-09-20.*

Objective

This report is prepared on behalf of *Whirlpool Microwave Products Development Limited.* in accordance with Part 2-Subpart J, and Part 18-Subparts A, B and C of the Federal Communication Commission rules and regulations.

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

This is a CIIPC base on the original report RSZ141028552-00 with FCC ID: PR4RED199X1 which was granted on 2014-12-05, the differences between the original device and the current one are as follows:

1. Changing the magnetron, the original magnetron is Toshiba-2M253J, and the current one is LG-2M226.

2. Changing the appearance.

For the changes 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.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) has been fully described in reports submitted to the Federal Communications Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 06, 2015.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

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.

Equipment Modifications

No modifications were made to the EUT tested.

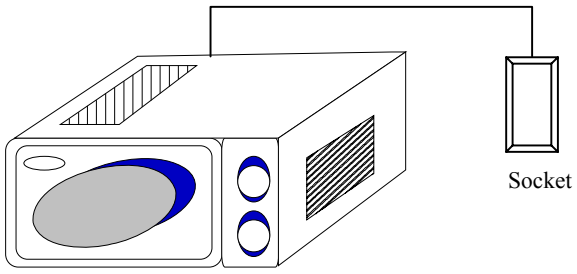
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	Remark
N/A	Socket	N/A	N/A	N/A

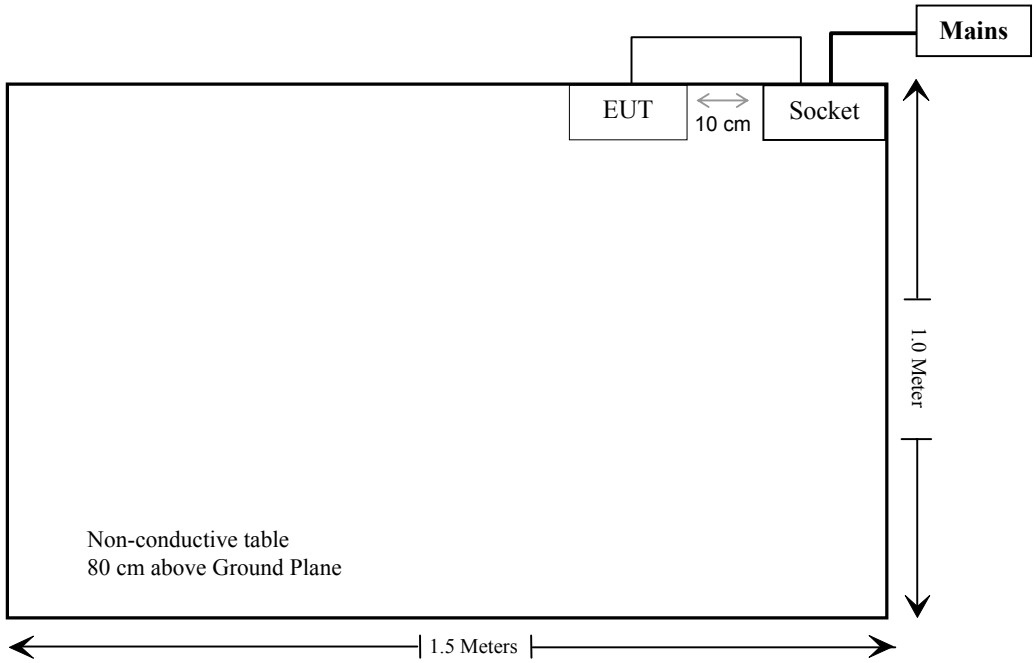
External Cable List and Details

Cable Description	Length (m)	From/Port	To
Un-shielding Un-detachable AC Cable	1.0	Mains	Socket

