

## EMC TEST REPORT

### No. 140401703SHA-001

Applicant : Royal Appliance Mfg. Co.  
7005 Cochran Road Glenwillow, OH 44139 USA

Manufacturer : Suzhou Cleanex Electric Co., Ltd  
22, Beiguandu Rd., Wuzhong District, Suzhou

Equipment : Vacuum Cleaner

Type/Model : LW1500RS

### SUMMARY

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

**47CFR Part 15 (2013):** Radio Frequency Devices

**ANSI C63.4 (2003):** American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz


Date of issue: June 16, 2014

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## Description of Test Facility

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## **1. General Information**

### **1.1 Applicant Information**

Applicant: Royal Appliance Mfg. Co.  
7005 Cochran Road Glenwillow, OH 44139 USA

Manufacturer: Suzhou Clean Bloom Electric Co., Ltd.  
8 Renan Street, Berhuan Road, Suzhou, 215128, China

Sample received date: April 29, 2014

Date of test : April 30, 2014 ~ May 30, 2013

### **1.2 Identification of the EUT**

Equipment: Vacuum Cleaner

Type/model: LW1500RS

FCC ID: 2ACGJLW1500RS

### 1.3 Technical specification

Operation Frequency Band:	434MHz
Modulation:	ASK
Antenna Designation:	Integral antenna, non-user removable.
Rating:	120V, 60Hz Transmitter: DC 3V
Description of EUT:	There is one model only. EUT is a floor vacuum cleaner. It has a remote controller to control the status of the product. The controller is battery operated and located in the handle of the floor vacuum cleaner.
Channel Description:	There is one channel only, namely 434MHz.

### 1.4 Mode of operation during the test / Test peripherals used

Within this test report, EUT was tested with modulation and tested under its rating voltage and frequency.

It was set up as its normal use condition.

## 2. Test Specification

### 2.1 Instrument list

Equipment	Type	Manu.	Internal no.	Cal. Date	Due date
Test Receiver	ESIB 26	R&S	EC 3045	2013-10-21	2014-10-20
Semi-anechoic chamber	-	Albatross project	EC 3048	2014-5-21	2015-5-20
Bilog Antenna	CBL 6112D	TESEQ	EC 4206	2014-5-16	2015-5-15
Horn antenna	HF 906	R&S	EC 3049	2014-5-13	2015-5-12
Pre-amplifier	Pre-amp 18	R&S	EC 3222	2014-4-12	2015-4-11
Test Receiver	ESCS 30	R&S	EC 2107	2013-10-21	2014-10-20
A.M.N.	ESH2-Z5	R&S	EC 3119	2014-1-9	2015-1-8
A.M.N.	ESH3-Z5	R&S	EC 2109	2014-1-10	2015-1-9
High Pass Filter	WHKX 1.0/15G-10SS	Wainwright	EC4297-1	2014-2-8	2015-2-7
High Pass Filter	WHKX 2.8/18G-12SS	Wainwright	EC4297-2	2014-2-8	2015-2-7
High Pass Filter	WHKX 7.0/1.8G-8SS	Wainwright	EC4297-3	2014-2-8	2015-2-7
Band Reject Filter	WRCGV 2400/2483- 2390/2493- 35/10SS	Wainwright	EC4297-4	2014-2-8	2015-2-7
Test Receiver	FSV40	R&S	/	2013-10-21	2014-10-20
Preamplifier	AP-025C	Quietek	QT-AP003	2013-11-25	2014-11-24
Preamplifier	AP-180C	Quietek	CHM- 0602013	2013-11-25	2014-11-24
Broad-Band Horn Antenna	BBHA9120D	Schwarzbeck	496	2013-11-25	2014-11-24
Broad-Band Horn Antenna	BBHA9170	Schwarzbeck	294	2013-11-25	2014-11-24

