

# Ecovacs Robotics Co., Ltd.

# EMC TEST REPORT

**Report Type:**

FCC Part 15B & ICES-003 EMC report

**Model:**

DEX55

**REPORT NUMBER:**

211101023SHA-004+A1

**ISSUE DATE:**

June 2, 2022

**DOCUMENT CONTROL NUMBER:**

TTRF15b\_V1 © 2018 Intertek



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**FCC ID** : **2AZAT-DEX55**

### SUMMARY:

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

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

**ANSI C63.4 (2014):** 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

**ICES-003 Issue 7 October 2020:** Information Technology Equipment (Including Digital Apparatus) —Limits and Methods of Measurement.

**PREPARED BY:**

**REVIEWED BY:**



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**TEST REPORT**

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## Revision History

Report No.	Version	Description	Issued Date
211101023SHA-004+A1	Rev. 01	This report is based on the original report 211101023SHA-004 for amendment. The client adds an alternative docking station CH2118. There is no effect to the wireless part, only the EMC items of charging mode were conducted and the worst results were listed in this report.	June 2, 2022

## Measurement result summary

TEST ITEM	FCC REFERENCE	IC REFERENCE	RESULT
Power line conducted emission	15.107	3.2.1	Pass
Radiated emission	15.109	3.2.2	Pass

Notes: 1: NA =Not Applicable

2: "\*" means this test is no need and not performed within this report, and the result can refer to the related base report(s).

## 1 GENERAL INFORMATION

### 1.1 Description of Equipment Under Test (EUT)

Product name:	Floor Cleaning Robot
Type/Model:	DEX55
Description of EUT:	This report is based on the original report 211101023SHA-004 for amendment. The client adds an alternative docking station CH2118. There is no effect to the wireless part, only the EMC items of charging mode were conducted and the worst results were listed in this report.
Rating:	20V DC, 1A
Category of EUT:	Class B
EUT type:	<input type="checkbox"/> Table top <input checked="" type="checkbox"/> Floor standing
Highest operating frequency	< 108MHz
Software Version:	/
Hardware Version:	/
Sample received date:	2022.5.11
Date of test:	2022.5.11~2022.5.16

## 1.2 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: CN1175
	IC Registration Lab Registration code No.: 2042B-1
	VCCI Registration Lab Registration No.: R-4243, G-845, C-4723, T-2252
	A2LA Accreditation Lab Certificate Number: 3309.02

Subcontractor:	Name:	Shenzhen UnionTrust Quality and Technology Co., Ltd.
	Address:	Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng Science and Technology Park, Longhua District, Shenzhen, China
	Telephone:	+86 (0) 755 2823 0888
	Telefax:	+86 (0) 755 2823 0886
	FCC Accredited Lab Designation Number:	CN1194
	CNAS Accreditation Lab:	Registration No. CNAS L9069
	A2LA Accreditation Lab:	Certificate Number: 4312.01

## 2 TEST SPECIFICATIONS

### 2.1 Standards or specification

47CFR Part 15 (2020)

ANSI C63.10 (2014)

ICES-003 Issue 7 October 2020

### 2.2 Mode of operation during the test

Within this test report, EUT was tested under all available operation modes and tested under its rating voltage and frequency. Other voltage and frequency are specified if used.

### 2.3 Test software list

Test Items	Software	Manufacturer	Version
Conducted emission	e3	Audix	9.20151119i
Radiated emission	e3	Audix	9.160323

### 2.4 Test peripherals list

Item No.	Name	Brand and Model	Description
1			-



**TEST REPORT**

**2.5 Test environment condition:**

Test items	Temperature	Humidity
Power line conducted emission	23°C	51% RH
Radiated Emissions	24°C	52% RH

