



Test report No:  
6175652.50

## TEST REPORT

### Electromagnetic Compatibility (EMC)

Identification of item tested	Vacuum Cleaner
Trademark	N/A
Model and /or type reference	For Vacuum cleaner: VC7231, VC7231-1, VC7236, AMC-3501A, VC7236-1, VC7237, VC7237-1  For motorized cleaning head: DS01-1  For docking station: VC7231, VC7237, AMC-3501A
Ratings	For vacuum cleaner: 25,2 Vdc  For motorized cleaning head: DS01-1: 25,2 Vdc, 20 W  For docking station: Class II Input: 220-240 Vac, 50-60 Hz, 1000 W Output: 31,0 Vdc, 0,6 A  For adapter: Class II JJ018W1-300050VX & JJ018W1-300050BX: Input: 100-240 Vac, 50-60 Hz, 0,5 A Output: 30,0 Vdc, 0,5 A, 15,0 W
Test Laboratory / address	DEKRA Testing and Certification (Shanghai) Ltd. No.250, Jiangchangsan Road, Jing'an District, Shanghai, China
Applicant's name / address	Hengxun Appliance (Suzhou) Co., Ltd. 3rd Floor, Building 1, No. 13, Huashihu Road, Yangchenghu Town, Xiangcheng District, 215138 Suzhou Jiangsu, China
Test method requested, standard	EN IEC 55014-1:2021 EN IEC 55014-2:2021 EN IEC 61000-3-2:2019+A1:2021 EN 61000-3-3:2013+A1:2019+A2:2021
Verdict Summary	IN COMPLIANCE
Tested by (name / position & signature)	Vincent Gao Project Manager 
Approved by (name / position & signature)	Wency Yang Technical Manager 
Date of issue	2024-01-29
Report template No	TRF_EN55014-1_EN55014-2_EMC01 V1.1

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## COMPETENCES AND GUARANTEES

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DEKRA is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

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## GENERAL CONDITIONS

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1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or Competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA.

## UNCERTAINTY

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For all measurements where guidance for the calculation of the instrumentation uncertainty of a measurement is specified in EN 55016-4-2 (CISPR 16-4-2), EN/IEC 61000-4 series or a product standard, the measurement instrumentation uncertainty has been calculated and applied in accordance with these standards.

Uncertainties have been calculated according to the DEKRA internal document PROD-P-EMC-M22. The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%. Refer to the Annex 1 for further information.

The measurement result is considered in conformance with the requirement if it is within the prescribed limit, It is not necessary to calculate the uncertainty associated with the measurement result.

## ENVIRONMENTAL CONDITIONS

The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment. The climatic conditions during the tests were within the following limits:

Ambient temperature	15 °C – 35 °C
Relative Humidity air	30% - 60%
Atmospheric pressure	86 kPa – 106 kPa

If explicitly required in the basic standard or applied product / product family standard the climatic values are recorded and documented separately in this test report.

## POSSIBLE TEST CASE VERDICTS

Test case does not apply to test object	N/A
Test object does meet requirement	P (Pass) / PASS
Test object does not meet requirement	F (Fail) / FAIL
Not measured	N/M

## DEFINITION OF SYMBOLS USED IN THIS TEST REPORT

<input checked="" type="checkbox"/> Indicates that the listed condition, standard or equipment is applicable for this report/test/EUT.			
<input type="checkbox"/> Indicates that the listed condition, standard or equipment is not applicable for this report/test/EUT.			
Decimal separator used in this report	<input type="checkbox"/>	Comma (,)	<input checked="" type="checkbox"/> Point (.)

## ABBREVIATIONS

For the purposes of the present document, the following abbreviations apply:

EUT	: Equipment Under Test
QP	: Quasi-Peak
CAV	: CISPR Average
AV	: Average
CDN	: Coupling Decoupling Network
SAC	: Semi-Anechoic Chamber
OATS	: Open Area Test Site
BW	: Bandwidth
AM	: Amplitude Modulation
PM	: Pulse Modulation
HCP	: Horizontal Coupling Plane
VCP	: Vertical Coupling Plane
$U_N$	: Nominal voltage

## DOCUMENT HISTORY

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Report nr.	Date	Description
6175652.50	2024-01-29	First release.

## REMARKS AND COMMENTS

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The equipment under test (EUT) does meet the requirements of the stated standard(s)/test(s).

The test results relate only to the samples tested.

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The vacuum cleaner is powered by rechargeable battery pack.

There are two alternative battery pack, the only difference in the capacity.

For vacuum cleaner, model VC7231 is assembly with a docking station while VC7231-1 is assembly with an adapter.

The same rule goes to VC7236 & VC7236-1, VC7237 & VC7237-1. Model VC7236 is totally the same as AMC-3501A expect the model name.

The difference between model VC7231, VC7236 & VC7237 is the control mode. Model VC7231 & VC7236 combined with a mechanical power switch on hand-held part while VC7237 only combined with an electronic switch on control panel.

For docking station, model VC7231 is totally same as AMC-3501A expect the model name. The difference between docking station VC7231 and VC7237 is the appearance.

Adapter JJ018W1-300050VX is totally the same as JJ018W1-300050BX expect the plug portion.

Therefore, model VC7231 is assembly with a docking station and adapter JJ018W1-300050VX was selected for the full tests and the results are also representative for the others.

VC7231 was selected for RE, ESD, RS and the results are also representative for the others.

# 1 GENERAL INFORMATION

## 1.1 General Description of the Item(s)

Description of the item .....	Vacuum Cleaner
Test model / Type number.....	VC7236, VC7231
Serial number .....	N/A
Trademark.....	N/A
Manufacturer.....	Hengxun Appliance (Suzhou) Co., Ltd. 3rd Floor, Building 1, No. 13, Huashihu Road, Yangchenghu Town, Xiangcheng District, 215138 Suzhou Jiangsu, China
Factory .....	Hengxun Appliance (Suzhou) Co., Ltd. 3rd Floor, Building 1, No. 13, Huashihu Road, Yangchenghu Town, Xiangcheng District, 215138 Suzhou Jiangsu, China

Rated power supply .....	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	<input checked="" type="checkbox"/>	AC: 220 – 240 V, 50-60 Hz	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	<input checked="" type="checkbox"/>	AC: 100 – 240 V, 50-60 Hz	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	DC: 12 V, 24 V, 12 / 24 V					
<input checked="" type="checkbox"/>	Battery: 25,2 Vdc						
Rated Power .....	For vacuum cleaner: 25,2 Vdc  For motorized cleaning head: DS01-1: 25,2 Vdc, 20 W  For docking station: Class II Input: 220-240 Vac, 50-60 Hz, 1000 W Output: 31,0 Vdc, 0,6 A  For adapter: Class II Input: 100-240 Vac, 50-60 Hz, 0,5 A Output: 30,0 Vdc, 0,5 A, 15,0 W						
Clock frequencies .....	< 15 MHz						
Other parameters.....	Class II						
Software version .....	N/A						
Hardware version.....	N/A						
Mounting position.....	<input type="checkbox"/>	Table top equipment					
	<input type="checkbox"/>	Wall/Ceiling mounted equipment					
	<input checked="" type="checkbox"/>	Floor standing equipment					
	<input checked="" type="checkbox"/>	Hand-held equipment					
	<input type="checkbox"/>	Other:					

Intended use of the Equipment Under Test (EUT)
The apparatus as supplied for the test is a vacuum Cleaner, intended for residential and indoor use. These products have electronic control unit.

No	Module/parts of test item	Type	Manufacturer
1	Adapter	JJ018W1-300050VX	Dongguan JinJin Electronic Technology Co., Ltd.

No	Documents as provided by the applicant - Description	File name	Issue date
	N/A		

Modifications to the test item during testing .....	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	Refer to the chapter 6.
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Copy of marking plate:
N/A

## 1.2 Environment

The requirements and standards apply to equipment intended for use in:

<input checked="" type="checkbox"/>	Residential (domestic) environment.
<input type="checkbox"/>	Commercial and light-industrial environment.
<input type="checkbox"/>	Industrial environment.

## 1.3 Test data

Other tests:

Test Location	DEKRA Testing and Certification (Shanghai) Ltd. No.250, Jiangchangsan Road, Jing'an District, Shanghai, China
Date(receive sample)	2023-12-06 (sample(s) provided by applicant)
Date (start test)	2023-12-06
Date (finish test)	2023-12-18

## 1.4 Classification according to EN IEC 55014-2

The standard EN IEC 55014-2 is subdivided in five categories. For each category, specific immunity requirements are formulated.

<input type="checkbox"/>	<p><b>Category I:</b> equipment containing no electronic control circuitry.</p> <p><u>Examples:</u> Appliances, tools and toys that contain no electronic control circuits and only electromechanical components such as switches, thermostats, brush motors, induction motors, heating elements, lighting toys containing only batteries and LED.</p> <p>Electric circuits consisting of passive components (such as radio interference suppression capacitors or inductors, mains transformers and mains frequency rectifiers) are not considered to be electronic control circuitry.</p>
<input checked="" type="checkbox"/>	<p><b>Category II:</b> mains operated equipment containing electronic control circuitry with no clock frequency higher than 15 MHz.</p>
<input checked="" type="checkbox"/>	<p><b>Category III:</b> battery operated equipment not included in Category I.</p> <p><u>Examples:</u> Appliances, tools and toys powered by batteries and that include a microprocessor to provide a selection of functions.</p> <p>NOTE The assignment to Category III is independent of the clock frequency.</p> <p>This category also includes equipment provided with rechargeable batteries, which can be charged, directly or indirectly, from the mains. Accordingly, this equipment shall also be subjected to the test requirements for mains operated equipment but only when testing the charging function.</p> <p>If the equipment can operate its intended functions when connected, directly or indirectly to the mains, then it is not battery operated. Accordingly, it shall be classified as Category II, Category IV or Category V, as applicable, and subjected to the corresponding test requirements when in mains operation.</p>
<input type="checkbox"/>	<p><b>Category IV:</b> mains operated equipment containing electronic control circuitry with a highest clock frequency greater than 15 MHz but lower than or equal to 200 MHz.</p>
<input type="checkbox"/>	<p><b>Category V:</b> mains operated equipment containing electronic control circuitry with a highest clock frequency greater than 200 MHz.</p>
<p><b>Clock frequency:</b> Fundamental frequency of any signal used in the device, excluding those which are solely used inside integrated circuits (IC).</p>	

## 2 DESCRIPTION OF TEST SETUP

### 2.1 Operating mode(s) used for tests

During the tests the following operating mode(s) has(have) been used.

