

**Electrolux Home Products, Inc.**

# **RF TEST REPORT**

**Report Type:**

FCC Part 15.247 & ISED RSS-247 RF report

**Model:**

EHAW4010AG, EHAW6020AG

**REPORT NUMBER:**

210900634SHA-001+A1

**ISSUE DATE:**

September 18, 2022

**DOCUMENT CONTROL NUMBER:**

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## TEST REPORT

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Report no.: 210900634SHA-001+A1

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**Manufacturer:** Electrolux Home Products, Inc.  
10200 David Taylor Drive, Charlotte, NC 28262, United States

**FCC ID:** 2A3EWEHAW4

**IC:** 12012A-EHAW4

### SUMMARY:

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

**47CFR Part 15 (2020):** Radio Frequency Devices (Subpart C)

**ANSI C63.10 (2013):** American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

**RSS-247 Issue 2 (February 2017):** Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

**RSS-Gen Issue 5 (April 2018)+A1(March 2019):** General Requirements for Compliance of Radio Apparatus

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**TEST REPORT****Revision History**

Report No.	Version	Description	Issued Date
210900634SHA-001+A1	Rev. 01	<p>This report is based on the original report 210900634SHA-001 for amendment, there is no change on the RF wireless part.</p> <p>The changes as below:</p> <p>1, add alternative cost out motor, the spec is the same as before</p> <p>2, add alternative TVOC sensor on the RFID board, the spec is the same as before</p> <p>3, remove TVS on control board and RFID board</p> <p>Construction checked and after review, we test the Radiated Emissions of 30MHz-1GHz and conducted emission for WIFI.</p>	September 18, 2022

**TEST REPORT****Measurement result summary**

TEST ITEM	FCC REFERANCE	IC REFERANCE	RESULT
Minimum 6dB Bandwidth	15.247(a)(2)	RSS-247 Issue 2 Clause 5.2	Pass*
Maximum conducted output power and e.i.r.p.	15.247(b)(3)	RSS-247 Issue 2 Clause 5.4	Pass*
Power spectrum density	15.247(e)	RSS-247 Issue 2 Clause 5.2	Pass*
Emission outside the frequency band	15.247(d)	RSS-247 Issue 2 Clause 5.5	Pass*
Radiated Emissions in restricted frequency bands	15.247(d), 15.205&15.209	RSS-Gen Issue 5 Clause 8.9&8.10	Pass
Power line conducted emission	15.207(a)	RSS-Gen Issue 5 Clause 8.8	Pass*
Occupied bandwidth	-	RSS-Gen Issue 5 Clause 6.7	Tested*
Antenna requirement	15.203	-	Pass*

Notes: 1: NA =Not Applicable

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

3:“\*” means this test is no need and not performed within this report, and the result can refer to the original report(s).

**TEST REPORT****1 GENERAL INFORMATION****1.1 Description of Equipment Under Test (EUT)**

Product name:	Air Purifier
Type/Model/PMN/HVIN:	EHAW4010AG, EHAW6020AG
Description of EUT:	<p>This report is based on the original report 210900634SHA-001 for amendment, there is no change on the RF wireless part.</p> <p>The changes as below:</p> <p>1, add alternative cost out motor, the spec is the same as before 2, add alternative TVOC sensor on the RFID board, the spec is the same as before 3, remove TVS on control board and RFID board</p> <p>Construction checked and after review, we test the Radiated Emissions of 30MHz-1GHz and conducted emission for WIFI.</p>
Rating:	120V~, 60Hz
EUT type:	<input type="checkbox"/> Table top <input checked="" type="checkbox"/> Floor standing
Software Version:	/
Hardware Version:	/
Sample No.:	0220817-06-002
Sample received date:	August 17, 2022
Date of test:	August 18, 2022~ August 23, 2022

**1.2 Technical Specification**

Frequency Range:	2412MHz ~ 2462MHz
Support Standards:	IEEE 802.11b, IEEE 802.11g, IEEE 802.11n-HT20, IEEE 802.11n-HT40
Type of Modulation:	IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM (64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11n-HT20: OFDM (64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11n-HT40: OFDM (64-QAM, 16-QAM, QPSK, BPSK)
Channel Number:	11 Channels for 802.11b, 802.11g and 802.11n(HT20) 7 Channels for 802.11n(HT40)
Data Rate:	IEEE 802.11b: Up to 11 Mbps IEEE 802.11g: Up to 54 Mbps IEEE 802.11n-HT20: Up to MCS7 IEEE 802.11n-HT40: Up to MCS7
Channel Separation:	5 MHz