**2.6 Instrument list**

Radiated Emission Test - 3M Chamber						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
<input checked="" type="checkbox"/>	3m SAC	ETS-LINDGREN	3m	N/A	Jan. 22, 2021	Jan. 21, 2024
<input checked="" type="checkbox"/>	Receiver	R&S	ESIB26	100114	Nov. 5, 2021	Nov. 4, 2022
<input checked="" type="checkbox"/>	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Nov.11, 2021	Nov.10, 2023
<input checked="" type="checkbox"/>	6dB Attenuator	Talent	RA6A5-N-18	18103001	Nov.11, 2021	Nov.10, 2023
<input checked="" type="checkbox"/>	Preamplifier	HP	8447F	2805A02960	Nov. 5, 2021	Nov. 4, 2022
<input checked="" type="checkbox"/>	Multi device Controller	ETS-LINDGREN	7006-001	00160105	Nov. 17, 2020	Nov. 16, 2022
Conducted Emission Test Equipment List						
<input checked="" type="checkbox"/>	Receiver	R&S	ESR7	1316.3003K07-101181-K3	Nov. 05, 2021	Nov. 04, 2022
<input checked="" type="checkbox"/>	Pulse Limiter	R&S	ESH3-Z2	0357.8810.54	Nov. 05, 2021	Nov. 04, 2022
<input checked="" type="checkbox"/>	LISN	R&S	ESH2-Z5	860014/024	Nov. 05, 2021	Nov. 04, 2022

**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.

<b>Test item</b>	<b>Measurement uncertainty</b>
Radiated Emissions in restricted frequency bands below 1GHz	$\pm 4.90\text{dB}$
Radiated Emissions in restricted frequency bands above 1GHz	$\pm 5.02\text{dB}$
Power line conducted emission	$\pm 3.19\text{dB}$

### 3 Radiated Emissions

Test result: Pass

#### 3.1 Limit

##### 3.1.1 Limits for radiated disturbance of class A device

FCC

Frequency (MHz)	Permitted limit in dB $\mu$ V/m (Quasi-peak) of Measurement Distance 10m
30 – 88	39
88 – 216	43.5
216 – 960	46.4
Above 960	49.5

Note: for the measurement distance other than 3m and 10m, the limit is varied according to 20dB/10 decades.

IC

Frequency (MHz)	Permitted limit in dB $\mu$ V/m (Quasi-peak) of Measurement Distance 10m	Permitted limit in dB $\mu$ V/m (Quasi-peak) of Measurement Distance 3m
30 ~ 88	40.0	50.0
88 ~ 216	43.5	54.0
216 ~ 230	46.4	56.9
230 ~ 960	47.0	57.0
960 ~ 1000	49.5	60.0

Note: The more stringent limit applies at transition frequencies.

Frequency (GHz)	Permitted limit in dB $\mu$ V/m (Peak) of Measurement Distance 3m	Permitted limit in dB $\mu$ V/m (Average) of Measurement Distance 3m
1 ~ F <sub>M</sub>	80.0	60.0

Note: These limit levels apply for a measurement distance of 3 m. If using a different measurement distance, the measured levels shall be extrapolated to the 3 m limit distance using a factor of 20 dB per decade of distance. The measurement distance shall place the measurement antenna in the far field of the ITE or digital apparatus under test.

**TEST REPORT**

3.1.2 Limits for radiated disturbance of class B device

FCC

Frequency (MHz)	Permitted limit in dB $\mu$ V/m (Quasi-peak) of Measurement Distance 3m
30 – 88	40.0
88 – 216	43.5
216 – 960	46.0
Above 960	54.0

Note: for the measurement distance other than 3m and 10m, the limit is varied according to 20dB/10 decades.

IC

Frequency (MHz)	Permitted limit in dB $\mu$ V/m (Quasi-peak) of Measurement Distance 10m	Permitted limit in dB $\mu$ V/m (Quasi-peak) of Measurement Distance 3m
30 ~ 88	30.0	40.0
88 ~ 216	33.1	43.5
216 ~ 230	35.6	46.0
230 ~ 960	37.0	47.0
960 ~ 1000	43.5	54.0

