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Test report No:
6060138.50V1.1

TEST REPORT
Electromagnetic Compatibility (EMC)

Identification of item tested	Electric Air Pump
Trademark	N/A
Model and /or type reference	#62076,#62142
Ratings	DC12.0V/AC220-240 V, 30 W
Test Laboratory / address	DEKRA Testing and Certification (Shanghai) Ltd. 3 F., No. 250 Jiangchangsan Road, Jing'an District, Shanghai City, 200436, China
Applicant´s name / address	Bestway (Hongkong) International Ltd Suite 713, 7/Floor, East Wing, Tsim Sha Tsui Centre, 66 Mody Road, Kowloon, Hongkong
Test method requested, standard	EN 55014-1:2006+A1:2009+A2:2011 EN 55014-1:2017 EN 55014-2:2015; EN 50498:2010
Verdict Summary	IN COMPLIANCE
Tested by (name / position & signature)	Xingyu He Test Engineer
Approved by (name / position & signature)	Zuyao Fan Project Manager
Date of issue	2020-04-14
Report template No	TRF_EN55014-1_EN55014-2_EMC01 V1.0

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COMPETENCES AND GUARANTEES

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

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

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. 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 furter information.

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

☒ Indicates that the listed condition, standard or equipment is applicable for this report/test/EUT.				
☐ Indicates that the listed condition, standard or equipment is not applicable for this report/test/EUT.				
Decimal separator used in this report	☐	Comma (,)	☒	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
N/A : Not Applicable
N/M : Not Measured

DOCUMENT HISTORY

Report nr.	Date	Description
6060138.50	2019-10-24	First release.
6060138.50V1.1	2020-04-14	Second release.

REMARKS AND COMMENTS

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

The test results relate only to the samples tested.

According to the declaration from manufacturer, both models are identical except the model name

The test results stated in this report of model #62097 are also representative for the others.

1 GENERAL INFORMATION

1.1 General Description of the Item(s)

Description of the item .....:	Electric Air Pump
Model / Type number .....:	#62076,#62142
Serial number .....:	N/A
Trademark.....:	N/A
Manufacturer.....:	Bestway Inflatables & Material Corp No. 3065 Cao An Road , Shanghai 201812 , P. R. China
Factory.....:	GOLEADER INDUSTRIES (JINHUA) CO., LTD. No.618 Wenxi Road, Jinpan Development New Zone, Jinhua, Zhejiang Province, 321025, China.

Rated power supply .....:	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☒	AC: 220 – 240 V	☒	☐	☐	☒	☐
	☐	AC: 100 – 240 V, 50/60 Hz	☐	☐	☐	☐	☐
	☐	DC: 12 V, 24 V, 12 / 24 V					
	☒	Battery: 12 V					
Rated Power .....:	DC12.0V/AC220-240						
Clock frequencies .....:	N/A						
Other parameters.....:	N/A						
Mounting position.....:	☒	Table top equipment					
	☐	Wall/Ceiling mounted equipment					
	☐	Floor standing equipment					
	☐	Hand-held equipment					
	☐	Other:					

Intended use of the Equipment Under Test (EUT)
The apparatus as supplied for the test is Electric Air Pump, intended for residential and commercial use. These products have no electronic control unit

No	Module/parts of test item	Type	Manufacturer
1	N/A		

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

Modifications to the test item during testing .....:	☒	N/A	☐	Supplemental information:

Copy of marking plate:
N/A

1.2 Environment

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

☒	Residential (domestic) environment.
☒	Commercial and light-industrial environment.
☐	Industrial environment.

1.3 Test data

Test Location	TUV Rheinland (Shanghai) Co., Ltd. Np.177, 178, Lane 777 West Guangzhong Road, Jing'an District, Shanghai, China
Date(receive sample)	2018-10
Date (start test)	2018-10
Date (finish test)	2018-10

1.4 Classification according to EN 55014-2

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

☐	**Category I:** Apparatus containing no electronic control circuitry. Examples: Motor operated appliances, lighting toys, track sets without electronic control units, tools, heating appliances, UV and IR radiators and apparatus containing components such as electromechanical switches and thermostats. 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.
☒	**Category II:** transformer toys, dual supply toys, mains powered motor operated appliances, tools, heating appliances and similar electric apparatus (for example – UV radiators, IR radiators and microwave ovens) containing electronic control circuitry with no clock frequency higher than 15 MHz. (For toys, examples include educational computers, organs, track sets with electronic control units.)
☒	**Category III:** equipment which in normal use, is not connected to a power network and has no cables attached. This category includes apparatus provided with rechargeable batteries, solar or other similar d.c. power sources which can be charged or operated by connecting the apparatus to the mains power. However, this apparatus shall also be tested as an apparatus in category II while it is connected to the mains network.(For toys, examples include musical soft toys, cord-controlled toys and motor-operated electronic toys.)
☐	**Category IV:** All other apparatus covered by the scope of the EN 55014-2 standard.
Clock frequency: Fundamental frequency of any signal used in the device, excluding those which are solely used inside integrated circuits (IC).	

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 operates normally with charger	☒	☒
2	The EUT operates normally	☒	☒
3		☐	☐
4		☐	☐
5		☐	☐
Supplemental information:			

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 port	AC mains	1m	☒	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐
Supplemental information:				

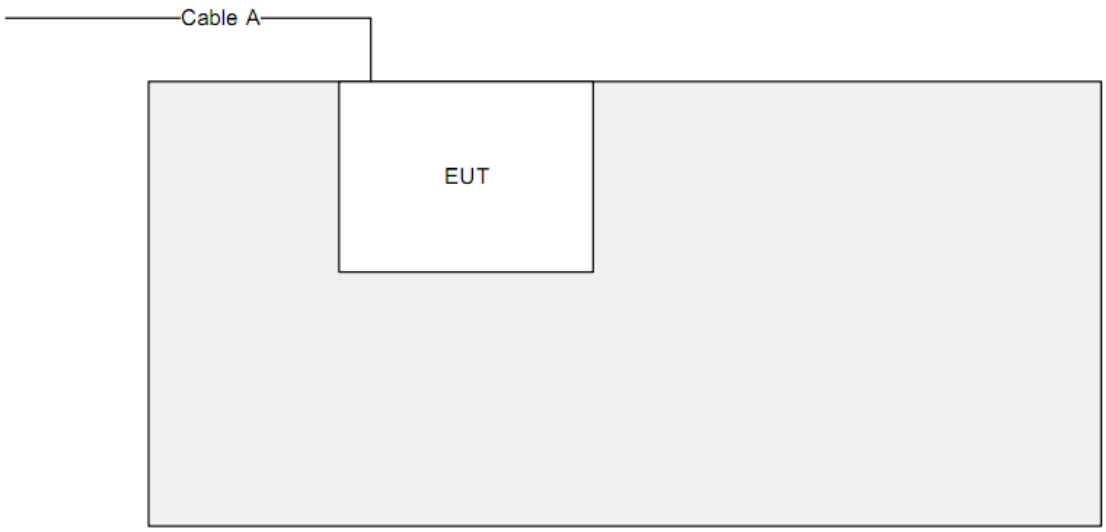
2.3 Support / Auxiliary equipment / unit / software for the EUT

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

Auxiliary equipment / unit / software	Type / Version	Manufacturer	Supplied by
N/A			Applicant
			DEKRA
Supplemental information:			

2.4 Test Configuration / Block diagram used for tests

The following test setup / configuration / block diagram has been used during the tests:

Test Configuration / Block diagram


Cable Type		Signal cable Description
A	Mains Cable	Non-Shielded, 1 m, 3pin

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 55014-1 A1 A2	2006 2009 2011	Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission.
EN 55014-1	2017	
EN 55016-2-1	2014	Methods of measurement of disturbances and immunity - Conducted disturbance measurements.
EN 55016-2-2	2010	Methods of measurement of disturbances and immunity – Measurement of disturbance power.
EN 55016-2-3 +A1 +A2	2010 2010 2014	Methods of measurement of disturbances and immunity - Radiated disturbance measurements.
EN 61000-3-2	2014	Limits for harmonic current emissions (equipment input current ≤ 16 A per phase).
EN 61000-3-3	2013	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 55014-2	2015	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	2014	Surge immunity test.
EN 61000-4-6	2014	Immunity to conducted disturbances, induced by radio-frequency fields.
EN 61000-4-11	2004	Voltage dips, short interruptions and voltage variations immunity tests.
EN 50498	2010	Product family standard for aftermarket electronic equipment in vehicles

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 55014-1			
Requirement – Test case	**Basic standard(s)**	**Verdict**	**Remark**
Conducted disturbance voltage at mains terminals (150 KHz – 30 MHz)	EN 55016-2-1	PASS	---
Conducted disturbance voltage at load terminals (150 KHz – 30 MHz)	EN 55016-2-1	N/A	---
Conducted disturbance voltage at additional terminals (150 KHz – 30 MHz)	EN 55016-2-1	N/A	---
Disturbance power (30 MHz to 300 MHz)	EN 55016-2-2	PASS	See 3)
Radiated electromagnetic disturbances (30 - 1000 MHz)	EN 55016-2-3	PASS	---
Radiated disturbances	EN 50498	PASS	---
Conducted transient disturbances	EN 50498	PASS	
Discontinuous disturbance (clicks) on AC power leads	EN 55014-1	N/A	See 1)
Supplementary information: 1) Exemptions from click measurements applicable (clause 4.2.3). 2) Not applicable because no test requirements have been specified for DC/battery powered apparatus. 3) According to clause 4.3.4.2 procedure (a) of the CISRP 14-1 standard the EUT is deemed to comply in the frequency range from 300 MHz to 1000 MHz without further measurements.			

EMISSION TESTS – EN 61000-3-2, EN 61000-3-3			
Requirement – Test case	**Basic standard(s)**	**Verdict**	**Remark**
Harmonic current emissions	EN 61000-3-2	N/A	---
Voltage changes, voltage fluctuations and flicker	EN 61000-3-3	N/A	---
Supplementary information: 1) The EUT is regarded as an "Equipment with rated power of ≤ 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. 2) The EUT is regarded as a professional equipment with a total rated power greater than 1 KW. The test is not applicable.			

IMMUNITY TESTS – EN 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	N/A	---
Surge transient	EN 61000-4-5	N/A	---
Injected currents (radio-frequency common mode)	EN 61000-4-6	N/A	---
Voltage dips and short interruptions	EN 61000-4-11	N/A	---
Supplementary information: 1) Not applicable because no test requirements have been specified for DC/battery powered apparatus. 2) The equipment is classified as category 1 equipment according to EN 55014-2; no immunity tests are applicable.			

4 EMISSION TEST RESULTS

4.1	**Conducted disturbance voltage - Mains**	**VERDICT: PASS**

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

Limits

Frequency range [MHz]	Limit: QP [dB(μV)[1)]]	Limit: AV [dB(μV) [1)]]	IF BW	Detector(s)
0,15 - 0,50	66 – 56 [2)]	59 - 46 [2)]	9 KHz	QP, CAV
0,50 - 5,0	56	46	9 KHz	QP, CAV
5,0 - 30	60	50	9 KHz	QP, CAV

[1)] At the transition frequency, the lower limit applies.
[2)] The limit decreases linearly with the logarithm of the frequency.

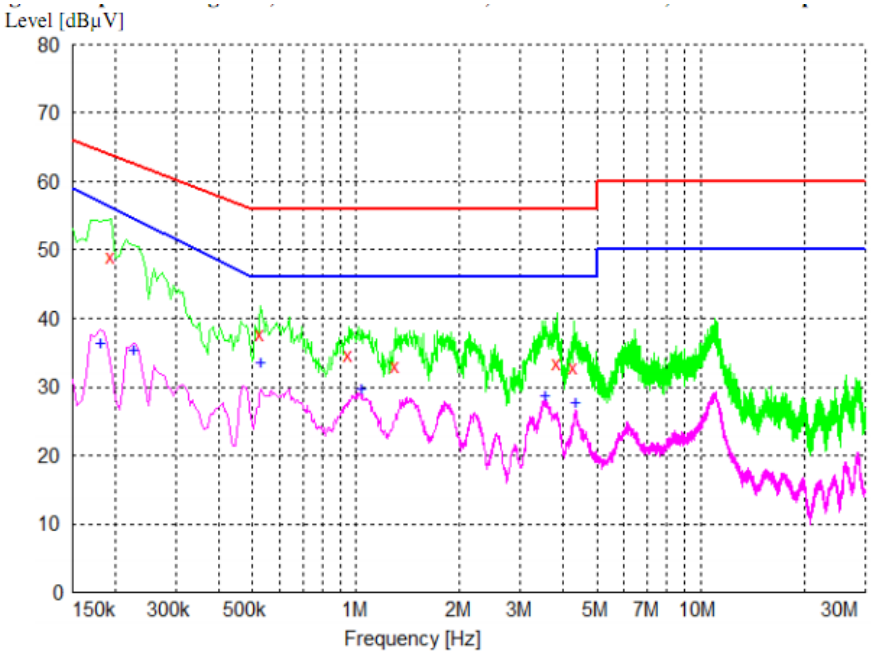
Performed measurements

Tested terminal(s) / port	☒	AC mains input power	☒	N	☒	L1	☐	L2	☐	L3
	☐	DC mains input power	☐	Positive (+)			☐	Negative (-)		
Voltage – Mains [V]	230 Vac									
Frequency – Mains [Hz]	50 Hz									
Test method applied	☒	Artificial mains network								
	☐	Voltage probe								
Test setup	☒	Table top	☐	Artificial hand applied						
	☐	Floor standing	☐	Other:						
	Refer to the Annex 3 for test setup photo(s).									
Operating mode(s) used	Mode 1									
Remark	---									

See next page.

Measurement data	Port under test	AC input power
Operating mode / voltage / frequency used during the test		Mode 1 sample 1/ 230 Vac / 50 Hz

Line:



Final quasi-peak measurement results:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line
0.195000	49.00	9.9	63.8	14.8	L1
0.530000	37.80	9.9	56.0	18.2	L1
0.955000	34.70	9.9	56.0	21.3	L1
1.300000	33.00	10.0	56.0	23.0	L1
3.835000	33.50	10.1	56.0	22.5	L1
4.305000	32.80	10.1	56.0	23.2	L1

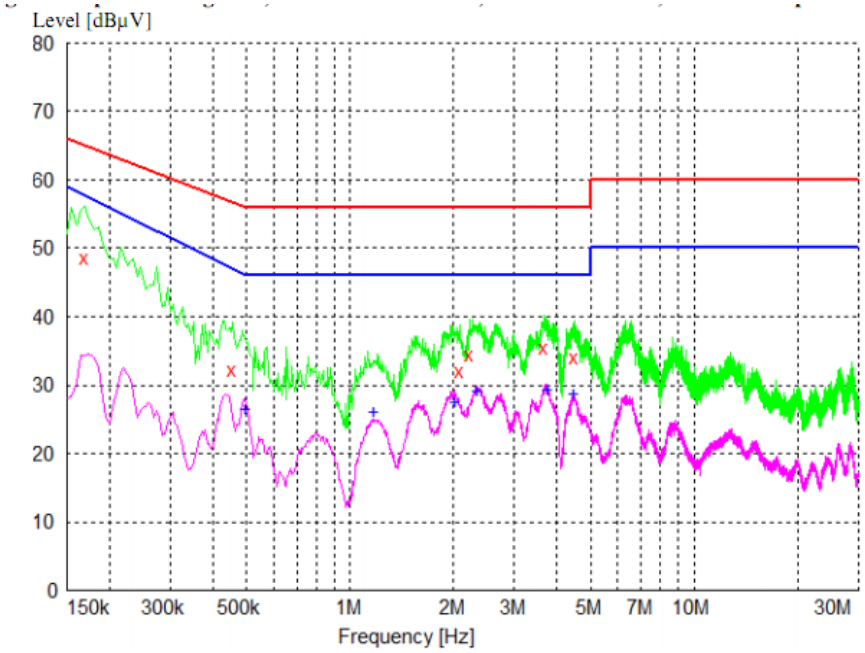
Final average measurement results:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line
0.180000	36.30	9.9	57.0	20.7	L1
0.225000	35.20	9.9	54.6	19.4	L1
0.530000	33.40	9.9	46.0	12.6	L1
1.040000	29.60	9.9	46.0	16.4	L1
3.535000	28.60	10.1	46.0	17.4	L1
4.345000	27.60	10.1	46.0	18.4	L1

Note:
1. All Readings are performed with Quasi-Peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Factor +Cable Loss.

Measurement data	Port under test	AC input power
Operating mode / voltage / frequency used during the test		Mode 1 sample 1/ 230 Vac / 50 Hz

Neutral:



Final quasi-peak measurement results:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line
0.170000	48.70	9.6	65.0	16.2	N
0.455000	32.30	9.7	56.8	24.5	N
2.090000	32.00	9.9	56.0	24.0	N
2.225000	34.50	9.9	56.0	21.5	N
3.680000	35.40	10.1	56.0	20.6	N
4.480000	34.00	10.2	56.0	22.0	N

Final average measurement results:

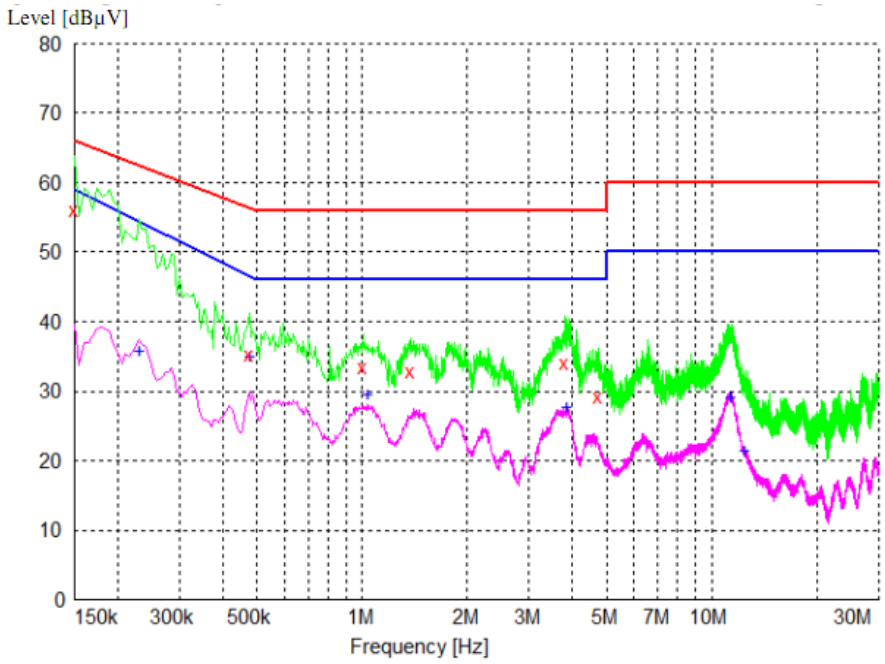
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line
0.495000	26.40	9.7	46.1	19.7	N
1.165000	26.10	9.7	46.0	19.9	N
2.010000	27.50	9.9	46.0	18.5	N
2.330000	29.00	9.9	46.0	17.0	N
3.735000	29.20	10.1	46.0	16.8	N
4.455000	28.70	10.2	46.0	17.3	N

Note:
1. All Readings are performed with Quasi-Peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Factor +Cable Loss.

