TEST REPORT

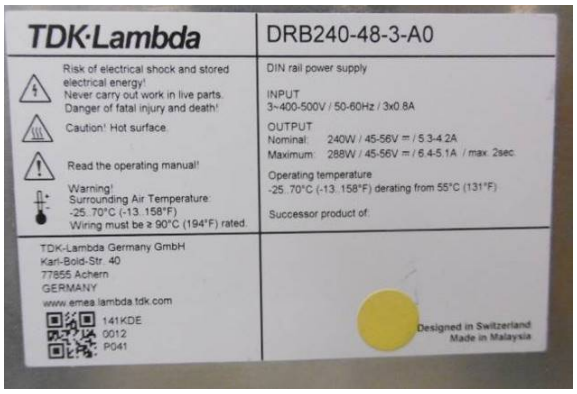
Electromagnetic compatibility (EMC)

Generic standards for residential and industrial environments

Report Reference No. ..... :	429784-5TRFEMC		
Tested by (name, function and signature) ..... :	D. Teruzzi	(project handler)	
Approved by (name, function and signature) ..... :	P. Barbieri	(verifier)	
Date of issue ..... :	2021-04-01		
Testing Laboratory ..... :	**Nemko Spa**		
Address ..... :	Via del Carroccio, 4 – 20853 Biassono (MB) – Italy		
Testing location	Nemko Spa		
Address ..... :	Via del Carroccio, 4 – 20853 Biassono (MB) – Italy		
Applicant's name ..... :	**Nextys SA**		
Address ..... :	Via Luserte Sud, 6 – 6572 Quartino – Switzerland		
Test specification:			
Standard ..... :	EN 55011:2016 + A11:2020 – EN 61000-6-2:2019 EN 61000-6-3:2007 + A1:2011 + AC:2012 EN 61000-3-2:2019 – EN 61000-3-3:2013 + A1:2019 EN 61000-4-2:2009 – EN 61000-4-3:2006 + A1:2008 + A2:2010 EN 61000-4-4:2012 – EN 61000-4-5:2014 +A1:2017 EN 61000-4-6:2014 / AC:2015 – EN 61000-4-8:2010 EN 61000-4-11:2020 – EN61000-4-34:2007 + A1:2009		
	Full application of the standards	☐	
	Partial application of the standards	☒	
Test procedure ..... :	Nemko WM L0077, WM L0177 and WM L1002		
Test Report Form No. ..... :	61000-6-XTRFEMC		
TRF Originator ..... :	Nemko Spa		
Master TRF ..... :	2014-06		

Test item description ..... :	**DIN rail power supply**	
Trade Mark ..... :	TDK-Lambda	
Manufacturer ..... :	Nextys SA	
Address of manufacturer ..... :	Via Luserte Sud, 6 – 6572 Quartino – Switzerland	
Model ..... :	DRB240-48-3-A0	
Ratings ..... :	Input:	3~ 400-500V / 50-60 Hz / 3x0.8A
	Output:	45 – 56 VDC – 240 W nominal

Test Report No. : 429784-5TRFEMCFAIL	2021-04-01 Date of issue

Short description of the EuT	Copy of marking plate
The EUT is a DIN rail power supply	

Number of tested samples	1
Serial number	4297840005 (number assigned by Nemko Spa)
Highest internal frequency	< 108 MHz
Electromagnetic environment	Residential and industrial locations
Device type	Rack Mounting
Accessories and detachable parts included	The E.U.T. is composed of a single unit
Other options included	//

Testing

Date of receipt of test sample	2021-03-01
Testing commenced on	2021-03-01
Testing concluded on	2021-03-31

Possible test case verdicts:

test case does not apply to the test object	N (Not applicable)
test Not Performed	NP (Not Performed)
test object does meet the requirement	P (Pass)
test object does not meet the requirement	F (Fail)

Symbols used in this test report

☒ The crossed square indicates that the listed condition or equipment is applicable for this report.

☐ The empty square indicates that the listed condition or equipment is not applicable for this report.

Throughout this report point is used as decimal separator.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

Verdict according to the standards on page 5:	**PASS**

PROJECT HISTORY		
Report number	**Modification to the report / comments**	**Date**
429784-5TRFEMC	First release	2021-04-01
--	--	--
--	--	--
--	--	--
REMARKS		

PRODUCT VARIANTS		
Variant model	**Difference against the main model**	**Additional test performed**
--	--	--
REMARKS		

Contents

1 TEST STANDARDS

The tests were performed according to following standards and procedures.

