ACCREDITED
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CERTIFICATE # 4821.01

BACL
Bay Area Compliance Labs Corp.

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: PR4REDACU2X

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

Report Number: RSZ180518550-00

Report Date: 2018-05-29

Seal Deng

Reviewed By: EMC Engineer

Prepared By: Bay Area Compliance Laboratories Corp. (Shenzhen)
6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China
Tel: +86-755-33320018
Fax: +86-755-33320008
www.baclcorp.com.cn

Note: This report must not be used by the customer to claim product certification, approval, or endorsement by A2LA* or any agency of the Federal Government. * This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "*"

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Whirlpool Microwave Products Development Limited.'*s product, model number: *WMH53521 (FCC ID: PR4REDACU2X)* or the "EUT" in this report is a *Microwave oven*, which was measured approximately: 760 mm (L) x 435 mm (W) x 410 mm (H), the input power is AC 120V/60Hz. The highest operating frequency is 2450 MHz.

**All measurement and test data in this report was gathered from production sample serial number: 1805024 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2018-05-18.*

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 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. Changing the high voltage transformer to "W-1770(A)";

2. Changing the product model number to "WMH53521";

3. The door cosmetic is changed, including the control panel, outer door frame and handle;

4. The rating of cement resistance is changed.

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

Item			Expanded Measurement uncertainty
AC Power Line Conducted Emissions			2.20 dB (k=2, 95% level of confidence)
Radiated emission	30MHz~200MHz	Horizontal	4.58 dB (k=2, 95% level of confidence)
		Vertical	4.59 dB (k=2, 95% level of confidence)
	200MHz~1 GHz	Horizontal	4.83 dB (k=2, 95% level of confidence)
		Vertical	5.85 dB (k=2, 95% level of confidence)
	1 GHz~6 GHz	Horizontal/Vertical	4.08 dB (k=2, 95% level of confidence)
	Above 6 GHz	Horizontal/Vertical	4.59 dB (k=2, 95% level of confidence)
Occupied Bandwidth			±0.5kHz
Temperature			±1.0℃

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.

Equipment Modifications

No modifications were made to the EUT tested.

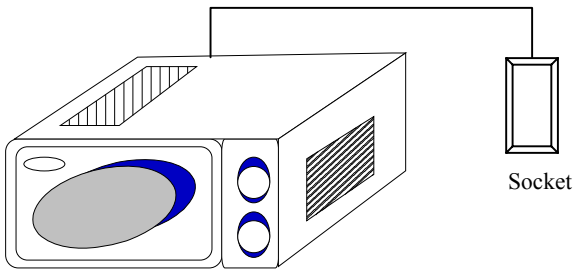
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Bull	Socket	N/A	140217