Configuration of Test Setup



Block Diagram of Test Setup



CONDUCTED EMISSIONS

Applicable Standard

FCC §18.307

Measurement Uncertainty

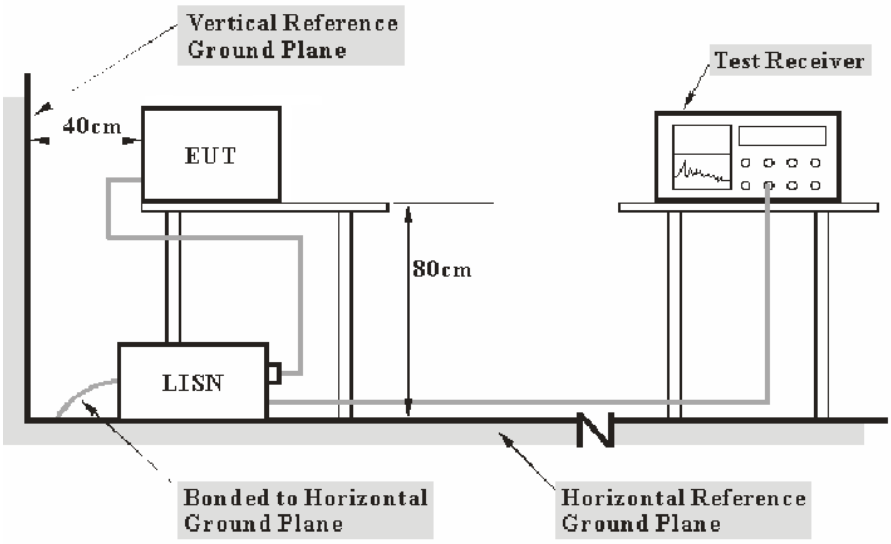
Compliance or non- compliance with a disturbance limit shall be determined in the following manner：

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:
– compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
– non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.
If U_{lab} is greater than U_{cispr} of Table 1, then:
– compliance is deemed to occur if no measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit;
– non - compliance is deemed to occur if any measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit.

Based on CISPR 16-4-2: 2011, measurement uncertainty of conducted disturbance at mains port using AMN at Bay Area Compliance Laboratories Corp. (Dongguan) is 3.12 dB (150 kHz to 30 MHz).

Port	Measurement uncertainty
AC Mains	3.34 dB (k=2, 95% level of confidence)

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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCS 30	830245/006	2015-12-10	2016-12-09
R&S	L.I.S.N	ESH2-Z5	892107/021	2016-09-01	2017-08-31
R&S	Two-line V-network	ENV 216	3560.6550.12	2015-11-26	2016-11-25
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A

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

Test Results Summary

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

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL., $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

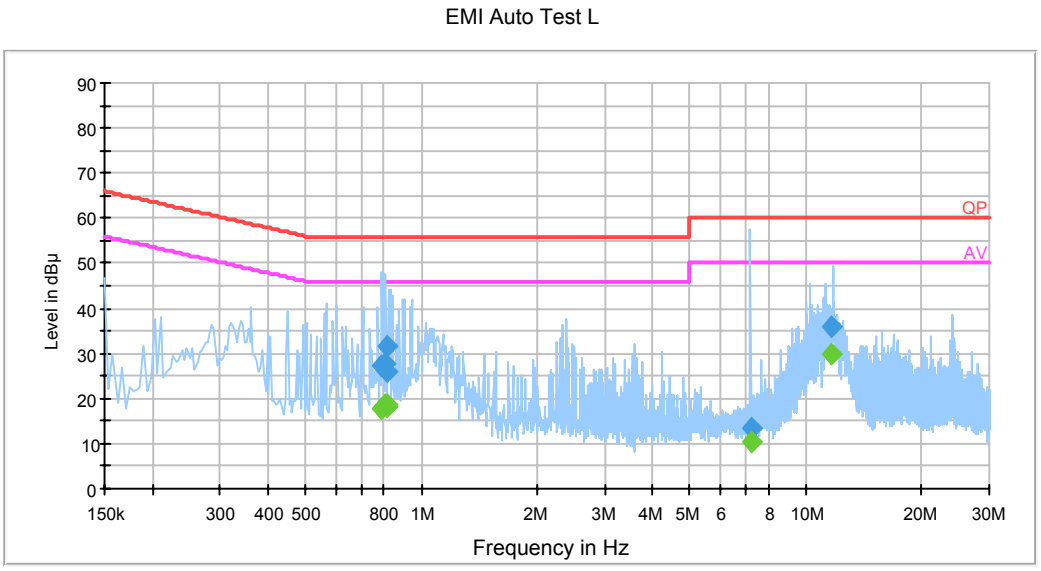
Environmental Conditions

Temperature:	30.9 ℃
Relative Humidity:	52 %
ATM Pressure:	99.7 kPa

The testing was performed by Kevin Yang on 2016-09-25.