Operating mode	Operating mode description	Used for testing	
		Emission	Immunity
1	The EUT is operating continuously at maximum speed.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	The EUT is operating continuously at medium speed.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3	Vacuum cleaner in docking station on charge mode and cleaning dust mode.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4	There is no vacuum cleaner in the docking station on standby mode and cleaning dust mode.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
5	charge mode by battery	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<u>Supplemental information:</u>			

### 2.2 Port(s) of the EUT

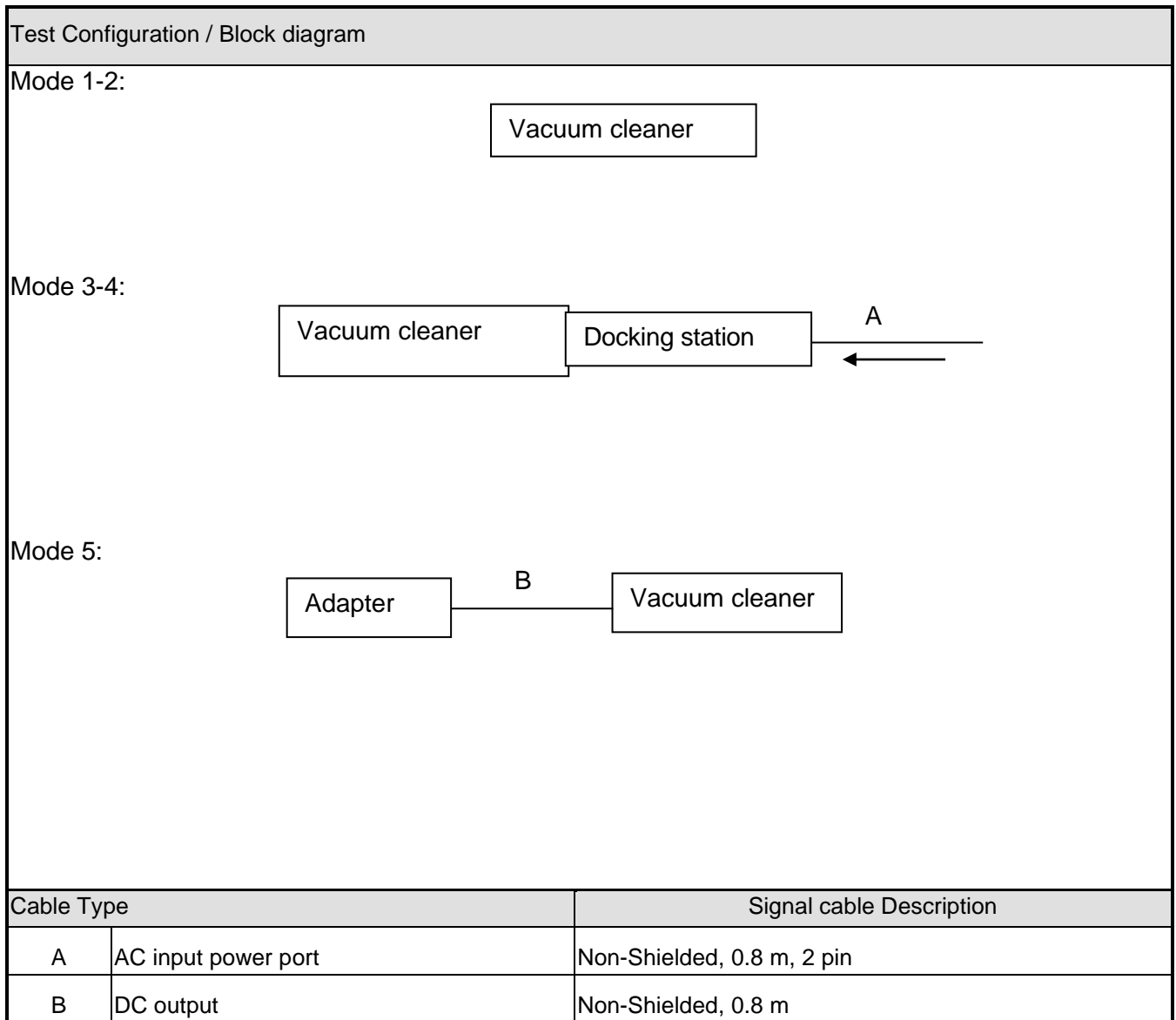
Port name and description	Connected to / Termination	Cable		
		Length used during test [m]	Attached during test	Shielded
AC input	AC mains	0.8	<input checked="" type="checkbox"/>	<input type="checkbox"/>
DC output	Adapter	0.8	<input checked="" type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>
<u>Supplemental information:</u>				

### 2.3 Support / Auxiliary equipment / unit / software for the EUT

The EUT has been tested with the following auxiliary equipment / unit / software:

Auxiliary equipment / unit / software	Type / Version	Manufacturer	Supplied by
N/A			
<u>Supplemental information:</u>			

## 2.4 Test Configuration / Block diagram used for tests



### 3 VERDICT SUMMARY SECTION

This chapter presents an overview of standards and results. Refer to the next chapters for details of measured test results and applied test levels.

#### 3.1 Standards

Standard	Year	Description
EN IEC 55014-1	2021 <sup>1)</sup>	Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission.
EN 55016-2-1 +A1	2014 2017	Methods of measurement of disturbances and immunity - Conducted disturbance measurements.
EN 55016-2-2	2011	Methods of measurement of disturbances and immunity – Measurement of disturbance power.
EN 55016-2-3 +A1	2017 2019	Methods of measurement of disturbances and immunity - Radiated disturbance measurements.
EN IEC 61000-3-2 +A1	2019 <sup>1)</sup> 2021 <sup>1)</sup>	Limits for harmonic current emissions (equipment input current ≤ 16 A per phase).
EN 61000-3-3 +A1 +A2	2013 2019 <sup>1)</sup> 2021 <sup>1)</sup>	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection.
EN IEC 55014-2	2021 <sup>1)</sup>	Requirements for household appliances, electric tools and similar apparatus – Part 2: Immunity – Product family standard.
EN 61000-4-2	2009	Electrostatic discharge immunity test.
EN 61000-4-3 +A1 +A2	2006 2008 2010	Radiated, radio-frequency, electromagnetic field immunity test.
EN 61000-4-4	2012	Electrical fast transient/burst immunity test.
EN 61000-4-5 +A1	2014 2017	Surge immunity test.
EN 61000-4-6	2014	Immunity to conducted disturbances, induced by radio-frequency fields.
EN IEC 61000-4-11	2020	Voltage dips, short interruptions and voltage variations immunity tests.

<sup>1)</sup> Not harmonized yet.

#### 3.2 Deviation(s) from the Standard(s) / Test Specification(s)

The following deviation(s) was / were made from the published requirements of the listed standards:  
 N/A.

### 3.3 Overview of results

EMISSION TESTS – EN IEC 55014-1			
Requirement – Test case	Basic standard(s)	Verdict	Remark
Conducted disturbance at mains terminals (150 kHz – 30 MHz)	EN 55016-2-1	PASS	---
Conducted disturbance at wired network ports (150 kHz – 30 MHz)	EN 55016-2-1	N/A	See 2)
Disturbance power (30 MHz – 300 MHz)	EN 55016-2-2	PASS	---
Radiated disturbance (30 MHz – 1000 MHz)	EN 55016-2-3	PASS	---
Radiated disturbance (1 GHz – 6 GHz)	EN 55016-2-3	N/A	See 3)
Discontinuous disturbance (clicks) on AC power leads	EN IEC 55014-1	PASS	---
<u>Supplementary information:</u>			
1) The test is not applicable as the EUT does not have associated ports / wired network ports.			
2) The highest internal frequency of the EUT is less than 108 MHz.			

EMISSION TESTS – EN IEC 61000-3-2, EN 61000-3-3			
Requirement – Test case	Basic standard(s)	Verdict	Remark
Harmonic current emissions	EN IEC 61000-3-2	PASS	See 1)
Voltage changes, voltage fluctuations and flicker	EN 61000-3-3	PASS	---
<u>Supplementary information:</u>			
1) The EUT is regarded as an “Equipment with rated power of $\leq 75$ W”. According to “Clause 7, Figure 1 - Flowchart for determining conformity” the EUT is deemed to comply with the requirements of the EN 61000-3-2 standard.			

IMMUNITY TESTS – EN IEC 55014-2			
Requirement – Test case	Basic standard(s)	Verdict	Remark
Electrostatic discharge	EN 61000-4-2	PASS	---
Radio-frequency electromagnetic fields	EN 61000-4-3	PASS	---
Fast transients	EN 61000-4-4	PASS	---
Surges	EN 61000-4-5	PASS	---
Injected currents (radio-frequency common mode)	EN 61000-4-6	PASS	---
Voltage dips and short interruptions	EN IEC 61000-4-11	PASS	---
<u>Supplementary information:</u>			

## 4 EMISSION TEST RESULTS

<b>4.1 Conducted disturbance voltage - Mains</b>	<b>VERDICT: PASS</b>
--	----------------------

Standard	EN IEC 55014-1
Basic standard	EN 55016-2-1

### Limits

Frequency range [MHz]	Limit: QP [dB(μV) <sup>1)</sup>	Limit: AV [dB(μV) <sup>1)</sup>	IF BW	Detector(s)
0.15 - 0.50	66 - 56 <sup>2)</sup>	59 - 46 <sup>2)</sup>	9 KHz	QP, CAV
0.50 - 5.0	56	46	9 KHz	QP, CAV
5.0 - 30	60	50	9 KHz	QP, CAV

<sup>1)</sup> At the transition frequency, the lower limit applies.

<sup>2)</sup> The limit decreases linearly with the logarithm of the frequency.

### Performed measurements

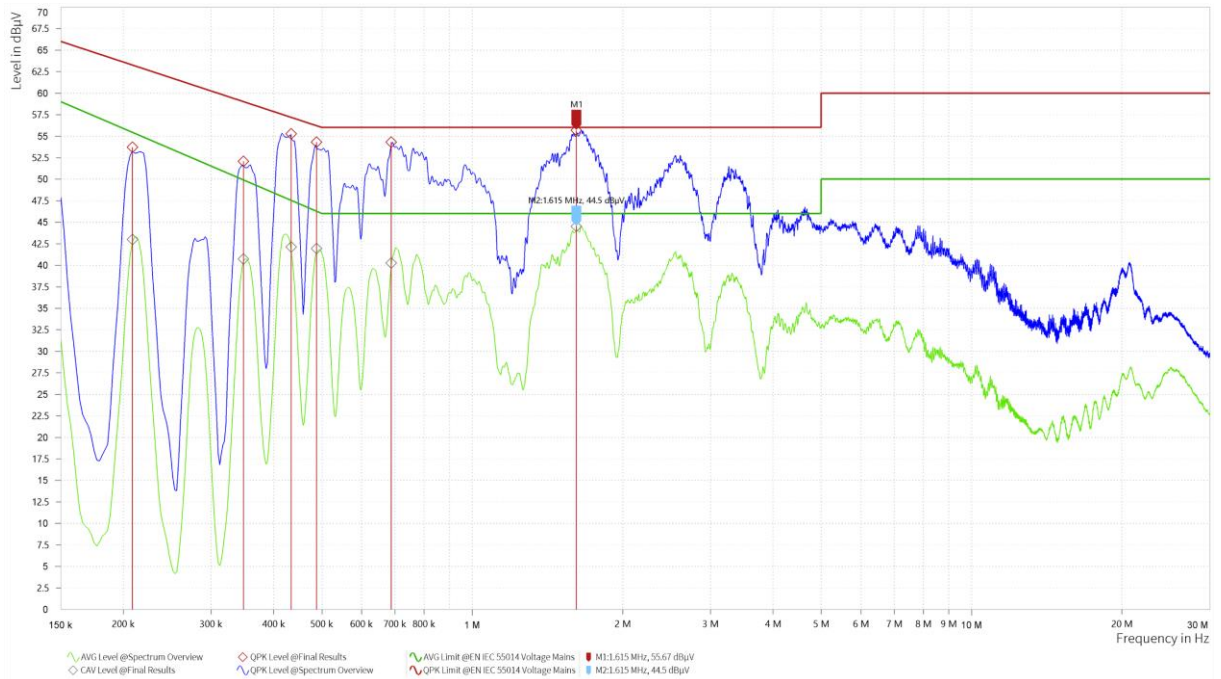
Scan range (0.9 – 1.1 $U_N$ )	<input type="checkbox"/>	198 – 264 V <sub>AC</sub>	<input type="checkbox"/>	207 – 253 V <sub>AC</sub>	<input checked="" type="checkbox"/>	230 V <sub>AC</sub>				
Tested terminal(s) / port	<input checked="" type="checkbox"/>	AC mains input power	<input checked="" type="checkbox"/>	N	<input checked="" type="checkbox"/>	L1	<input type="checkbox"/>	L2	<input type="checkbox"/>	L3
	<input type="checkbox"/>	DC mains input power	<input type="checkbox"/>	Positive (+)	<input type="checkbox"/>	Negative (-)				
Voltage – Mains [V]	230 Vac									
Frequency – Mains [Hz]	50 Hz									
Test method applied	<input checked="" type="checkbox"/>	Artificial mains network								
	<input type="checkbox"/>	Voltage probe								
Test setup	<input checked="" type="checkbox"/>	Table top <sup>1)</sup>			<input type="checkbox"/>	Artificial hand applied				
	<input checked="" type="checkbox"/>	Floor standing			<input type="checkbox"/>	Other:				
Refer to the Annex 3 for test setup photo(s).										
Operating mode(s) used	Mode 3, Mode 4, Mode 5									
Remark	1) For Mode 5									

See next page.