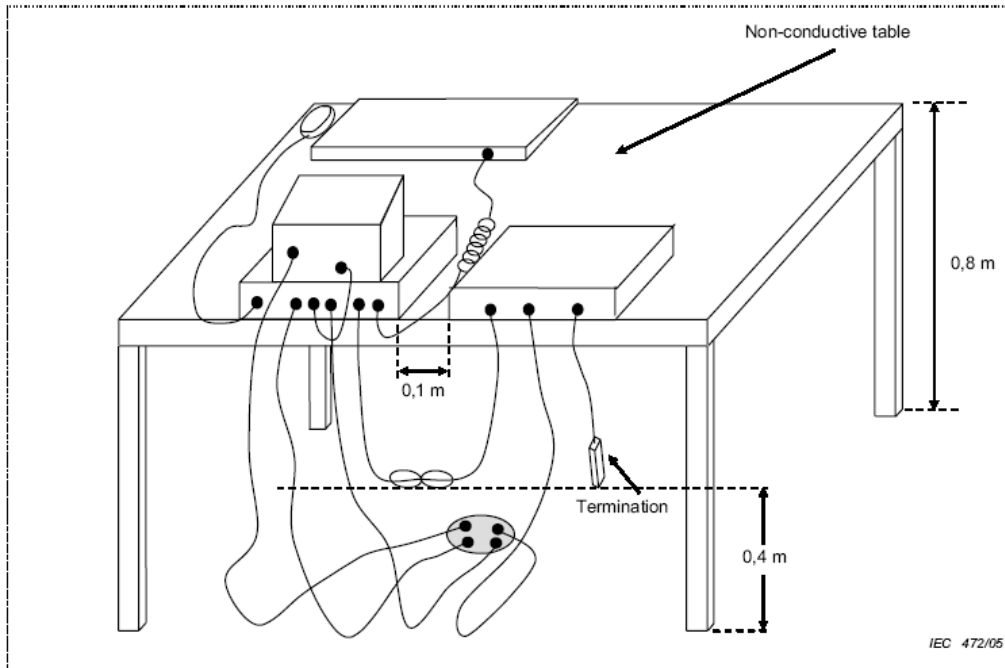
Note: The more stringent limit applies at transition frequencies.

Frequency (GHz)	Permitted limit in dB $\mu$ V/m (Peak) of Measurement Distance 3m	Permitted limit in dB $\mu$ V/m (Average) of Measurement Distance 3m
1 ~ F <sub>M</sub>	74.0	54.0

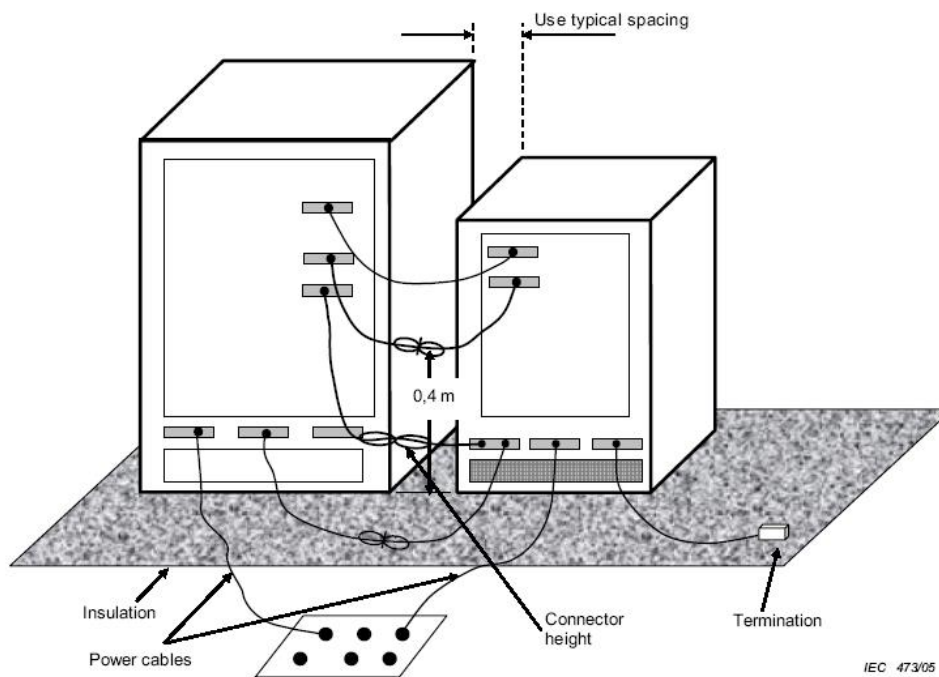
Note: These limit levels apply for a measurement distance of 3 m. If using a different measurement distance, the measured levels shall be extrapolated to the 3 m limit distance using a factor of 20 dB per decade of distance. The measurement distance shall place the measurement antenna in the far field of the ITE or digital apparatus under test.

### 3.2 Block diagram and test set up

For table top equipment



For floor standing equipment



### 3.3 Measurement Procedure

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

The distance from EUT to receiving antenna is 3 meters.

Measurement was performed according to clause 4 and clause 5 of ANSI 63.4.