**TEST REPORT****1.3 Antenna information**

Antenna No.	Model	Antenna type	Antenna Gain	Note
1	/	PCB antenna	1.5	

Mode	Tx/Rx Function	Beamforming function	CDD function
802.11b	1Tx/1Rx	NO	NO
802.11g	1Tx/1Rx	NO	NO
802.11n(HT20)	1Tx/1Rx	NO	NO
802.11n(HT40)	1Tx/1Rx	NO	NO

**TEST REPORT****1.4 Description of Test Facility**

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

The test facility is recognized, certified, or accredited by these organizations:	CNAS Accreditation Lab Registration No. CNAS L0139
	FCC Accredited Lab Designation Number: CN0175
	IC Registration Lab CAB identifier.: CN0051
	VCCI Registration Lab Registration No.: R-14243, G-10845, C-14723, T-12252
	A2LA Accreditation Lab Certificate Number: 3309.02

## TEST REPORT

## 2 TEST SPECIFICATIONS

### 2.1 Standards or specification

47CFR Part 15 (2020)  
 ANSI C63.10 (2013)  
 KDB 558074 D01(v05r02)  
 RSS-247 Issue 2 (February 2017)  
 RSS-Gen Issue 5 (April 2018)+A1(March 2019)

### 2.2 Mode of operation during the test

While testing transmitting mode of EUT, the continuously transmission was applied by following software.

Software name	Manufacturer	Version	Supplied by
WiFi_QA_Tool	/	v3.0.4	Manufacturer

The lowest, middle and highest channel were tested as representatives.

Frequency Band (MHz)	Mode	Lowest (MHz)	Middle (MHz)	Highest (MHz)
2400-2483.5	802.11b	2412	2437	2462
	802.11g	2412	2437	2462
	802.11n(HT20)	2412	2437	2462
	802.11n(HT40)	2422	2437	2452

#### Data rate VS Power:

The pre-scan for the conducted power with all rates in each modulation and bands was used, and the worst case was found and used in all test cases. After this pre-scan, we choose the following table of the data rate as the worst case.

Frequency Band (MHz)	Mode	Worst case data rate
2400-2483.5	802.11b	1Mbps
	802.11g	6Mbps
	802.11n(HT20)	MCS0
	802.11n(HT40)	MCS0

### 2.3 Test software list

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

**TEST REPORT****2.4 Test peripherals list**

Item No.	Name	Band and Model	Description
1	Laptop computer	HP ProBook 6470b	100-240V AC, 50/60Hz

**2.5 Test environment condition:**

Test items	Temperature	Humidity
Minimum 6dB Bandwidth	NA	NA
Maximum conducted output power and e.i.r.p.		
Power spectrum density		
Emission outside the frequency band		
Occupied bandwidth		
Radiated Emissions in restricted frequency bands	25°C	51% RH
Power line conducted emission	25°C	51% RH

**TEST REPORT**
**2.6 Instrument list**

Conducted Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
<input checked="" type="checkbox"/>	Test Receiver	R&S	ESCS 30	EC 2107	2023-07-15
<input checked="" type="checkbox"/>	A.M.N.	R&S	ESH2-Z5	EC 3119	2022-11-30
<input checked="" type="checkbox"/>	Shielded room	Zhongyu	-	EC 2838	2023-01-07
Radiated Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
<input checked="" type="checkbox"/>	Test Receiver	R&S	ESIB 26	EC 3045	2022-09-15
<input checked="" type="checkbox"/>	Bilog Antenna	TESEQ	CBL 6112D	EC 4206	2022-09-23
<input checked="" type="checkbox"/>	Pre-amplifier	R&S	AFS42-00101800-25-S-42	EC5262	2023-06-11
<input checked="" type="checkbox"/>	Semi-anechoic chamber	Albatross	-	EC 3048	2023-07-31
Additional instrument					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
<input checked="" type="checkbox"/>	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 5198	2023-01-05
<input checked="" type="checkbox"/>	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3481	2023-01-05