Measurement data	Port under test	AC mains power input
------------------	-----------------	----------------------

Operating mode / voltage / frequency used during the test	Mode 3 / 230 Vac / 50 Hz
---	--------------------------

Line:



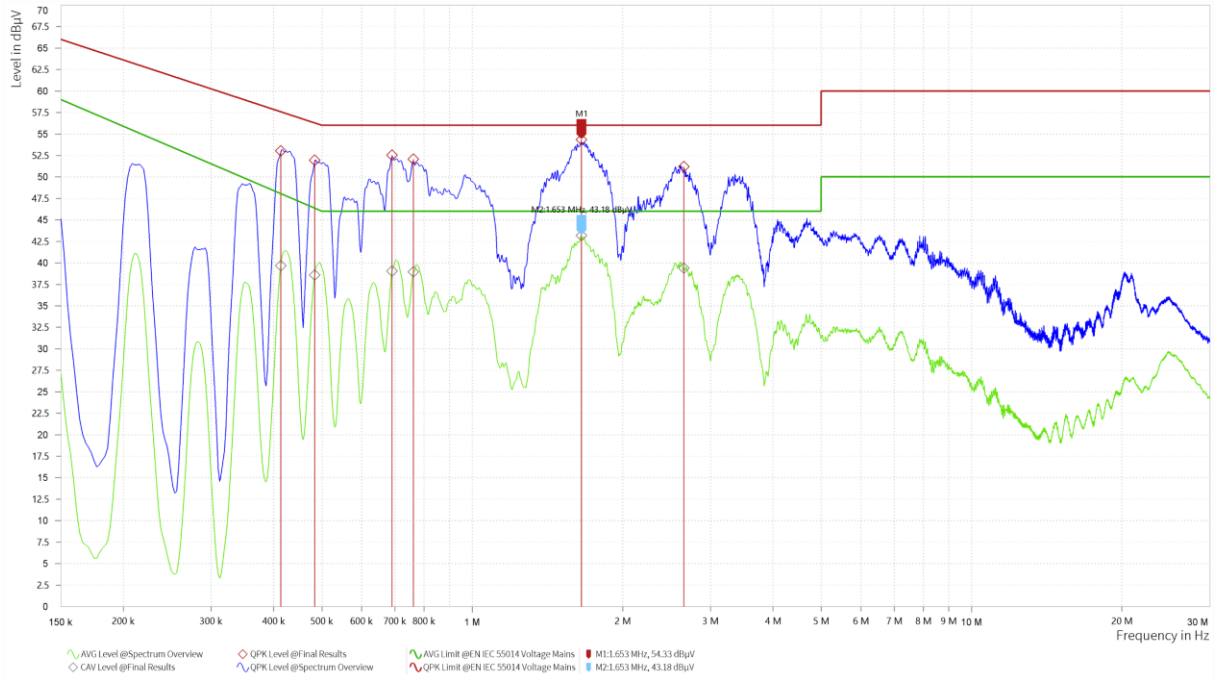
Frequency [MHz]	QPK Level [dBµV]	QPK Limit [dBµV]	QPK Margin [dB]	CAV Level [dBµV]	CAV: AVG Limit [dBµV]	CAV Margin [dB]	Correction [dB]	Line
0.209	53.71	63.26	9.56	42.98	55.44	12.47	9.89	L1
0.348	52.06	59.01	6.95	40.71	49.91	9.20	9.89	L1
0.434	55.27	57.19	1.92	42.12	47.54	5.42	9.90	L1
0.488	54.30	56.21	1.91	41.94	46.27	4.33	9.90	L1
0.688	54.32	56.00	1.68	40.25	46.00	5.75	9.89	L1
1.615	55.67	56.00	0.33	44.50	46.00	1.50	9.86	L1

1. QPK Level [dBµV]=Reading QPK Level [dBµV] + Correction [dB]
2. CAV Level [dBµV]=Reading CAV Level [dBµV] + Correction [dB]
3. Correction [dB]= AMN VDF [dB] + Cable Loss [dB]

Remark	Pre-test all operating modes during the testing, then listed the worst data (mode 3) in this report.
--------	--

<b>Measurement data</b>	Port under test	AC mains power input
Operating mode / voltage / frequency used during the test		Mode 3 / 230 Vac / 50 Hz

**Neutral:**



Frequency [MHz]	QPK Level [dBµV]	QPK Limit [dBµV]	QPK Margin [dB]	CAV Level [dBµV]	CAV: AVG Limit [dBµV]	CAV Margin [dB]	Correction [dB]	Line
0.413	53.03	57.58	4.55	39.66	48.06	8.40	9.81	N
0.483	51.93	56.29	4.36	38.57	46.37	7.81	9.78	N
0.690	52.54	56.00	3.46	39.03	46.00	6.97	9.84	N
0.762	52.08	56.00	3.92	38.95	46.00	7.05	9.86	N
1.653	54.33	56.00	1.67	43.18	46.00	2.82	9.92	N
2.652	51.20	56.00	4.80	39.38	46.00	6.62	9.92	N

1. QPK Level [dBµV]=Reading QPK Level [dBµV] + Correction [dB]
2. CAV Level [dBµV]=Reading CAV Level [dBµV] + Correction [dB]
3. Correction [dB]= AMN VDF [dB] + Cable Loss [dB]

Remark Pre-test all operating modes during the testing, then listed the worst data (mode 3) in this report.

<b>4.2 Disturbance power (30 MHz – 300 MHz)</b>	<b>VERDICT: PASS</b>
---	----------------------

Standard	EN 55014-1
Basic standard	EN 55016-2-2

**Limits**

Frequency range [MHz]	Limit: QP [dB(pW)]	Limit: AV [dB(pW)]	IF BW	Detector(s)
30 - 300	45 – 55 <sup>1)</sup>	35 – 45 <sup>1)</sup>	120 KHz	QP, CAV
Margin				
200 - 300	0 – 10 <sup>1)</sup>	---	120 KHz	QP, CAV

<sup>1)</sup> The limit increases linearly with the frequency.

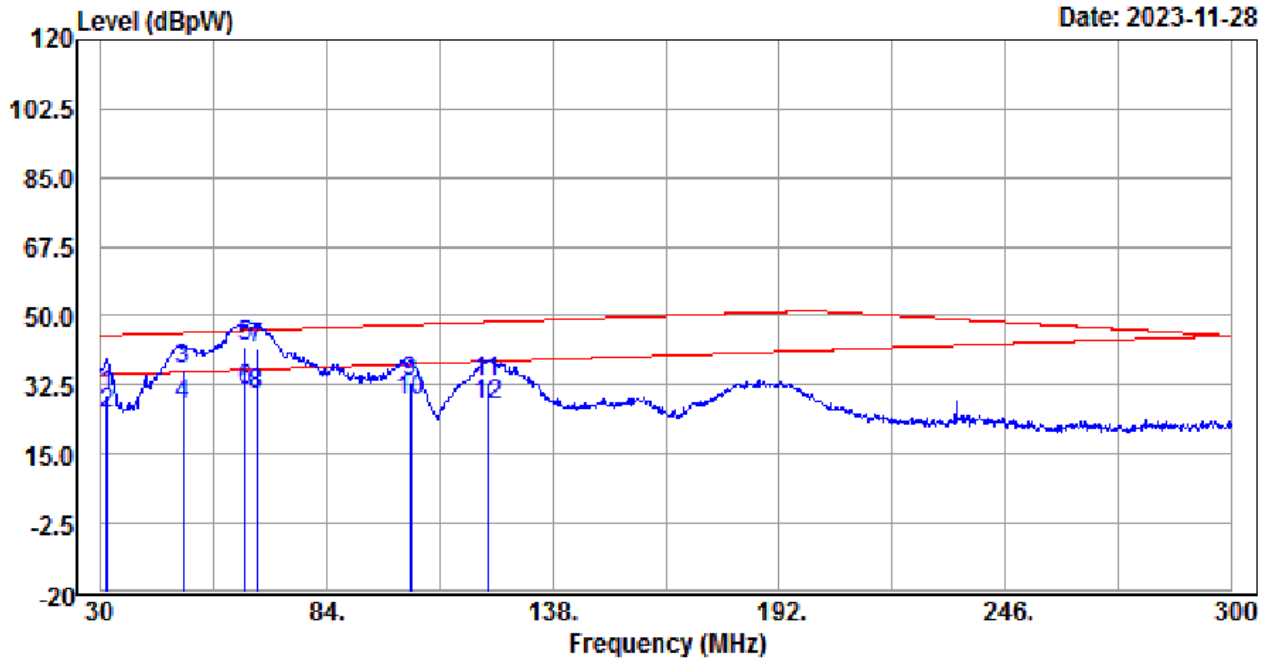
**Performed measurements**

Port(s) under test						
<input checked="" type="checkbox"/>	AC mains input power	<input type="checkbox"/>	Load	<input type="checkbox"/>	Control	
<input checked="" type="checkbox"/>	Other: DC output power	<input type="checkbox"/>	Other:	<input type="checkbox"/>	Other:	
Scan range (0.9 – 1.1 U <sub>N</sub> )	<input type="checkbox"/>	198 – 264 V <sub>AC</sub>	<input type="checkbox"/>	207 – 253 V <sub>AC</sub>	<input checked="" type="checkbox"/>	230 V <sub>AC</sub>
Voltage – Mains [V]	230 Vac					
Frequency – Mains [Hz]	50 Hz					
Test setup	<input checked="" type="checkbox"/>	Table top <sup>1)</sup>	<input type="checkbox"/>	Floor standing		
	<input type="checkbox"/>	Other: Hand-held equipment				
	Refer to the Annex 3 for test setup photo(s).					
Conditions for exemption from measurements above 300 MHz	<input checked="" type="checkbox"/>	“Limits” reduced by “Margin” applied and passed				
	<input checked="" type="checkbox"/>	Maximum clock frequency < 30 MHz				
Operating mode(s) used	Mode 3, Mode 4, Mode 5					
Remark	1) For mode 5					

See next page.