Test Mode: cooking

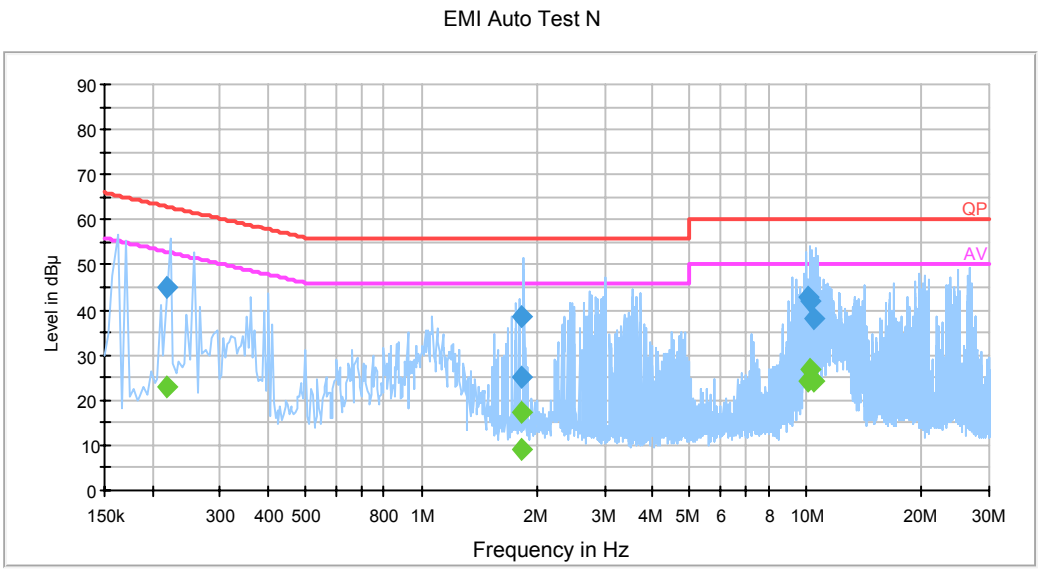
AC 120V/60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.786150	27.2	9.000	L1	19.9	28.8	56.0	Compliance
0.801910	27.8	9.000	L1	19.9	28.2	56.0	Compliance
0.809970	26.1	9.000	L1	19.9	29.9	56.0	Compliance
0.813670	31.7	9.000	L1	19.9	24.3	56.0	Compliance
7.250270	13.2	9.000	L1	20.0	46.8	60.0	Compliance
11.625810	36.0	9.000	L1	20.1	24.0	60.0	Compliance

Frequency (MHz)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)	Comment
0.786150	17.7	9.000	L1	19.9	28.3	46.0	Compliance
0.801910	18.8	9.000	L1	19.9	27.2	46.0	Compliance
0.809970	18.2	9.000	L1	19.9	27.8	46.0	Compliance
0.813670	18.5	9.000	L1	19.9	27.5	46.0	Compliance
7.250270	10.3	9.000	L1	20.0	42.5	50.0	Compliance
11.625810	30.1	9.000	L1	20.1	19.9	50.0	Compliance

AC120V/60Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.217500	45.2	9.000	N	20.0	17.7	62.9	Compliance
1.830190	38.5	9.000	N	20.0	17.5	56.0	Compliance
1.830310	25.3	9.000	N	20.0	30.7	56.0	Compliance
10.100270	43.0	9.000	N	20.1	17.0	60.0	Compliance
10.228910	41.9	9.000	N	20.1	18.1	60.0	Compliance
10.467570	38.0	9.000	N	20.1	22.0	60.0	Compliance

Frequency (MHz)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)	Comment
0.217500	22.9	9.000	N	20.0	30.1	52.9	Compliance
1.830190	17.3	9.000	N	20.0	28.7	46.0	Compliance
1.830310	8.9	9.000	N	20.0	37.1	46.0	Compliance
10.100270	24.1	9.000	N	20.1	25.9	50.0	Compliance
10.228910	26.8	9.000	N	20.1	23.2	50.0	Compliance
10.467570	24.0	9.000	N	20.1	26.0	50.0	Compliance

Note:
1) Corrected Amplitude = Reading + Correction Factor
2) Correction Factor =LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter
3) Margin = Limit – Corrected Amplitude