NEMKO WM L0177: General routines for using instruments at Nemko

NEMKO WM L1002: Measurement Uncertainty - Policy and Statement

NEMKO WM L0077: General routines to perform EMC tests

EN 55011:2016 + A11:2020
Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement

EN 61000-6-2:2019
Electromagnetic compatibility (EMC) -- Part 6-2: Generic standards - Immunity for industrial environments

EN 61000-6-3:2007 + A1:2011 / AC:2012
Electromagnetic compatibility (EMC) -- Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments

EN 61000-3-2:2019
Electromagnetic compatibility (EMC) -- Part 3-2: Limits - Limits for harmonic current emissions (equipment input current <= 16 A per phase)

EN 61000-3-3:2013 + A1:2019
Electromagnetic compatibility (EMC) - Part 3-3: Limits - 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 61000-4-2:2009
Electromagnetic compatibility (EMC) -- Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test

EN 61000-4-3:2006 + A1:2008 + A2:2010
Electromagnetic compatibility (EMC) -- Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test

EN 61000-4-4:2012
Electromagnetic compatibility (EMC) -- Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test

EN 61000-4-5:2014 + A1:2017
Electromagnetic compatibility (EMC) -- Part 4-5: Testing and measurement techniques - Surge immunity test

EN 61000-4-6:2014 / AC:2015
Electromagnetic compatibility (EMC) -- Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields

EN 61000-4-8:2010
Electromagnetic compatibility (EMC) -- Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test

EN 61000-4-11:2020
Electromagnetic compatibility (EMC) -- Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests

EN 61000-4-34:2007 + A1:2009
Electromagnetic compatibility (EMC) - Part 4-34: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests for equipment with mains current more than 16 A per phase

2 SUMMARY OF TEST RESULTS

EN 55011 / EN 61000-6-3 / EN 61000-3-2 / EN 61000-3-3		
Requirement – Test	Frequency range	Verdict
Enclosure port – Radiated disturbance	30 MHz to 1 000 MHz	P
AC mains port – Terminal disturbance voltages	150 kHz to 30 MHz	P
AC mains port – Discontinuous disturbance	150 kHz to 30 MHz	NP[1]
AC mains port – Harmonic current emissions	0 kHz – 2 kHz	P
AC mains port – Voltage changes, voltage fluctuations and flicker	50 Hz	P
DC power port –Terminal disturbance voltages	150 kHz to 30 MHz	N[2]
Telecommunications port - Terminal disturbance voltages	150 kHz to 30 MHz	N
Immunity tests		
Requirement - Test	Ref standard	Verdict
Enclosure port – Electrostatic discharges	EN 61000-4-2	P
Enclosure port – Radio-frequency electromagnetic field	EN 61000-4-3	P
I/O AC power ports – Fast transients	EN 61000-4-4	P
I/O DC power ports – Fast transients	EN 61000-4-4	P[1]
Signal ports – Fast transients	EN 61000-4-4	P[1]
I/O AC power ports – Surges	EN 61000-4-5	P
I/O DC power ports – Surges	EN 61000-4-5	P
Signal ports – Surges	EN 61000-4-5	N
I/O AC power ports – Radio-frequency common mode	EN 61000-4-6	P
I/O DC power ports – Radio-frequency common mode	EN 61000-4-6	N
Signal ports – Radio-frequency common mode	EN 61000-4-6	N
Enclosure port – Power-frequency magnetic field	EN 61000-4-8	P
Input AC power ports – Voltage dips	EN 61000-4-11 EN 61000-4-34	P
Input AC power ports – Voltage interruptions	EN 61000-4-11 EN 61000-4-34	P
GENERAL REMARKS		
[1] according to applicant's request [2] Applicable only to ports intended for connection to: - a local DC power network, or - a local battery by a connecting cable exceeding a length of 30 m		

3 EQUIPMENT UNDER TEST

3.1 Power supply system utilised

Power supply voltage:	☐	230 V/50 Hz / 1ϕ	☐	115 V/60 Hz / 1ϕ
	☒	400 V/50 Hz 3PE	☐	400 V/50 Hz 3NPE
	☐	12 V DC	☐	24 V DC

3.2 EuT operation modes

Mode	Description
1	The EUT has been tested connected to an adequate load to obtain maximum output power

3.3 EuT Configuration modes

Emission: the EuT was configured to measure its highest possible radiation level. The test modes selected are according to EuT instruction manual.