**TEST REPORT****2.7 Measurement uncertainty**

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

Test item	Measurement uncertainty
Maximum peak output power	± 0.74dB
Radiated Emissions in restricted frequency bands below 1GHz	± 4.90dB
Radiated Emissions in restricted frequency bands above 1GHz	± 5.02dB
Emission outside the frequency band	± 2.89dB
Occupied Channel Bandwidth	± 0.88 %
Power line conducted emission	± 3.19dB

**TEST REPORT**

### 3 Radiated Emissions in restricted frequency bands

**Test result:** Pass

#### 3.1 Limit

The radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified showed as below:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

#### 3.2 Measurement Procedure

##### For Radiated emission below 30MHz:

- a) The EUT was placed on the top of a rotating table 0.8 meters (0.1 meters for floor-standing device) above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b) The EUT was set 3 meters away from the interference-receiving antenna, the lowest height of the magnetic antenna was 1 m above the ground.
- c) Both X and Y axes of the antenna are set to make the measurement.
- d) For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e) The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

**NOTE:**

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

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

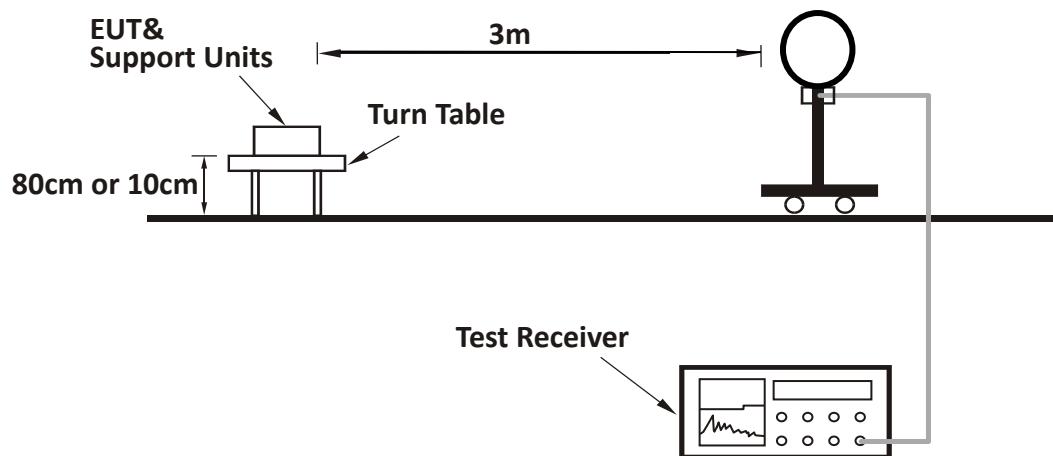
- a) The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) or 0.1 meters (for floor-standing device) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c) The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e) The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f) The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

**Note:**

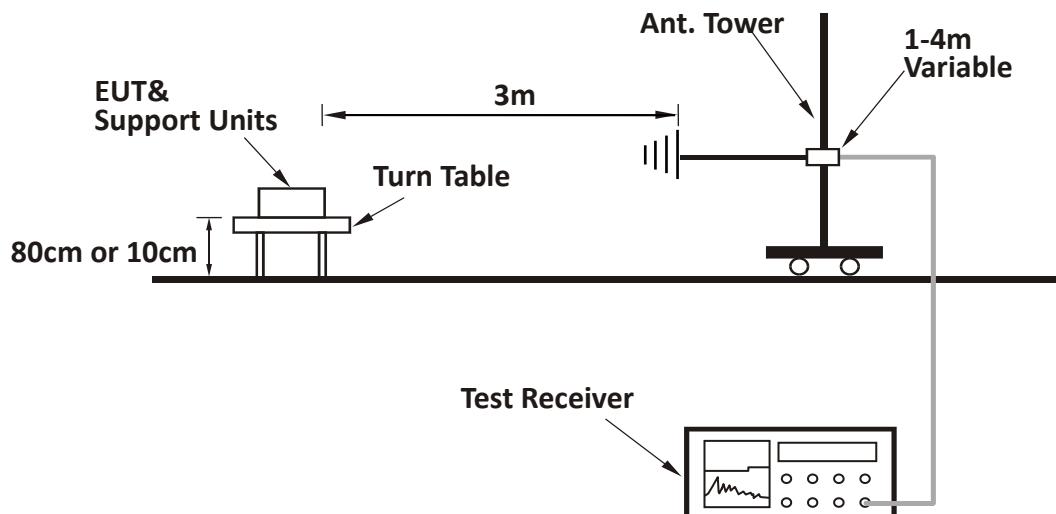
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