Remark	---

Measurement data	Port under test	AC input power
Operating mode / voltage / frequency used during the test		Mode 1 sample 2/ 230 Vac / 50 Hz

Line:



Final quasi-peak measurement results:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line
0.150000	56.10	10.0	66.0	9.9	L1
0.475000	35.30	9.9	56.4	21.1	L1
1.005000	33.50	9.9	56.0	22.5	L1
1.375000	32.90	10.0	56.0	23.1	L1
3.815000	34.00	10.1	56.0	22.0	L1
4.740000	29.20	10.1	56.0	26.8	L1

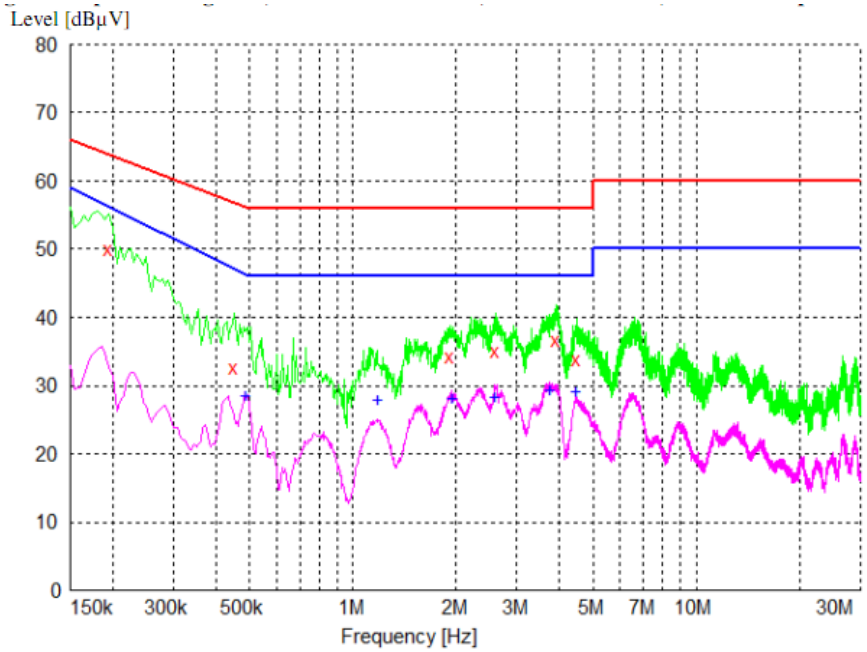
Final average measurement results:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line
0.230000	35.70	9.9	54.4	18.7	L1
0.475000	34.90	9.9	46.6	11.7	L1
1.030000	29.50	9.9	46.0	16.5	L1
3.830000	27.70	10.1	46.0	18.3	L1
11.305000	29.00	10.2	50.0	21.0	L1
12.450000	21.30	10.3	50.0	28.7	L1

Note:
1. All Readings are performed with Quasi-Peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Factor +Cable Loss.

Measurement data	Port under test	AC input power
Operating mode / voltage / frequency used during the test		Mode 1 sample 2/ 230 Vac / 50 Hz

Neutral:



Final quasi-peak measurement results:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line
0.195000	50.00	9.6	63.8	13.9	N
0.450000	32.70	9.7	56.9	24.1	N
1.925000	34.20	9.9	56.0	21.8	N
2.605000	35.00	10.0	56.0	21.0	N
3.910000	36.60	10.1	56.0	19.4	N
4.490000	33.90	10.2	56.0	22.1	N

Final average measurement results:

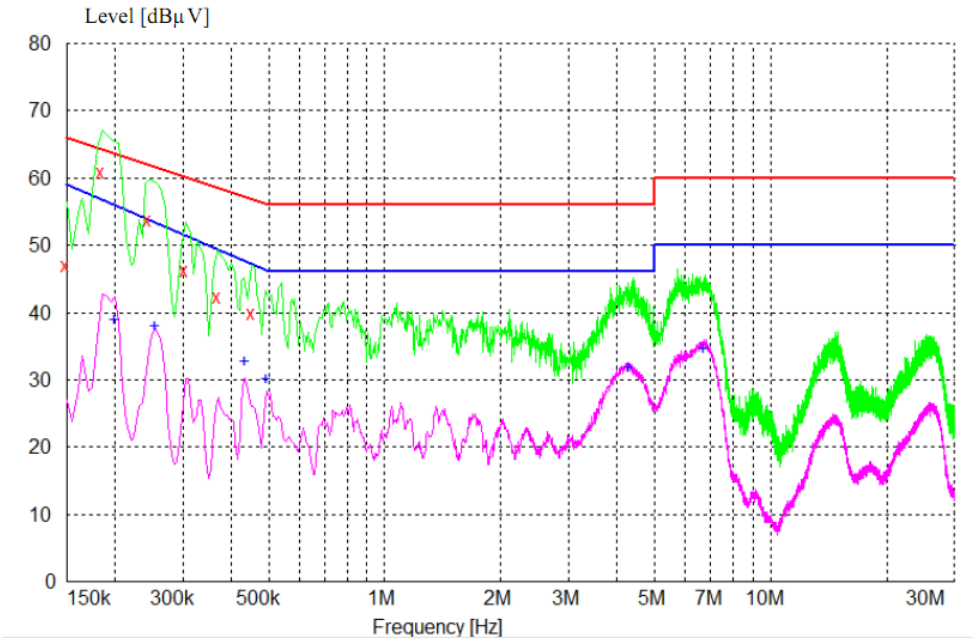
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line
0.485000	28.40	9.7	46.3	17.9	N
1.175000	27.80	9.7	46.0	18.2	N
1.945000	28.10	9.9	46.0	17.9	N
2.585000	28.20	10.0	46.0	17.8	N
3.730000	29.30	10.1	46.0	16.7	N
4.450000	29.10	10.2	46.0	16.9	N

Note:
1. All Readings are performed with Quasi-Peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Factor +Cable Loss.

Remark	---

Measurement data	Port under test	AC input power
Operating mode / voltage / frequency used during the test		Mode 1 with new adapter/ 230 Vac / 50 Hz

Line:



Final quasi-peak measurement results:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB
0.150000	47.10	9.9	66.0	18.9
0.185000	60.80	9.9	64.3	3.5
0.245000	53.70	9.9	61.9	8.3
0.305000	46.30	9.8	60.1	13.8
0.370000	42.30	9.8	58.5	16.2
0.455000	39.90	9.8	56.8	16.9

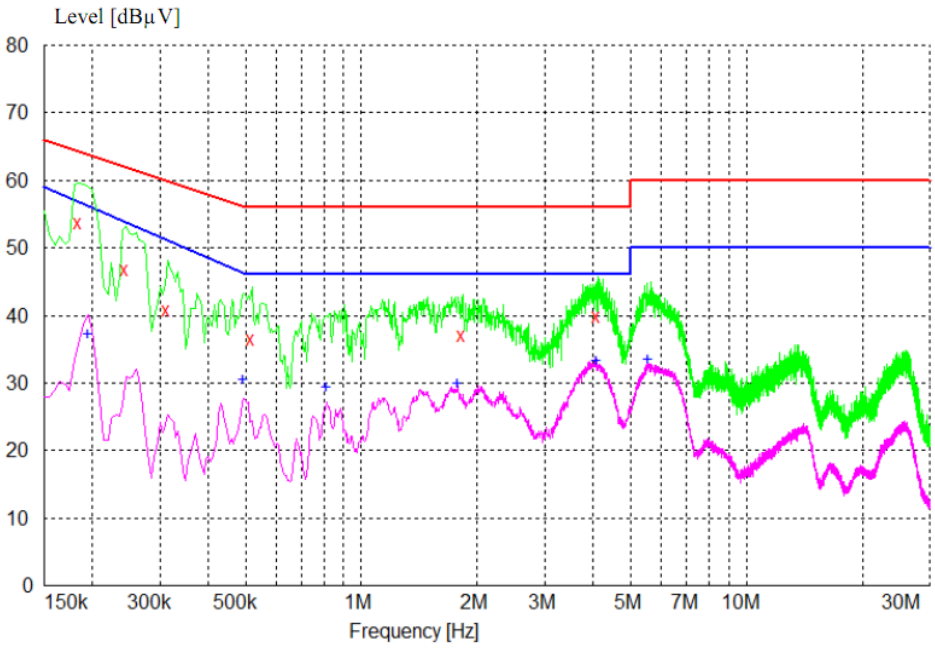
Final average measurement results:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB
0.200000	39.00	9.9	55.9	16.9
0.255000	38.10	9.9	53.3	15.2
0.435000	32.80	9.8	47.5	14.7
0.495000	30.20	9.7	46.1	15.9
4.295000	31.90	10.1	46.0	14.1
6.715000	34.60	10.2	50.0	15.4

Note:
1. All Readings are performed with Quasi-Peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Factor +Cable Loss.

Measurement data	Port under test	AC input power
Operating mode / voltage / frequency used during the test		Mode 1 with new adapter / 230 Vac / 50 Hz

Neutral:



Final quasi-peak measurement results:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB
0.185000	53.70	9.7	64.3	10.6
0.245000	46.90	9.7	61.9	15.0
0.315000	40.80	9.7	59.8	19.0
0.520000	36.50	9.8	56.0	19.5
1.830000	37.10	9.8	56.0	18.9
4.115000	40.00	9.9	56.0	16.0

Final average measurement results:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB
0.195000	37.30	9.7	56.2	18.9
0.495000	30.60	9.8	46.1	15.6
0.815000	29.50	9.8	46.0	16.5
1.780000	29.90	9.8	46.0	16.1
4.075000	33.40	9.9	46.0	12.6
5.565000	33.50	9.9	50.0	16.5

Note:
1. All Readings are performed with Quasi-Peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Factor +Cable Loss.

Remark	---

4.2 **Disturbance power (30 MHz – 300 MHz)**	**VERDICT: PASS**

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 [1)]	35 – 45 [1)]	120 KHz	QP, CAV
Margin				
200 - 300	0 – 10 [1)]	---	120 KHz	QP, CAV
[1)] The limit increases linearly with the frequency.				

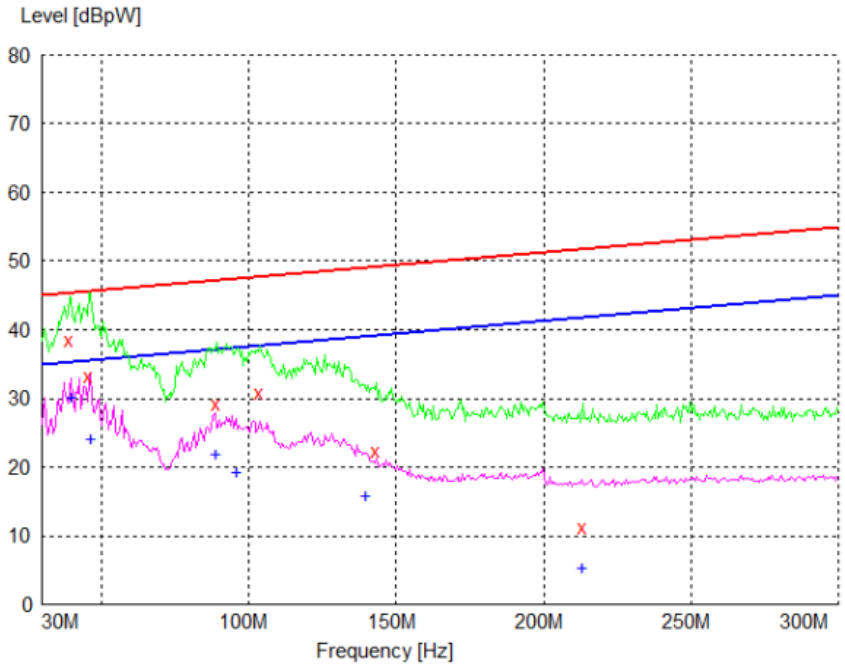
Performed measurements

Port(s) under test					
☒	AC mains input power	☐	Load	☐	Control
☐	Other:	☐	Other:	☐	Other:

Voltage – Mains [V]	230 Vac			
Frequency – Mains [Hz]	50 Hz			
Test setup	☒	Table top	☐	Floor standing
	☐	Other:		
	Refer to the Annex 3 for test setup photo(s).			
Conditions for exemption from measurements above 300 MHz	☒	"Limits" reduced by "Margin" applied and passed		
	☒	Maximum clock frequency < 30 MHz		
Operating mode(s) used	Mode 1			
Remark	---			

See next page.

Measurement data	Port under test	AC input power
Operating mode / voltage / frequency used during the test		Mode 1 sample 1 ac / 230 Vac / 50 Hz



Final quasi-peak measurement results:

Frequency MHz	Level dBpW	Transd dB	Limit dBpW	Margin dB
39.198397	38.50	6.6	45.3	6.8
45.691383	33.30	6.5	45.6	12.3
88.977956	29.20	5.7	47.2	18.0
103.587174	30.90	5.4	47.7	16.9
143.086172	22.30	4.9	49.2	26.9
213.426854	11.30	3.6	51.8	40.5

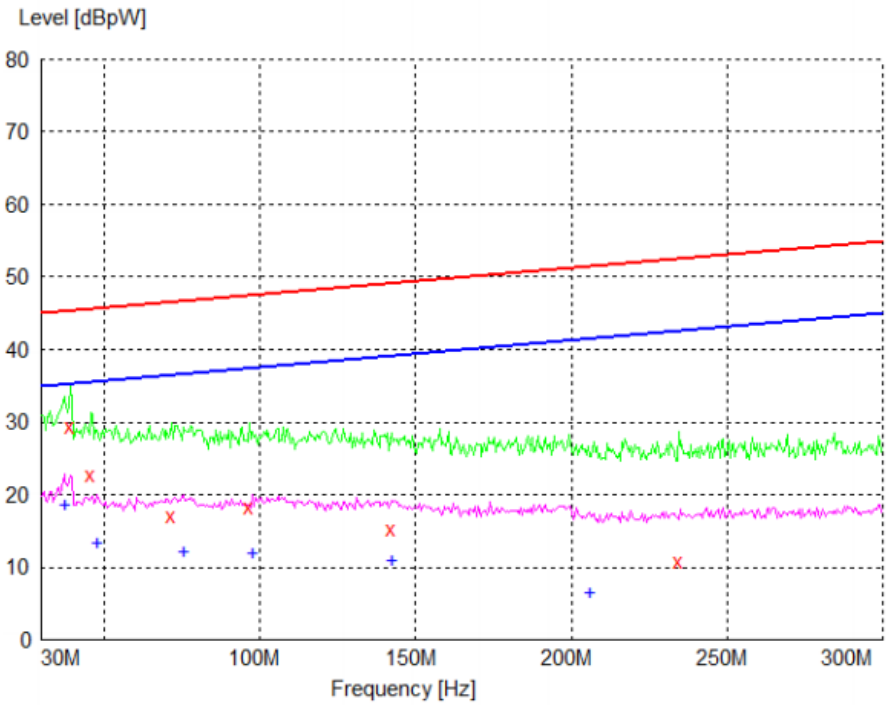
Final average measurement results:

Frequency MHz	Level dBpW	Transd dB	Limit dBpW	Margin dB
39.739479	30.00	6.5	35.4	5.4
46.232465	24.00	6.5	35.6	11.6
88.436874	21.70	5.7	37.2	15.5
95.470942	19.20	5.5	37.4	18.2
139.298597	15.60	5.2	39.0	23.4
212.885772	5.30	3.6	41.8	36.5

Note:
1. All Readings are performed with Quasi-Peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Factor +Cable Loss.

Remark	According to clause 4.3.4.2: Appliances are deemed to comply in the frequency range from 300 MHz to 1 000 MHz if both of the following conditions (1) and 2)) are fulfilled: 1) All emission readings from the equipment under test shall be lower than the applicable limits reduced by the margin; 2) The maximum clock frequency shall be less than 30 MHz;

Measurement data	Port under test	AC input power
Operating mode / voltage / frequency used during the test		Mode 1 sample 1 dc / 230 Vac / 50 Hz



Final quasi-peak measurement results:

Frequency MHz	Level dBpW	Transd dB	Limit dBpW	Margin dB
39.198397	29.50	6.6	45.3	15.9
45.691383	22.70	6.5	45.6	22.8
71.663327	17.10	6.6	46.5	29.5
96.553106	18.40	5.4	47.5	29.1
142.004008	15.30	5.0	49.1	33.9
234.529058	10.80	3.9	52.6	41.8

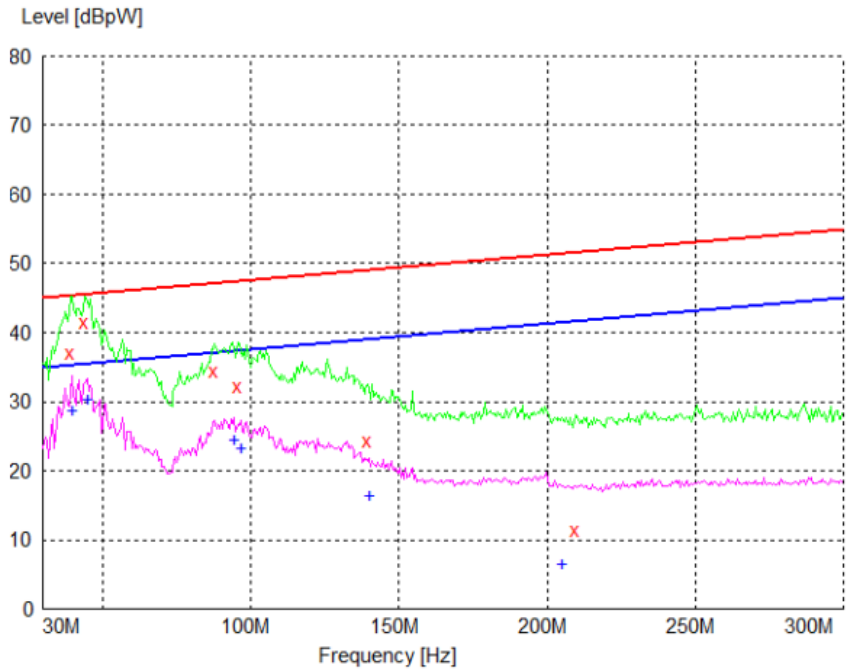
Final average measurement results:

Frequency MHz	Level dBpW	Transd dB	Limit dBpW	Margin dB
37.034068	18.60	6.9	35.3	16.7
47.855711	13.20	6.3	35.7	22.5
75.450902	12.10	6.3	36.7	24.6
97.635271	11.90	5.4	37.5	25.6
142.004008	10.80	5.0	39.1	28.4
205.851703	6.40	3.7	41.5	35.1

Note:
1. All Readings are performed with Quasi-Peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Factor +Cable Loss.