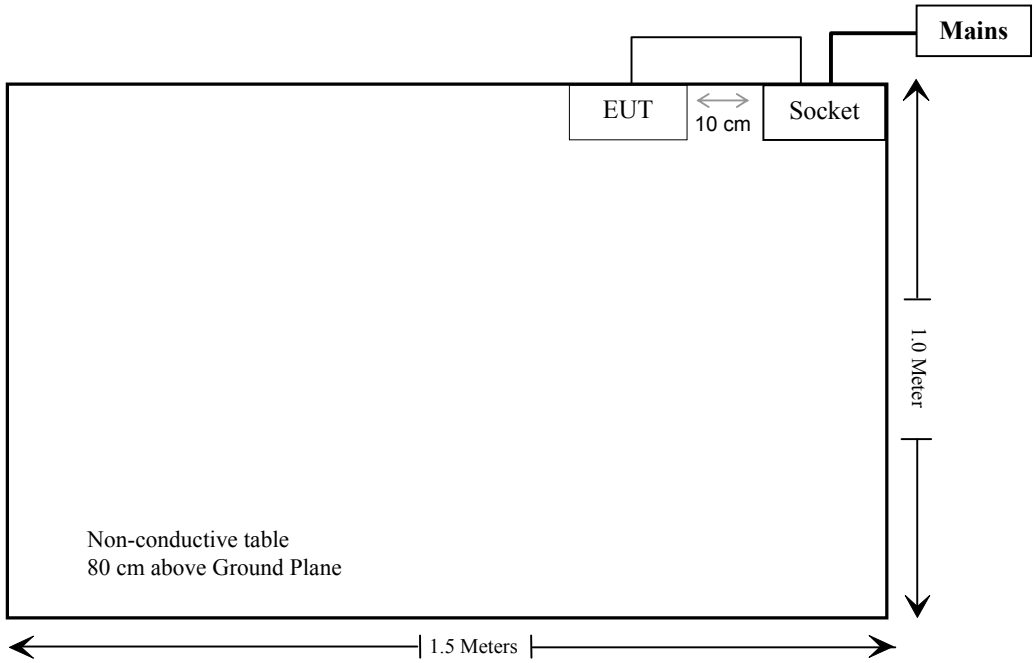
External Cable List and Details

Cable Description	Length (m)	From/Port	To
Un-shielding Un-detachable AC Cable	0.8	EUT	Socket
Un-shielding Un-detachable AC Cable	1.0	Mains	Socket

Configuration of Test Setup



Block Diagram of Test Setup



TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
CONDUCTED EMISSIONS					
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2017-08-04	2018-08-04
Rohde & Schwarz	LISN	ENV216	3560.6650.12-101613-Yb	2017-12-21	2018-12-21
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2018-05-21	2018-11-19
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
N/A	Conducted Emission Cable	N/A	UF A210B-1-0720-504504	2018-05-12	2018-11-12
RADIATION HAZARD MEASUREMENT					
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2018-04-24	2019-04-24
GW Instek	Power Meter	GPM 8212	CL110034	2018-04-09	2019-04-09
GW Instek	AC Power Meter	GPM 8212	CL110045	2018-04-09	2019-04-09
MC	Thermometer	N/A	N/A	2017-11-01	2018-11-01
A.H. System	Horn Antenna	SAS-200/571	135	2015-08-18	2018-08-17
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2018-05-21	2019-05-21
ETS	Microwave Survery Meter	1501	N/A	NCR	NCR
CAMRY	Electronic Weigher	EK3820	N/A	2017-11-03	2018-11-02
Ducommun technologies	RF Cable	UFA210A-1-4724-30050U	MFR64369 223410-001	2018-05-21	2018-11-19
Ducommun technologies	RF Cable	104PEA	218124002	2018-05-21	2018-11-19
RADIATED EMISSIONS					
HP	Amplifier	HP8447E	1937A01046	2018-05-21	2018-11-19
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2018-01-11	2019-01-11
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017-12-22	2020-12-21
Rohde & Schwarz	Signal Analyzer	FSEM	845987/005	2018-04-24	2019-04-24
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2018-05-21	2019-05-21
A.H.System	Horn Antenna	SAS-200/571	135	2015-08-18	2018-08-17
TDK	Chamber	Chamber A	2#	2016-12-05	2019-12-05
TDK	Chamber	Chamber B	1#	2016-12-06	2019-12-06
R&S	Auto test Software	EMC32	V9.10	NCR	NCR
Ducommun technologies	RF Cable	UFA210A-1-4724-30050U	MFR64369 223410-001	2018-05-21	2018-11-19
Ducommun technologies	RF Cable	104PEA	218124002	2018-05-21	2018-11-19