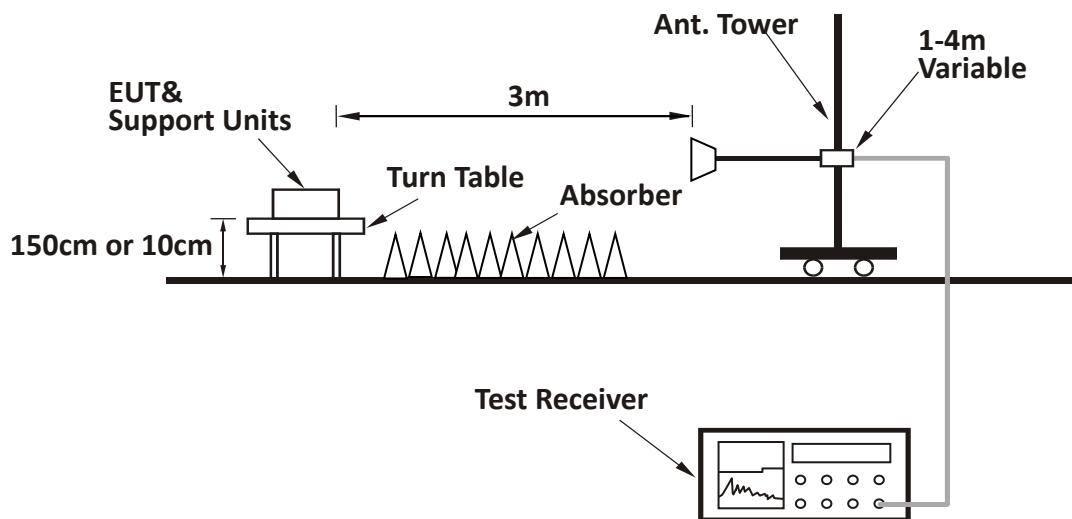
**TEST REPORT****3.3 Test Configuration**

For Radiated emission below 30MHz:



For Radiated emission 30MHz to 1GHz:



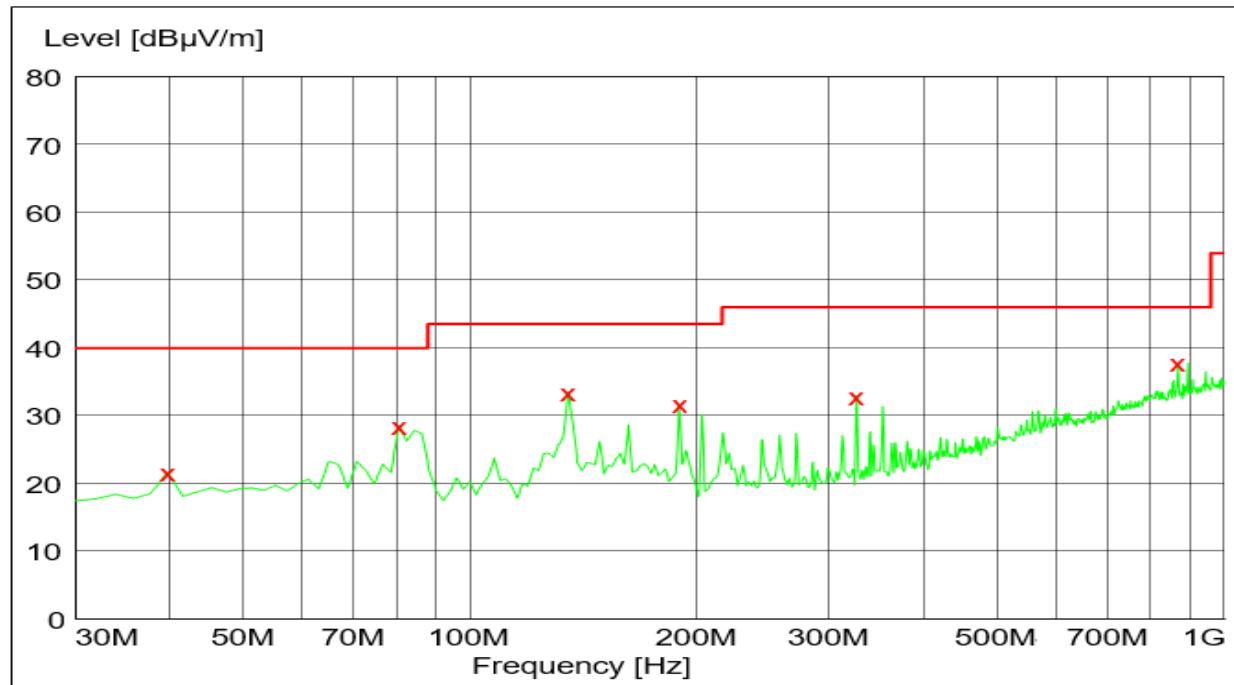
**TEST REPORT****For Radiated emission above 1GHz:**