Remark	According to clause 4.3.4.2: Appliances are deemed to comply in the frequency range from 300 MHz to 1 000 MHz if both of the following conditions (1) and 2)) are fulfilled: 1) All emission readings from the equipment under test shall be lower than the applicable limits reduced by the margin; 2) The maximum clock frequency shall be less than 30 MHz;

Measurement data	Port under test	AC input power
Operating mode / voltage / frequency used during the test		Mode 1 sample 2 ac/ 230 Vac / 50 Hz



Final quasi-peak measurement results:

Frequency MHz	Level dBpW	Transd dB	Limit dBpW	Margin dB
39.198397	37.10	6.6	45.3	8.2
44.068136	41.50	6.5	45.5	4.0
87.895792	34.50	5.7	47.1	12.6
95.470942	32.30	5.5	47.4	15.1
139.298597	24.40	5.2	49.0	24.6
209.639279	11.50	3.7	51.7	40.1

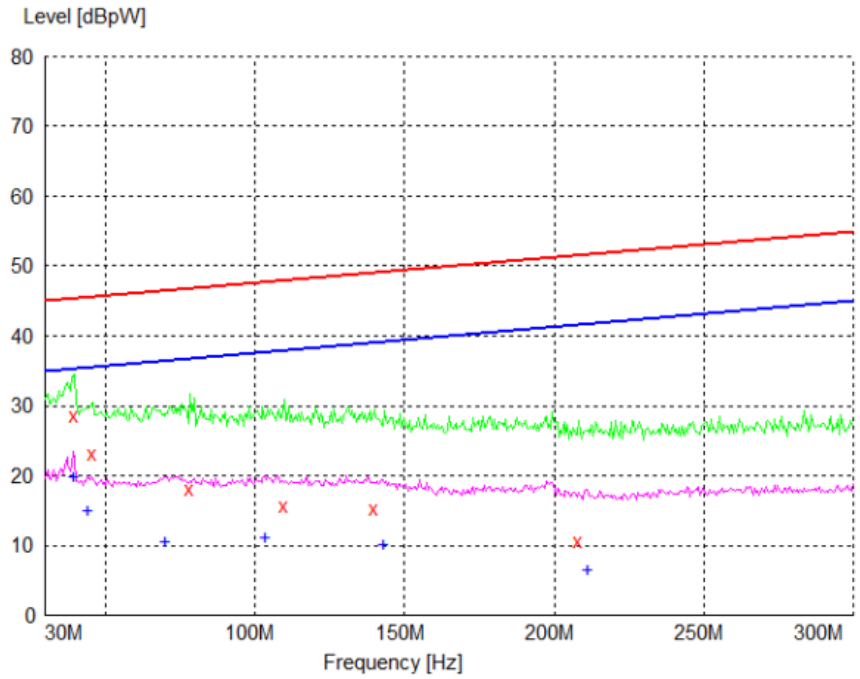
Final average measurement results:

Frequency MHz	Level dBpW	Transd dB	Limit dBpW	Margin dB
39.739479	28.60	6.5	35.4	6.7
44.609218	30.30	6.5	35.5	5.2
94.388778	24.50	5.5	37.4	12.9
96.553106	23.20	5.4	37.5	14.2
139.839679	16.20	5.2	39.1	22.9
204.769539	6.50	3.7	41.5	35.0

Note:
1. All Readings are performed with Quasi-Peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Factor +Cable Loss.

Remark	According to clause 4.3.4.2: Appliances are deemed to comply in the frequency range from 300 MHz to 1 000 MHz if both of the following conditions (1) and 2)) are fulfilled: 1) All emission readings from the equipment under test shall be lower than the applicable limits reduced by the margin; 2) The maximum clock frequency shall be less than 30 MHz;

Measurement data	Port under test	AC input power
Operating mode / voltage / frequency used during the test		Mode 1 sample 2 dc/ 230 Vac / 50 Hz



Final quasi-peak measurement results:

Frequency MHz	Level dBpW	Transd dB	Limit dBpW	Margin dB
39.739479	28.60	6.5	45.4	16.7
45.691383	23.20	6.5	45.6	22.4
78.156313	18.10	6.0	46.8	28.6
109.539078	15.70	5.7	47.9	32.3
139.839679	15.30	5.2	49.1	33.7
208.016032	10.60	3.7	51.6	41.0

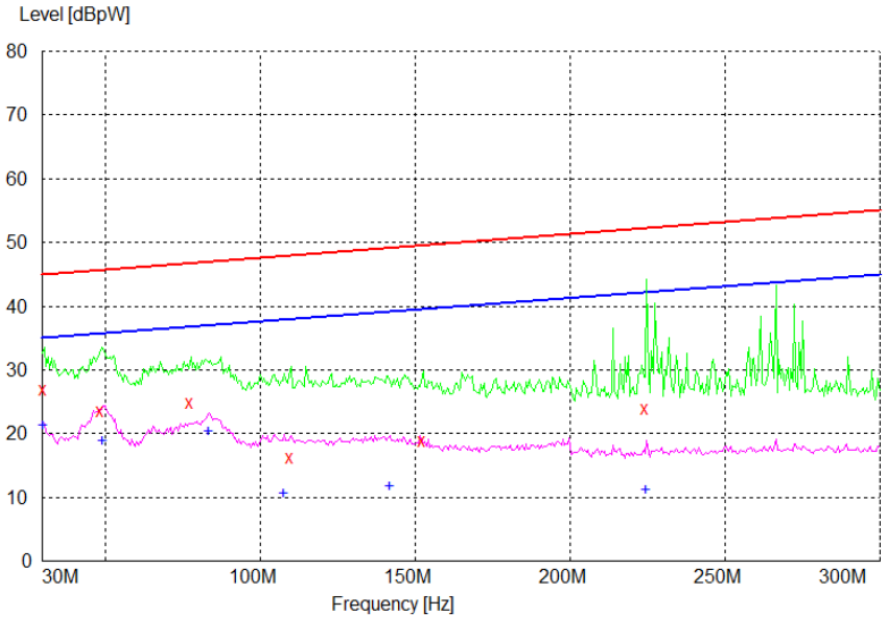
Final average measurement results:

Frequency MHz	Level dBpW	Transd dB	Limit dBpW	Margin dB
39.198397	19.70	6.6	35.3	15.6
44.068136	14.90	6.5	35.5	20.6
70.040080	10.50	6.8	36.5	26.0
103.046092	11.00	5.4	37.7	26.7
142.545090	10.00	4.9	39.2	29.2
210.721443	6.40	3.6	41.7	35.3

Note:
1. All Readings are performed with Quasi-Peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Factor +Cable Loss.

Remark	According to clause 4.3.4.2: Appliances are deemed to comply in the frequency range from 300 MHz to 1 000 MHz if both of the following conditions (1) and 2)) are fulfilled: 1) All emission readings from the equipment under test shall be lower than the applicable limits reduced by the margin; 2) The maximum clock frequency shall be less than 30 MHz;

Measurement data	Port under test	AC input power
Operating mode / voltage / frequency used during the test		Mode 1 with new adapter ac/ 230 Vac / 50 Hz



Final quasi-peak measurement results:

Frequency MHz	Level dBpW	Transd dB	Limit dBpW	Margin dB
30.541082	27.00	9.5	45.0	18.0
48.937876	23.60	7.8	45.7	22.1
77.615230	24.90	6.8	46.8	21.9
110.080160	16.30	5.9	48.0	31.7
152.825651	18.90	5.9	49.5	30.7
224.789579	24.00	6.2	52.2	28.2

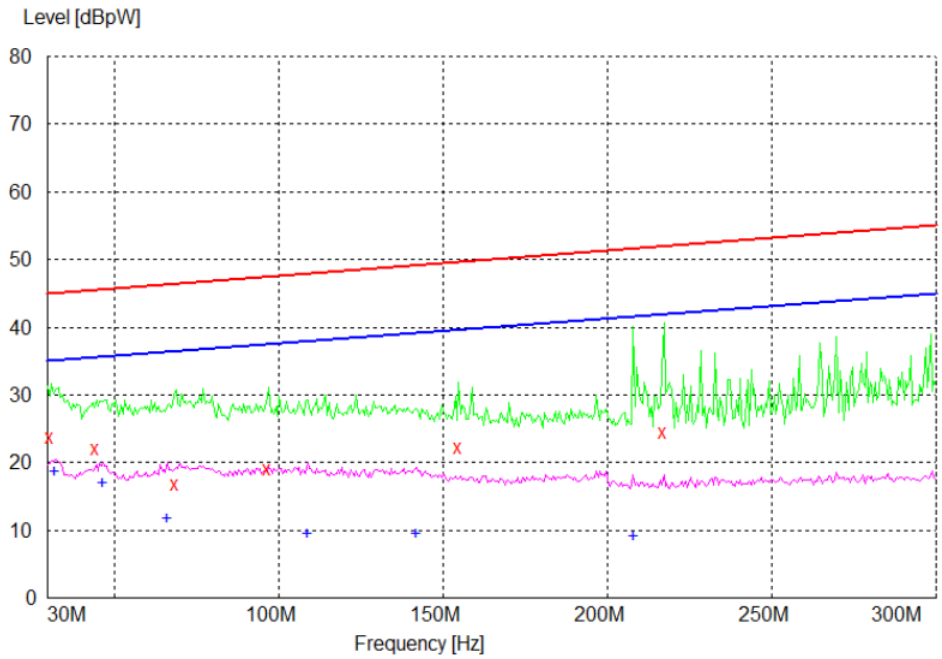
Final average measurement results:

Frequency MHz	Level dBpW	Transd dB	Limit dBpW	Margin dB
30.000000	21.30	9.5	35.0	13.7
49.478958	18.90	7.8	35.7	16.9
83.567134	20.40	6.7	37.0	16.6
107.915832	10.70	5.9	37.9	27.2
142.004008	11.90	5.9	39.1	27.2
224.789579	11.30	6.2	42.2	31.0

Note:
1. All Readings are performed with Quasi-Peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Factor +Cable Loss.

Remark	According to clause 4.3.4.2: Appliances are deemed to comply in the frequency range from 300 MHz to 1 000 MHz if both of the following conditions (1) and 2)) are fulfilled: 1) All emission readings from the equipment under test shall be lower than the applicable limits reduced by the margin; 2) The maximum clock frequency shall be less than 30 MHz;

Measurement data	Port under test	AC input power
Operating mode / voltage / frequency used during the test		Mode 1 towards pump DC / 230 Vac / 50 Hz



Final quasi-peak measurement results:

Frequency MHz	Level dBpW	Transd dB	Limit dBpW	Margin dB
31.082164	23.90	9.4	45.0	21.1
44.609218	22.20	8.3	45.5	23.4
68.957916	16.90	7.0	46.4	29.5
97.094188	19.10	6.0	47.5	28.4
154.989980	22.30	5.9	49.6	27.3
217.214429	24.60	6.1	51.9	27.3

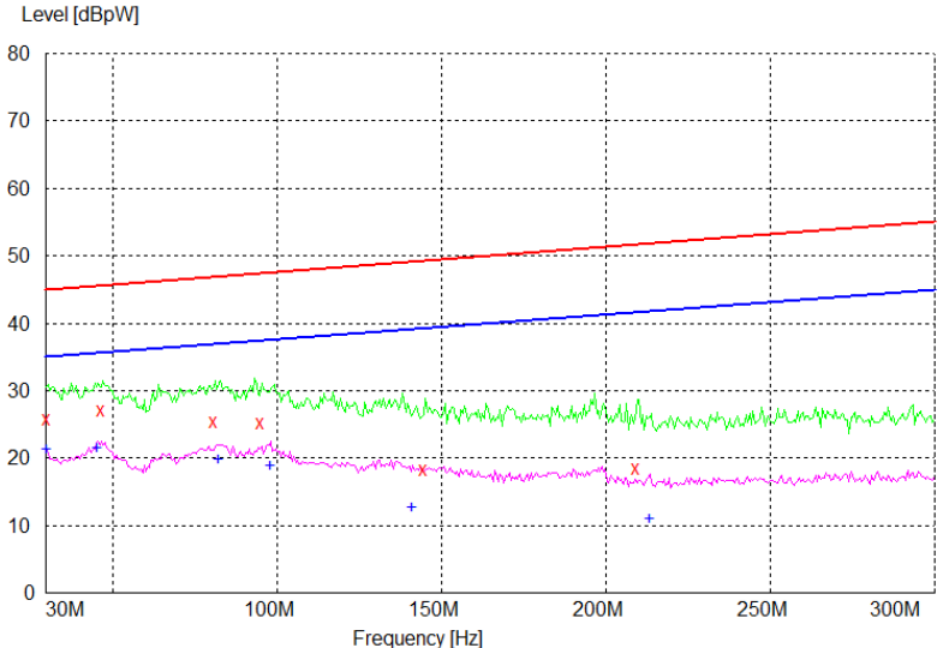
Final average measurement results:

Frequency MHz	Level dBpW	Transd dB	Limit dBpW	Margin dB
32.164329	18.70	9.3	35.1	16.3
46.773547	17.10	8.1	35.6	18.5
66.252505	11.90	7.1	36.3	24.5
108.997996	9.60	5.9	37.9	28.4
142.004008	9.60	5.9	39.1	29.6
208.016032	9.10	6.0	41.6	32.5

Note:
1. All Readings are performed with Quasi-Peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Factor +Cable Loss.

Remark	According to clause 4.3.4.2: Appliances are deemed to comply in the frequency range from 300 MHz to 1 000 MHz if both of the following conditions (1) and 2)) are fulfilled: 1) All emission readings from the equipment under test shall be lower than the applicable limits reduced by the margin; 2) The maximum clock frequency shall be less than 30 MHz;

Measurement data	Port under test	AC input power
Operating mode / voltage / frequency used during the test		Mode 1 toward adapter DC / 230 Vac / 50 Hz



Final quasi-peak measurement results:

Frequency MHz	Level dBpW	Transd dB	Limit dBpW	Margin dB
30.541082	25.80	9.5	45.0	19.2
47.314629	27.10	8.0	45.6	18.5
81.402806	25.50	6.7	46.9	21.4
95.470942	25.30	6.1	47.4	22.1
145.250501	18.30	5.9	49.3	31.0
209.639279	18.50	6.0	51.7	33.1

Final average measurement results:

Frequency MHz	Level dBpW	Transd dB	Limit dBpW	Margin dB
30.000000	21.30	9.5	35.0	13.7
45.691383	21.50	8.2	35.6	14.1
82.484970	19.90	6.7	36.9	17.0
98.176353	19.00	6.0	37.5	18.5
141.462926	12.80	5.9	39.1	26.4
213.426854	11.10	6.0	41.8	30.7

Note:
1. All Readings are performed with Quasi-Peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Factor +Cable Loss.

Remark	According to clause 4.3.4.2: Appliances are deemed to comply in the frequency range from 300 MHz to 1 000 MHz if both of the following conditions (1) and 2)) are fulfilled: 1) All emission readings from the equipment under test shall be lower than the applicable limits reduced by the margin; 2) The maximum clock frequency shall be less than 30 MHz;

4.3	**Radiated electromagnetic disturbances (30 – 1000 MHz)**	**VERDICT: PASS**

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)[1)]]			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
[1)] At the transition frequency, the lower limit applies.					

~~**Performed measurements**~~

~~Port under test~~	~~Enclosure~~	
~~Voltage – Mains [V]~~	~~---~~	
~~Frequency – Mains [Hz]~~	~~---~~	
~~Test method applied~~	☒	~~OATS or SAC with measurement distance [m]: 3 m.~~
	☐	~~OATS or SAC with measurement distance [m]: 5 m.~~
	☐	~~OATS or SAC with measurement distance [m]: 10 m.~~
~~Test setup~~	☒	~~Equipment on a table of 80 cm height~~
	☐	~~Equipment on the floor (insulated from ground plane)~~
	☐	~~Other:~~
	~~Refer to the Annex 3 for test setup photo(s).~~	
~~Operating mode(s) used~~	~~Mode 1~~	
~~Remark~~	~~---~~	

See next page.

Measurement data	☒	**Horizontal**	☒	**Vertical**
Operating mode / voltage / frequency used during the test		---		

According to a) of Clause 4.1.2.3.2 of EN 55014-1:2006+A1+A2:
" Appliances are deemed to comply in the frequency range from 300MHz to 1000MHz if both the following conditions 1) and 2) are fulfilled:
1) all emission readings from the equipment under test shall be lower than the applicable limits (Table 2a) reduced by the margin (Table 2b);
2) the maximum clock frequency shall be less than 30MHz."
The EUT is deemed to meet the requirements without actual testing, as the EUT fulfilled the above two conditions.

4.4 Radiated disturbances — VERDICT: PASS

Standard / Regulation	EN 50498: 2010
Test method	Antenna Method according to CISPR 25 standard.
Antenna polarisation	Horizontal and Vertical
Limits	**Table 1 – Limits for broadband radiated disturbances**

Frequency range F MHz	Limits Quasi peak dBµV/m
30 to 75	62 – 52 [a]
75 to 400	52 – 63 [b]
400 to 1 000	63

[a] Decreasing linearly with the log of the frequency.
[b] Increasing linearly with the log of the frequency.