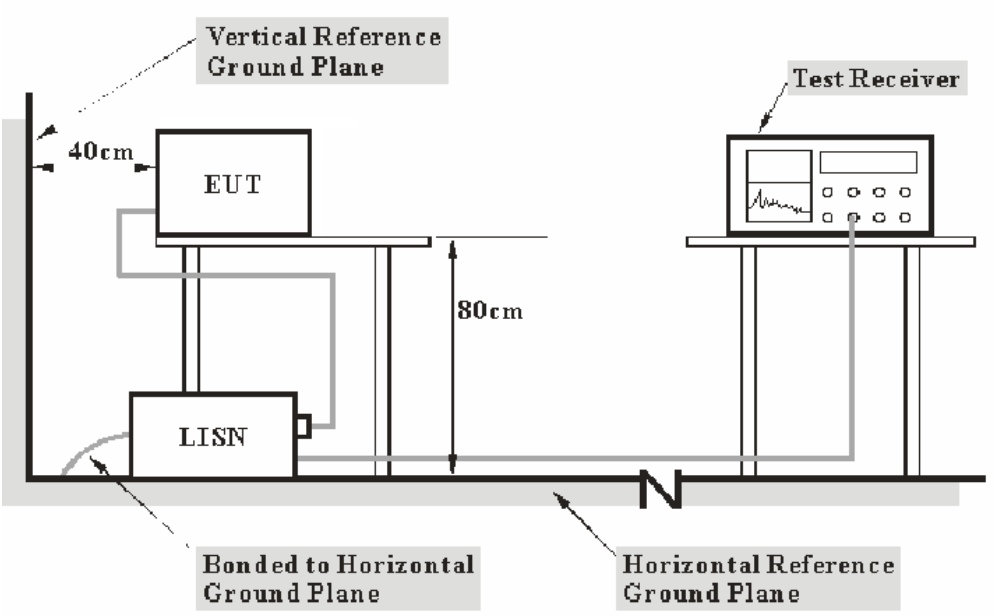
*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

CONDUCTED EMISSIONS

Applicable Standard

FCC §18.307

EUT Setup



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 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

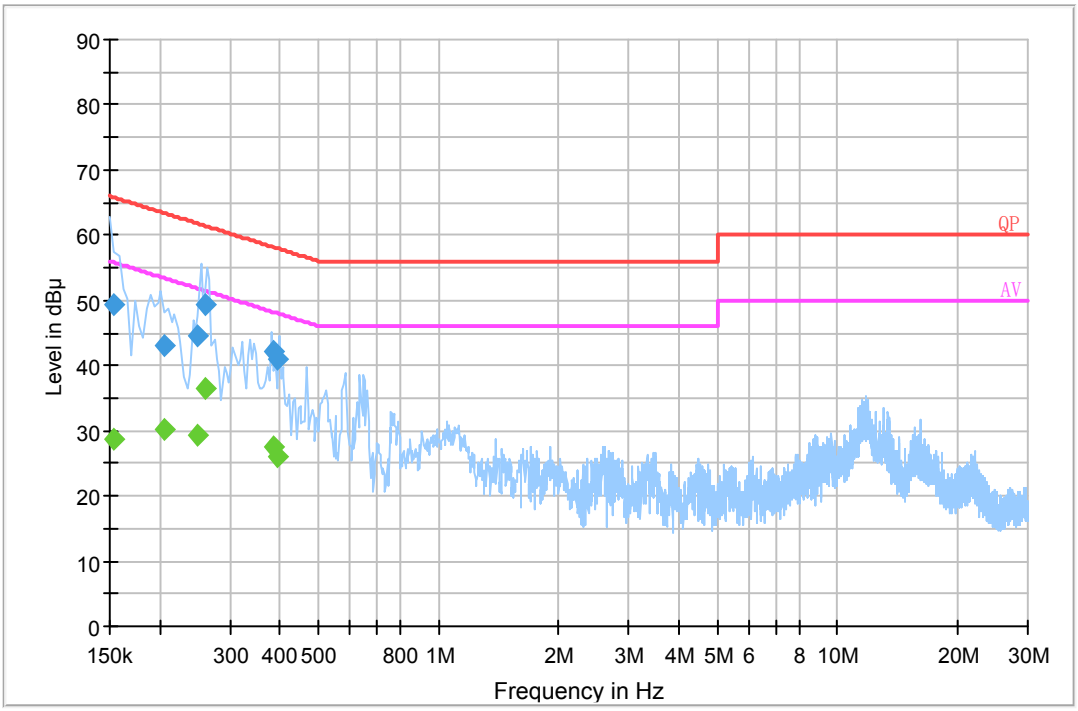
Environmental Conditions

Temperature:	26 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Hardy Wang on 2018-05-24.