Measurement data	Port under test	AC mains power input
------------------	-----------------	----------------------

Operating mode / voltage / frequency used during the test	Mode 3 / 230 Vac / 50 Hz
---	--------------------------



Item	Freq. MHz	Reading Level dBpW	C.F dB	Emission Level dBpW	Limit dBpW	Over Limit dB	Detector
1	31.62	5.72	24.38	30.10	45.07	-14.97	QP
2	31.62	0.82	24.38	25.20	35.07	-9.87	Average
3	49.98	12.71	23.62	36.33	45.75	-9.42	QP
4	49.98	3.61	23.62	27.23	35.75	-8.52	Average
5	64.83	19.21	22.85	42.06	46.30	-4.24	QP
6	64.83	8.11	22.85	30.96	36.30	-5.34	Average
7	67.53	18.71	23.17	41.88	46.40	-4.52	QP
8	67.53	6.81	23.17	29.98	36.40	-6.42	Average
9	103.98	10.31	22.73	33.04	47.75	-14.71	QP
10	103.98	5.51	22.73	28.24	37.75	-9.51	Average
11	122.61	10.71	22.33	33.04	48.44	-15.40	QP
12	122.61	5.31	22.33	27.64	38.44	-10.80	Average

Remarks: 1. C.F (Correction Factor) = Clamp factor + Cable loss+ATT..  
 2. Emission Level = Reading Level + C.F (Correction Factor).

Remark	Pre-test all operating modes during the testing, then listed the worst data (mode 3) in this report.
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<b>4.3 Radiated electromagnetic disturbances (30 – 1000 MHz)</b>	<b>VERDICT: PASS</b>
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Standard	EN 55014-1
Basic standard	EN 55016-2-3
Test method	Antenna method according to EN 55016-2-3 standard.

**Limits**

Frequency [MHz]	Limit: QP [dB(μV/m) <sup>1)</sup> ]			IF BW	Detector
	@3 m.	@5 m.	@10 m.		
30 - 230	40	36	30	120 KHz	QP
230 - 1000	47	43	37	120 KHz	QP

<sup>1)</sup> At the transition frequency, the lower limit applies.

**Performed measurements**

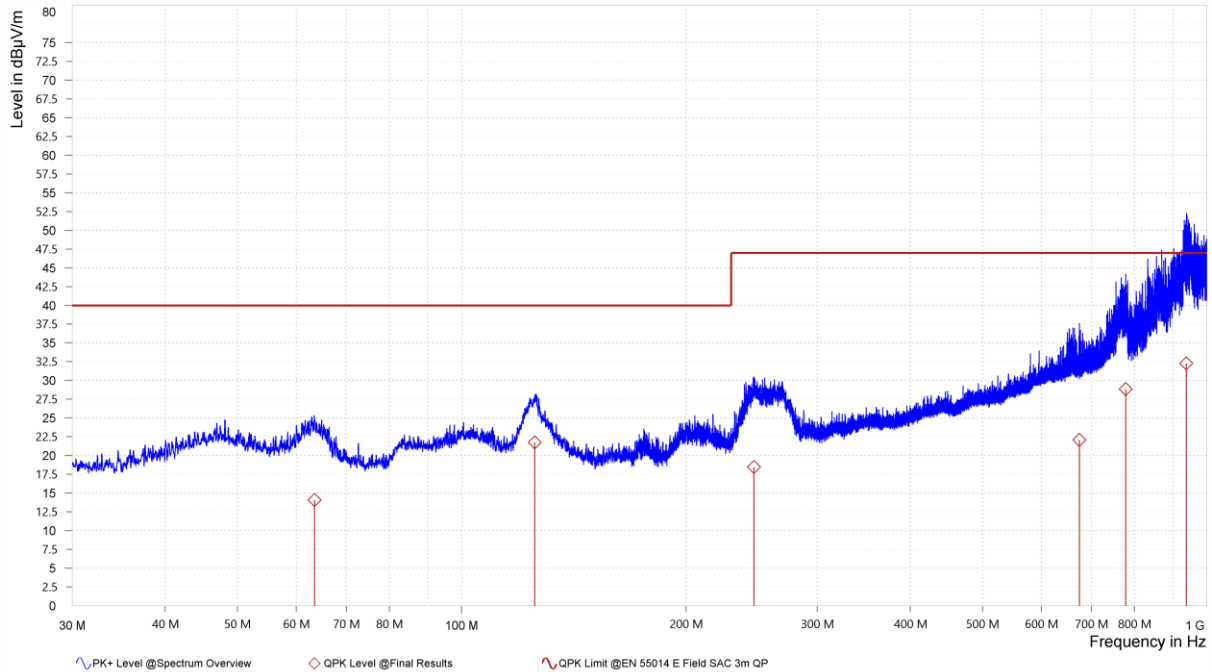
Port under test	Enclosure	
Voltage – Mains [V]	25,2 Vdc	
Frequency – Mains [Hz]	---	
Test method applied	<input checked="" type="checkbox"/>	OATS or SAC with measurement distance [m]: 3 m.
	<input type="checkbox"/>	OATS or SAC with measurement distance [m]: 5 m.
	<input type="checkbox"/>	OATS or SAC with measurement distance [m]: 10 m.
Test setup	<input type="checkbox"/>	Equipment on a table of 80 cm height
	<input checked="" type="checkbox"/>	Equipment on the floor (insulated from ground plane)
	<input type="checkbox"/>	Other:
	Refer to the Annex 2 for test setup photo(s).	
Operating mode(s) used	Mode 1, Mode 2	
Remark	---	

See next page.

Measurement data	<input checked="" type="checkbox"/> Horizontal	<input type="checkbox"/> Vertical
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Operating mode / voltage / frequency used during the test Mode 1 / 25,2 Vdc

VC7236:



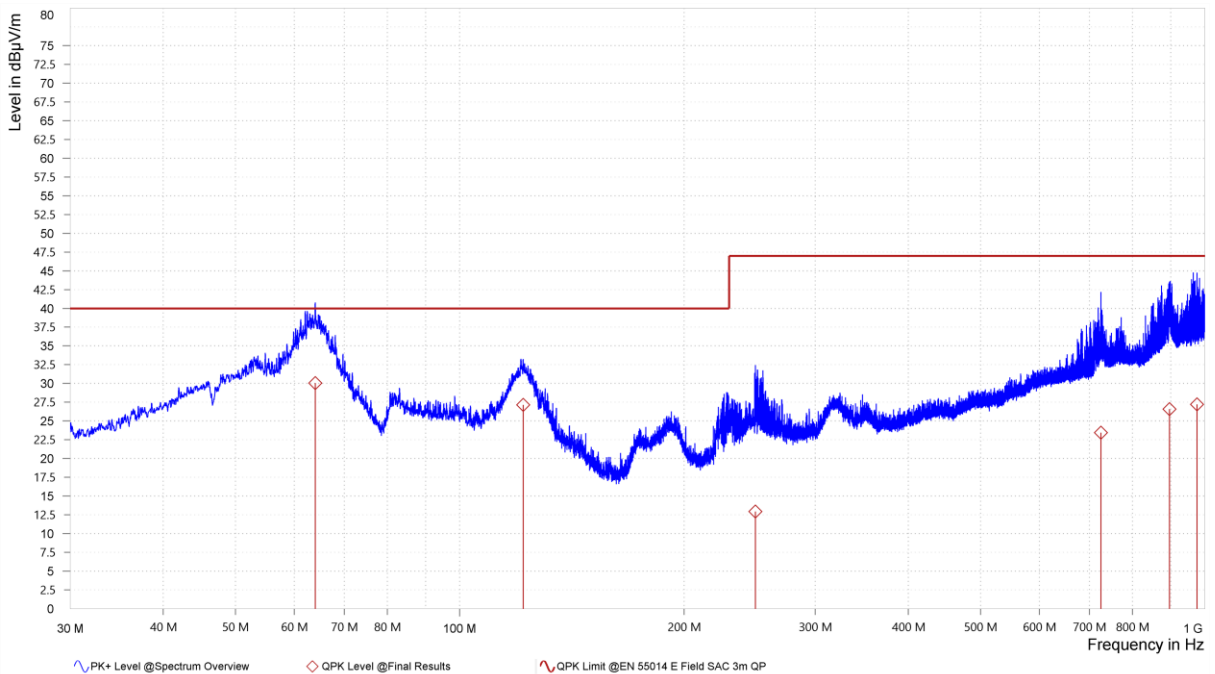
Rg	Frequency [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Meas. BW [kHz]	Meas. Time [ms]	Time of Meas.	Source
1	63.480	14.08	40.00	25.92	19.21	H	120.000	1,000.000	9:06:07	Critical Points
1	125.370	21.75	40.00	18.25	16.89	H	120.000	1,000.000	9:05:26	Critical Points
1	246.690	18.48	47.00	28.52	22.15	H	120.000	1,000.000	9:05:57	Critical Points
1	674.430	22.06	47.00	24.94	31.15	H	120.000	1,000.000	9:05:04	Critical Points
1	778.500	28.85	47.00	18.15	33.17	H	120.000	1,000.000	9:06:32	Critical Points
1	938.910	32.27	47.00	14.73	35.18	H	120.000	1,000.000	9:06:22	Critical Points

1. QPK Level [dBµV/m]=Reading QPK Level [dBµV/m] + Correction [dB/m]
2. Correction [dB/m]=Antenna Factor [dB/m] + Cable Loss [dB]

Remark Pre-test all operating modes during the testing, then listed the worst data (mode 1) in this report.