RADIATION HAZARD MEASUREMENT

Applicable Standard

FCC §18.301

Environmental Conditions

Temperature:	29.1 ℃
Relative Humidity:	48 %
ATM Pressure:	99.3 kPa

The testing was performed by Kevin Yang on 2016-09-27.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSEM	DE23437	2015-11-23	2016-11-22
ETS-Lindgren	Horn Antenna	3115	9808-5557	2015-09-06	2018-09-06
Mini-Circuit	Amplifier	ZVA-213-S+	054201245	2016-02-19	2017-02-19
MC	Thermometer	N/A	N/A	2015-11-01	2016-11-01
Holaday	Microwave Survey Meter	HI-1501	N/A	2015-11-01	2016-11-01
GW Instek	AC Power Meter	GPM-8212	CH150074	2016-04-10	2017-04-09
CAMRY	Electronic Weigher	EK3820	N/A	2015-11-03	2016-11-02

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

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 0.2mW/cm^2 observed at any point 5 cm or more from the external surface of the oven.

A maximum of 1.0mW/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.

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)
120	14.72	1766.4	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.

The RF output power is rated at 1000 watts

Load used for power output measurement = 1000 milliliters of water
Load used for frequency measurement = 1000 milliliters of water
Load used for harmonic measurement = 700 & 300 milliliters of water
Load used for other measurement = 700 milliliters of water

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 ºC ± 1 ºC C is used for the test. The water temperature is measured immediately before it is poured into the container.

A quantity of 1 000 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 20 ºC ± 2 ºC 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	377.0	24.5	10.0	20.0	45.0

RF Output Power = (4.187 x 1000 x (20.0 – 10) +0.55 x 377.0 x (20.0 – 24.5)) / 45 = 909.71 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_o 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 (909.71/500)

LFS = 33.72

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
33.72	30.56	70.56

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

Operating Frequency Measurement

Variation in Operating Frequency with Time

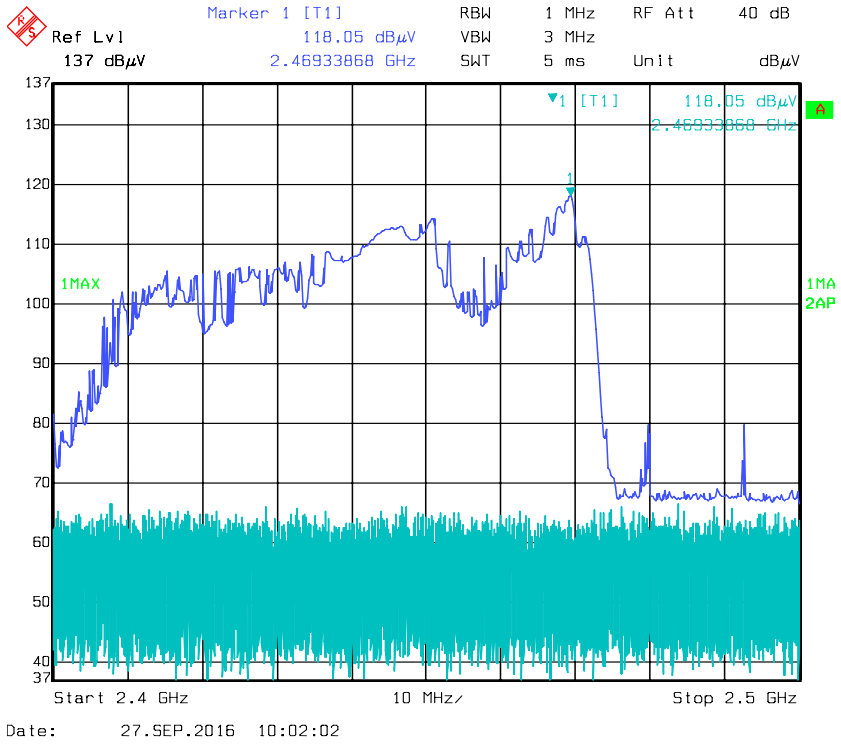
The operating frequency was measured using a spectrum analyzer. Starting with the EUT at room temperature, a 1000mL water load was placed in the center of the oven and the oven was operated at maximum output power. The fundamental operating frequency was monitored until the water load was reduced to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

The results of this test are as follows:

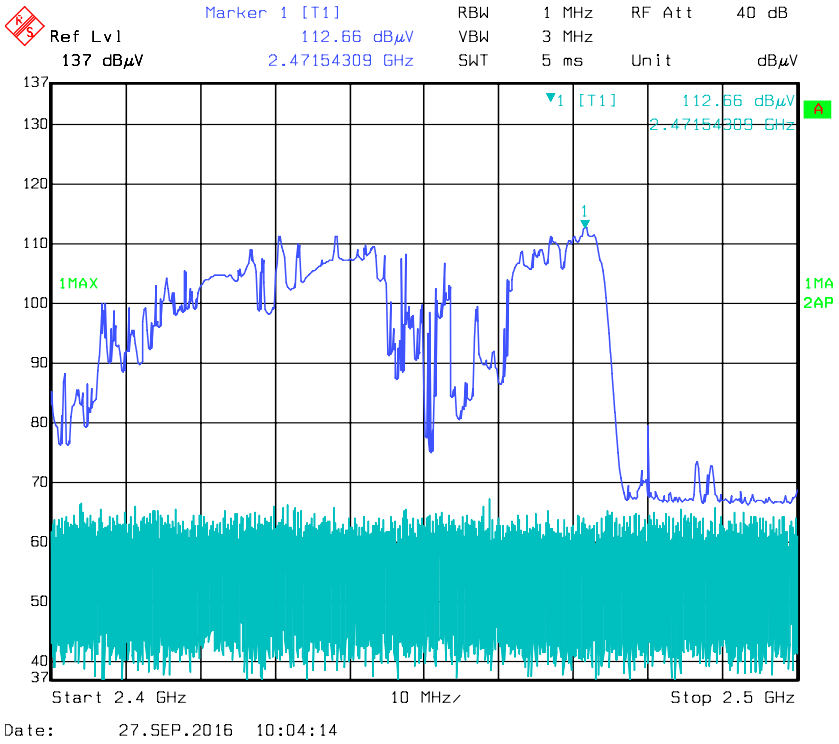
Frequency at Start time (MHz)	Frequency at End time (MHz)
2469.34	2471.54

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

Start time:



End time:



Variation in Operating Frequency with Line Voltage

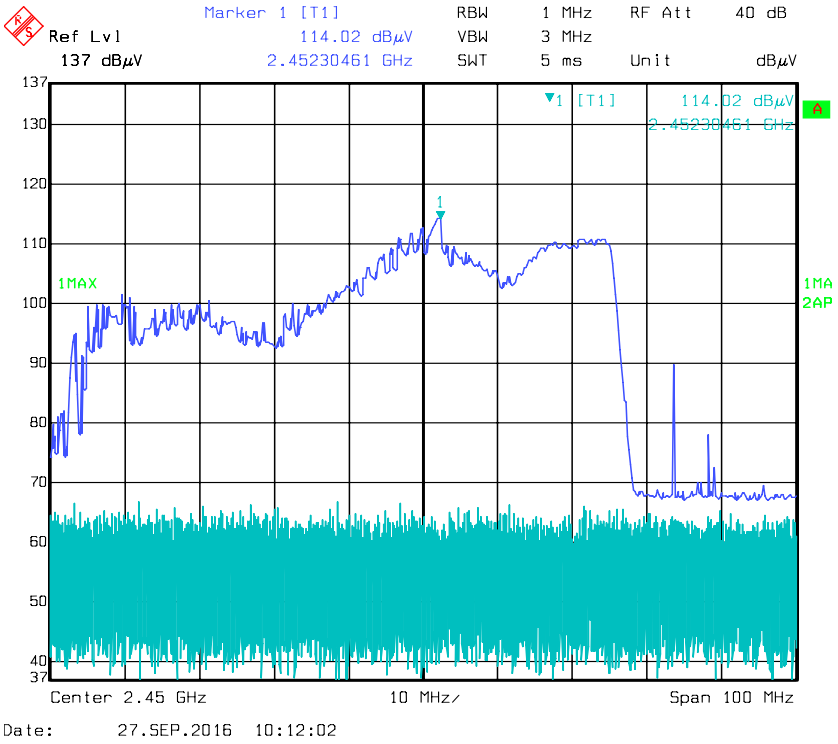
The EUT was operated / warmed by at least 10 minutes of use with a 1000 mL water load at room temperature at the beginning of the test. Then the operating frequency was monitored as the input voltage was varied between 80 and 125 percent of the nominal rating.