### 2.2 Test Standard

47CFR Part 15 (2013): Radio Frequency Devices

ANSI C63.4 (2003): American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

### 2.3 Test Summary

**This report applies to tested sample only. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.**

TEST ITEM	FCC REFERENCE	RESULT
Fundamental & spurious emission	15.231(b)	Pass
Restrict band radiated emission	15.205	Pass
Power line conducted emission	15.207	NA
Emission bandwidth	15.231(c)	Pass
Deactivating time	15.231(a)(1)	Pass

### 3. Fundamental & Spurious Emission & Restrict band radiated emission

**Test result: PASS**

### 3.1 Test limit

**3.1.1** The emission shall test through the 10th harmonic or to 40GHz, whichever is lower. It must comply with the limits below:

Fundamental Frequency (MHz)	Fundamental limit (uV/m)	Spurious limit (uV/m)
<input type="checkbox"/> 40.66 – 40.70	2250	225
<input type="checkbox"/> 70 – 130	1250	125
<input type="checkbox"/> 130 - 174	1250 to 3750	125 to 375
<input type="checkbox"/> 174 - 260	3750	375
<input checked="" type="checkbox"/> 260 – 470	3750 to 12500	375 to 1250
<input type="checkbox"/> Above 470	12500	1250

The formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz,  $\mu\text{V/m}$  at 3 meters =  $56.81818(\text{Frequency}) - 6136.3636$ ; for the band 260-470 MHz,  $\mu\text{V/m}$  at 3 meters =  $41.6667(\text{Frequency}) - 7083.3333$ . The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

For that the EUT use fundamental frequency of 433.92MHz, after calculation, the limit is:

Fundamental limit =  $41.6667 * 434 - 7083.3333 = 11000.01 \text{ uV/m} = 80.83 \text{ dBuV/m}$

$$\text{Spurious limit} = 80.83 - 20 = 60.83 \text{ dBuV/m}$$

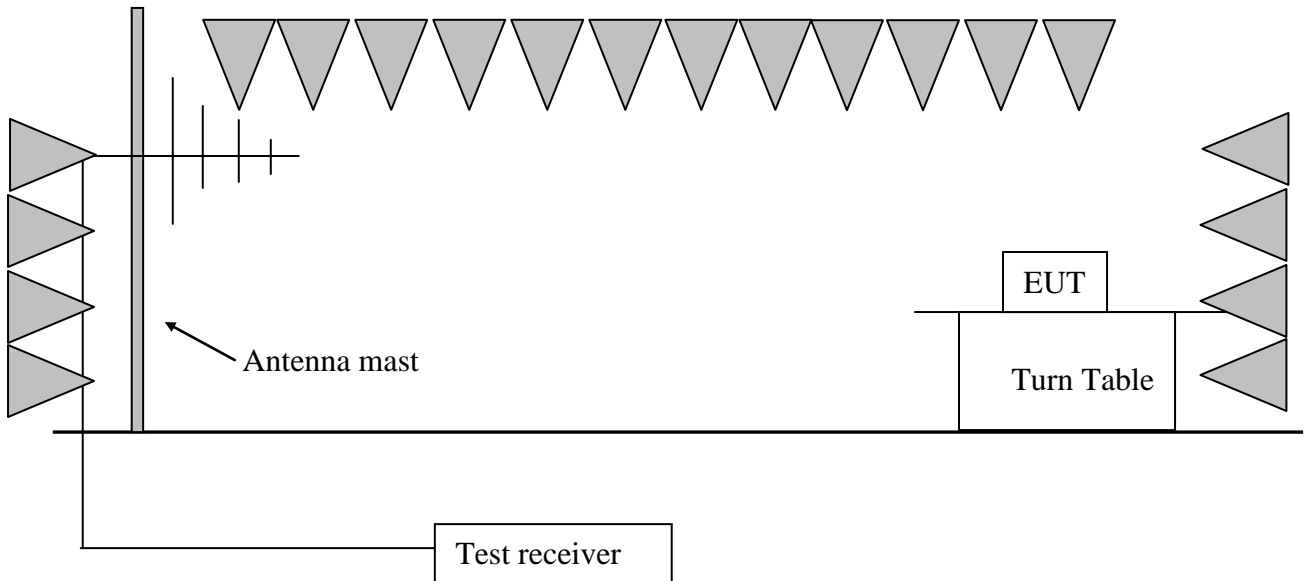
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**3.1.2** The radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) showed as below:

Frequency (MHz)	Field Strength (dBuV/m)	Measurement Distance (m)
30 - 88	40.0	3
88 - 216	43.5	3
216 - 960	46.0	3
Above 960	54.0	3



### 3.2 Test Configuration



### 3.3 Test procedure and test setup

The measurement was applied in a semi-anechoic chamber. While testing for spurious emission higher than 1GHz, the pre-amplifier and high pass filter is equipped just at the output terminal of the antenna.

The EUT and simulators were placed on a 0.8m high wooden turntable above the horizontal metal ground plane. The turn table rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1meter to 4 meters to find out the maximum emission level.

Both horizontal and vertical polarities of the receiving antenna were assessed and the higher reading was listed in this report.

The radiated emission was measured using the test receiver with the resolutions bandwidth set as:

RBW = 100kHz, VBW = 300kHz (30MHz~1GHz)

RBW = 1MHz, VBW = 3MHz (>1GHz for PK)

### 3.4 Test protocol

Antenna	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Emission Type	Limit (dBuV/m)	Margin	Detector
H	434.00	18.80	73.60	Fundamental	80.83	7.23	PK
H	868.00	23.60	34.20	Spurious	60.63	26.43	PK
H	*1302.00	-13.40	34.40	Restrict	54.00	19.60	PK
H	2170.00	-9.70	47.20	Spurious	60.63	13.43	PK
V	434.00	18.80	74.00	Fundamental	80.83	6.83	PK
V	868.00	23.60	34.00	Spurious	60.63	26.63	PK
V	*1302.00	-13.40	36.80	Restrict	54.00	17.20	PK
V	2170.00	-9.70	46.10	Spurious	60.63	14.53	PK

Peak detector meets the average limits.

Note: \* means the frequency is located in restricted band defined in section 15.205

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz)

2. Corrected Reading = Original Receiver Reading + Correct Factor

3. Margin = limit - Corrected Reading

4. If PK reading is less than AV limit, the AV test can be elided.

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,

Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBuV, limit = 40.00dBuV/m.

Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m; Corrected Reading = 10dBuV + 0.20dB/m = 10.20dBuV/m; Margin = 40.00dBuV/m - 10.20dBuV/m = 29.80dB.