Test procedure was according to clause 8.3 of ANSI 63.4.

EUT arrangement and operate condition were according to clause 6 and clause 8 of ANSI 63.4.

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)

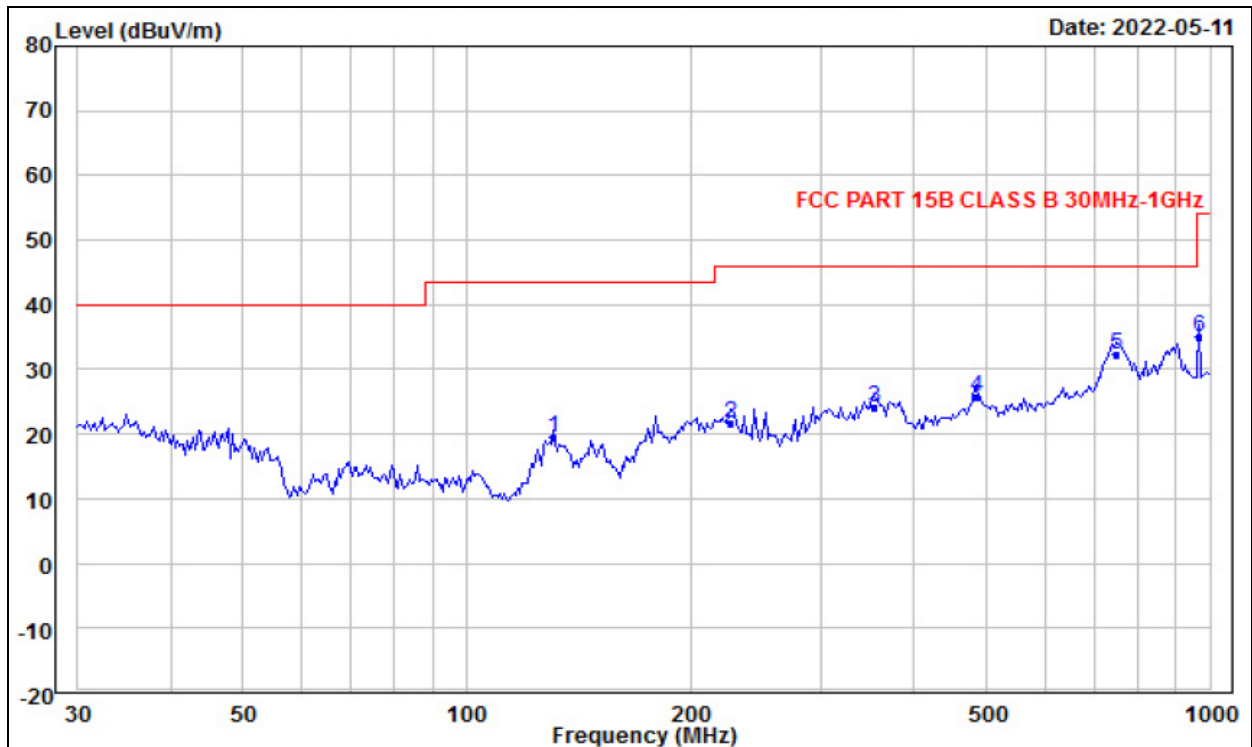
Highest internal frequency (F <sub>x</sub> )	Highest measured frequency F <sub>M</sub> for radiated measurement	Measured Bandwidth
F <sub>x</sub> ≤ 108 MHz	1 GHz	120kHz
108 MHz < F <sub>x</sub> ≤ 500 MHz	2 GHz	1MHz
500 MHz < F <sub>x</sub> ≤ 1 GHz	5 GHz	1MHz
F <sub>x</sub> > 1 GHz	5 × F <sub>x</sub> up to a maximum of 40 GHz	1MHz
Note: 1. F <sub>x</sub> is the highest fundamental frequency generated and/or used in the ITE or digital apparatus under test.		