Measurement data	<input type="checkbox"/>	Horizontal	<input checked="" type="checkbox"/>	Vertical
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Operating mode / voltage / frequency used during the test Mode 1 / 25,2 Vdc



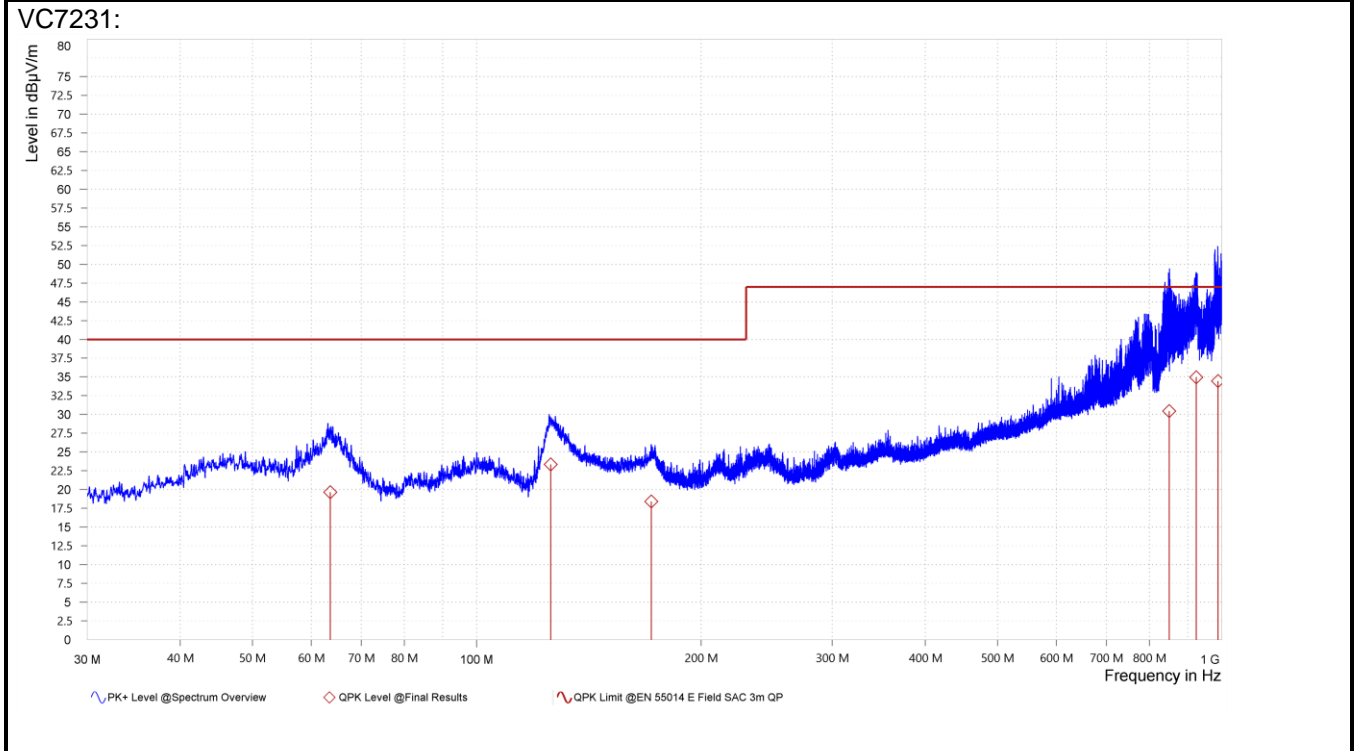
Rg	Frequency [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Meas. BW [kHz]	Meas. Time [ms]	Time of Meas.	Source
1	63.990	30.06	40.00	9.94	19.06	V	120.000	1,000.000	9:20:19	Critical Points
1	121.650	27.15	40.00	12.85	17.27	V	120.000	1,000.000	9:20:37	Critical Points
1	249.330	12.93	47.00	34.07	22.19	V	120.000	1,000.000	9:19:55	Critical Points
1	725.280	23.46	47.00	23.54	31.89	V	120.000	1,000.000	9:20:57	Critical Points
1	896.580	26.57	47.00	20.43	34.90	V	120.000	1,000.000	9:20:46	Critical Points
1	976.410	27.22	47.00	19.78	34.99	V	120.000	1,000.000	9:19:34	Critical Points

1. QPK Level [dBµV/m]=Reading QPK Level [dBµV/m] + Correction [dB/m]
2. Correction [dB/m]=Antenna Factor [dB/m] + Cable Loss [dB]

Remark Pre-test all operating modes during the testing, then listed the worst data (mode 1) in this report.

Measurement data	<input checked="" type="checkbox"/>	Horizontal	<input type="checkbox"/>	Vertical
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Operating mode / voltage / frequency used during the test Mode 1 / 25,2 Vdc

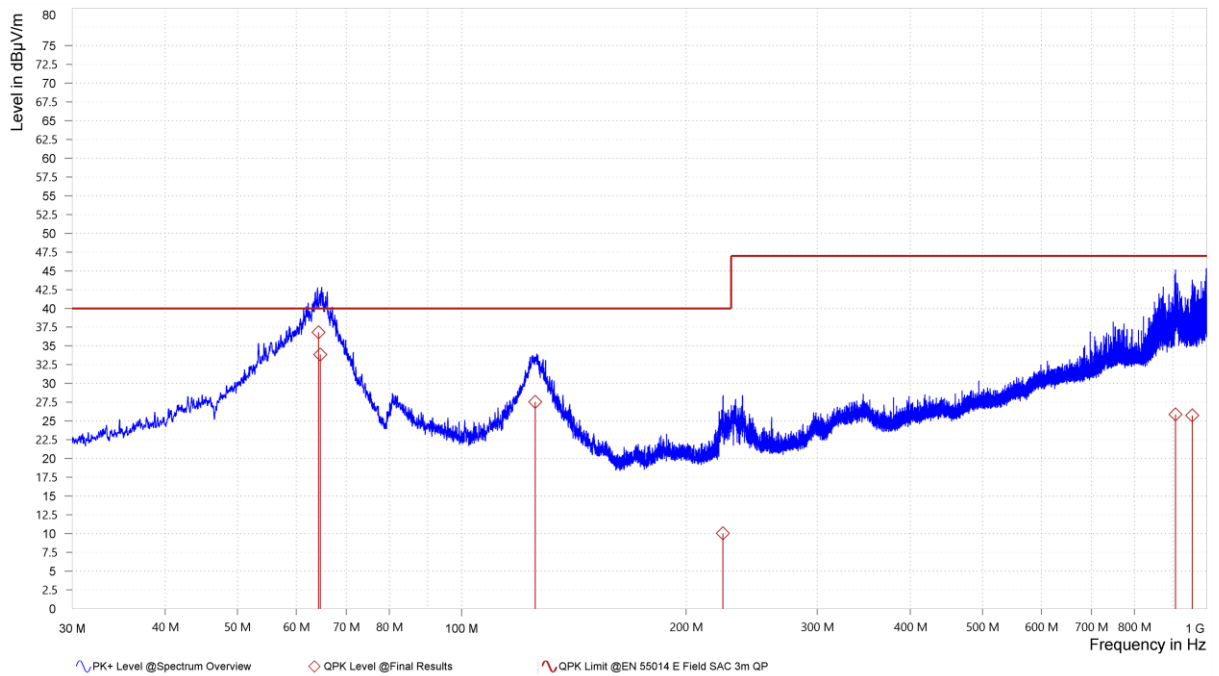


Rg	Frequency [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Meas. BW [kHz]	Meas. Time [ms]	Time of Meas.	Source
1	63.600	19.65	40.00	20.35	19.17	H	120.000	1,000.000	20:04:36	Critical Points
1	125.700	23.35	40.00	16.65	16.85	H	120.000	1,000.000	20:04:00	Critical Points
1	171.600	18.41	40.00	21.59	17.63	H	120.000	1,000.000	20:03:47	Critical Points
1	850.320	30.44	47.00	16.56	33.87	H	120.000	1,000.000	20:05:28	Critical Points
1	923.820	34.94	47.00	12.06	35.17	H	120.000	1,000.000	20:04:56	Critical Points
1	988.140	34.44	47.00	12.56	35.28	H	120.000	1,000.000	20:05:06	Critical Points

1. QPK Level [dBµV/m]=Reading QPK Level [dBµV/m] + Correction [dB/m]
2. Correction [dB/m]=Antenna Factor [dB/m] + Cable Loss [dB]

Remark Pre-test all operating modes during the testing, then listed the worst data (mode 1) in this report.

Measurement data	<input type="checkbox"/>	Horizontal	<input checked="" type="checkbox"/>	Vertical
Operating mode / voltage / frequency used during the test		Mode 1 / 25,2 Vdc		



Rg	Frequency [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Meas. BW [kHz]	Meas. Time [ms]	Time of Meas.	Source
1	64.260	36.83	40.00	3.17	18.97	V	120.000	1,000.000	19:58:44	Critical Points
1	64.620	33.84	40.00	6.16	18.85	V	120.000	1,000.000	19:54:57	Critical Points
1	125.550	27.55	40.00	12.45	16.87	V	120.000	1,000.000	19:54:36	Critical Points
1	224.130	10.05	40.00	29.95	20.61	V	120.000	1,000.000	19:55:28	Critical Points
1	907.530	25.88	47.00	21.12	35.08	V	120.000	1,000.000	19:54:45	Critical Points
1	956.490	25.75	47.00	21.25	34.91	V	120.000	1,000.000	19:55:00	Critical Points

1. QPK Level [dBµV/m]=Reading QPK Level [dBµV/m] + Correction [dB/m]
2. Correction [dB/m]=Antenna Factor [dB/m] + Cable Loss [dB]

Remark	Pre-test all operating modes during the testing, then listed the worst data (mode 1) in this report.
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<b>4.4 Voltage changes, voltage fluctuations and flicker</b>	<b>VERDICT: PASS</b>
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Standard	EN 61000-3-3
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**Limits**

P <sub>ST</sub> (Short term flicker)	<input checked="" type="checkbox"/>	≤ 1	<input type="checkbox"/>	Not Applicable
P <sub>LT</sub> (Long term flicker)	<input type="checkbox"/>	≤ 0.65	<input checked="" type="checkbox"/>	Not Applicable
d <sub>C</sub> (Relative Voltage change)	<input checked="" type="checkbox"/>	≤ 3.3%	<input type="checkbox"/>	Not Applicable
T <sub>MAX</sub> (Maximum time duration)	<input checked="" type="checkbox"/>	≤ 500ms	<input type="checkbox"/>	Not Applicable
d <sub>MAX</sub> (Max. voltage change)	<input checked="" type="checkbox"/>	≤ 4%	<input type="checkbox"/>	6%
	<input type="checkbox"/>	7%	<input type="checkbox"/>	Not Applicable
<u>Supplemental information:</u>				

**Performed measurements**

Reason for not performing the measurement(s)	<input type="checkbox"/>	Tests are not necessary because the EUT is unlikely to produce significant voltage fluctuations or flicker (clause 6.1).				
Port under test	AC Mains power input					
Voltage – Mains [V]	230 Vac					
Frequency – Mains [Hz]	50 Hz					
Test method	<input checked="" type="checkbox"/>	Flickermeter according EN / IEC 61000-4-15:2011				
	<input type="checkbox"/>	Simulation (Clause 4.2.3 of EN / IEC 61000-3-3)				
	<input type="checkbox"/>	Analytical method (Clause 4.2.4 of EN / IEC 61000-3-3)				
	<input checked="" type="checkbox"/>	Use of P <sub>st</sub> = 1 curve (Clause 4.2.5 of EN / IEC 61000-3-3)				
Observation period	<input type="checkbox"/>	10 min.	<input checked="" type="checkbox"/>	120 min.	<input type="checkbox"/>	Other:
	<input type="checkbox"/>	24 times switching according to Annex B				
Operating mode(s) used	Mode 3, Mode 4, Mode 5					
Remark	Mode 4 of EUT does not produce significant voltage fluctuations of flicker.					

See next page.

Measurement data	Port under test	AC input power
Operating mode used during the test	230 Vac / 50 Hz	
Test results for mode 3:		
Tmax (dt > 3,3%)	0,0 ms	
Maximum relative voltage change $d_{MAX}$	2,232%	
Relative Voltage change $d_C$	1,098%	
Short term flicker $P_{ST}$	0,489	
Long term flicker $P_{LT}$	0,369	
Test results for mode 5:		
Tmax (dt > 3,3%)	0,0 ms	
Maximum relative voltage change $d_{MAX}$	0,52%	
Relative Voltage change $d_C$	0,00%	
Short term flicker $P_{ST}$	0,054	
Long term flicker $P_{LT}$	0,029	
Remark		

## 5 IMMUNITY TEST RESULTS

### 5.1 Performance (Compliance) criteria

[According to EN IEC 55014-2 (CISPR 14-2)]

Performance criteria A : The apparatus shall continue to operate as intended during the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer when the apparatus is used as intended. If the minimum performance level or the permissible performance loss is not specified by the manufacturer then either of these may be derived from the product description and documentation and from what the user may reasonably expect from the apparatus if used as intended.