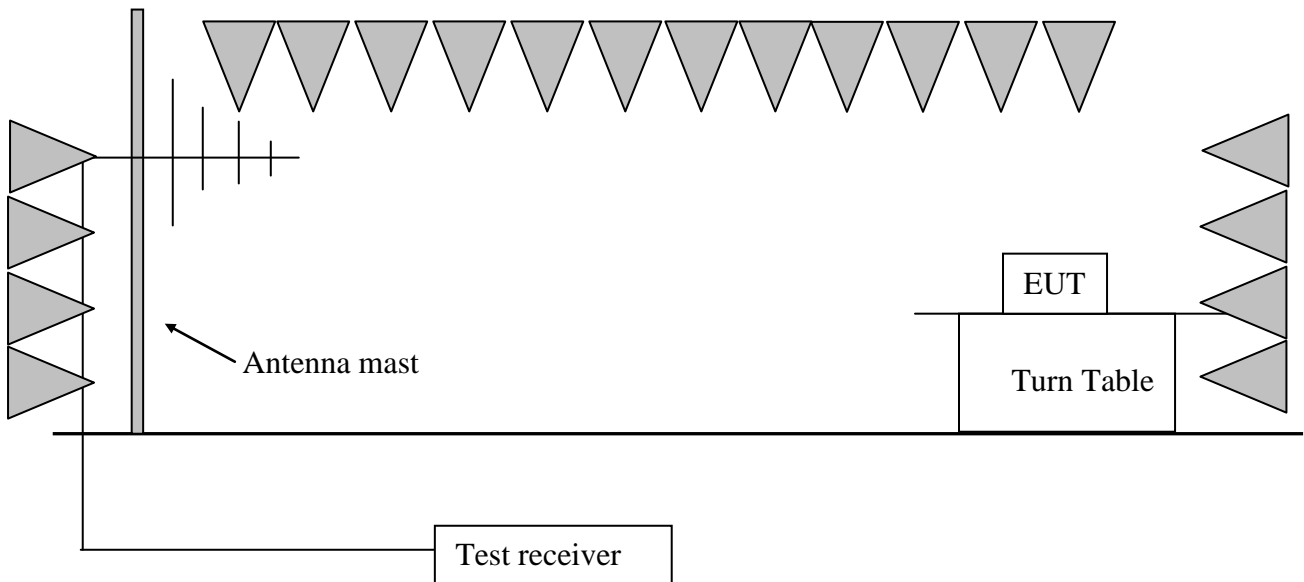
#### 4. Deactivating time

**Test result:** PASS

##### 4.1 Test limit

- ☒ (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
- ☐ (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
- ☐ (3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.
- ☐ (4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.
- ☐ (5) Transmission of set-up information for security systems may exceed the transmission duration limits in (1) and (2) above, provided such transmission are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

## 4.2 Test Configuration



## 4.3 Test procedure and test setup

The measurement was applied in a semi-anechoic chamber.

The central frequency of test receiver was set as the operating frequency of EUT and the Span was set as 0.

The EUT was switched once. The test receiver recorded the whole time from the triggered moment to the time of stopping radiating. For manual switching, to avoid uncertainty, the operating above would be repeated five times and the worst data is recorded.

## 4.4 Test protocol

Whole time from the triggered moment to the time of stopping radiating: 250ms.

As a result, the EUT complies with the limit of 5s' deactivating time.

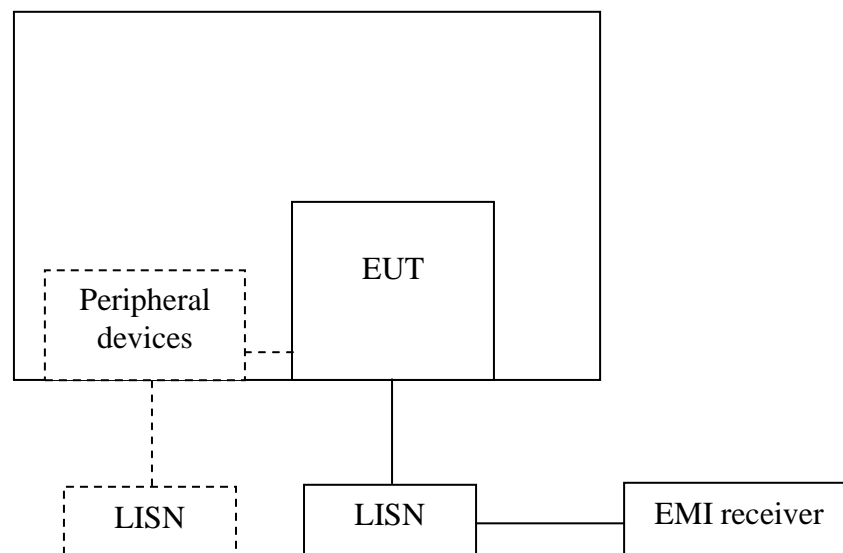
## 5. Power line conducted emission

**Test result:** NA

### 5.1 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.		

### 5.2 Test configuration



- ☐ For table top equipment, wooden support is 0.8m height table
- ☐ For floor standing equipment, wooden support is 0.1m height rack.

### **5.3 Test procedure and test set up**

The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a  $50\Omega/50\mu\text{H}$  coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a  $50\Omega/50\mu\text{H}$  coupling impedance with  $50\Omega$  termination.

Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4 on conducted measurement. The bandwidth of the test receiver is set at 9 kHz.