TEST REPORT

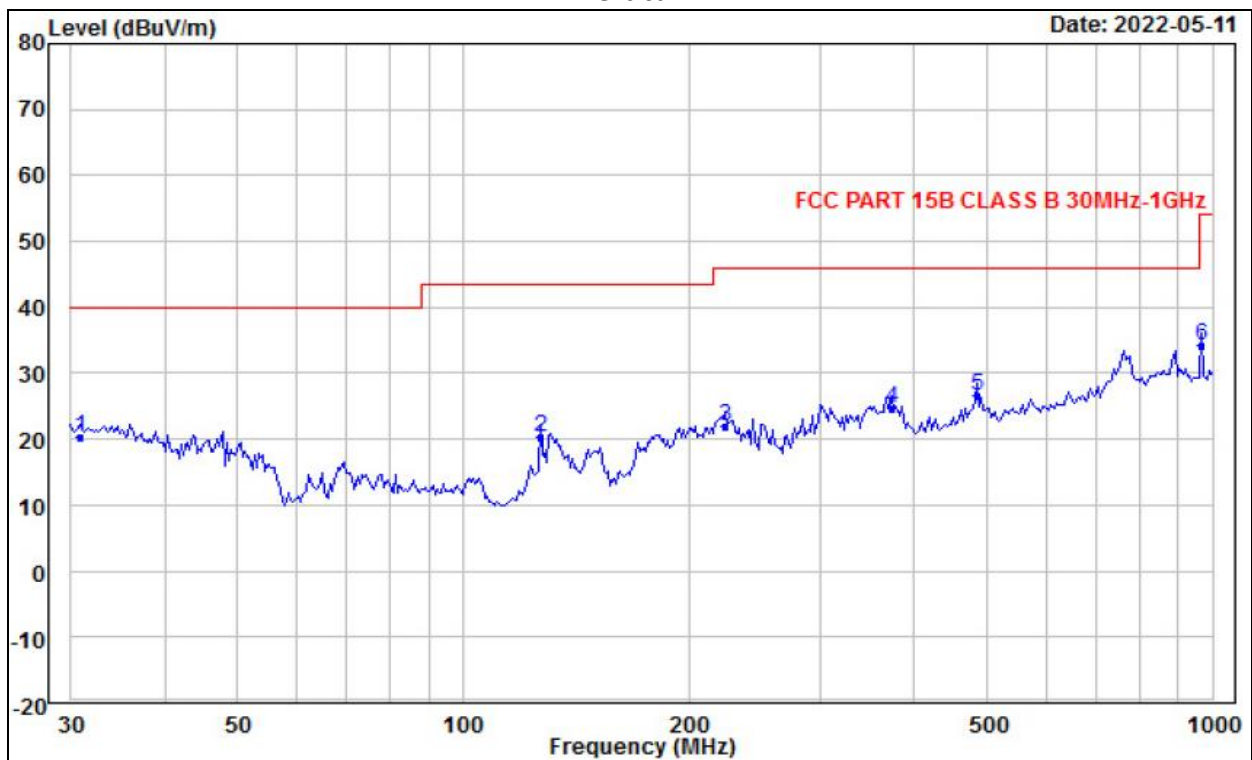
3.4 Test Results of Radiated Emissions

Test Curve of Charging mode:

Horizontal



Vertical



**TEST REPORT**

**Test data below 1GHz**

Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
H	131.22	19.56	43.50	23.94	PK
H	227.02	21.80	46.00	24.20	PK
H	353.45	24.13	46.00	21.87	PK
H	484.91	25.71	46.00	20.29	PK
H	749.68	32.21	46.00	13.79	PK
H	965.47	35.07	54.00	18.93	PK
V	30.86	20.36	40.00	19.64	PK
V	126.69	20.20	43.50	23.30	PK
V	223.85	22.03	43.50	23.97	PK
V	373.89	24.70	46.00	21.30	PK
V	483.91	26.51	46.00	19.49	PK
V	965.47	34.09	54.00	19.91	PK

**Remark:**

1. Factor= Antenna Factor + Cable Loss (-Amplifier, is employed)
2. Measured level= Original Receiver Reading + Factor
3. Margin = Limit – Measured level
4. If the PK measured level is lower than AV limit, the AV test can be elided.



## 4 Power line conducted emission

Test result: Pass

### 4.1 Limit

#### 4.1.1 Limits for conducted disturbance voltage at the mains ports of class A device

Frequency range (MHz)	Limits dB(μV)	
	Quasi-peak	Average
0.15 ~ 0.5	79	66
0.5 ~ 30	73	60

Note: If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the equipment under test shall be deemed to meet both limits and the measurement using the receiver with an average detector need not be carried out.