Performance criteria B : The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level ( or permissible loss of performance) specified by the manufacturer when the apparatus is used as intended. During the test, degradation of performance is allowed however no change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer then either of these may be derived from the product description and documentation and from what the user may reasonable expect from the apparatus if used as intended.

Performance criteria C : Temporary loss of function is allowed provided the function is self- recoverable or can be restored by the operation of the controls or by any operation specified in the instruction for use.

#### 5.1.1 Performance criteria related to immunity tests

Immunity test	Performance criteria
Electrostatic discharge	B
Fast transients	B
Surge transient	B
Injected currents (radio-frequency common mode)	A
Voltage dips and short interruptions	C

#### 5.1.2 Manufacturer defined performance criteria

Not provided.

**5.2 Monitored – Checked Functions / Parameters**

During the immunity tests the following functions of the EUT has/have been monitored/checked.

<input checked="" type="checkbox"/>	Motor speed	<input type="checkbox"/>	Display data
<input type="checkbox"/>	Switching	<input type="checkbox"/>	Data storage
<input type="checkbox"/>	Standby mode	<input type="checkbox"/>	Sensor functions
<input type="checkbox"/>	Temperature	<input type="checkbox"/>	Audible signals
<input type="checkbox"/>	Power consumption	<input checked="" type="checkbox"/>	Others : Functional status
<input type="checkbox"/>	AC mains input current	<input type="checkbox"/>	Others :
<input type="checkbox"/>	Timing	<input type="checkbox"/>	Others :
<input type="checkbox"/>	Illumination	<input type="checkbox"/>	Others :
<u>Supplementary information :</u>			

Immunity test	Monitored - Checked function(s)/parameter(s) during / after the test	Method
Electrostatic discharge	Motor speed & Functional status	Visual
Radio-frequency electromagnetic fields	---	Visual / Camera
Fast transients	Motor speed & Functional status	Visual
Surge transient	Motor speed & Functional status	Visual
Injected currents (radio-frequency common mode)	Motor speed & Functional status	Visual
Voltage dips and short interruptions	Motor speed & Functional status	Visual
<u>Supplementary information :</u>		

<b>5.3 Electrostatic discharge immunity</b>	<b>VERDICT: PASS</b>
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Electrostatic discharges (ESD) are the result of persons or objects that accumulate static electricity due to for instance walking on synthetic carpets. The ESD can influence the operation of equipment or damage its electronics, either by a direct discharge or indirectly by coupling or radiation. Both effects are simulated during the tests.

**Requirements**

Standard	EN IEC 55014-2							
Basic standard	EN 61000-4-2							
Port under test	Enclosure							
Air discharges <sup>1)</sup>	<input type="checkbox"/>	±2 kV	<input type="checkbox"/>	±4 kV	<input checked="" type="checkbox"/>	±8 kV	<input type="checkbox"/>	kV
Contact discharges <sup>1)</sup>	<input type="checkbox"/>	±2 kV	<input checked="" type="checkbox"/>	±4 kV	<input type="checkbox"/>	±8 kV	<input type="checkbox"/>	kV
Number of discharges	≥ 10 per polarity with ≥ 1 sec interval.							
<sup>1)</sup> Tests with lower voltages are not required.								

**Performed tests for all test models:**

Set-up	<input checked="" type="checkbox"/>	Table-top <sup>1)</sup>	<input type="checkbox"/>	Floor standing
Ambient temperature [°C]	24 °C		Relative Humidity air [%]	48 %
Voltage – Mains [V]	230 Vac, 25,2 Vdc			
Frequency – Mains [Hz]	50 Hz			
Operating mode(s) used	Mode 2, Mode 3, Mode 4, Mode 5			

	Test Point	Test Voltage [kV] & Polarity	Coupling type	# of applied discharges / polarity	Discharge interval [s]
<input checked="" type="checkbox"/>	Points on conductive surface.	±4	Contact	10	1
<input checked="" type="checkbox"/>	Points on non-conductive surface.	±8	Air	10	1
<input checked="" type="checkbox"/>	HCP top side. <sup>1)</sup>	±4	Contact	10	1
<input checked="" type="checkbox"/>	HCP bottom side. <sup>1)</sup>	±4	Contact	10	1
<input checked="" type="checkbox"/>	VCP right side.	±4	Contact	10	1
<input checked="" type="checkbox"/>	VCP left side.	±4	Contact	10	1
<input checked="" type="checkbox"/>	VCP front side.	±4	Contact	10	1
<input checked="" type="checkbox"/>	VCP rear side.	±4	Contact	10	1

Observation(s)	During the test no loss of performance was observed. After the test the EUT functioned as intended. No unacceptable loss of performance or data was observed.
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Supplementary information:  
 1) For mode 5

<b>5.4</b>	<b>Radio-frequency electromagnetic fields immunity</b>	<b>VERDICT: PASS</b>
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During the test it is verified if the equipment under test (EUT) has sufficient immunity against radiated electromagnetic fields. Industrial electromagnetic sources, walkie-talkies, radio transmitters, television transmitters and telecommunication equipment including cellular telephones and other emitting devices can generate these fields.

**Requirements**

Standard	EN 55014-2			
Basic standard	EN 61000-4-3			
Port under test	Enclosure			
Frequency range	Test level	Modulation	Dwell time	Step size
80 – 1000 MHz	3 V/m	80% AM (1kHz)	≥ 0.5 s	≤ 1%
<u>Supplementary information:</u>				

**Performed tests for all test models:**

Test method	<input checked="" type="checkbox"/>	EN 61000-4-3	<input type="checkbox"/>	EN 61000-4-20	
Test set-up	<input type="checkbox"/>	Equipment on the table (0.8 m height)			
	<input checked="" type="checkbox"/>	Equipment standing on floor (0.05 – 0.15 m height)			
Voltage – Mains [V]	25,2 Vdc				
Frequency – Mains [Hz]	---				
Operating mode(s) used	Mode 2				
Frequency range (applied)	Antenna Polarization	Test level (applied)	Modulation (applied)	Dwell time (applied)	Remark
80 – 1000 MHz (step size 1%)	H	3 V/m	80% AM (1kHz)	3 s	
	V	3 V/m	80% AM (1kHz)	3 s	
Exposed side of the EUT	<input checked="" type="checkbox"/>	Front (0°)	<input checked="" type="checkbox"/>	Right (90°)	<input type="checkbox"/> Top
	<input checked="" type="checkbox"/>	Rear (180°)	<input checked="" type="checkbox"/>	Left (270°)	<input type="checkbox"/> Bottom
Observation(s)	During the test no loss of performance was observed. After the test the EUT functioned as intended. No unacceptable loss of performance was observed.				
<u>Supplementary information:</u>					

<b>5.5 Electrical Fast Transients immunity</b>	<b>VERDICT: PASS</b>
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The EFT immunity test simulates disturbances by bursts of very short transients caused for example by switching off loads such as an AC motor or bouncing relay contacts. The transients are likely to disturb electronics but less likely to cause damage.

### Requirements

Standard	EN IEC 55014-2			
Basic standard	EN 61000-4-4			
Pulse characteristics	5/50 ns			
Port	Test level	Repetition frequency	Duration	
<input checked="" type="checkbox"/> AC input-output power <sup>1)</sup>	± 1000 V	5 KHz	2 min. / polarity	
<input type="checkbox"/> DC input-output power <sup>2)</sup>	± 500 V	5 KHz	2 min. / polarity	
<input type="checkbox"/> Signal and Control lines <sup>3)</sup>	± 500 V	5 KHz	2 min. / polarity	
<sup>1)</sup> For extra low voltage a.c ports, this testing is only applicable to ports interfacing with cables whose total length may exceed 3 m according to the manufacturer's functional specification. <sup>2)</sup> Not applicable to battery operated appliances that cannot be connected to the mains while in use. <sup>3)</sup> Applicable only to ports interfacing with cables whose total length may exceed 3 m according to the manufacturer's functional specification.				

### Performed tests

Voltage – Mains [V]	230 Vac			
Frequency – Mains [Hz]	50 Hz			
Operating mode(s) used	Mode 3, Mode 4, Mode 5			
Test Set-up (see annex 3 for photo)	<input type="checkbox"/>	Equipment standing on floor at (0.1 ± 0.01) m above ground plane		
	<input checked="" type="checkbox"/>	Equipment on the table (0.1 ± 0.01) m above ground plane		
	<input type="checkbox"/>	Artificial hand applied. Location refer to annex 3.		
Coupling	<input type="checkbox"/>	Common mode	<input checked="" type="checkbox"/>	Other: unsymmetric mode

Port(s) under test	Test Voltage & Polarity	Repetition Frequency	Test duration / polarity	Injection method		
AC mains power input	1000 V	5 KHz	2 min	<input checked="" type="checkbox"/>	CDN	<input type="checkbox"/> Clamp
Observation(s)	During the test no loss of performance was observed. After the test the EUT functioned as intended. No unacceptable loss of performance or data was observed.					
Supplementary information:						

<b>5.6</b>	<b>Surge transient immunity</b>	<b>VERDICT: PASS</b>
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The surge transient immunity test simulates the surges that are caused by over-voltages due to indirect (induced) lightning transients. The pulse is a slow transient with high-energy contents and due to its long duration may cause damage to an unprotected EUT.

**Requirements**

Standard	EN IEC 55014-2		
Basic standard	EN 61000-4-5		
Pulse characteristics	1.2/50 µs Voltage; 8/20 µs Current		
Repetition rate	≥ 60 secs. (for each test level and phase angle)		
Number of pulses	5 pulses (at each polarity and phase angle)		
Port	Test level & Polarity & Coupling		Phase angle [°]
	Line to Line	Line to Earth	
AC input power <sup>1)</sup>	+ 1 kV	+ 2 kV	90
AC input power <sup>1)</sup>	- 1 kV	- 2 kV	270
<sup>1)</sup> Tests with lower voltages are not required.			

**Performed tests**

Voltage – Mains [V]	230 Vac
Frequency – Mains [Hz]	50 Hz
Operating mode(s) used	Mode 3, Mode 4, Mode 5
Repetition rate	60 secs. (for each test level and phase angle)
Number of pulses	5 pulses (at each polarity and phase angle)

Port(s) under test	Coupling	Test level & Polarity	Phase angle [°]	Remark
<input checked="" type="checkbox"/> AC mains input power	Line to Neutral	+1 kV	90	
<input checked="" type="checkbox"/> AC mains input power	Line to Neutral	-1 kV	270	
<input type="checkbox"/> AC mains input power	Line to Earth	+2 kV	90	
<input type="checkbox"/> AC mains input power	Line to Earth	-2 kV	270	
<input type="checkbox"/> AC mains input power	Neutral to Earth	+2 kV	90	
<input type="checkbox"/> AC mains input power	Neutral to Earth	-2 kV	270	
Observation(s)	During the test no loss of performance was observed. After the test the EUT functioned as intended. No unacceptable loss of performance or data was observed.			
Supplementary information:				

<b>5.7</b>	<b>Injected currents (RF common mode) immunity</b>	<b>VERDICT: PASS</b>
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During this test the immunity of the equipment for induced or conducted electromagnetic fields is checked. Fields generated by radio and other transmitters cause RF voltages in long cables like the mains network. This test reproduces these induced disturbing voltages by injecting them to the EUT via the cabling.