## 5.4 Test protocol

Power line: L

Frequency	Correct Factor (dB)	Corrected Reading (dBuV)		Limit (dBuV)		Margin (dB)	
		QP	AV	QP	AV	QP	AV
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
Remark: 1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB). 2. Margin (dB) = Limit - Corrected Reading. 3. If the margin higher than 20dB, it would be marked as *.							

Power line: N

Frequency	Correct Factor (dB)	Corrected Reading (dBuV)		Limit (dBuV)		Margin (dB)	
		QP	AV	QP	AV	QP	AV
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
Remark: 1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB). 2. Margin (dB) = Limit - Corrected Reading. 3. If the margin higher than 20dB, it would be marked as *.							

## 6. Emission Bandwidth

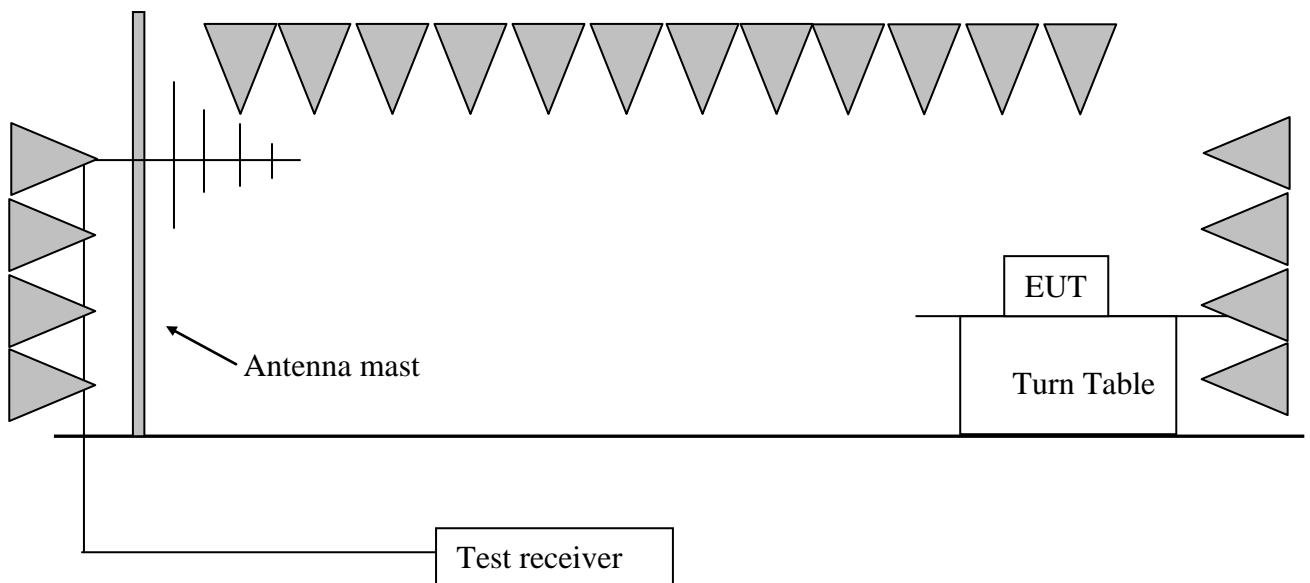
**Test Status: Pass**

### 6.1 Test limit

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated carrier.

The limit for the EUT =  $0.25\% * 434 \text{ MHz} = 1085 \text{ kHz}$

### 6.2 Test Configuration



### 6.3 Test procedure and test setup

The EUT and simulators were placed on a 0.8m high wooden turntable above the horizontal metal ground plane. The turn table rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1 meter to 4 meters to find out the maximum emission level.

The central frequency of test receiver was set near the operating frequency of EUT.

The test was conducted using the Spectrum Analyzer with the resolutions bandwidth set at 10 kHz, the video bandwidth set at 30 kHz.



**6.4 Test protocol**

Temperature : 25 °C  
Relative Humidity : 55 %

Channel	Emission Bandwidth (kHz)	Limit (kHz)
1	378.76	1085