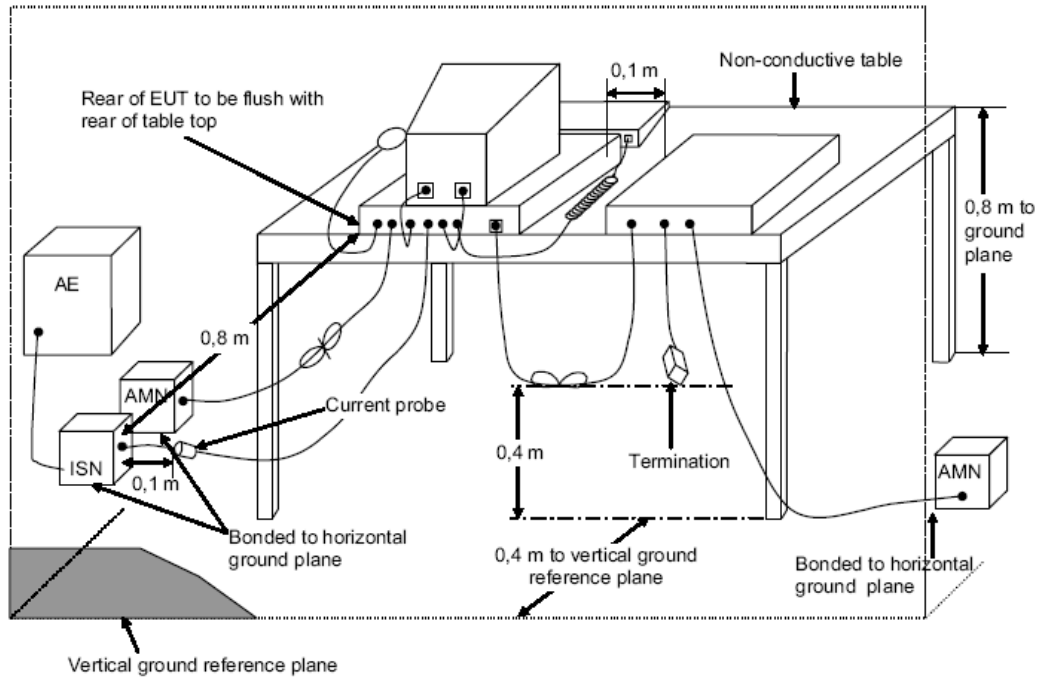
#### 4.1.2 Limits for conducted disturbance voltage at the mains ports of class B device

Frequency range (MHz)	Limits dB(μV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 ~ 56 *	56 ~ 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

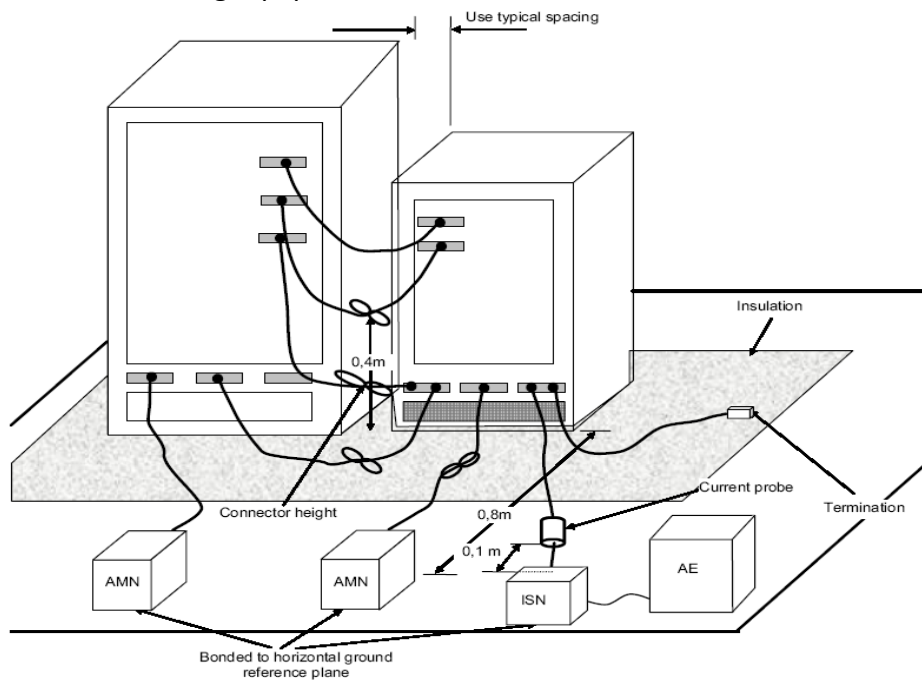
Note: 1. \* Means the limit decreasing linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz  
 2. If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the equipment under test shall be deemed to meet both limits and the measurement using the receiver with an average detector need not be carried out.