Table 2 – Limits for narrowband radiated disturbances of ESAs

Frequency range F MHz	Limits Average dBµV/m
30 to 75	52 – 42 [a]
75 to 400	42 – 53 [b]
400 to 1 000	53

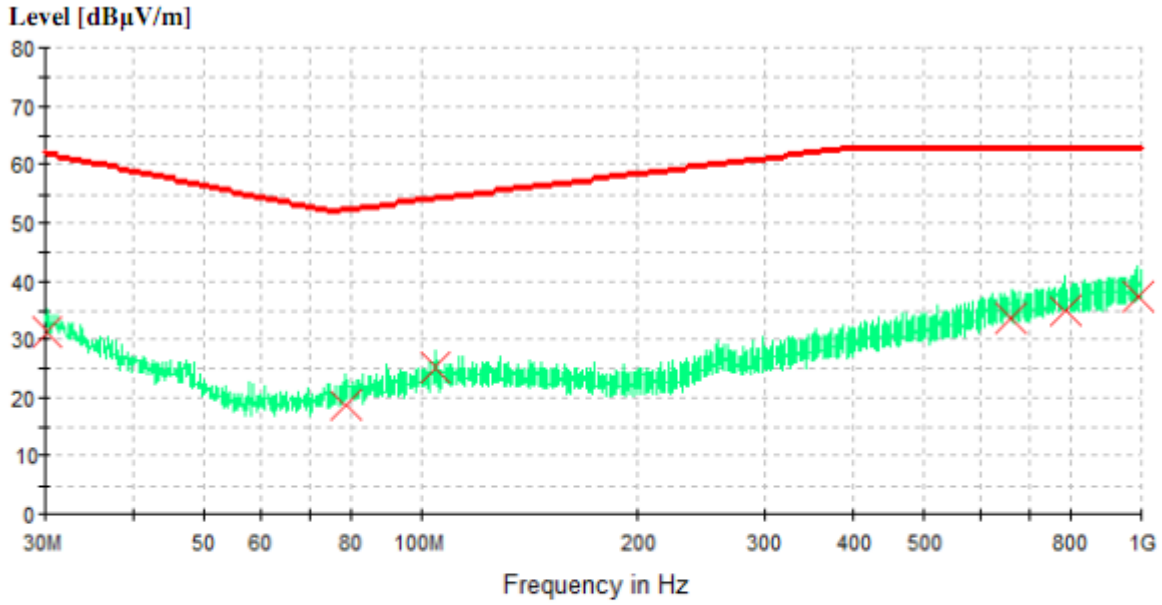
[a] Decreasing linearly with the log of the frequency.
[b] Increasing linearly with the log of the frequency.

Performed measurements

Port under test	Enclosure					
Voltage – Mains [V_{DC}]	☒	13	☐	27	☐	Other:
Test method applied	a. Turn on the measurement equipment and allow a sufficient time for stabilization. b. Calibration. Perform the measuring system checking using the measurement system check setup. c. Turn on the EUT and allow a sufficient time for stabilization. Make sure all the functions of DUT are normally before testing. d. EUT Testing. Perform the emission data scan using the measurement setup.					
Test setup	OATS or SAC with measurement distance of 1 m. from the tip / middle of the antenna. Device on a table of 90 cm high and (50 ± 5) mm above ground plane. The test harness shall be placed on a non-conductive, low relative permittivity material ($\varepsilon_r \leqslant 1{,}4$), at (50 ± 5) mm above the reference ground plane. The length of test harness parallel to the front of the reference ground plane shall be (1 500 ± 75) mm. Refer to the Annex 3 for test setup photo(s).					
Operating mode(s) used	Mode 1					

Remark	---

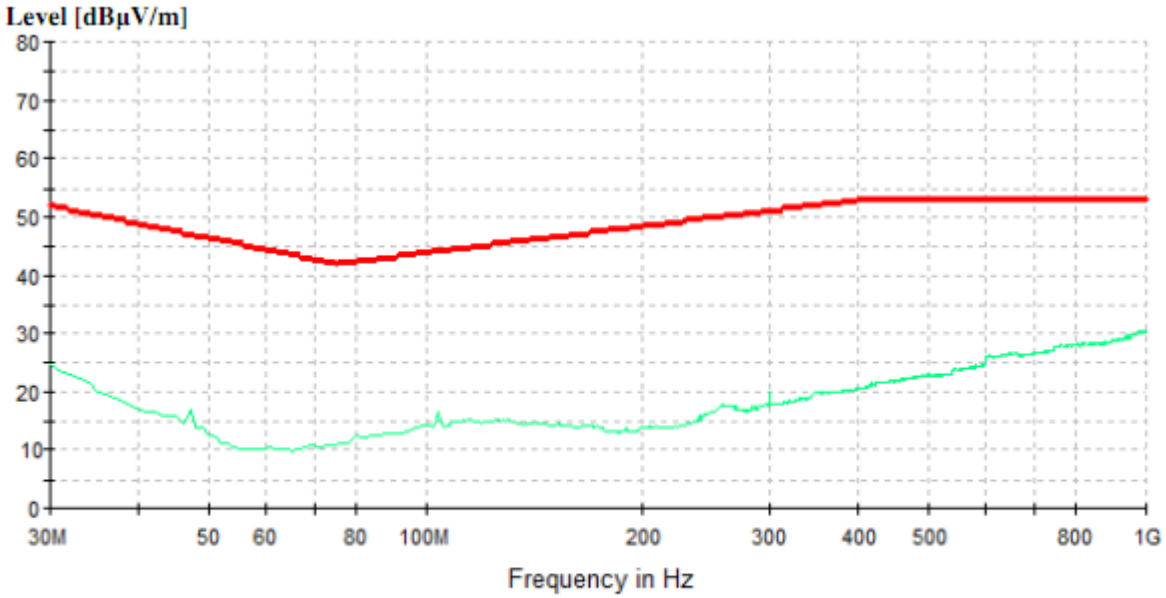
Measurement data(RE 30~200MHz QP+AV)	☒	**Horizontal**	☐	**Vertical**
Operating mode / voltage	Mode 1 / 13.5 Vdc sample 1 broadband			



Final Quasi-peak measurement result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.120000	31.5	1000.0	120.000	100.0	H	24.1	30.5	62.0
78.780000	18.6	1000.0	120.000	100.0	H	11.8	33.8	52.3
104.760000	25.4	1000.0	120.000	100.0	H	13.8	28.8	54.2
658.800000	33.5	1000.0	120.000	100.0	H	23.8	29.5	63.0
785.940000	34.9	1000.0	120.000	100.0	H	25.2	28.1	63.0
991.020000	37.2	1000.0	120.000	100.0	H	27.4	25.8	63.0

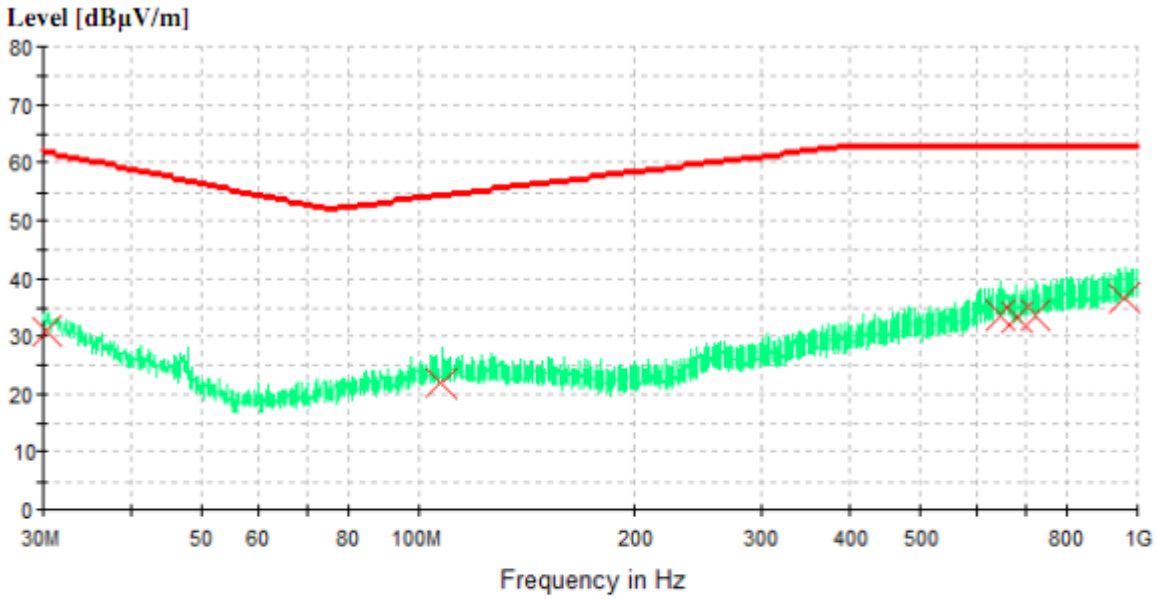
Measurement data(RE 30~200MHz QP+AV)	☒	**Horizontal**	☐	**Vertical**
Operating mode / voltage	Mode 1 / 13.5 Vdc sample 1 broadband			



Note: due to the pre-scan results is far below the limit of EN 50498:2010, there is no need for final measurement.

Remark	

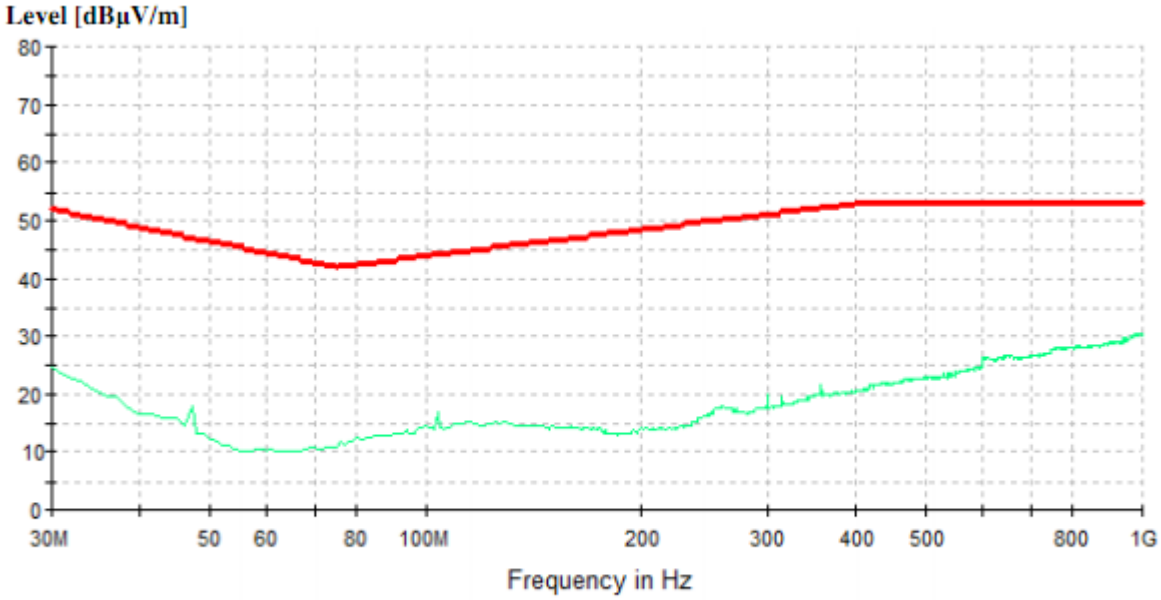
Measurement data(RE 30~200MHz QP+AV)	☐	**Horizontal**	☒	**Vertical**
Operating mode / voltage	Mode 1 / 13.5 Vdc sample 1 narrow			



Final Quasi-peak measurement result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.540000	31.0	1000.0	120.000	100.0	H	23.7	30.8	61.8
108.180000	21.9	1000.0	120.000	100.0	H	14.4	32.5	54.4
645.720000	33.6	1000.0	120.000	100.0	H	23.8	29.4	63.0
682.740000	33.3	1000.0	120.000	100.0	H	23.7	29.7	63.0
721.200000	33.9	1000.0	120.000	100.0	H	24.4	29.1	63.0
962.700000	36.7	1000.0	120.000	100.0	H	27.0	26.3	63.0

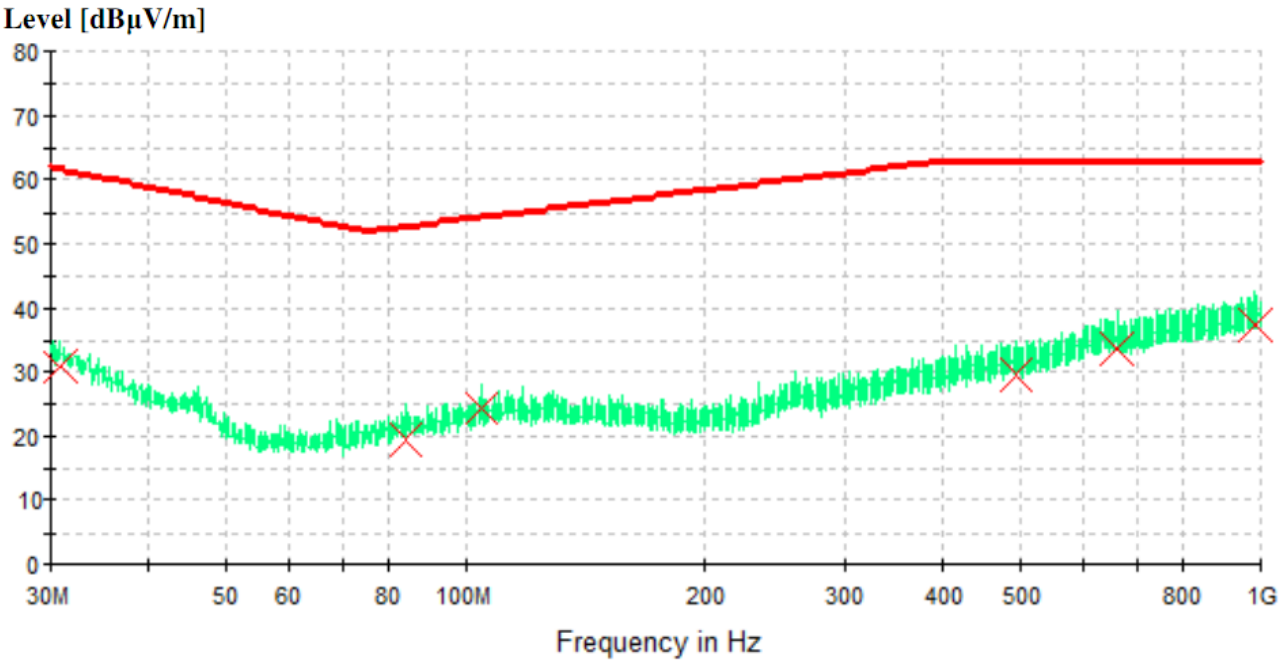
Measurement data(RE 30~200MHz QP+AV)	☐	**Horizontal**	☒	**Vertical**
Operating mode / voltage	Mode 1 / 13.5 Vdc sample 1 narrow			



Note: due to the pre-scan results is far below the limit of EN 50498:2010, there is no need for final measurement.

Remark	

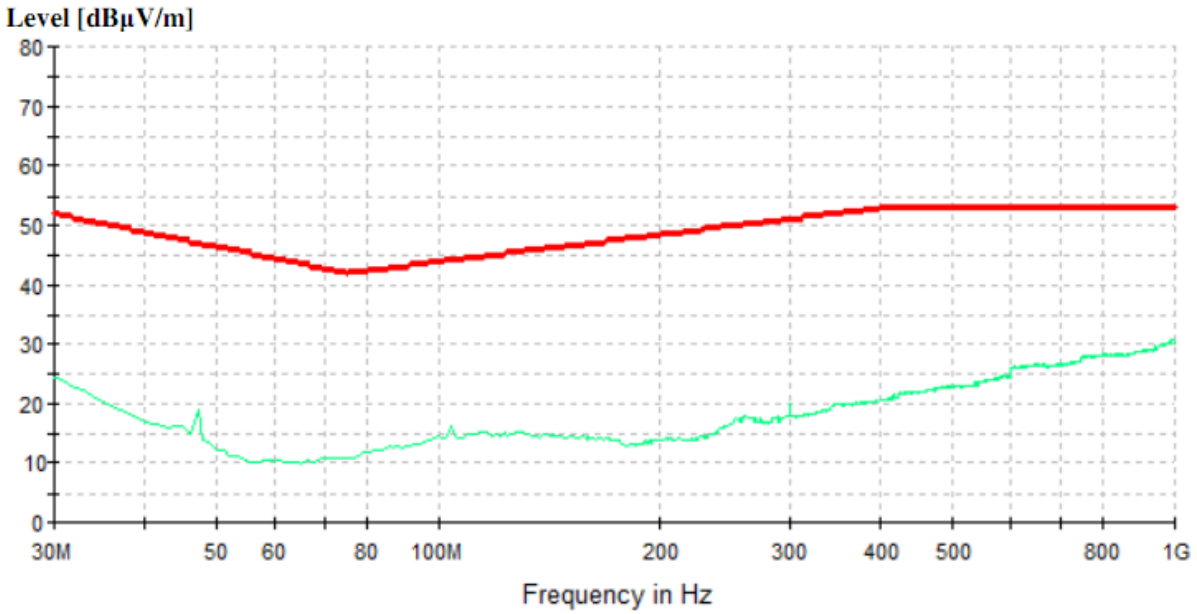
Measurement data(RE 30~200MHz QP+AV)	☒	Horizontal	☐	Vertical
Operating mode / voltage	Mode 1 / 13.5 Vdc sample 2 broadband			



Final Quasi-peak measurement result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.840000	30.7	1000.0	120.000	99.0	H	23.3	31.0	61.7
84.300000	19.4	1000.0	120.000	99.0	H	12.6	33.3	52.8
104.760000	24.5	1000.0	120.000	99.0	H	13.8	29.7	54.2
492.780000	29.8	1000.0	120.000	99.0	H	21.9	33.2	63.0
660.660000	33.5	1000.0	120.000	99.0	H	23.8	29.5	63.0
988.560000	37.2	1000.0	120.000	99.0	H	27.4	25.8	63.0

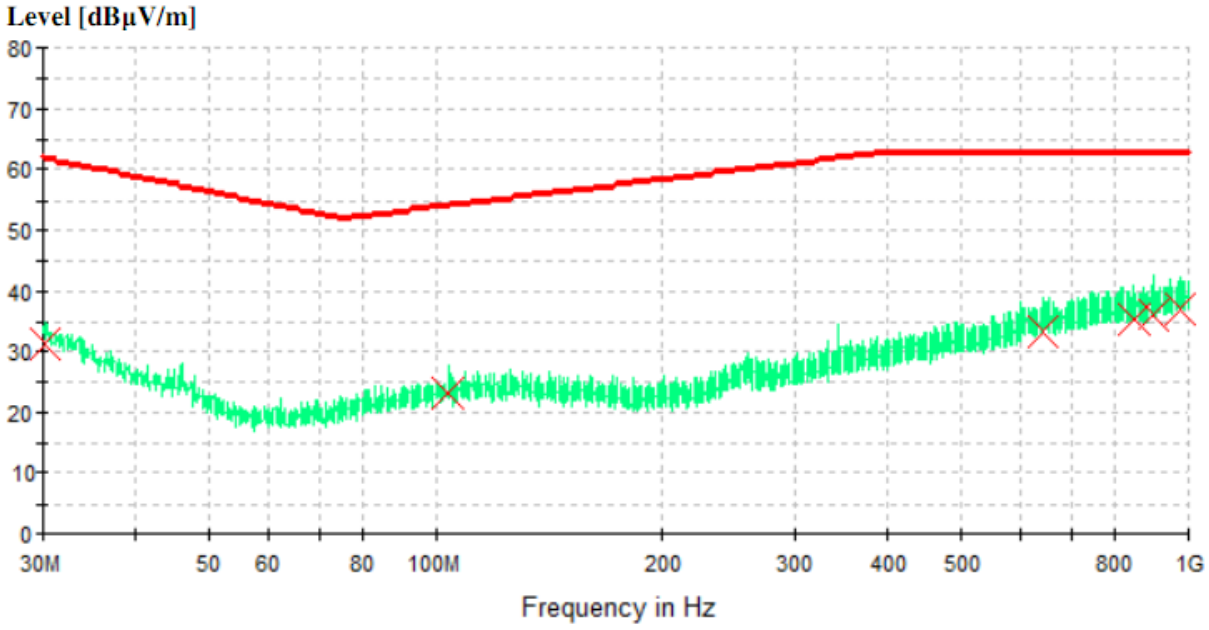
Measurement data(RE 30~200MHz QP+AV)	☒	**Horizontal**	☐	**Vertical**
Operating mode / voltage	Mode 1 / 13.5 Vdc sample 2 broadband			



Note: due to the pre-scan results is far below the limit of EN 50498:2010, there is no need for final measurement.