**Requirements**

Standard		EN IEC 55014-2		
Basic standard		EN 61000-4-6		
	Frequency range	Modulation	Step size	Dwell time
<input type="checkbox"/>	0.15 – 80 MHz	80% AM (1kHz)	≤ 1%	≥ 0.5 s
<input checked="" type="checkbox"/>	0.15 – 230 MHz	80% AM (1kHz)	≤ 1%	≥ 0.5 s
Port			Test level, U <sub>0</sub>	
<input checked="" type="checkbox"/>	AC input-output power <sup>1)</sup>		3 V	
<input type="checkbox"/>	DC input-output power <sup>2) 3)</sup>		1 V	
<input type="checkbox"/>	Signal and Control lines <sup>4)</sup>		1 V	
<sup>1)</sup> For extra low voltage a.c ports, this testing is only applicable to ports interfacing with cables whose total length may exceed 3 m according to the manufacturer's functional specification. <sup>2)</sup> Not applicable to battery operated appliances that cannot be connected to the mains while in use. <sup>3)</sup> Applicable to battery operated appliances that can be connected to the mains while in use, or to appliances for which the length of d.c. cables may exceed 3 m according to the manufacturer's functional specification. <sup>4)</sup> Applicable only to ports interfacing with cables whose total length may exceed 3 m according to the manufacturer's functional specification.				

**Performed tests**

Frequency range (applied)		Modulation (applied)		Step size (applied)	
<input type="checkbox"/>	0.15 – 80 MHz	<input checked="" type="checkbox"/>	0.15 – 230 MHz	80% AM (1kHz)	1%
Voltage – Mains [V]		230 Vac		Frequency – Mains [Hz]	50 Hz
Operating mode(s) used		Mode 3, Mode 4, Mode 5			
Test set-up (see annex 3 for photo)		<input type="checkbox"/>	Equipment standing on floor at (0.1 ± 0.01) m above ground plane.		
		<input checked="" type="checkbox"/>	Equipment on the table (0.1 ± 0.01) m above ground plane.		
		<input type="checkbox"/>	Artificial hand applied. Location refer to annex 3.		

Port(s) under test	Test Level (applied)	Injection method	Dwell time (applied)	Remark
AC mains power input	3 V	CDN-M2	3 s	1
Observation(s)	During the test no loss of performance was observed. After the test the EUT functioned as intended. No unacceptable loss of performance was observed.			
Supplementary information:				

<b>5.8</b>	<b>Power supply interruptions and dips immunity</b>	<b>VERDICT: PASS</b>
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The purpose of the test is to verify the immunity of the equipment against voltage dips and voltage interruptions. It helps to ensure that the equipment functions properly (as expected and safely) with power supply fluctuations. Voltage dips and interruptions are caused by faults in the LV, MV, HV networks (short-circuit or ground faults).

**Requirements**

Standard	EN IEC 55014-2			
Basic standard	EN 61000-4-11			
# of dips & interruptions	3 dips / interruptions for each test level and phase angle			
Interval between events	≥ 10 seconds			
Port	Test level <sup>1)</sup>	Period (Cycles)		Performance Criterion
		50 Hz	60 Hz	
AC input power port	$U_{NOM} - 100\%$	0.5	0.5	C; Refer to the chapter 5.1 for details.
AC input power port	$U_{NOM} - 60\%$	10	12	C; Refer to the chapter 5.1 for details.
AC input power port	$U_{NOM} - 30\%$	25	30	C; Refer to the chapter 5.1 for details.
<sup>1)</sup> Changes to the voltage level shall occur at a zero crossing point in the a.c. voltage waveform. <b>NOTE:</b> Where the equipment has a rated voltage range the following shall apply: <ul style="list-style-type: none"> <li>- If the voltage range does not exceed 20% of the lower voltage specified for the rated voltage range. A single voltage within that range may be selected for testing.</li> <li>- In all other cases, the test procedure shall be applied for both the lowest and highest voltages declared in the voltage range.</li> </ul>				

**Performed tests**

$U_{NOM}$ [V <sub>AC</sub> ]	Terminal	Voltage dip [% $U_{NOM}$ ]	Duration [cycles]		Repetition rate [s]	Number of dips per test	Phase angle [°]
			50 Hz	60 Hz			
230 <sup>1) 2)</sup>	L-N	0	0.5	0.5	10	3	0
230 <sup>1) 2)</sup>	L-N	40	10	12	10	3	0
230 <sup>1) 2)</sup>	L-N	70	25	30	10	3	0
120 <sup>1)</sup>	L-N	0	---	0.5	10	3	0
120 <sup>1)</sup>	L-N	40	---	12	10	3	0
120 <sup>1)</sup>	L-N	70	---	30	10	3	0
Operating mode(s) used	Mode 3, Mode 4, Mode 5						
Observation(s)	During the test no loss of performance was observed. After the test the EUT functioned as intended. No unacceptable loss of performance was observed.						
<u>Supplementary information:</u>							
1) Adapter for 120Vac/60Hz, 230 Vac/ 50Hz							
2) Docking station for 230Vac/50 Hz, 230Vac/60 Hz							

## 6 IDENTIFICATION OF THE EQUIPMENT UNDER TEST

### EUT PHOTOS



## 7 ANNEX 1 - MEASUREMENT UNCERTAINTIES

The table(s) below show(s) measurement uncertainties of the EMC test set-ups. The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

Emission tests		$U_{LAB}$	$U_{CISPR}$
Conducted disturbance using AMN 150 kHz – 30 MHz	Shielded Room No.1 AMN: R&S ENV216	2.6 dB	3.4 dB
Disturbance power using Absorbing clamp 30 MHz – 300 MHz	Absorbing clamp: MDS 21B	4.0 dB	4.5 dB
Radiated disturbance in a SAC 30 MHz – 1000 MHz	Horizontal polarization	4.8 dB	6.3 dB
	Vertical polarization	5.4 dB	
Harmonic current emissions		0.6 %	N/A
Voltage changes, Voltage fluctuations and Flicker		2.8 %	N/A

Immunity tests		$U_{LAB}$	$U_{IEC}$ (Recommendation)
Electrostatic discharge	Rise time ( $t_r$ )	12.4 %	$\leq 15$ %
	Peak current ( $I_p$ )	6.4 %	$\leq 7$ %
	Current at 30 ns ( $I_{30}$ )	6.4 %	$\leq 7$ %
	Current at 60 ns ( $I_{60}$ )	6.4 %	$\leq 7$ %
Electrical fast transients/burst	Rise time ( $t_r$ )	7.2 %	N/A
	Peak voltage ( $V_p$ )	6.8 %	
	Pulse width ( $t_w$ )	5.4 %	
Surge	Front time ( $t_f$ )	4.3 %	N/A
	Peak voltage ( $V_p$ )	6.7 %	
	Voltage duration ( $T_d$ )	1.3 %	
Conducted disturbances, induced by radio-frequency fields	CDN ( $\nu$ )	1.6 dB	N/A
Voltage dips, short interruptions and voltage variations	Time at reduced voltage ( $t_s$ )	3.0 %	N/A
	Voltage rising time ( $t_r$ )	3.0 %	
	Voltage fall time ( $t_f$ )	3.0 %	
	Voltage dips ( $\nu$ )	0.4 %	
Radiated radio-frequency electromagnetic field 80 MHz – 1000 MHz		1.9 dB	N/A

## 8 ANNEX 2 – USED EQUIPMENT

### Conducted disturbance -Shielded Room No.1

Equipment	Manufacturer	Model No.	Serial No.	Cal. due date
EMI test receiver	R&S	ESR3	102958	2024/08/25
Artificial Mains Network	R&S	ENV216	102772	2023/12/29
Software	R&S	ELEKTRA	4.32.0	N/A

### Disturbance power

Equipment	Manufacturer	Model No.	Serial No.	Cal. due date
EMI test receiver	R&S	ESCI	101351	2024/06/05
EMI absorbing clamp	TESEQ	MDS 21B	58888	2024/07/12
Software	AUDIX	e3	V8.130528a	N/A

### Discontinuous disturbance (clicks)

Equipment	Manufacturer	Model No.	Serial No.	Cal. due date
EMI test receiver	R&S	ESR3	102305	2024/06/29
Artificial Mains Network	R&S	ENV216	102747	2024/11/28
Software	R&S	Click Rate Analyzer	2.52	N/A

### Radiated disturbance (30 MHz to 1000 MHz) -Anechoic Chamber No.1

Equipment	Manufacturer	Model No.	Serial No.	Cal. due date
EMI test receiver	R&S	ESR7	102433	2023/12/29
Trilog broadband antenna+Attenuator	SCHWARZBECK	VULB9163/ 6dB	01514	2024/03/12
Open Switch and control unit	R&S	OSP220	102232	N/A
Coupling/Decoupling Network	SCHWARZBECK	CDNE M2	00194	2024/06/05
Coupling/Decoupling Network	SCHWARZBECK	CDNE M3	00204	2023/12/29
CMAD	SCHWARZBECK	CMAD1614	00538	2023/12/29
Software	R&S	ELEKTRA	4.20.2	N/A

### Harmonic current emissions & Voltage changes, voltage fluctuations and flicker

Equipment	Manufacturer	Model No.	Serial No.	Cal. due date
Harmonic currents and flicker tester	EMTEST	DPA 500N	P2114250803	2024/01/12
AC power source	EMTEST	Netwave7-400	P2136256253	2024/01/12
Software	AMETEK	NET.CONTROL	3.1.3	N/A

Electrostatic discharge immunity

Equipment	Manufacturer	Model No.	Serial No.	Cal. due date
ESD generator	TESEQ	NSG 437	1447	2024/10/10

Fast transient immunity

Equipment	Manufacturer	Model No.	Serial No.	Cal. due date
Compact immunity test system	TESEQ	NSG-3040-MF	2006/EFT:0535	2024/06/05

Surge immunity

Equipment	Manufacturer	Model No.	Serial No.	Cal. due date
Compact immunity test system	TESEQ	NSG-3040-MF	2006 /SURGE:1234	2024/06/05

Radio-frequency electromagnetic fields immunity (80 MHz~1000 MHz)  
 -Anechoic Chamber No.2

Equipment	Manufacturer	Model No.	Serial No.	Cal. due date
Signal generator	R&S	SMB100B	103114	2024/12/28
Broadband Amplifier	R&S	BBA150 BC250	104841	2024/12/28
High Gain Log-periodic antenna	R&S	HL046E	100355	NCR
Open Switch and control unit	R&S	OSP220	102233	NCR
NRP6AN average power sensor	R&S	NRP6AN	101697	2024/12/28
NRP6AN average power sensor	R&S	NRP6AN	101698	2024/12/28
Field probe	LUMILOOP	LSProbe 1.2	531	2024/08/14

Injected currents immunity

Equipment	Manufacturer	Model No.	Serial No.	Cal. due date
Compact immunity test system	TESEQ	NSG 4070-30	35895	2024/06/05
Coupling/Decoupling Network (CDN)	TESEQ	CDN M016S	34640	2024/06/05
EM clamp	TESEQ	KEMZ 801A	35475	2024/06/05
Attenuator	TESEQ	ANT 6050	34847	2024/06/05