The results of this test are as follows:

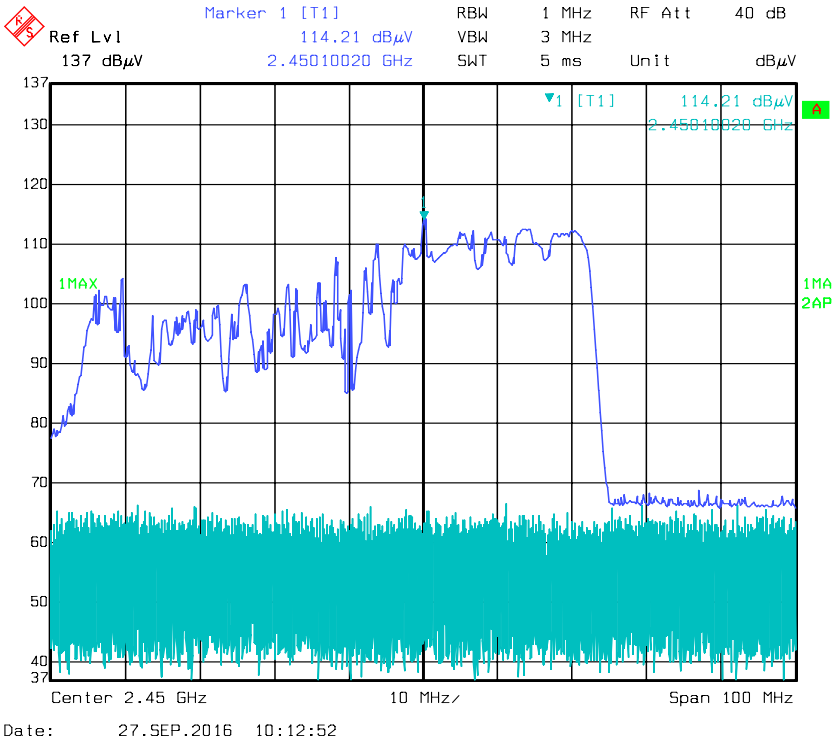
(Low voltage) Frequency (MHz)	(High voltage) Frequency (MHz)
2450.10	2452.30

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

High Voltage:



Low Voltage:



RADIATED EMISSIONS

Applicable Standard

FCC §18.305 and FCC §18.309

Measurement Uncertainty

Compliance or non- compliance with a disturbance limit shall be determined in the following manner：

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

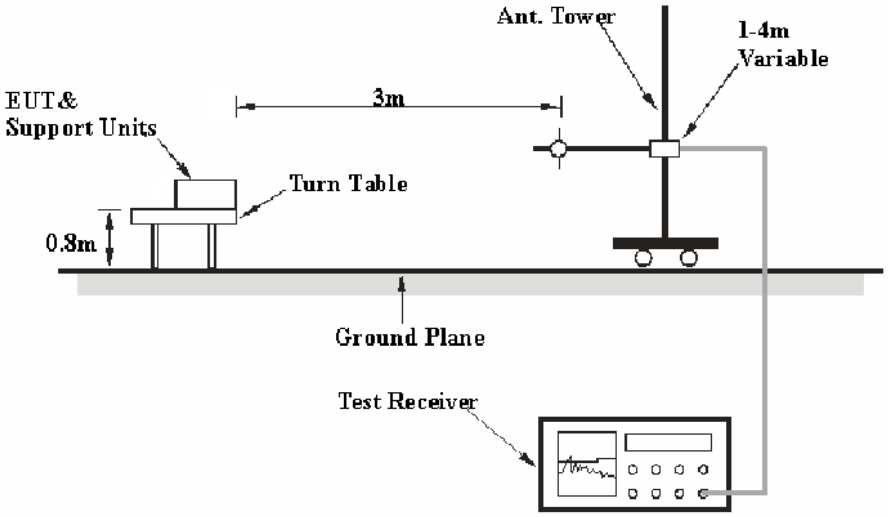
If U_{lab} is greater than U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit.