Remark	

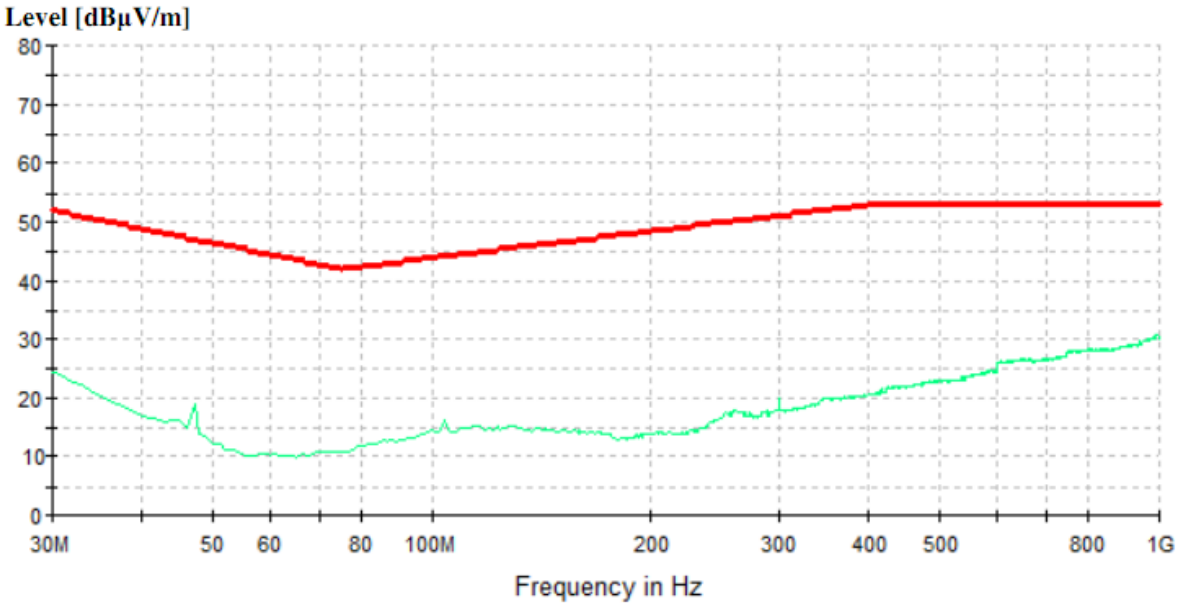
Measurement data(RE 30~200MHz QP+AV)	☐	Horizontal	☒	Vertical
Operating mode / voltage	Mode 1 / 13.5 Vdc sample 2 narrow			



Final Quasi-peak measurement result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.300000	31.4	1000.0	120.000	99.0	V	23.9	30.5	61.9
104.220000	23.0	1000.0	120.000	99.0	V	13.8	31.2	54.2
639.720000	33.4	1000.0	120.000	99.0	V	23.6	29.6	63.0
844.500000	35.2	1000.0	120.000	99.0	V	25.8	27.8	63.0
901.260000	35.9	1000.0	120.000	99.0	V	26.5	27.1	63.0
976.320000	37.0	1000.0	120.000	99.0	V	27.3	26.0	63.0

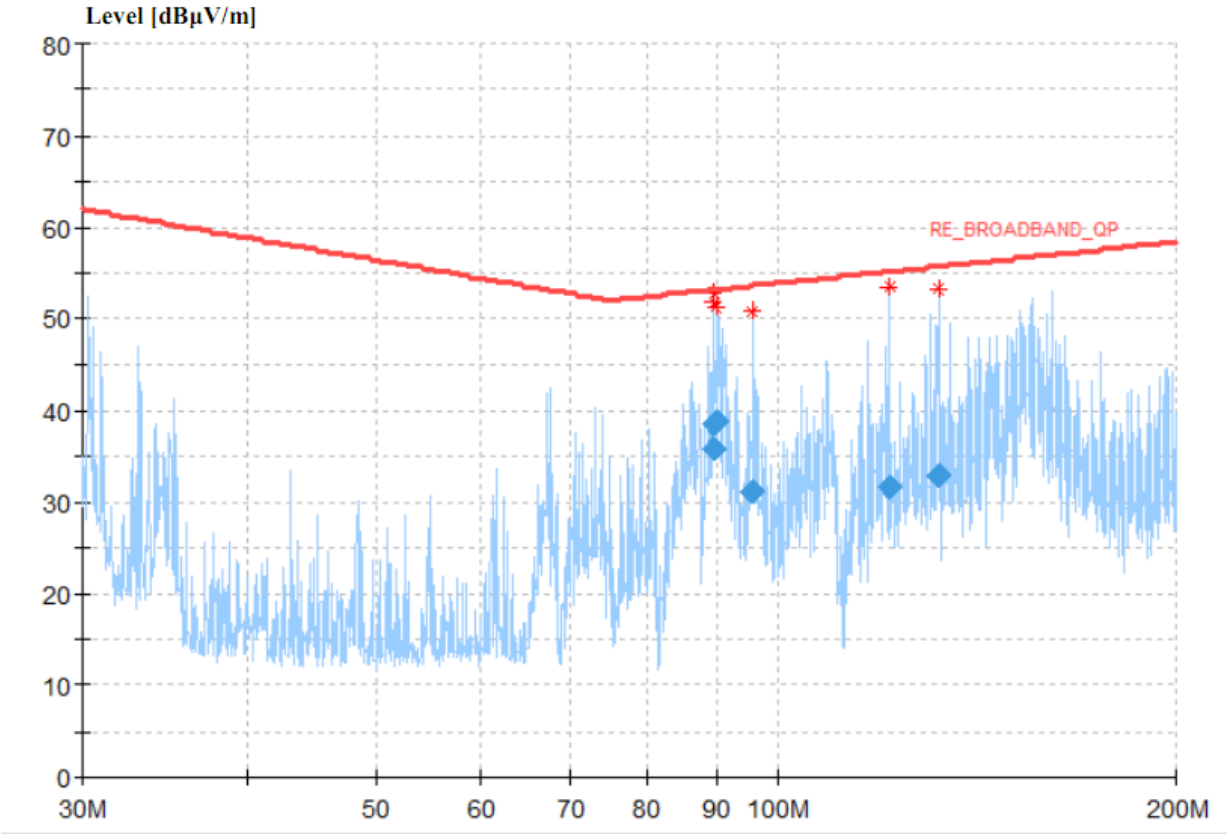
Measurement data(RE 30~200MHz QP+AV)	☐	**Horizontal**	☒	**Vertical**
Operating mode / voltage	Mode 1 / 13.5 Vdc sample 2 narrow			



Note: due to the pre-scan results is far below the limit of EN 50498:2010, there is no need for final measurement.

Remark	

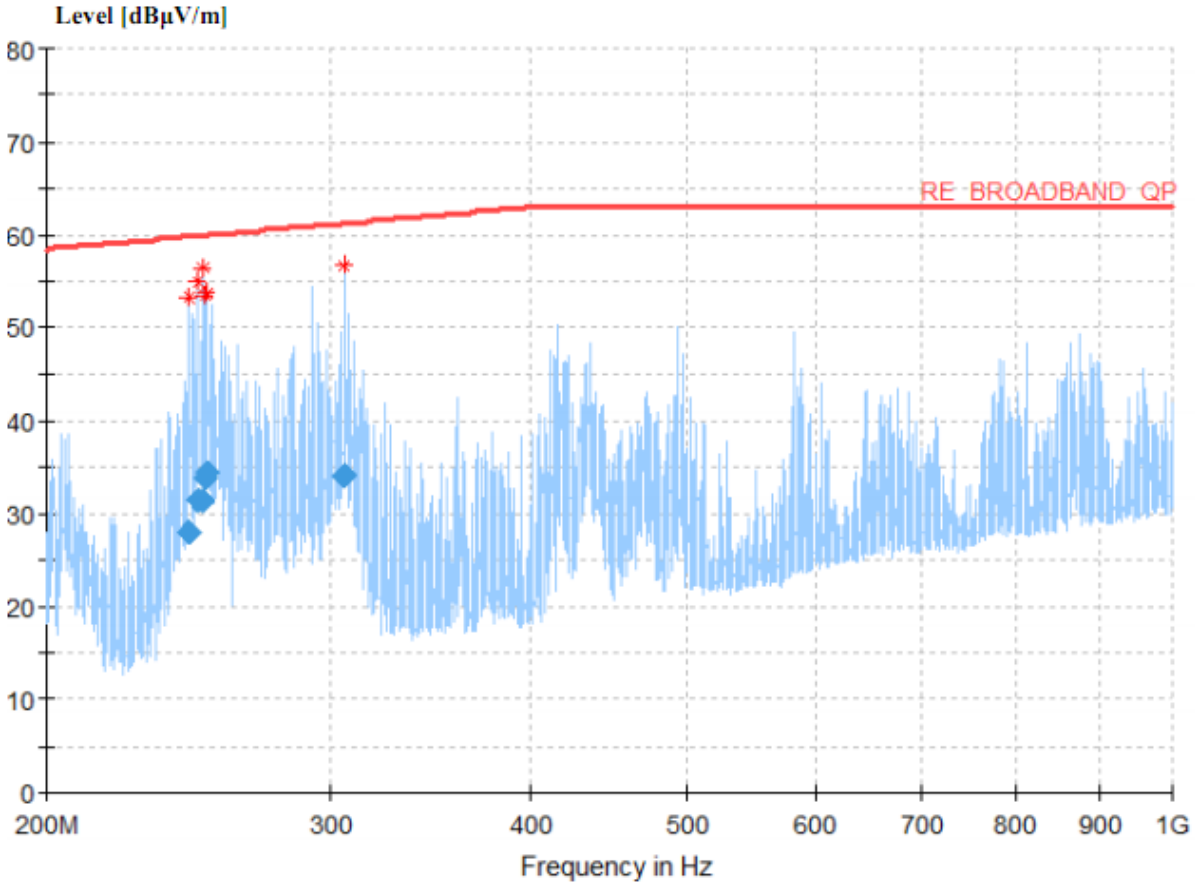
Measurement data(RE 30~200MHz QP+AV)	☒	Horizontal	☐	Vertical
Operating mode / voltage	Mode 1 / 13.5 Vdc			



Final_Result

Frequency (MHz)	QuasiPeak (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol
89.640000	35.93	53.17	17.24	1000.0	120.000	H
89.840000	38.57	53.19	14.62	1000.0	120.000	H
90.120000	38.79	53.21	14.42	1000.0	120.000	H
95.840000	31.19	53.61	22.42	1000.0	120.000	H
121.640000	31.58	55.18	23.60	1000.0	120.000	H
132.200000	32.88	55.72	22.84	1000.0	120.000	H

Measurement data(RE 30~200MHz QP+AV)	☒	Horizontal	☐	Vertical
Operating mode / voltage	Mode 1 / 13.5 Vdc			

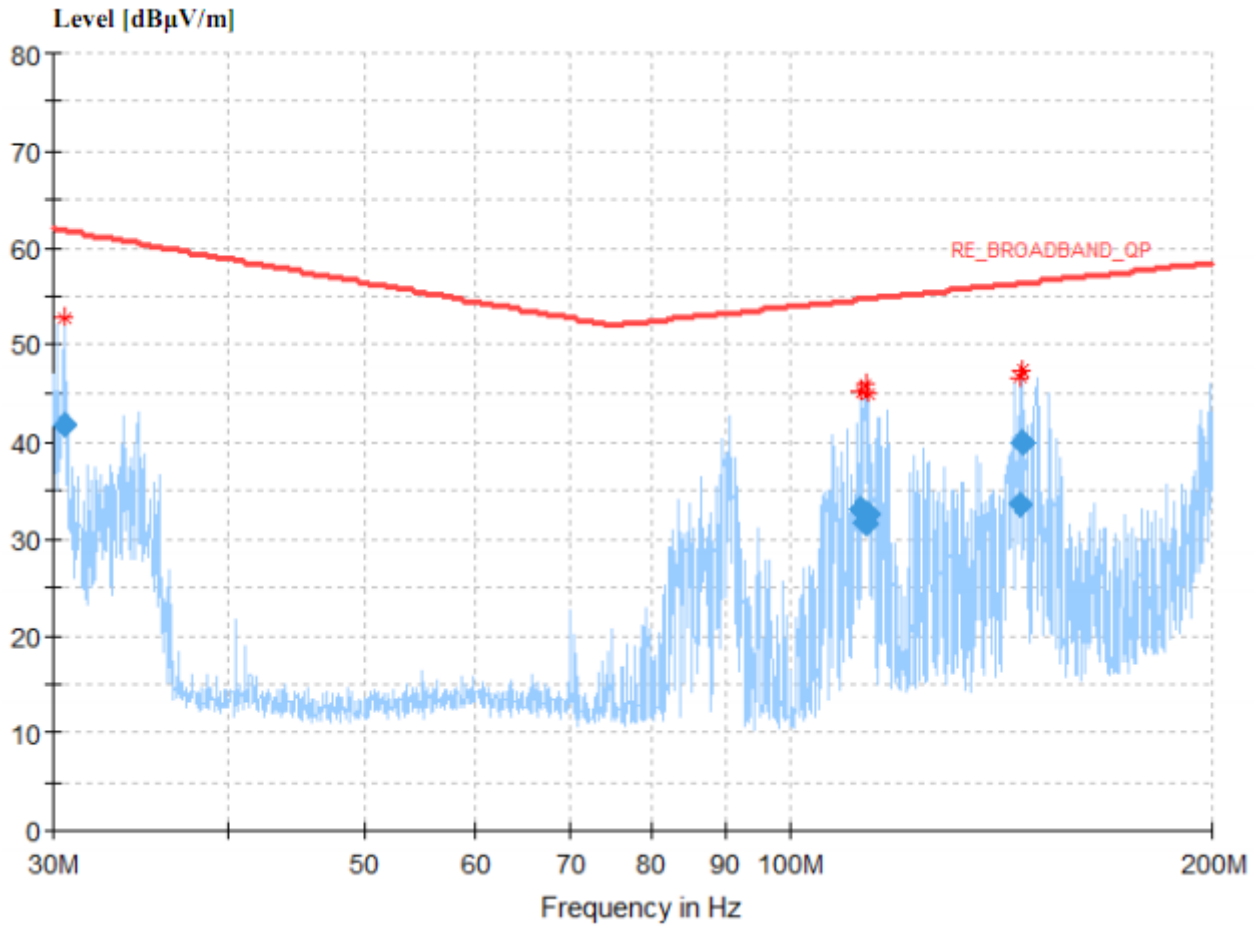


Final_Result

Frequency (MHz)	QuasiPeak (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol
245.600000	28.08	59.79	31.71	1000.0	120.000	H
248.560000	31.53	59.87	28.34	1000.0	120.000	H
250.400000	31.35	59.92	28.57	1000.0	120.000	H
251.120000	33.90	59.94	26.04	1000.0	120.000	H
252.080000	34.40	59.97	25.57	1000.0	120.000	H
306.040000	34.11	61.24	27.13	1000.0	120.000	H

Remark	

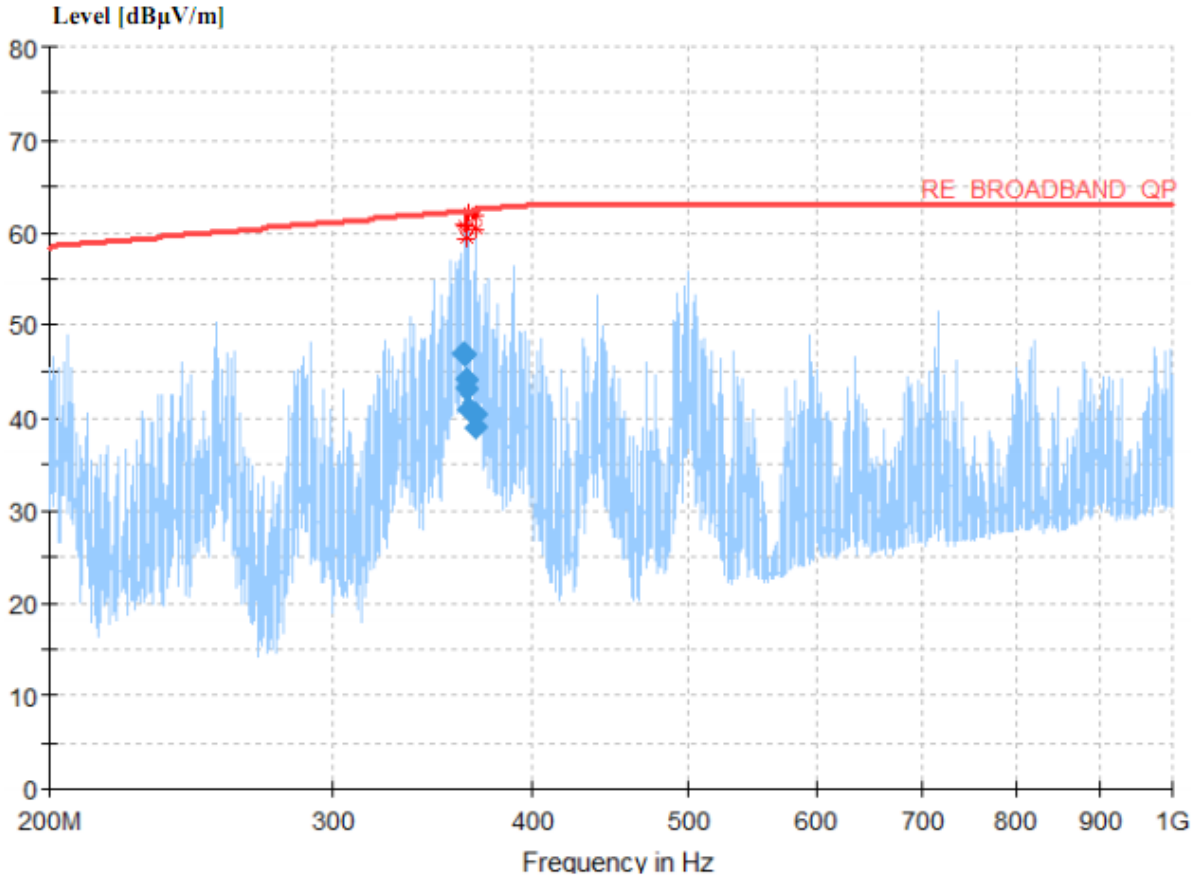
Measurement data(RE 30~200MHz QP+AV)	☐	Horizontal	☒	Vertical
Operating mode / voltage	Mode 1 / 13.5 Vdc			