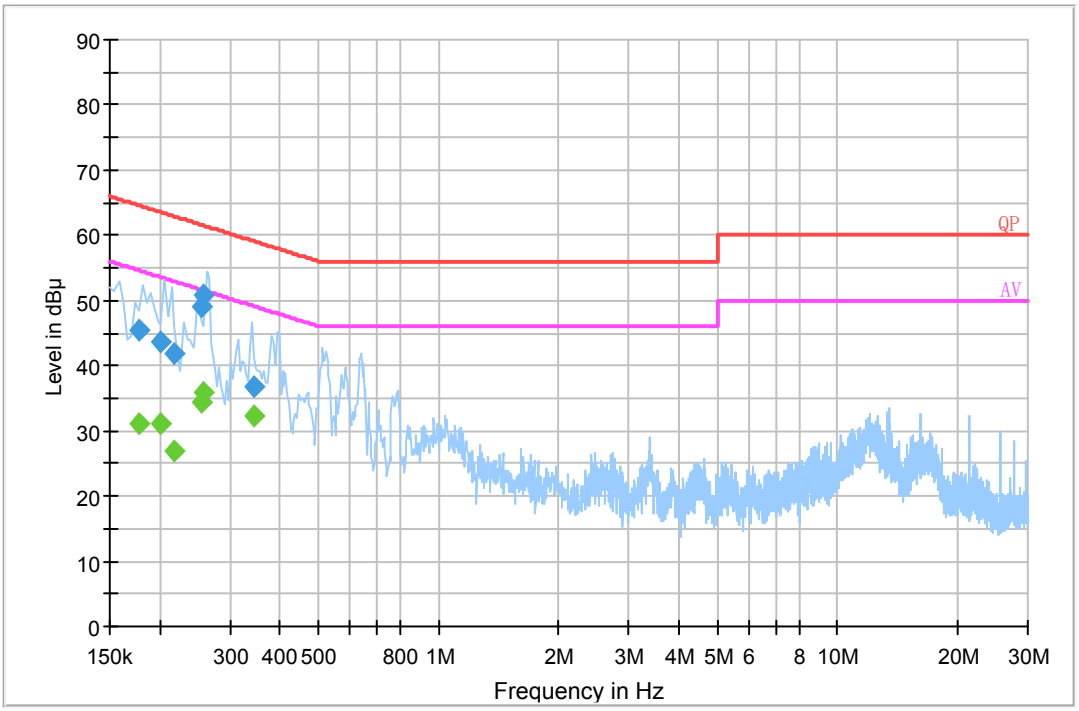
EUT operation mode: Boiling Water with MAX Power & Fan Maximum

AC 120V/60Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Corrected Factor (dB)	Limit (dBµV)	Margin (dB)	Remark (PK/QP/Ave.)
0.154000	49.4	20.1	65.8	16.4	QP
0.206500	43.2	20.1	63.3	20.1	QP
0.249500	44.5	20.1	61.8	17.3	QP
0.261500	49.2	20.1	61.4	12.2	QP
0.384270	42.3	20.1	58.2	15.9	QP
0.396030	40.9	20.1	57.9	17.0	QP
0.154000	28.7	20.1	55.8	27.1	Ave.
0.206500	30.3	20.1	53.3	23.0	Ave.
0.249500	29.4	20.1	51.8	22.4	Ave.
0.261500	36.5	20.1	51.4	14.9	Ave.
0.384270	27.4	20.1	48.2	20.8	Ave.
0.396030	25.9	20.1	47.9	22.0	Ave.