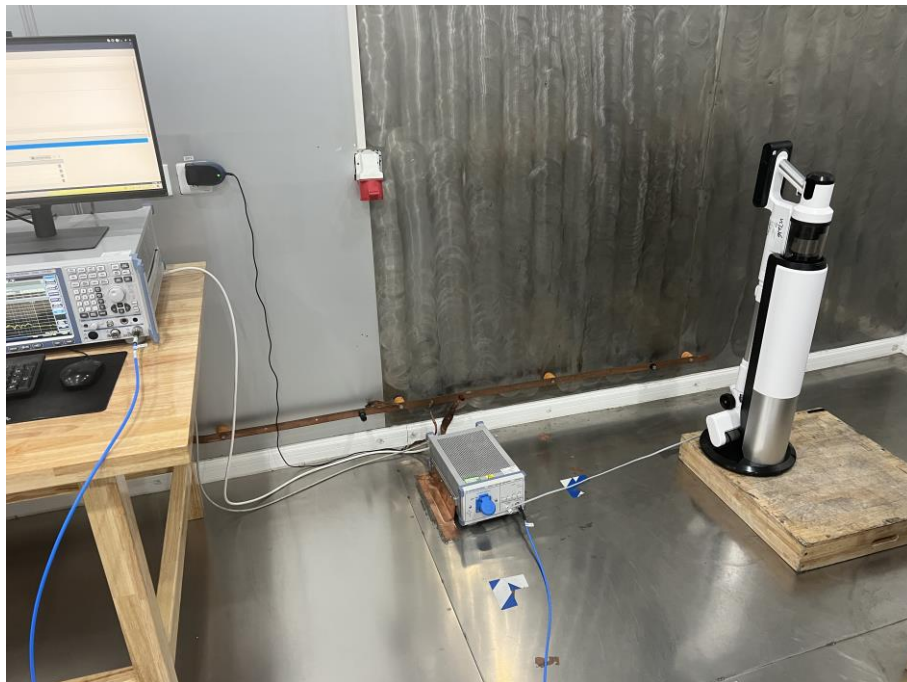
Voltage dips and short interruptions immunity

Equipment	Manufacturer	Model No.	Serial No.	Cal. due date
Compact immunity test system	TESEQ	NSG-3040-MF	2006/DIPS:2062	2024/06/05
Automatic step transformer with circuit breaker	TESEQ	INA 6502-CIB	217	N/A

## 9 ANNEX 3 - TEST PHOTOS

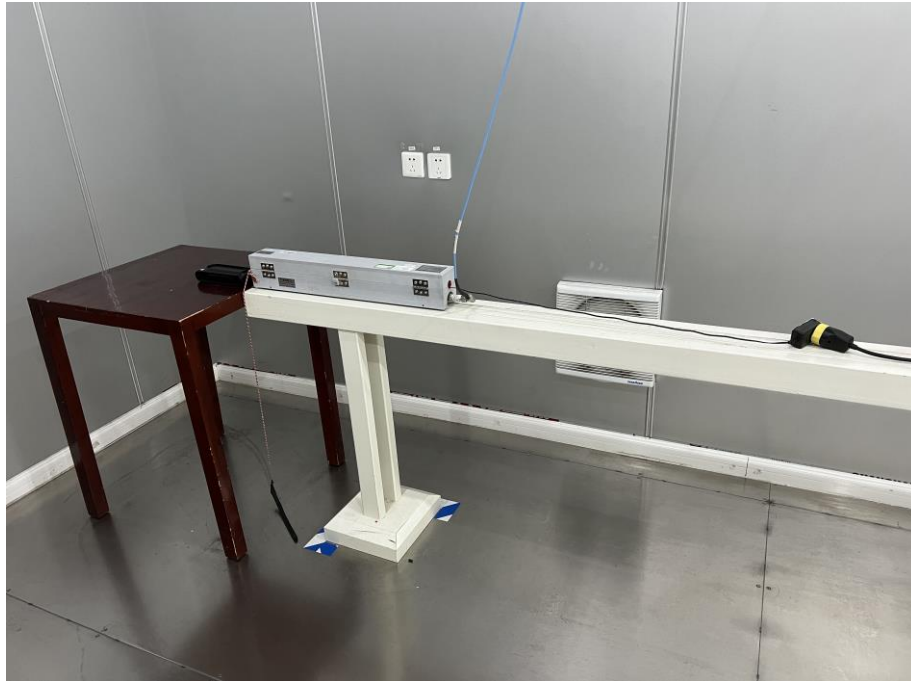
### Conducted disturbance voltage at mains terminals

Mode 3:

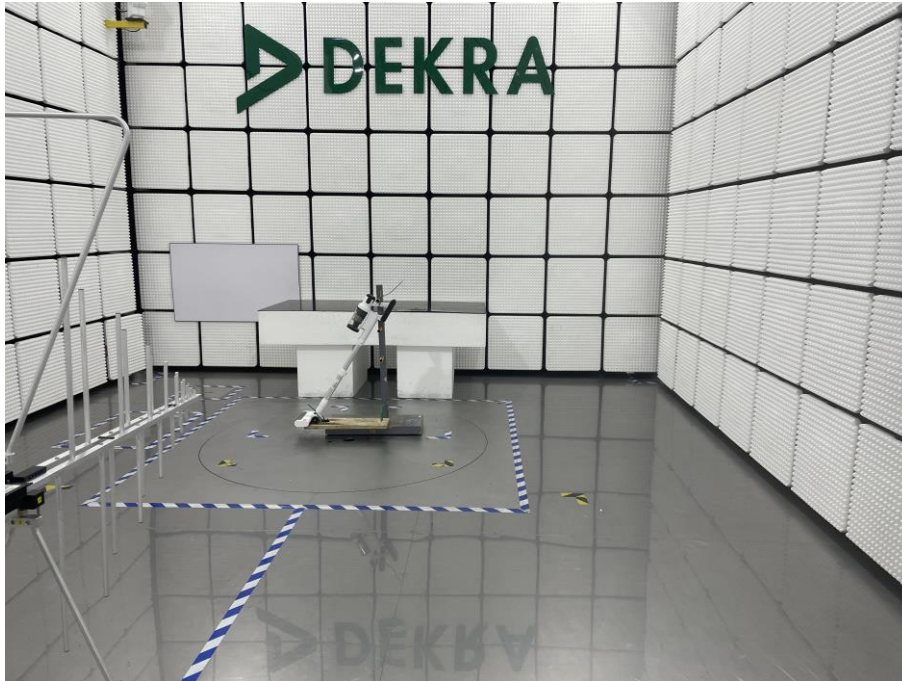


**Disturbance power (30 MHz – 300 MHz)**

Mode 3:

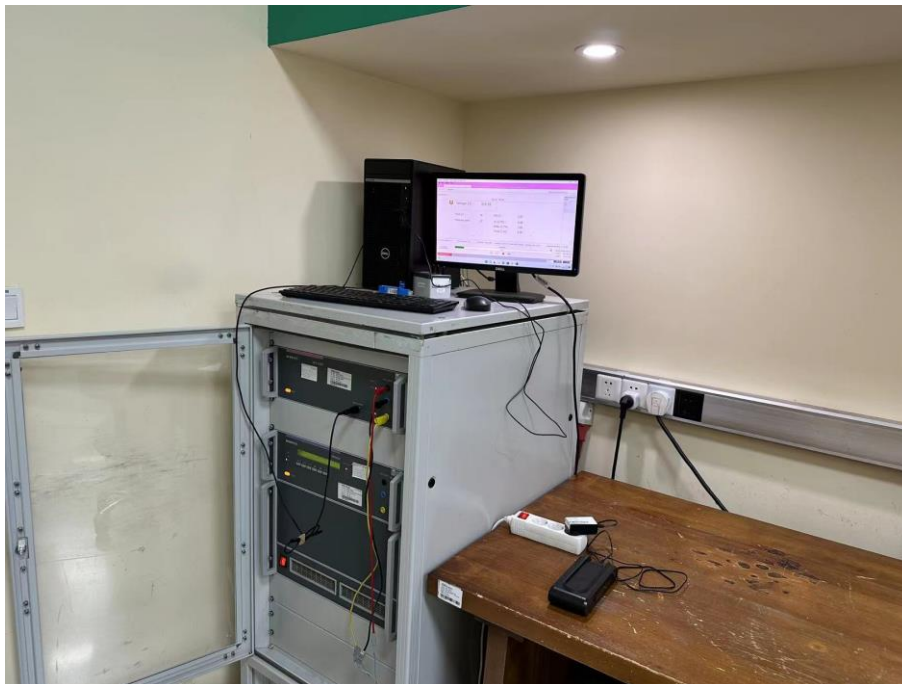


### Radio-frequency electromagnetic fields



### Harmonic current emissions & Voltage changes, Voltage fluctuations and Flicker

Mode 3:

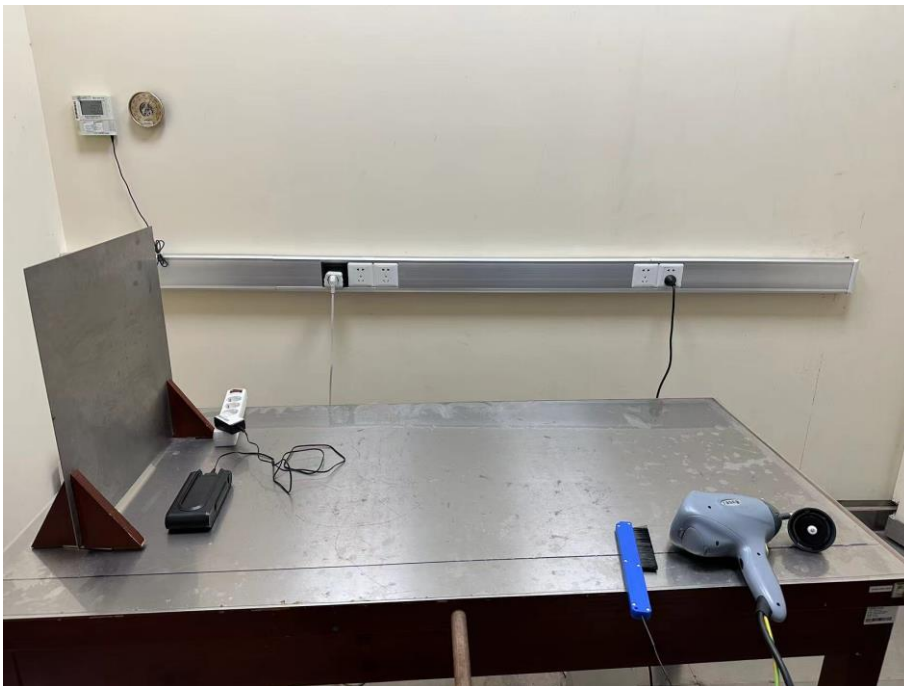


### Harmonic current emissions & Voltage changes, Voltage fluctuations and Flicker

Mode 3:



### Electrostatic discharge immunity



### Electrostatic discharge immunity

Mode 3:



### Fast transients & Surges & Voltage dips and short interruptions

Mode 3:



### Fast transients & Surges & Voltage dips and short interruptions

Mode 3:



### Injected currents (radio-frequency common mode)

Mode 3:



### Injected currents (radio-frequency common mode)

Mode 3:



End of the report