**TEST REPORT****3.4 Test Results of Radiated Emissions**

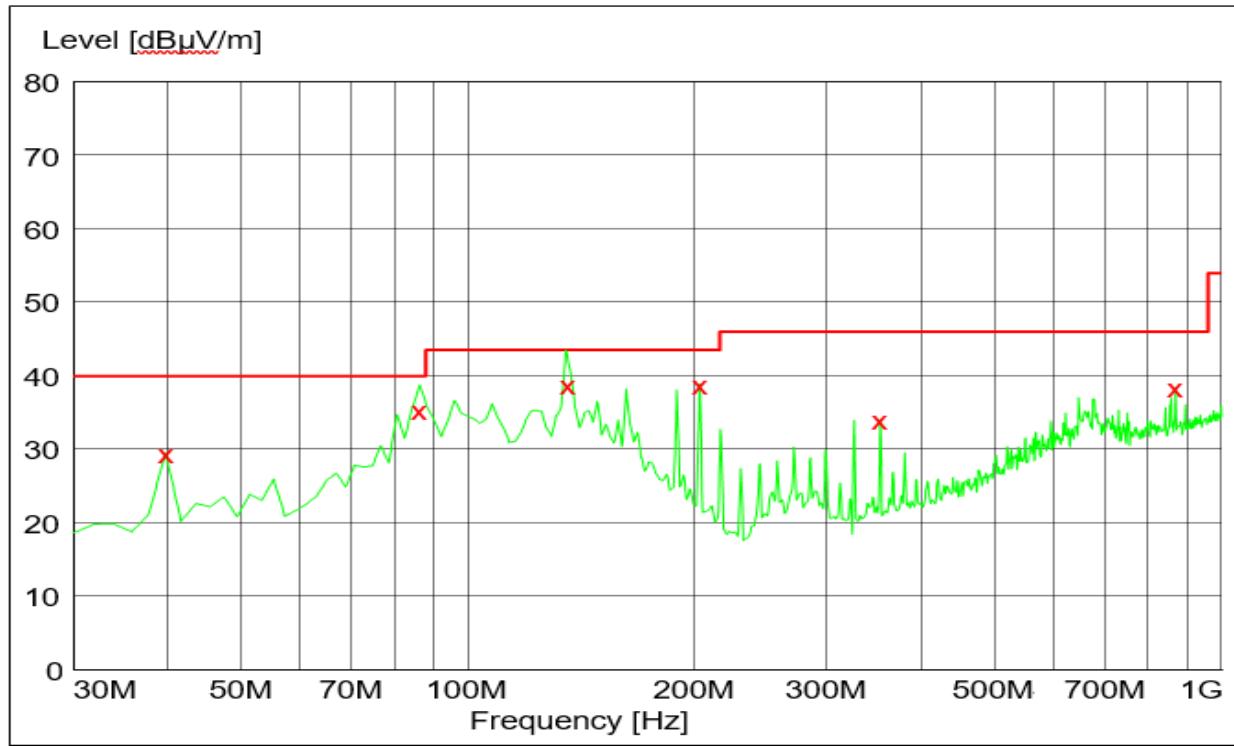
The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 1.5.31(o) was not reported.