AC 120V/60Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Corrected Factor (dB)	Limit (dBµV)	Margin (dB)	Remark (PK/QP/Ave.)
0.177500	45.4	20.1	64.6	19.2	QP
0.201500	43.7	20.1	63.5	19.8	QP
0.218501	41.9	20.1	62.9	21.0	QP
0.253500	48.9	20.1	61.6	12.7	QP
0.257500	50.9	20.1	61.5	10.6	QP
0.344870	36.8	20.1	59.1	22.3	QP
0.177500	31.1	20.1	54.6	23.5	Ave.
0.201500	31.0	20.1	53.5	22.6	Ave.
0.218501	26.9	20.1	52.9	26.0	Ave.
0.253500	34.4	20.1	51.6	17.2	Ave.
0.257500	35.8	20.1	51.5	15.7	Ave.
0.344870	32.2	20.1	49.1	16.9	Ave.

Note:

1) Corrected Amplitude = Reading + Correction Factor
2) Correction Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation
3) Margin = Limit – Corrected Amplitude

RADIATION HAZARD MEASUREMENT

Applicable Standard

FCC §18.301

Test Data

Environmental Conditions

Temperature:	26 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Hardy Wang on 2018-05-22.

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 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^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)
119.5	14.73	1760	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 of 25 ºC ± 1 ºC 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 35 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	380.0	22	11.5	21.2	43

RF Output Power = (4.187 x 1000 x (21.2 –11.5) +0.55 x 380 x (21.2 –22))/43= 940.6 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 (940.6/500)

LFS = 34.289

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
34.289	30.70	70.70

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

Operating Frequency Measurement

Variation in Operating Frequency with Time

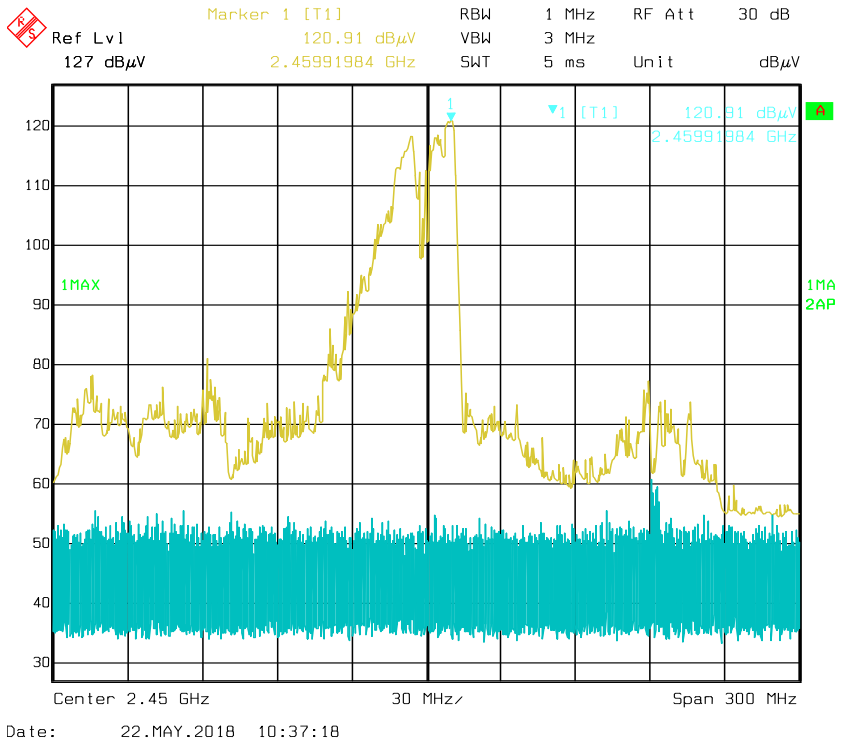
The operating frequency was measured using a spectrum analyzer. Starting with the EUT at room temperature, a 1000mL water load was placed in the center of the oven and the oven was operated at maximum output power. The fundamental operating frequency was monitored until the water load was reduced to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