## 4.2 Block diagram and test set up

For table top equipment



For floor standing equipment



**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  $\Omega$  LISN port (to which the EUT is connected), where permitted, terminated into a 50  $\Omega$  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  $\Omega$  measuring port is terminated by a measuring instrument having 50  $\Omega$  input impedance. All other ports are terminated in 50  $\Omega$  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.

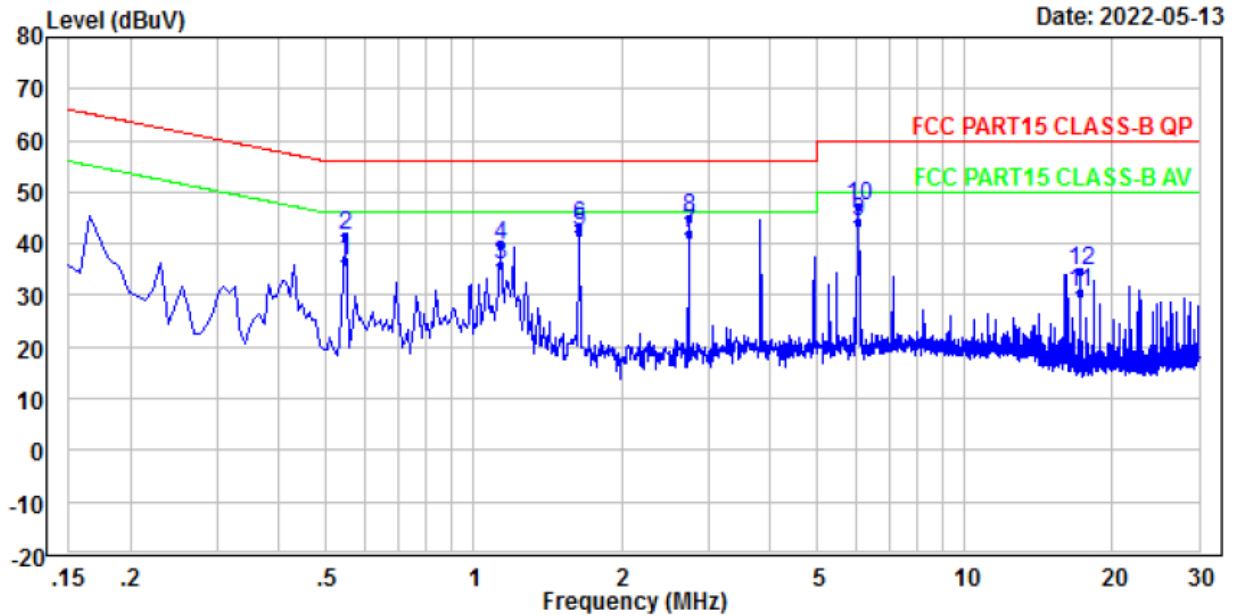
## TEST REPORT

### 4.4 Test Results of Power line conducted emission

Test Curve

Test voltage: AC 120V, 60Hz

L Line



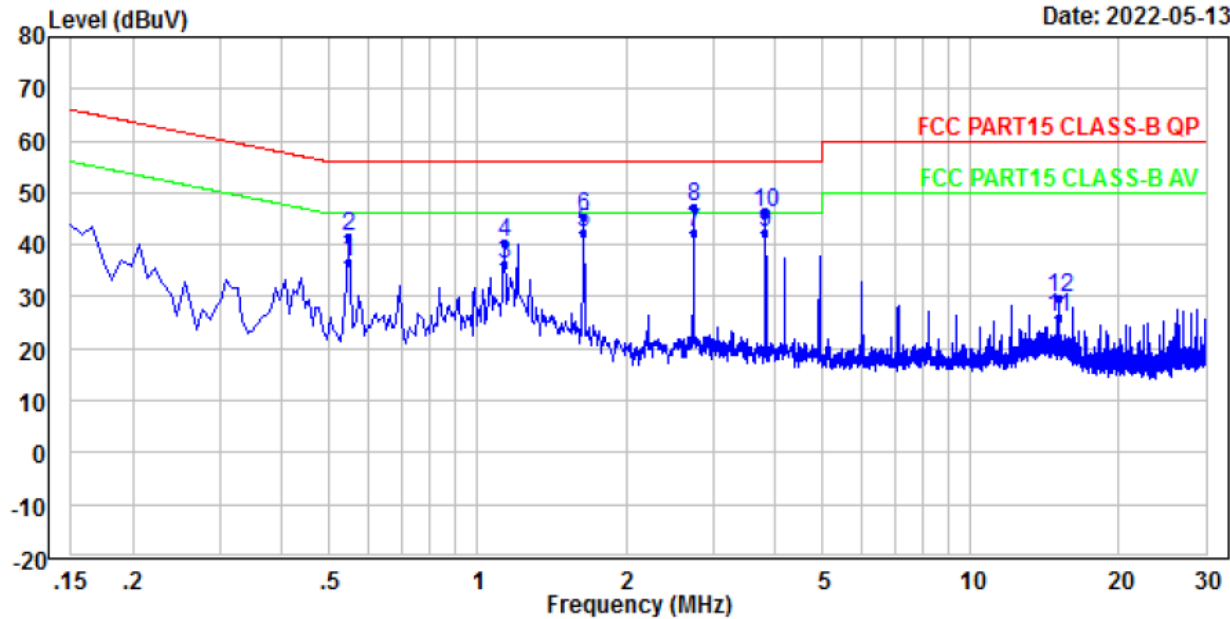
#### Test Data:

Freq MHz	Read Level dBuV	LISN Factor dB	Cable Loss dB	Aux Factor dB	Level dBuV	Limit Line dBuV	Over Limit dB	Remark
0.550	26.47	0.30	0.00	9.86	36.63	46.00	-9.37	Average
0.550	31.47	0.30	0.00	9.86	41.63	56.00	-14.37	QP
1.134	25.65	0.36	0.00	9.86	35.87	46.00	-10.13	Average
1.134	29.65	0.36	0.00	9.86	39.87	56.00	-16.13	QP
1.646	32.13	0.37	0.02	9.85	42.37	46.00	-3.63	Average
1.646	33.13	0.37	0.02	9.85	43.37	56.00	-12.63	QP
2.741	31.87	0.38	0.05	9.83	42.13	46.00	-3.87	Average
2.741	34.87	0.38	0.05	9.83	45.13	56.00	-10.87	QP