The worst waveform from 30MHz to 1000MHz is listed as below:

Horizontal



Vertical



**TEST REPORT****Test data below 1GHz**

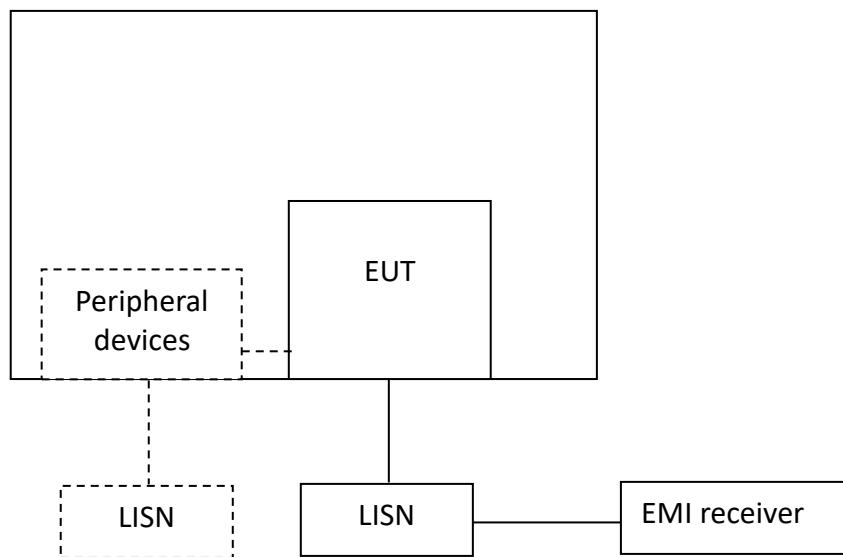
Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
H	39.72	21.70	13.80	40.00	18.30	PK
H	80.54	28.60	9.90	40.00	11.40	PK
H	134.97	33.50	13.50	43.50	10.00	PK
H	189.40	31.70	12.20	43.50	11.80	PK
H	325.47	33.00	15.80	46.00	13.00	PK
H	867.82	37.80	26.00	46.00	8.20	PK
V	39.72	29.60	13.80	40.00	10.40	PK
V	86.37	35.50	9.20	40.00	4.50	QP
V	135.63	39.00	13.50	43.50	4.50	QP
V	203.01	38.90	11.40	43.50	4.60	PK
V	352.69	34.10	16.50	46.00	11.90	PK
V	867.82	38.40	26.00	46.00	7.60	PK

Note: The worst test result (30MHz to 1GHz) of 802.11b channel L (2412MHz) was chosen to list in the report as representative.

**TEST REPORT****4 Power line conducted emission**Test result: **Pass****4.1 Limit**

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	QP	AV
0.15-0.5	66 to 56*	56 to 46 *
0.5-5	56	46
5-30	60	50

\* Decreases with the logarithm of the frequency.