Final_Result

Frequency (MHz)	QuasiPeak (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol
30.560000	41.66	61.80	20.14	1000.0	120.000	V
112.560000	33.02	54.67	21.65	1000.0	120.000	V
113.160000	31.59	54.70	23.11	1000.0	120.000	V
113.760000	32.72	54.74	22.02	1000.0	120.000	V
145.920000	33.73	56.37	22.64	1000.0	120.000	V
146.480000	40.04	56.40	16.36	1000.0	120.000	V

Measurement data(RE 30~200MHz QP+AV)	☐	Horizontal	☒	Vertical
Operating mode / voltage	Mode 1 / 13.5 Vdc			

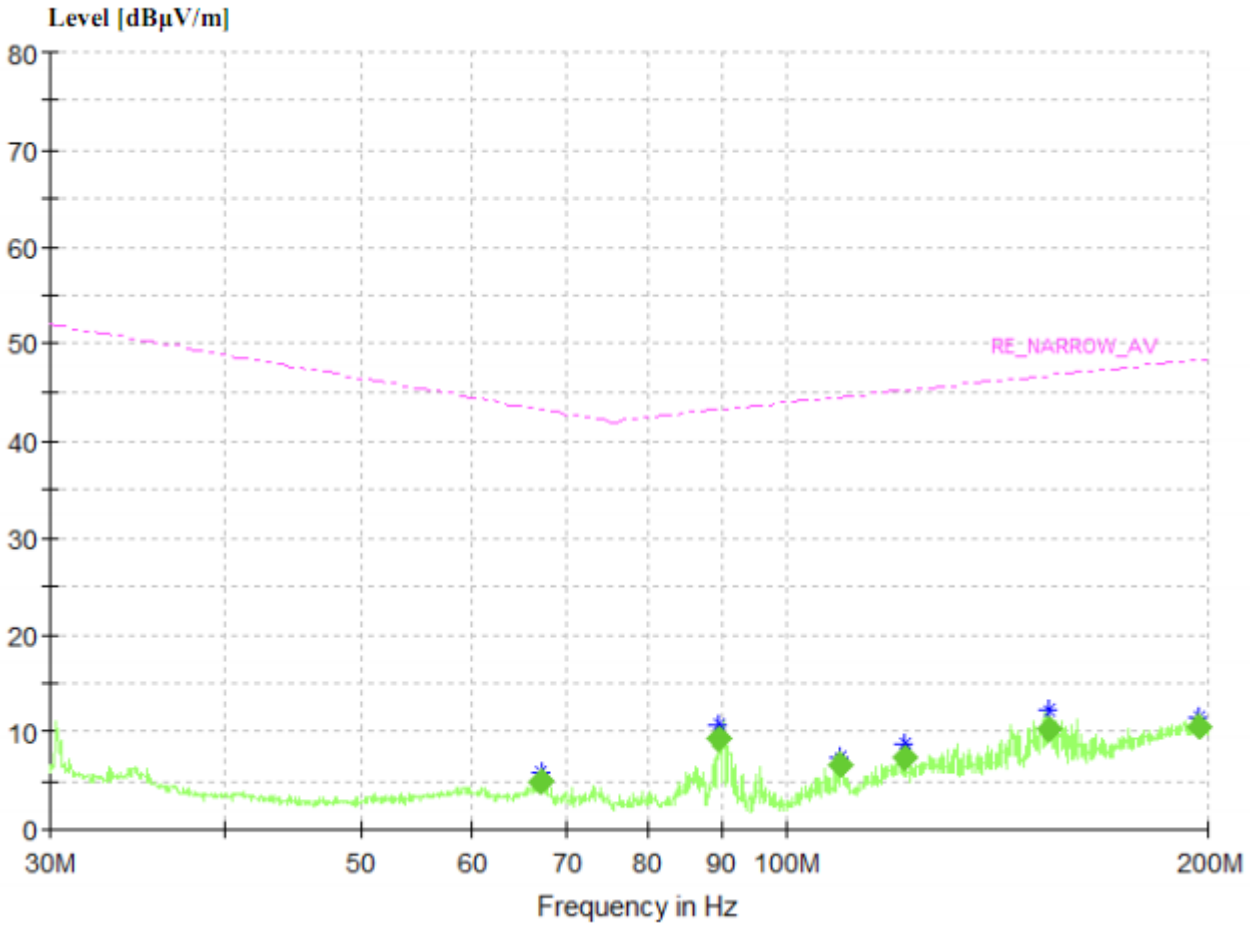


Final_Result

Frequency (MHz)	QuasiPeak (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol
363.000000	46.95	62.36	15.41	1000.0	120.000	V
363.520000	44.13	62.37	18.24	1000.0	120.000	V
364.280000	43.25	62.39	19.14	1000.0	120.000	V
364.640000	40.95	62.39	21.44	1000.0	120.000	V
368.080000	39.10	62.45	23.35	1000.0	120.000	V
368.320000	40.37	62.46	22.09	1000.0	120.000	V

Remark	

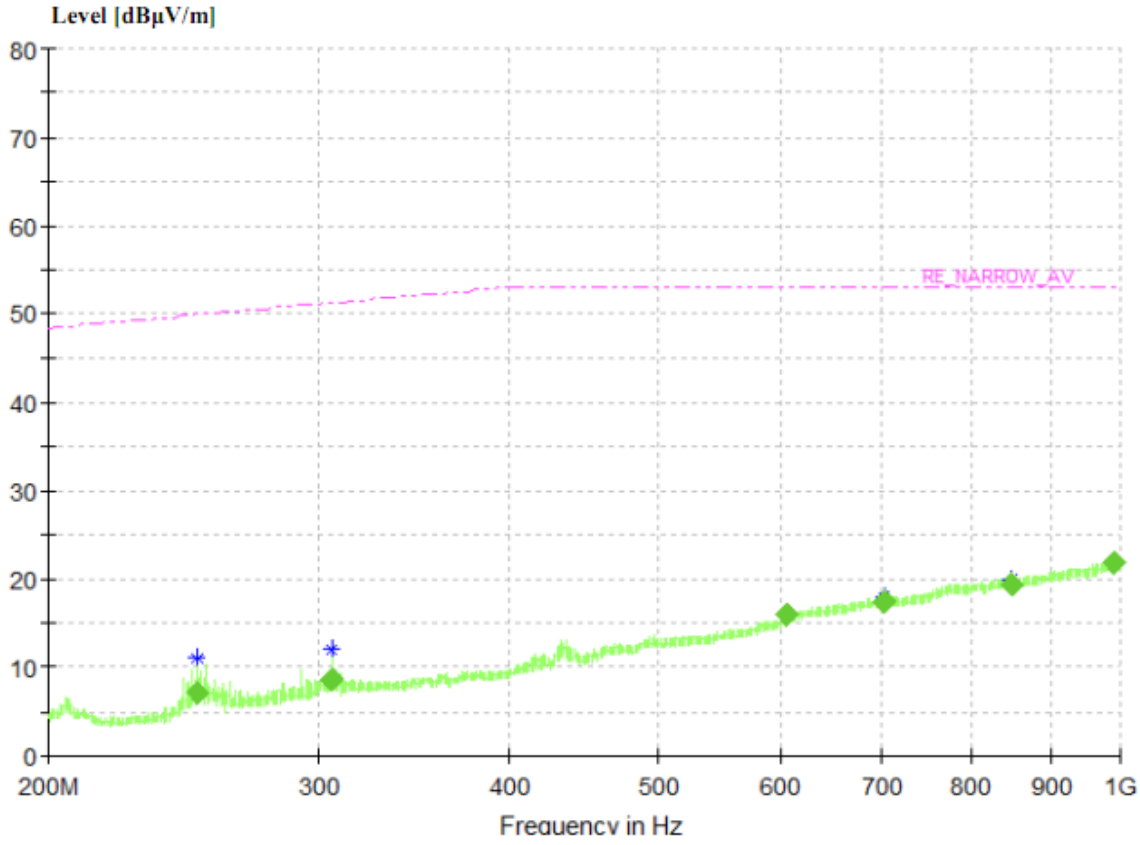
Measurement data(RE 30~200MHz QP+AV)	☒	Horizontal	☐	Vertical
Operating mode / voltage	Mode 1 / 13.5 Vdc			



Final_Result

Frequency (MHz)	CAverage (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol
67.200000	4.83	43.20	38.37	1000.0	120.000	H
89.840000	9.30	43.19	33.89	1000.0	120.000	H
109.600000	6.69	44.49	37.80	1000.0	120.000	H
121.640000	7.35	45.18	37.83	1000.0	120.000	H
154.080000	10.33	46.73	36.40	1000.0	120.000	H
196.880000	10.65	48.34	37.69	1000.0	120.000	H

Measurement data(RE 30~200MHz QP+AV)	☒	**Horizontal**	☐	**Vertical**
Operating mode / voltage	Mode 1 / 13.5 Vdc			

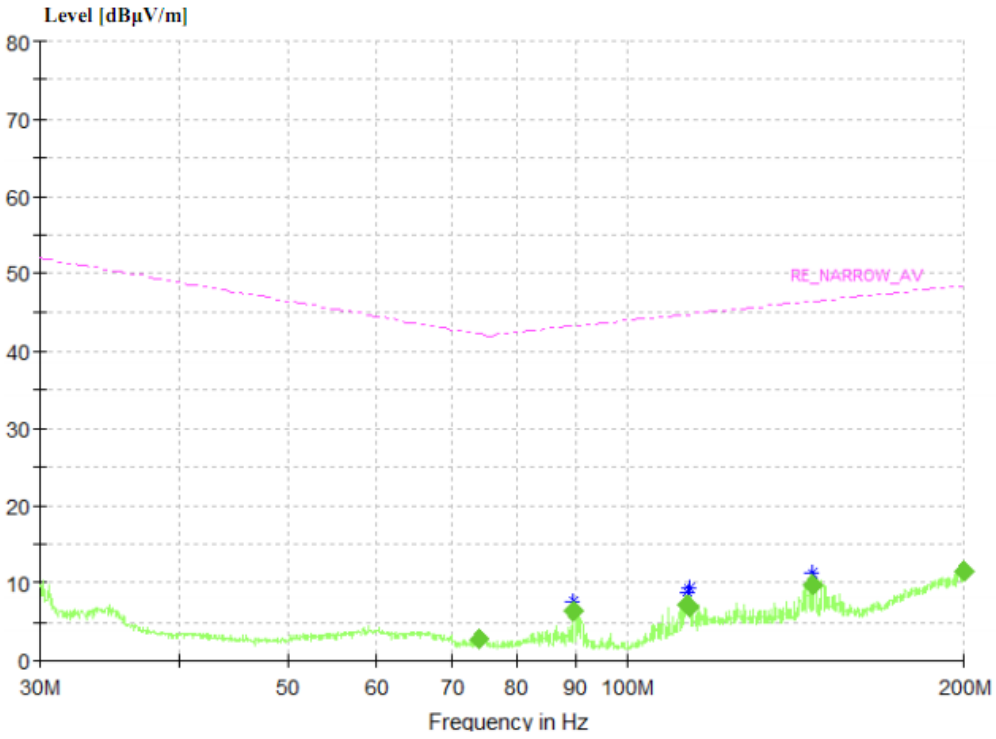


Final_Result

Frequency (MHz)	CAverage (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol
250.400000	7.03	49.92	42.89	1000.0	120.000	H
306.040000	8.60	51.24	42.64	1000.0	120.000	H
605.800000	15.89	53.00	37.11	1000.0	120.000	H
700.640000	17.54	53.00	35.46	1000.0	120.000	H
850.640000	19.49	53.00	33.51	1000.0	120.000	H
991.680000	21.76	53.00	31.24	1000.0	120.000	H

Remark	

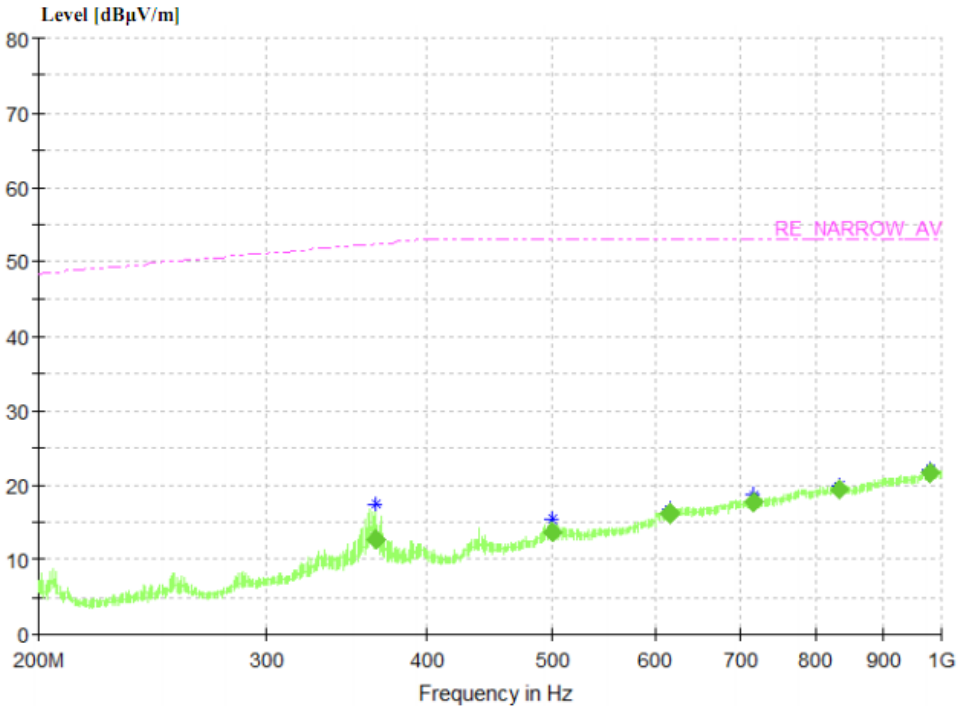
Measurement data(RE 30~200MHz QP+AV)	☐	**Horizontal**	☒	**Vertical**
Operating mode / voltage	Mode 1 / 13.5 Vdc			



Final_Result

Frequency (MHz)	CAverage (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol
73.840000	2.67	42.17	39.50	1000.0	120.000	V
89.960000	6.47	43.20	36.73	1000.0	120.000	V
113.160000	7.13	44.70	37.57	1000.0	120.000	V
113.760000	6.81	44.74	37.93	1000.0	120.000	V
146.600000	9.93	46.40	36.47	1000.0	120.000	V
199.920000	11.43	48.44	37.01	1000.0	120.000	V

Measurement data(RE 30~200MHz QP+AV)	☐	Horizontal	☒	Vertical
Operating mode / voltage	Mode 1 / 13.5 Vdc			



Final_Result

Frequency (MHz)	CAverage (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol
364.640000	12.69	52.39	39.70	1000.0	120.000	V
501.000000	13.70	53.00	39.30	1000.0	120.000	V
615.880000	16.08	53.00	36.92	1000.0	120.000	V
714.960000	17.65	53.00	35.35	1000.0	120.000	V
834.640000	19.42	53.00	33.58	1000.0	120.000	V
980.160000	21.59	53.00	31.41	1000.0	120.000	V

Remark	

4.5 **Conducted transient disturbances**	**VERDICT: PASS**

Standard / Regulation	EN 50498: 2010			
Port under test	☒	DC mains input power	☐	Other:

Limits

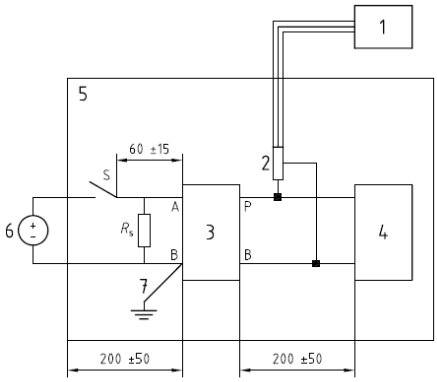
Table 3 – Limits of transient disturbances

Polarity of pulse amplitude	Maximum allowed pulse amplitude for	
	vehicles with 12 V systems	vehicles with 24 V systems
Positive	+ 75	+ 150
Negative	- 100	- 450

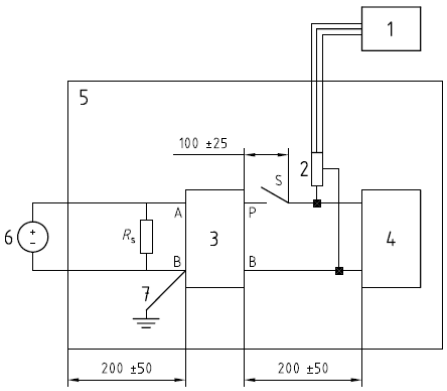
Performed measurements

Port under test	☒	DC mains input power	☐	Other:		
Voltage – Mains [V_{DC}]	☒	13.5	☐	27	☐	Other:
Test setup	All wiring connections between the artificial network,switch,and the DUT shall be spaced(50±5)mm above the metal ground plane. Refer to the Annex 3 for test setup photo(s).					
Test method applied	☒	According to Clause 4.3 of the ISO 7637-2 standard (see below).				
	☐	Other:				

Key:
1. Oscilloscope or equivalent
2. Voltage probe
3. Artificial network
4. DUT (source of transient)
5. Ground plane
6. Power supply
7. Ground connection; length <100 mm