Based on CISPR 16-4-2: 2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Dongguan) is:
30M~200MHz: 4.55 dB for Horizontal, 4.57 dB for Vertical; 200M~1GHz: 4.66 dB for Horizontal, 4.56 dB for Vertical; measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Dongguan) is:30M~200MHz: 4.58 dB for Horizontal, 4.59 dB for Vertical; 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical; 1G~6GHz: 4.45 dB, 6G~18GHz: 5.23 dB.

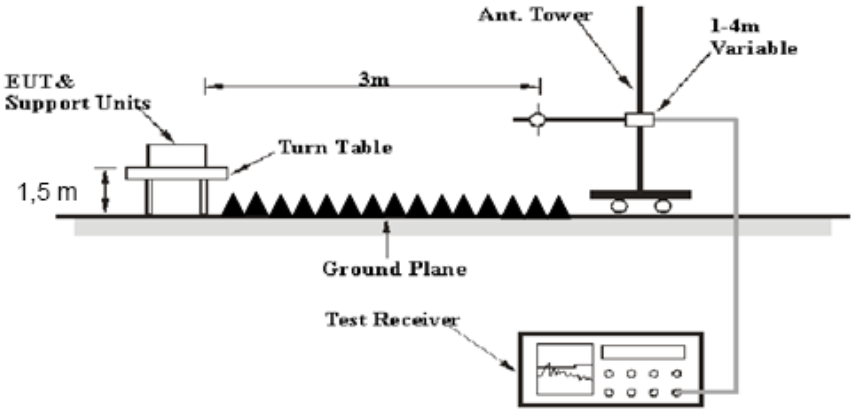
Frequency	Polarity	Measurement uncertainty
9 kHz~30MHz	/	4.04 dB (k=2, 95% level of confidence)
30MHz~200MHz	Horizontal	4.52 dB (k=2, 95% level of confidence)
	Vertical	4.72 dB (k=2, 95% level of confidence)
200MHz~1GHz	Horizontal	5.81 dB (k=2, 95% level of confidence)
	Vertical	4.64 dB (k=2, 95% level of confidence)
1 GHz~6 GHz	Horizontal / Vertical	4.88 dB (k=2, 95% level of confidence)
Above 6 GHz	Horizontal / Vertical	4.04 dB (k=2, 95% level of confidence)

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 24.5 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	Detector
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.

The data was recorded in the Quasi-peak detection mode from 30 MHz to 1 GHz, the average detection mode for above 1 GHz.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2016-09-01	2017-09-01
Sunol Sciences	Antenna	JB3	A060611-3	2014-11-06	2017-11-05
HP	Amplifier	8447E	2434A02181	2016-09-01	2017-09-01
Agilent	Spectrum Analyzer	E4440A	SG43360054	2015-11-23	2016-11-22
ETS-Lindgren	Horn Antenna	3115	9808-5557	2015-09-06	2018-09-06
Mini-Circuit	Amplifier	ZVA-213-S+	054201245	2016-02-19	2017-02-19
TDK	Chamber	Chamber A	2#	2013-10-15	2016-10-15
TDK	Chamber	Chamber B	1#	2016-07-23	2019-07-22

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

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

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL., $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data and Plots

Environmental Conditions

Temperature:	27.6 ℃
Relative Humidity:	40 %
ATM Pressure:	99.7 kPa

The testing was performed by Kevin Yang on 2016-09-25.

Test Mode: Running

30 MHz – 1 GHz:

Frequency (MHz)	Reading (dBuV/m)	Detector	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polar (H/V)
46.005100	45.52	QP	-10.52	35.00	70.56	35.56	V
54.102225	48.07	QP	-12.94	35.13	70.56	35.43	V
68.636250	50.09	QP	-12.29	37.80	70.56	32.76	V
82.617675	47.94	QP	-12.24	35.70	70.56	34.86	V
116.501300	34.07	QP	-6.27	27.80	70.56	42.76	V
389.767475	21.64	QP	-4.16	17.48	70.56	53.08	V

Above 1 GHz:

Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polar (H/V)
1204.409	45.70	AVG	-1.41	44.29	70.56	26.27	H
4236.473	36.01	AVG	7.74	43.75	70.56	26.81	H
8460.922	25.16	AVG	18.02	43.18	70.56	27.38	H
1204.409	52.25	AVG	-1.41	50.84	70.56	19.72	V
2567.134	39.71	AVG	2.98	42.69	70.56	27.87	V
8426.854	34.88	AVG	17.96	52.84	70.56	17.72	V

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