6.069	33.96	0.47	0.10	9.82	44.35	50.00	-5.65	Average
6.069	36.96	0.47	0.10	9.82	47.35	60.00	-12.65	QP
17.195	19.75	0.84	0.06	10.03	30.68	50.00	-19.32	Average
17.195	23.75	0.84	0.06	10.03	34.68	60.00	-25.32	QP

## TEST REPORT

N Line

Date: 2022-05-13



### Test Data:

Freq	Read Level	LISN Factor	Cable Loss	Aux Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
0.550	26.49	0.27	0.00	9.86	36.62	46.00	-9.38	Average
0.550	31.49	0.27	0.00	9.86	41.62	56.00	-14.38	QP
1.134	26.12	0.29	0.00	9.86	36.27	46.00	-9.73	Average
1.134	30.12	0.29	0.00	9.86	40.27	56.00	-15.73	QP
1.646	32.05	0.30	0.02	9.85	42.22	46.00	-3.78	Average
1.646	35.05	0.30	0.02	9.85	45.22	56.00	-10.78	QP
2.741	32.09	0.37	0.05	9.83	42.34	46.00	-3.66	Average
2.741	37.09	0.37	0.05	9.83	47.34	56.00	-8.66	QP
3.837	32.02	0.41	0.08	9.82	42.33	46.00	-3.67	Average
3.837	36.02	0.41	0.08	9.82	46.33	56.00	-9.67	QP
15.099	15.11	0.74	0.06	10.02	25.93	50.00	-24.07	Average
15.099	19.11	0.74	0.06	10.02	29.93	60.00	-30.07	QP

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.

**Appendix I: Photograph of equipment under test**

The External and Internal Photos refer to the documents of External and Internal Photos

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