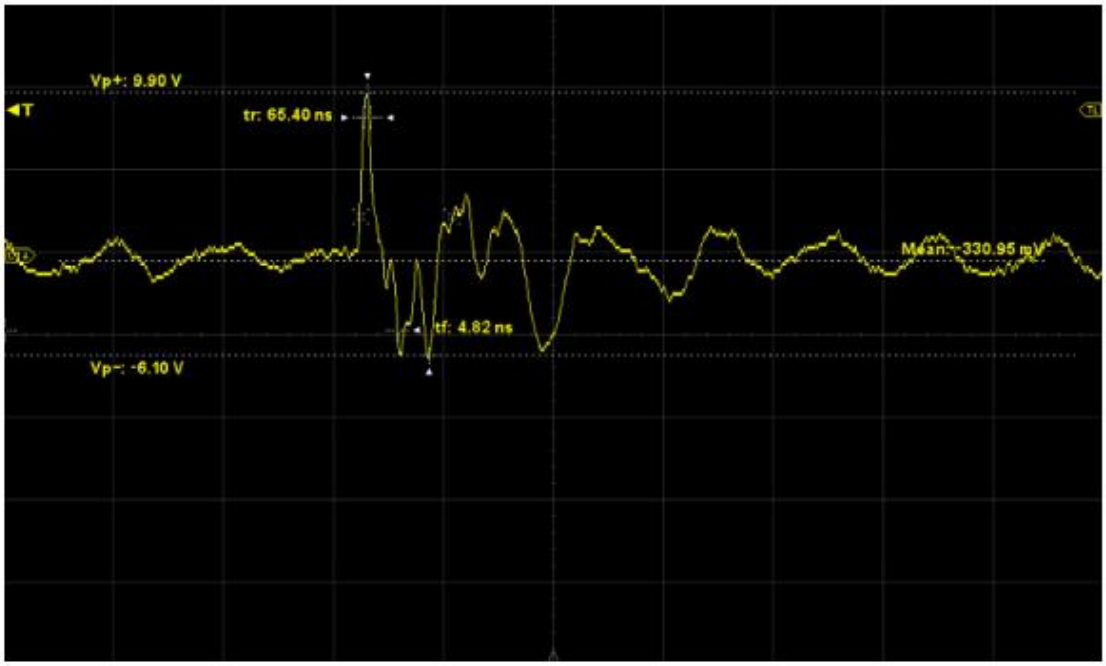
a) Slow pulses (millisecond range or slower)



b) Fast pulses (nanosecond-to-microsecond range)

Operating mode(s) used	Mode 1
Remark	---

Measurement data	Port under test	DC mains input power
Operating mode / voltage	Mode 1 / 13.5Vdc sample 1	



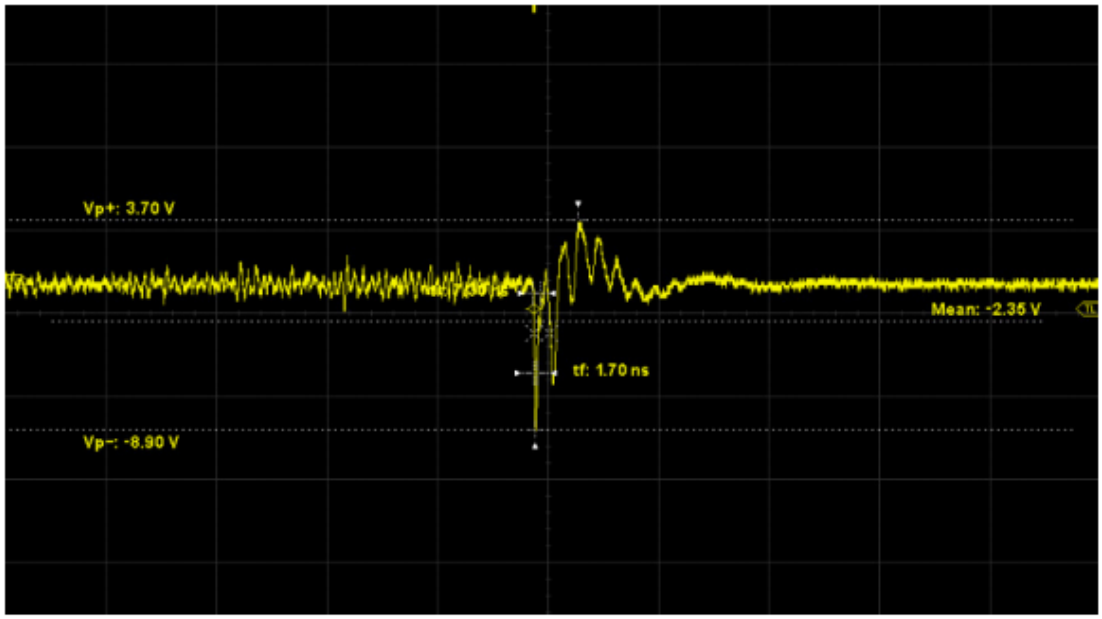
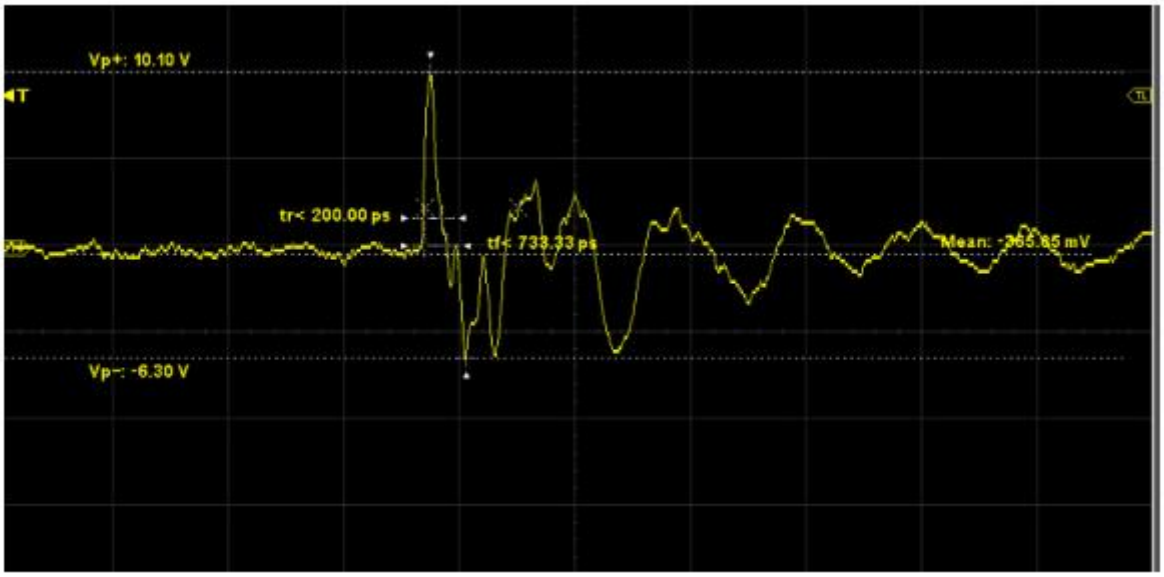


Table 3: List of measurement results for 1# sample

Polarity of pulse	Pulse amplitude (V)	Limit(V)
Positive	+9.1	75
Negative	-8.9	-100

Remark	

Measurement data	Port under test	DC mains input power
Operating mode / voltage	Mode 1 /13.5Vdc sample 2	



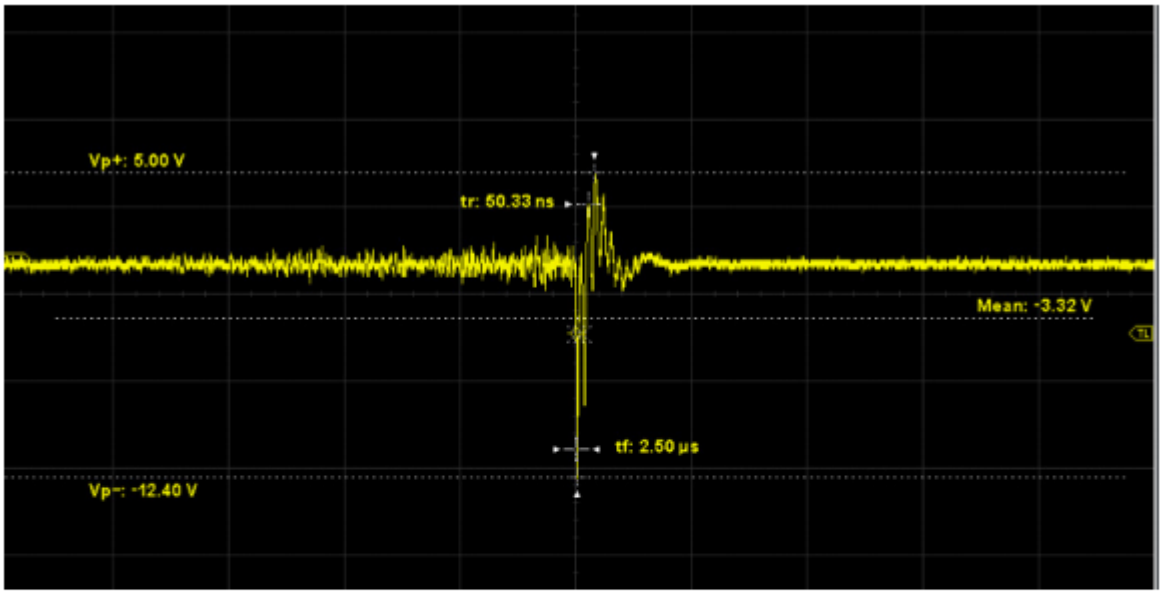
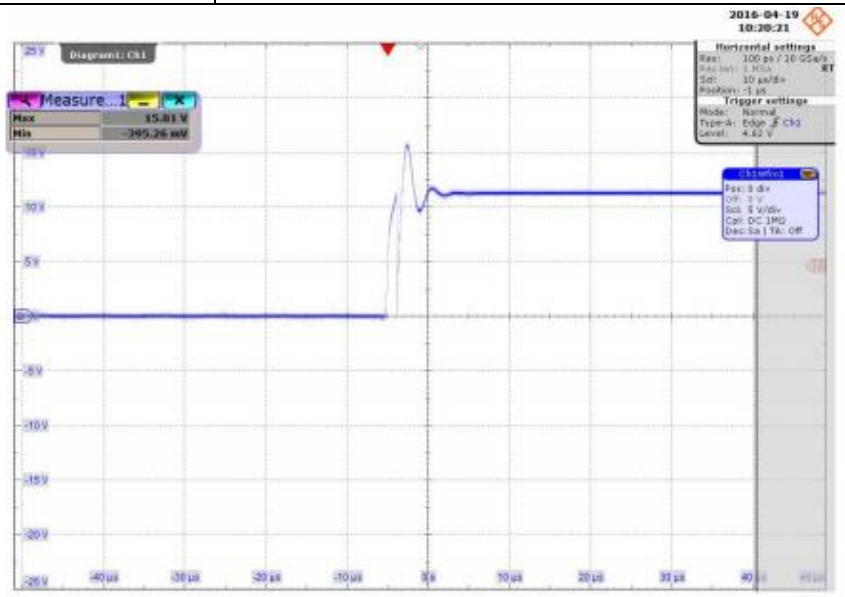


Table 4: List of measurement results for 2# sample

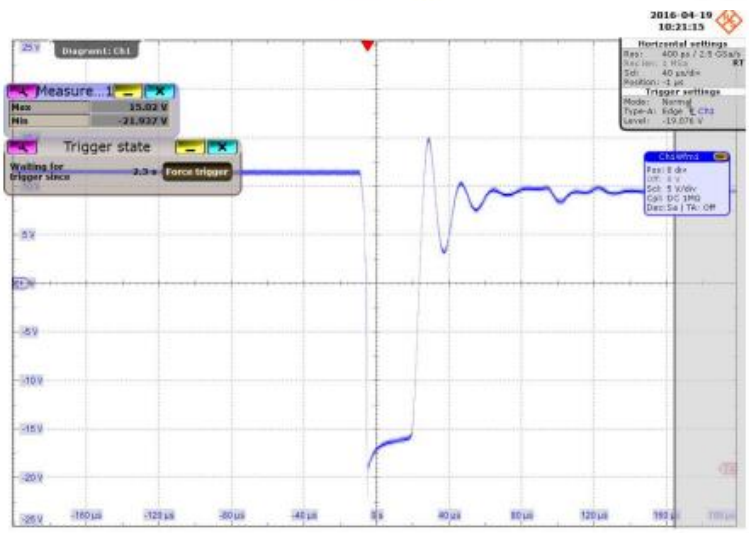
Polarity of pulse	Pulse amplitude (V)	Limit(V)
Positive	+10.1	75
Negative	-12.4	-100

Remark	

Measurement data	Port under test	DC mains input power
Operating mode / voltage	Mode 1 /13.5Vdc	



(Off→On)



(On→Off)

Table 3: Test result for conducted transient disturbances

Polarity of pulse amplitude	Test result	Maximum allowed pulse amplitude	Result
Positive	+15.81V	+75V	Pass
Negative	-21.937V	- 100V	Pass

Remark	

4.6 **Discontinuous disturbance (clicks) on AC power leads**	**VERDICT: N/A**

Standard	EN 55014-1		
Frequency [MHz]	Limit: QP [dB(μV)]	IF BW	Detector
0,15	66	9 KHz	Quasi-Peak (QP)
0,50	56	9 KHz	Quasi-Peak (QP)
1,40	56	9 KHz	Quasi-Peak (QP)
30,0	60	9 KHz	Quasi-Peak (QP)

~~**Performed measurements**~~

~~Voltage – Mains [V]~~	~~230 Vac~~			
~~Frequency – Mains [Hz]~~	~~50 Hz , 60 Hz~~			
~~Test method applied~~	☒	~~Artificial mains network~~		
	☐	~~Voltage probe~~		
~~Test setup~~	☒	~~Table top~~	☐	~~Floor standing~~
	☐	~~Other:~~		
	~~Refer to the Annex 3 for test setup photo(s).~~			
~~Operating mode(s) used~~	~~Mode 1~~			
~~Remark~~	~~---~~			

~~Reason for not performing the test~~	☒	~~The amplitudes of the observed disturbances were all below the limit for continuous disturbance, these are not considered to be clicks.~~							
~~Measurement results~~	☒	~~Neutral~~	☒	~~Line 1~~	☐	~~Line 2~~	☐	~~Line 3~~	
~~Frequency (MHz)~~	~~First Measurement: Determination of the limit L_q – Quasi-peak~~								
	~~Limit L (dBμV)~~	~~Number of short clicks~~	~~Number of long clicks~~	~~Number of clicks – N_1~~	~~Time of meas. (min.)~~	~~Click rate N~~	~~Increased limit (dB)~~	~~Increased Limit L_q~~	
~~0,15~~	~~66~~	~~0~~	~~0~~	~~0~~	~~120~~	~~5~~	~~16~~	~~82~~	
~~0,5~~	~~56~~	~~0~~	~~0~~	~~0~~	~~120~~	~~5~~	~~16~~	~~72~~	
~~1,4~~	~~56~~	~~0~~	~~0~~	~~0~~	~~120~~	~~5~~	~~16~~	~~72~~	
~~30~~	~~60~~	~~0~~	~~0~~	~~0~~	~~120~~	~~5~~	~~16~~	~~76~~	
☒	~~The calculated click rate N is not more than 5 times per minute and all the clicks are classified as short (t ≤ 10 ms). Thus, the EUT is deemed to comply with the limits without any further measurement at an increased limit.~~								
~~Frequency (MHz)~~	~~Second measurement with Limit = L_q (Upper quartile method):~~								
	~~Limit Lq (dBμV)~~	~~Number of clicks – N_2~~	~~Number of authorized clicks N2 ≤N1/4~~			~~Verdict~~			
~~0,15~~									
~~0,5~~									
~~1,4~~									
~~30~~									
~~Supplementary information:~~									

4.7 **Harmonic current emissions**	**VERDICT: N/A**

Standard	EN 61000-3-2	
Exlusions (For these categories of equipment, limits are not specified in the EN 61000-3-2 standard)	☐	Arc welding equipment intended for professional use.
	☐	System(s) with nominal voltage(s) less than 220 V_{AC} (line-to-neutral).
	☐	Equipment with rated power of ≤ 75 W (other than lighting equipment).
	☐	Professional equipment with total rated power > 1 kW.
	☐	Symmetrically controlled heating elements with a rated power ≤ 200 W.
	☐	Independent dimmers for incandescent lamps with rated power ≤ 1 kW.

Classification			
☒	Class A	All apparatus not classified as Class B, C or D	
☐	Class B	Portable tools, arc welding equipment which is not professional equipment.	
☐	Class C	☐	Lighting equipment with active input power > 25 W
		☐	Lighting equipment with active input power ≤ 25 W (First requirement, Table 3 column 2)
		☐	Lighting equipment with active input power ≤ 25 W (Second requirement)
☐	Class D	Personal computers, television receivers, refrigerators and freezers having one or more variable-speed drives to control compressor motor(s).	

~~**Performed measurements**~~

~~Port under test~~	~~AC mains power input~~					
~~Voltage – Mains [V]~~	~~230 Vac~~					
~~Frequency – Mains [Hz]~~	~~50Hz~~					
~~Observation peroid~~	☐	~~6.5 min.~~	☒	~~2.5 min.~~	☐	~~Other:~~
~~Version of measurement instrument standard used EN / IEC61000-4-7 (Cl. 7)~~	☒	~~EN 61000-4-7:2002 + AM1:2009 (IEC 61000-4-7:2002+AM1:2008)~~				
	☐	~~EN 61000-4-7:1991~~				
~~Control principle used in the EUT~~	☒	~~Comply with the requirements of the Clause 6.1 (EN / IEC 61000-3-2).~~				
	☐	~~Not comply with the requirements of the Clause 6.1 (EN / IEC 61000-3-2).~~				
~~Operating mode(s) used~~	~~Mode 1~~					
~~Remark~~	~~—~~					

4.8 **Voltage changes, voltage fluctuations and flicker**	**VERDICT: N/A**

Standard	EN 61000-3-3

Limits

P_{ST} (Short term flicker)	☒	≤ 1	☐	Not Applicable
P_{LT} (Long term flicker)	☒	≤ 0,65	☐	Not Applicable
d_C (Relative Voltage change)	☒	≤ 3,3%	☐	Not Applicable
T_{MAX}(Maximum time duration)	☒	500ms	☐	Not Applicable
d_{MAX} (Max. voltage change)	☒	≤ 4%	☐	6%
	☐	7%	☐	Not Applicable
Supplemental information:				

~~**Performed measurements**~~

~~Reason for not performing the measurement(s)~~	⊟	~~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]~~	~~50Hz~~					
~~Test method~~	⊠	~~Flickermeter according EN / IEC 61000-4-15:2011~~				
	⊟	~~Simulation (Clause 4.2.3 of EN / IEC 61000-3-3)~~				
	⊟	~~Analytical method (Clause 4.2.4 of EN / IEC 61000-3-3)~~				
	⊟	~~Use of P_{st} = 1 curve (Clause 4.2.5 of EN / IEC 61000-3-3)~~				
~~Observation peroid~~	⊠	~~10 min.~~	⊟	~~120 min.~~	⊟	~~Other:~~
	⊟	~~24 times switching according to Annex B~~				
~~Operating mode(s) used~~	~~Mode 1~~					
~~Remark~~	~~---~~					

5 IMMUNITY TEST RESULTS

5.1 Performance (Compliance) criteria

[According to EN 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
Radio-frequency electromagnetic fields	A
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.