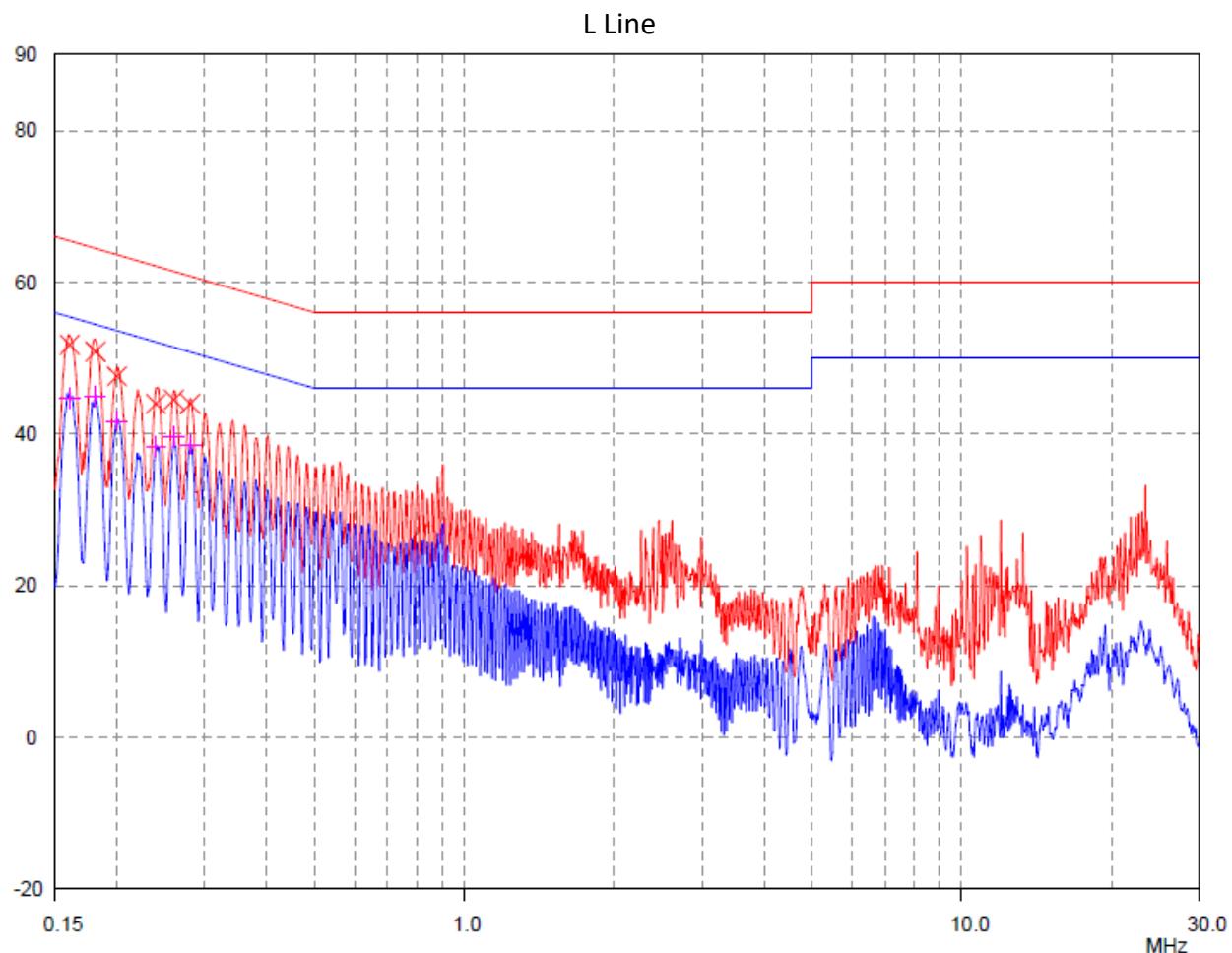
**4.2 Test Configuration**

**TEST REPORT****4.3 Measurement Procedure**

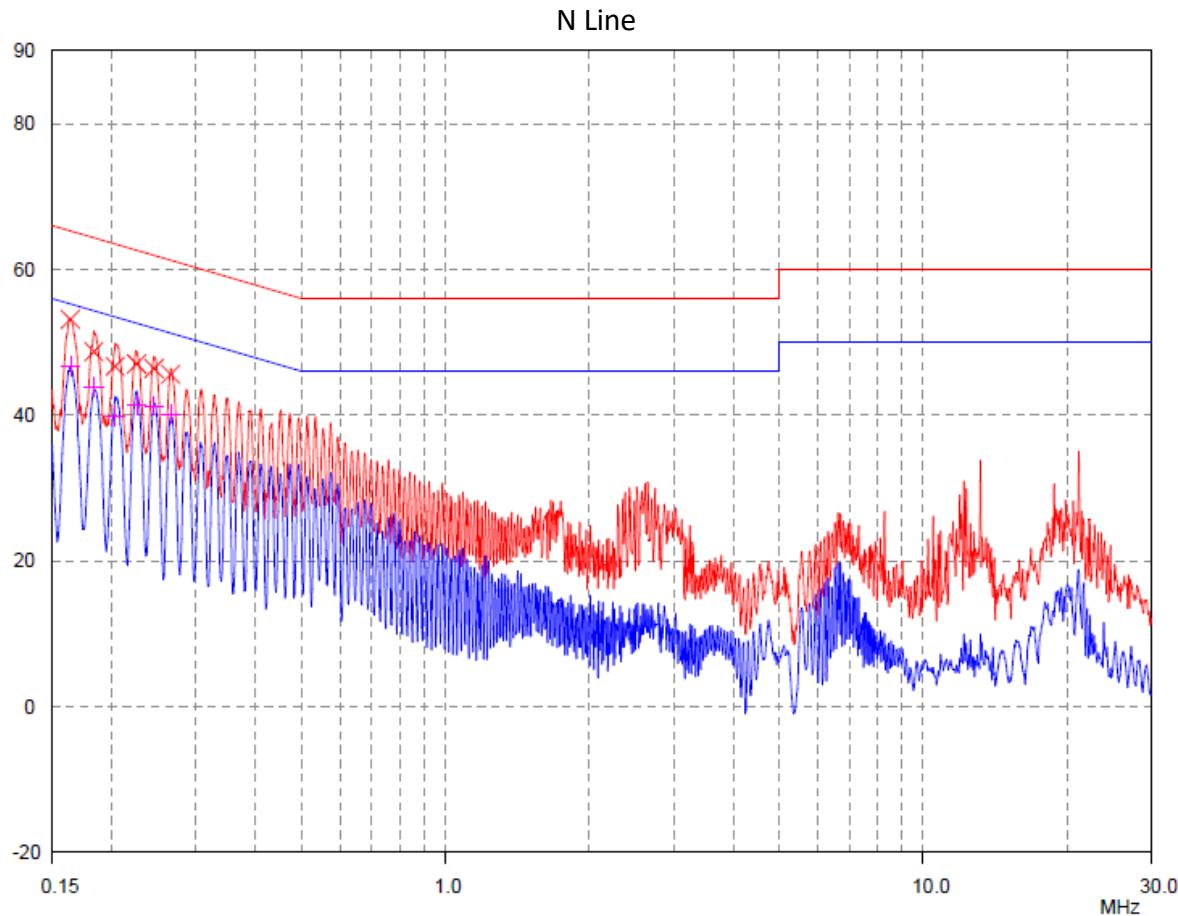
Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument. All emission voltage and current measurements shall be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

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

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

**TEST REPORT**
**4.4 Test Results of Power line conducted emission**
**Test Curve:**

**Test Data:**

Frequency (MHz)	Quasi-peak			Average		
	level dB(µV)	Limit dB(µV)	Margin (dB)	level dB(µV)	limit dB(µV)	Margin (dB)
0.16	51.76	65.44	13.68	44.76	55.44	10.68
0.18	50.87	64.44	13.57	44.93	54.44	9.51
0.20	47.59	63.61	16.02	41.69	53.61	11.92
0.24	43.99	62.12	18.13	38.30	52.12	13.82
0.26	44.54	61.42	16.88	39.61	51.42	11.81
0.28	43.99	60.79	16.80	38.62	50.79	12.17

**TEST REPORT**
**Test Curve:**

**Test Data:**

Frequency (MHz)	Quasi-peak			Average		
	level dB(µV)	Limit dB(µV)	Margin (dB)	level dB(µV)	limit dB(µV)	Margin (dB)
0.16	53.15	65.27	12.12	46.74	55.27	8.53
0.18	48.71	64.34	15.63	43.86	54.34	10.48
0.20	46.71	63.48	16.77	39.86	53.48	13.62
0.23	47.03	62.62	15.59	41.46	52.62	11.16
0.25	46.41	61.92	15.51	41.22	51.92	10.70
0.27	45.62	61.26	15.64	40.18	51.26	11.08

Remark: 1. Correct Factor = LISN Factor + Cable Loss, the value was added to Original Receiver Reading by the software automatically.

2. Corrected Reading = Original Receiver Reading + Correct Factor

3. Margin = Limit - Corrected Reading

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

\*\*\*\*\* END \*\*\*\*\*