The results of this test are as follows:

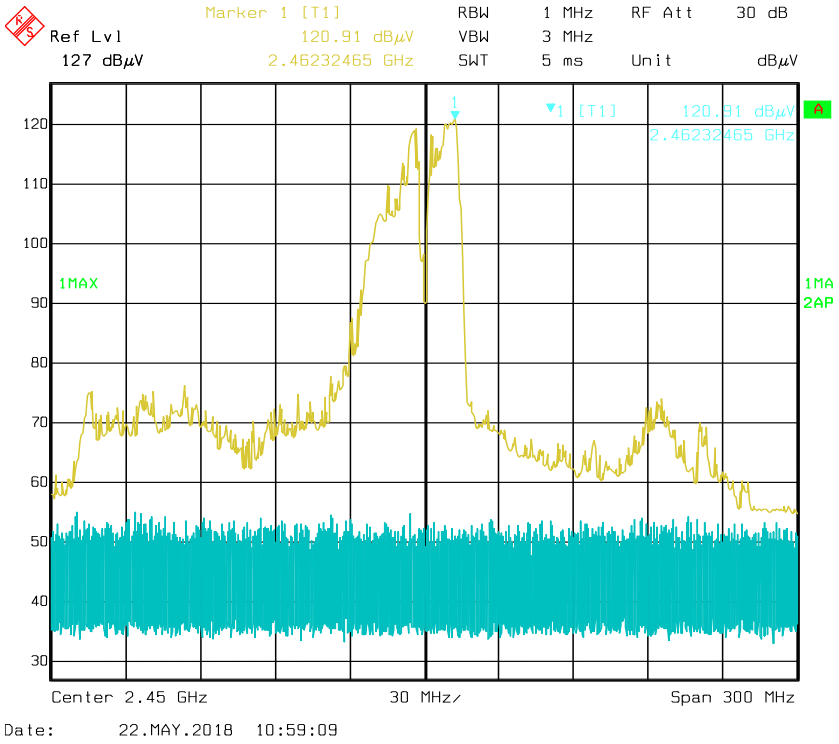
Frequency at Start time (MHz)	Frequency at End time (MHz)
2459.92	2462.32

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.

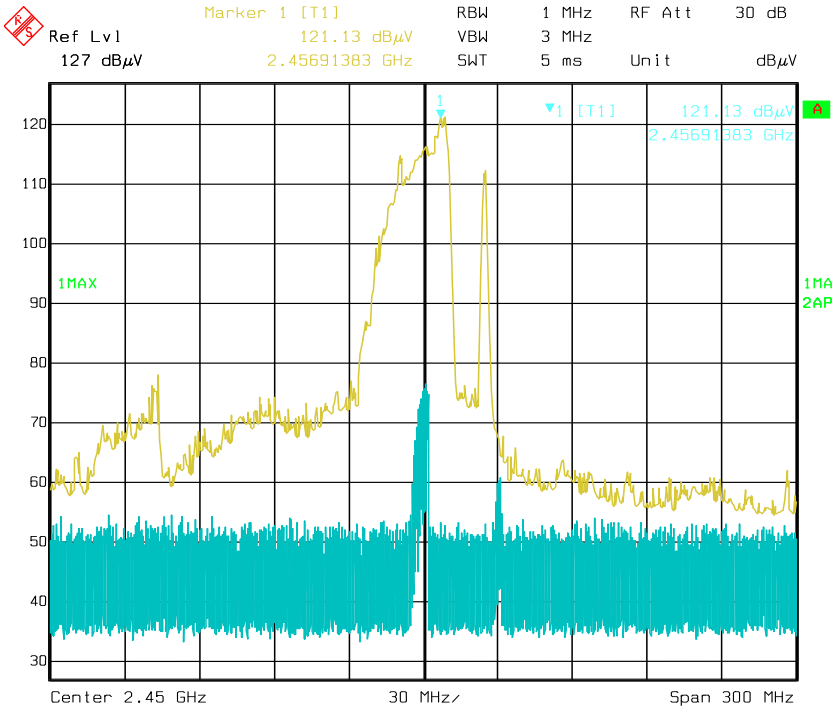
The results of this test are as follows:

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

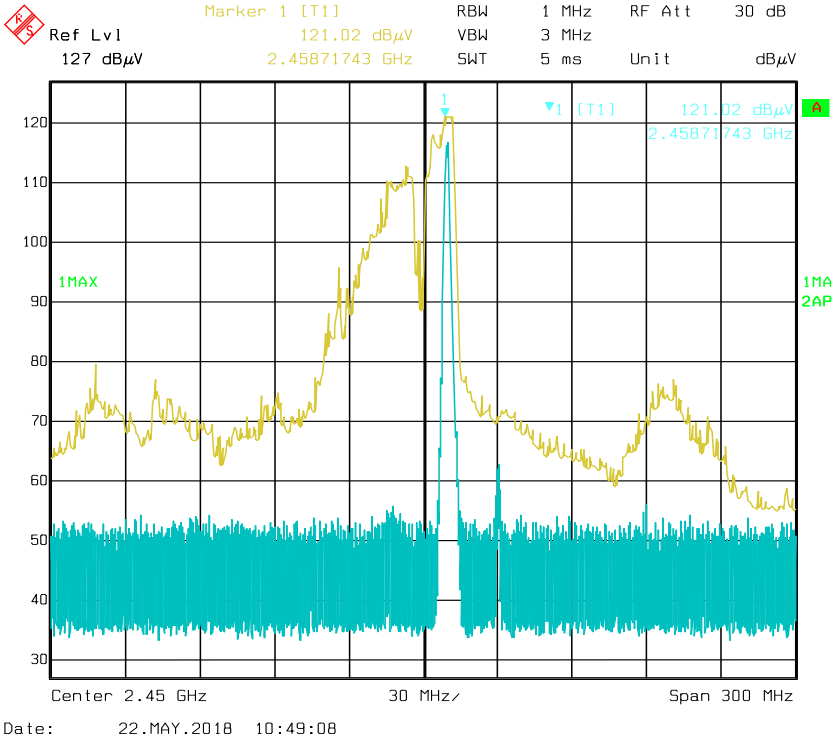
(Low voltage) Frequency (MHz)	(High voltage) Frequency (MHz)
2456.91	2458.72

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

High Voltage:



Low Voltage:



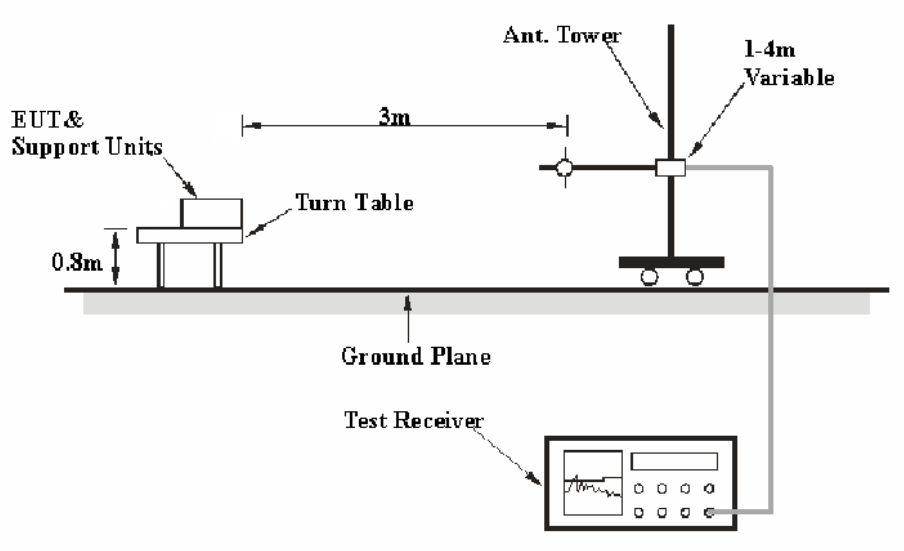
RADIATED EMISSIONS

Applicable Standard

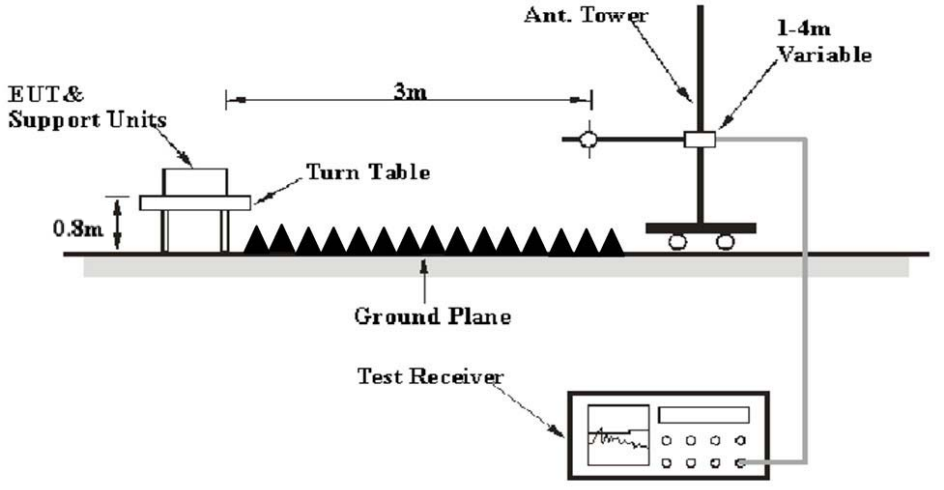
FCC §18.305 and FCC §18.309

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.

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 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:	26 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Hardy Wang on 2018-05-26.

EUT operation mode: Boiling Water with MAX Power & Fan Maximum

30 MHz – 1 GHz:

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Detector (PK/QP)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
30.388875	22.61	QP	332.0	V	95.0	0.5	70.70	48.09
460.964750	24.98	QP	116.0	H	166.0	0.9	70.70	45.72
542.364875	27.16	QP	187.0	V	103.0	5.0	70.70	43.54
691.060250	28.74	QP	390.0	V	0.0	6.4	70.70	41.96
788.265000	30.77	QP	256.0	H	47.0	9.0	70.70	39.93
886.122250	31.15	QP	226.0	V	183.0	10.0	70.70	39.55

1 GHz-25 GHz:

Frequency (MHz)	Measurement		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBµV/m)	FCC Part 18	
	Reading (dBµV)	PK/QP/Ave.		Height (m)	Polar (H / V)			Limit (dBµV/m)	Margin (dB)
4893.78	29.63	Ave.	244	1.6	H	6.21	35.84	70.70	34.86
4893.78	29.71	Ave.	244	1.6	V	6.21	35.92	70.70	34.78
7350.13	28.19	Ave.	118	2.2	H	13.02	41.21	70.70	29.49
7350.13	28.95	Ave.	118	2.2	V	13.02	41.97	70.70	28.73
8377.50	31.78	Ave.	257	1.2	H	12.80	44.58	70.70	26.12
8377.50	31.74	Ave.	257	1.2	V	12.80	44.54	70.70	26.16
2389.62	32.56	Ave.	186	1.6	H	-0.88	31.68	70.70	39.02
2389.62	32.78	Ave.	186	1.6	V	-0.88	31.90	70.70	38.80

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 *******