☐	Motor speed	☐	Display data
☐	Switching	☐	Data storage
☐	Standby mode	☐	Sensor functions
☐	Temperature	☐	Audible signals
☒	Power consumption	☐	Others : LED's
☐	AC mains input current	☐	Others :
☐	Timing	☐	Others :
☐	Illumination	☐	Others :
Supplementary information : ---			

Immunity test	**Monitored - Checked function(s)/parameter(s) during / after the test**	**Method**
Electrostatic discharge	Power consumption	Visual
Radio-frequency electromagnetic fields	---	Visual / Camera
Fast transients	Power consumption	Visual
Surge transient	Power consumption	Visual
Injected currents (radio-frequency common mode)	Power consumption	Visual
Voltage dips and short interruptions	Power consumption	Visual
Supplementary information : ---		

5.3 **Electrostatic discharge immunity**	**VERDICT: PASS**

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 55014-2							
Basic standard	EN 61000-4-2							
Port under test	Enclosure							
Air discharges [1)]	☐	±2 kV	☐	±4 kV	☒	±8 kV	☐	kV
Contact discharges [1)]	☐	±2 kV	☒	±4 kV	☐	±8 kV	☐	kV
Number of discharges	≥ 10 per polarity with ≥ 1 sec interval.							
[1)] Tests with lower voltages are not required.								

Performed tests

Set-up	☒	Table-top	☐	Floor standing	
Ambient temperature [°C]	20.7- 22.8°C			Relative Humidity air [%]	46.5-46.7%
Voltage – Mains [V]	230 V				
Frequency – Mains [Hz]	50 Hz				
Operating mode(s) used	Mode 1,2				

Test Point		Test Voltage [kV] & Polarity	Coupling type	# of applied discharges / polarity	Discharge interval [s]
☒	Points on conductive surface.	±4	Contact	10	1
☒	Points on non-conductive surface.	±8	Air	10	1
☒	HCP top side.	±4	Contact	10	1
☒	HCP bottom side.	±4	Contact	10	1
☒	VCP right side.	±4	Contact	10	1
☒	VCP left side.	±4	Contact	10	1
☒	VCP front side.	±4	Contact	10	1
☒	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.				
Supplementary information: ---					

5.4 Radio-frequency electromagnetic fields immunity — VERDICT: PASS

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%
Supplementary information: ---				

Performed tests

Test method	☒	EN 61000-4-3	☐	EN 61000-4-20		
Test set-up	☒	Equipment on the table (0,8 m height)				
(see Annex 3 for photo)	☐	Equipment standing on floor (0,05 – 0,15 m height)				
Voltage – Mains [V]	---					
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	H	3 V/m	80% AM (1kHz)	3 s	---
(step size 1%)	V	3 V/m	80% AM (1kHz)	3 s	---

Exposed side of the EUT	☒	Front (0°)	☒	Right (90°)	☒	Top
	☒	Rear (180°)	☒	Left (270°)	☒	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.					
Supplementary information: ---						

5.5	**Electrical Fast Transients immunity**	**VERDICT: PASS**

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 55014-2		
Basic standard		EN 61000-4-4		
Pulse characteristics		5/50 ns		
Port		Test level	Repetition frequency	Duration
☒	AC input-output power [1)]	± 1000 V	5 KHz	1 min. / polarity
☐	DC input-output power [2)]	± 500 V	5 KHz	1 min. / polarity
☐	Signal and Control lines [3)]	± 500 V	5 KHz	1 min. / polarity

[1)] 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.

[2)] Not applicable to battery operated appliances that cannot be connected to the mains while in use.

[3)] 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]	50Hz			
Operating mode(s) used	Mode 1			
Test Set-up (see Annex 3 for photo)	☐	Equipment standing on floor at (0,1 ± 0,01) m above ground plane		
	☒	Equipment on the table (0,1 ± 0,01) m above ground plane		
	☐	Artificial hand applied. Location refer to Annex 3.		
Coupling	☒	Common mode	☐	Other:

Port(s) under test	Test Voltage &Polarity	Repetition Frequency	Test duration / polarity	Injection method			
AC power input	± 1 kV	5 KHz	60 s	☒	CDN	☐	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 was observed.						
Supplementary information: ---							

5.6 Surge transient immunity — VERDICT: PASS

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 55014-2		
Basic standard	EN 61000-4-5		
Pulse characteristics	1,2/50µs Voltage; 8/20µs 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 [1)]	+ 1 kV	+ 2 kV	90
AC input power [1)]	- 1 kV	- 2 kV	270
[1)] Tests with lower voltages are not required.			

Performed tests

Voltage – Mains [V]	230 Vac
Frequency – Mains [Hz]	50Hz
Operating mode(s) used	Mode 1
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
☒	AC mains input power	Line to Neutral	+1 kV	90	---
☒	AC mains input power	Line to Neutral	-1 kV	270	---
☐	AC mains input power	Line to Earth	+2 kV	90	---
☐	AC mains input power	Line to Earth	-2 kV	270	---
☐	AC mains input power	Neutral to Earth	+2 kV	90	---
☐	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 was observed.			
Supplementary information:---					

5.7	**Injected currents (RF common mode) immunity**	**VERDICT: PASS**

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 55014-2		
Basic standard		EN 61000-4-6		
Frequency range		Modulation	Step size	Dwell time
☐	0,15 – 80 MHz	80% AM (1kHz)	≤ 1%	≥ 0,5 s
☒	0,15 – 230 MHz	80% AM (1kHz)	≤ 1%	≥ 0,5 s
Port			Test level, *Uo*	
☒	AC input-output power [1]		3 V	
☐	DC input-output power [2] [3]		1 V	
☐	Signal and Control lines [4]		1 V	

[1] 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.

[2] Not applicable to battery operated appliances that cannot be connected to the mains while in use.

[3] 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.

[4] 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)
☐	0,15 – 80 MHz	☒	0,15 – 230 MHz	80% AM (1kHz)	1%
Voltage – Mains [V]		230 Vac		Frequency – Mains [Hz]	50Hz
Operating mode(s) used		Mode 1			
Test set-up (see Annex 3 for photo)		☒	Equipment standing on floor at (0,1 ± 0,01) m above ground plane.		
		☐	Equipment on the table (0,1 ± 0,01) m above ground plane.		
		☐	Artificial hand applied. Location refer to Annex 3.		

Port(s) under test	Test Level (applied)	Injection method	Dwell time (applied)	Remark
AC input power	3V	CDN-M2/3	3s	---
Ethernet / LAN	3V	RF-Injection Clamp	3s	---
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: ---				

5.8	**Power supply interruptions and dips immunity**	**VERDICT: PASS**

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 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 [1)]	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.

[1)] Changes to the voltage level shall occur at a zero crossing point in the a.c. voltage waveform.

NOTE: Where the equipment has a rated voltage range the following shall apply:
- 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.
- In all other cases, the test procedure shall be applied for both the lowest and highest voltages declared in the voltage range.

Performed tests

U_{NOM} [V_{AC}]	Terminal	Voltage dip [% U_{NOM}]	Duration [cycles]		Repetion rate [s]	Number of dips per test	Phase angle [°]
			50 Hz	60 Hz			
230	L-N	0	0,5	0,5	10	3	0, 180
230	L-N	40	10	12	10	3	0, 180
230	L-N	70	25	30	10	3	0, 180

Operating mode(s) used	Mode 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: ---

6 IDENTIFICATION OF THE EQUIPMENT UNDER TEST

EUT PHOTOS



7 ANNEX 1 – MEASUREMENT UNCERTAINTIES

Expanded measurement uncertainty (k=2) : 5.49dB

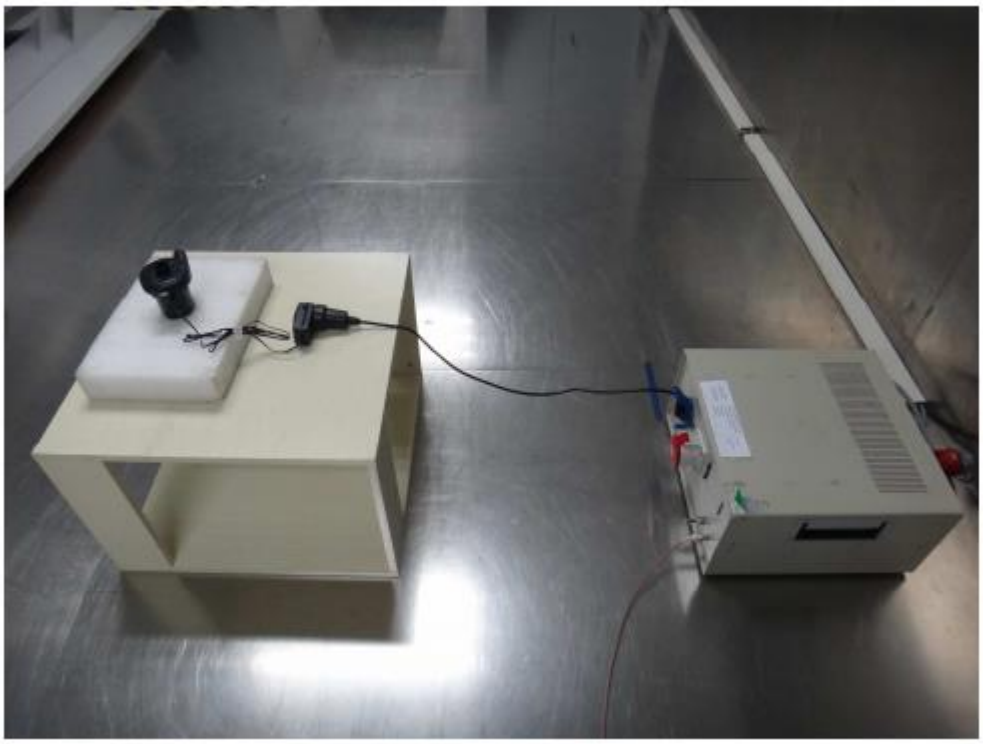
Expanded measurement uncertainty (k=2) : 4.35dB

8 ANNEX 2 – USED EQUIPMENT

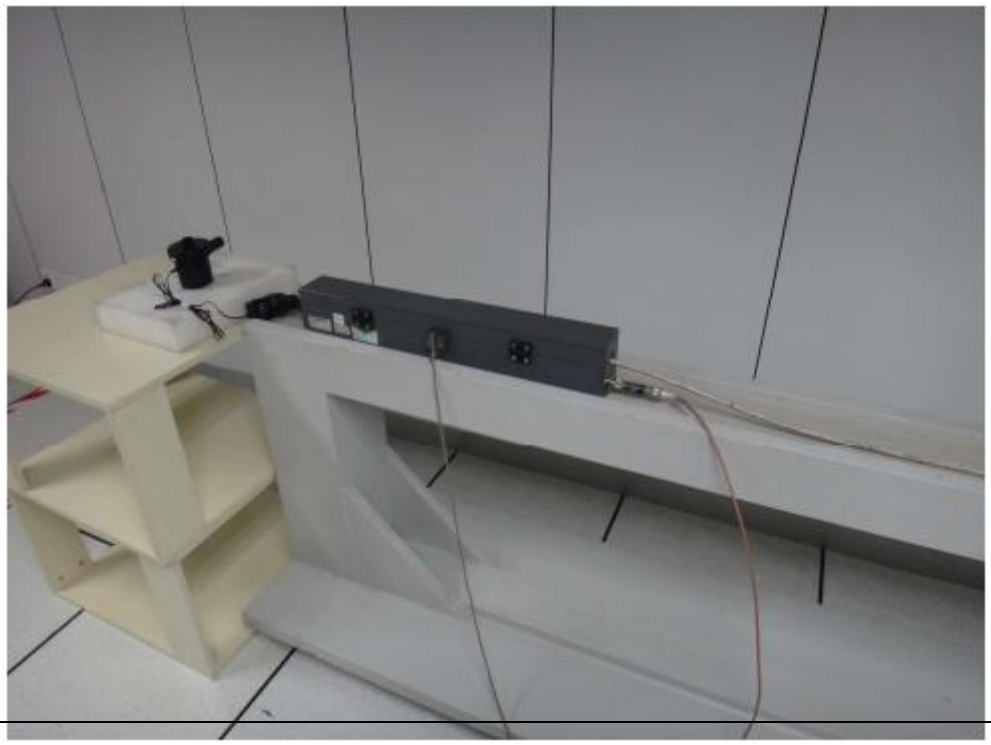
No.	Equipment	Model	Serial no.	Cal. due date
Lab. A				
1.	3m modified semi-anechoic chamber	SAC3	FJ129002	04.02.2015
2.	EMI test receiver	ESCI	100280	07.11.2014
3.	Broadband antenna	BTA-H	040005H	25.09.2015
Lab. B				
4.	3m modified semi-anechoic chamber	SAC	SIPAI/T-J07001	08.07.2016
5.	EMI test receiver	ESU40	SIPAI/T-J07101	20.03.2015
6.	Broadband antenna	CBL6112B	SIPAI/T-J07014	19.04.2017
7.	Artificial network	NNBM8126D	SIPAI/T-J07094	04.07.2015
8.	Artificial network	NNBM8126D	SIPAI/T-J07095	04.07.2015
9.	Digital oscilloscope	TDS784D	SIPAI/T-J06011	14.05.2016

9 ANNEX 3 – TEST PHOTOS

Disturbance voltage



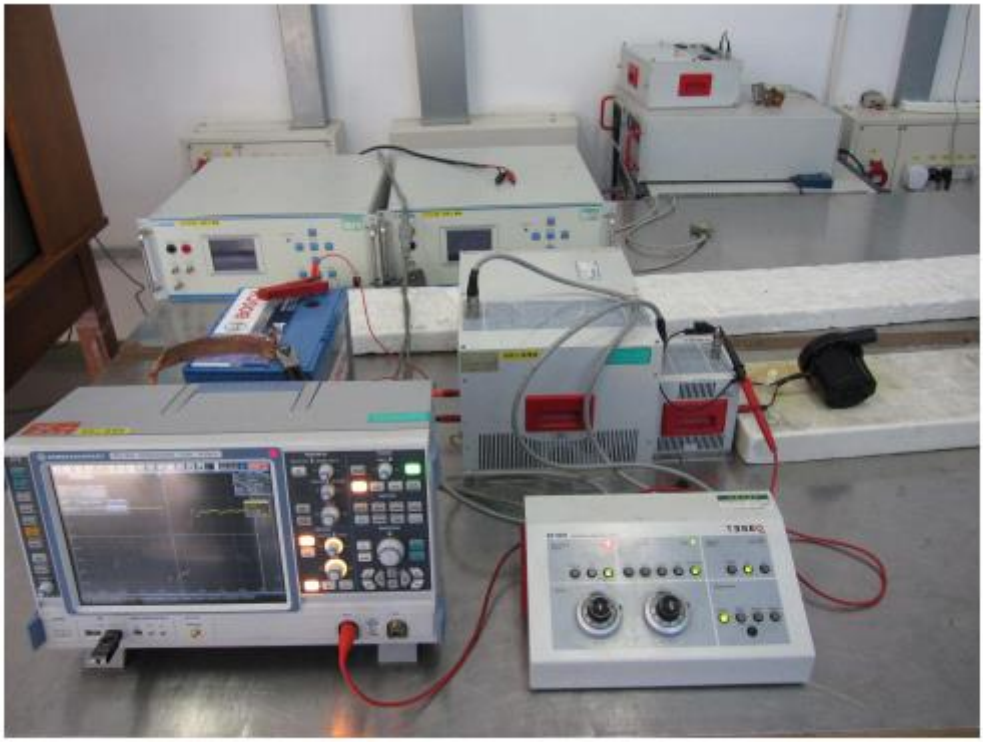
Disturbance power ac



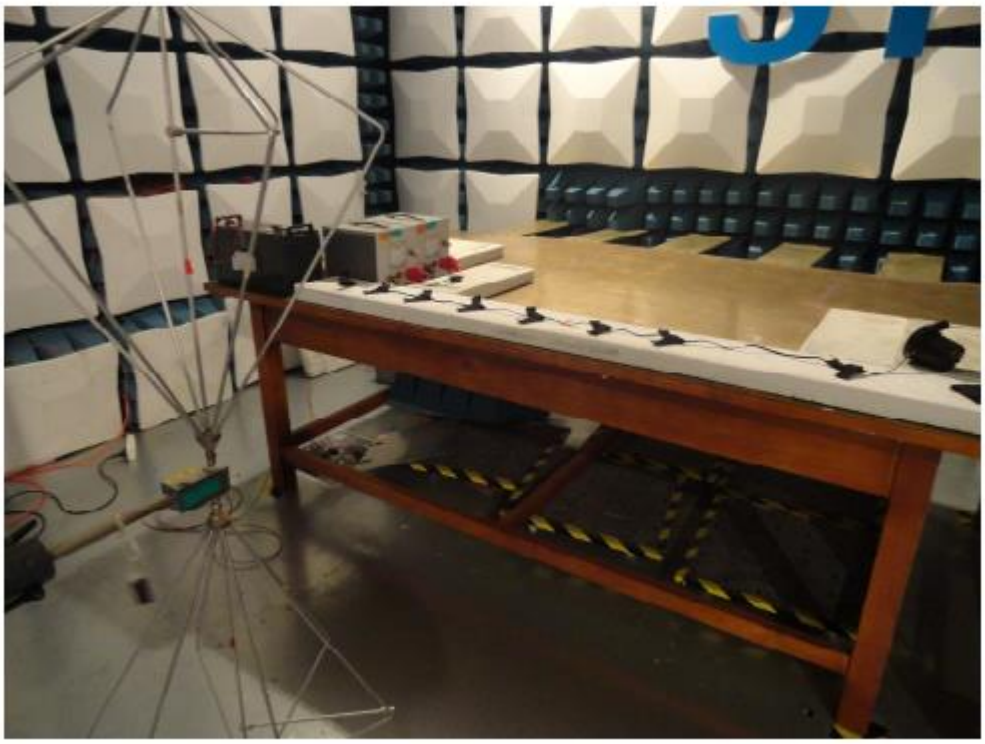
Disturbance power DC



Electrical fast transient (EFT) / Burst transients & Surge transients immunity



RADIATED EMISSION



End of the report