Immunity: the EuT was configured to have its highest possible susceptibility against tested phenomena. The test modes selected are according to EuT instruction manual.

Mode	Description
1	The EUT has been tested connected to the mains, the DC output is connected to a resistive load and only for fast transient tests, the signal cable has been connected to a multimeter.

3.4 Input/Output Ports

Port	Name	Type*	Cable Max. >3m	Cable Shielded	Description
0	Enclosure	N/E	—	—	—
1	Mains	AC	☐	☐	3 PE cable
2	Output	DC	☐	☐	Two wires cable
3	DC-OK signal	I/O	☐	☐	Two wires

*Note:

AC = AC Power Port DC = DC Power Port N/E = Non-Electrical

I/O = Signal/Control Input or Output Port TP = Telecommunication Ports

3.5 Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
AE	Load	Nextys	//	Supplied by customer
AE	Current clamp	Beha Amprobe	AMP-25-EUR	Supplied by customer
AE	Multimeter	FLUKE	867	Supplied by Nemko Spa

Note: * Use

EUT - Equipment Under Test

AE - Auxiliary/Associated Equipment (Not Subjected to Test)

SIM - Simulator (Not Subjected to Test)

3.6 Performance level

The test results shall be classified in terms of the loss of function or degradation of performance of the equipment under test, relative to a performance level defined by its manufacturer or the requestor of the test, or agreed between the manufacturer and the purchaser of the product.

Definition related to the performance level:

☐	based on the used product standard
☒	based on the declaration of the manufacturer, requestor or purchaser

Criterion A:
Definition: The apparatus shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance.

Representative parameter	Acceptable level of performance
Output current	±10 % of nominal value
Output Voltage	±10 % of nominal value

Criterion B:
Definition: 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 specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed.

Representative parameter	Acceptable level of performance
Output current	±10 % of nominal value
Output Voltage	±10 % of nominal value

Criterion C:
Definition: Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

4 TEST LABORATORY CONDITIONS

4.1 Address of the test laboratory

Nemko Spa
Via del Carroccio, 4
20853 Biassono (MB) - Italy

4.2 Environmental conditions

In the laboratory, the following ambient conditions are respected for each test reported below:

Ambient temperature:	18 ÷ 33 °C (1)
Relative Humidity:	25 ÷ 70 % (2)
Atmospheric pressure:	860 ÷ 1060 hPa

(1) For luminaire, temperature during tests was verified to be within 18 ÷ 30 °C
(2) During ESD test, humidity was verified to be within 30 ÷ 60 %

The following instruments are used to monitor the environmental conditions:

Equipment	Manufacturer	Model	Serial N°
Thermo-hygrometer data loggers	Testo	175-H2	20012380/305
Thermo-hygrometer data loggers	Testo	175-H2	38203337/703
Barometer	Castle	GPB 3300	072015

4.3 Measurement uncertainty and assessment of conformity

The measurement uncertainty was calculated for each test and quantity listed in this test report, according to CISPR 16-4-2 and other specific test standard and is documented in Nemko Spa working manual WML1002.

The assessment of conformity for each test performed on the equipment is performed not taking into account the measurement uncertainty. The two following possible verdicts are stated in the report:

P (Pass) - The measured values of the equipment respect the specification limit at the points tested. The specific risk of false accept is up to 50% when the measured result is close to the limit.

F (Fail) - One or more measured values of the equipment do not respect the specification limit at the points tested. The specific risk of false reject is up to 50% when the measured result is close to the limit.

Hereafter Nemko's measurement uncertainties are reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Disturbance 10m Chamber	Antenna distance 3 m, 10 m 0.009 ÷ 200 MHz	5.0 dB	(1)
	Antenna distance 1 m, 3 m, 10 m 200 ÷ 1000 MHz	5.2 dB	(1)
	Antenna distance 1 m, 3 m, 10 m 1 ÷ 6 GHz	5.2 dB	(1)
	Antenna distance 1 m, 3 m 6 ÷ 18 GHz	5.5 dB	(1)
	Antenna distance 1 m, 3 m 18 ÷ 40 GHz	7.2 dB	(1)
Radiated Disturbance with large loop antenna system (LLAS)	0.009 ÷ 30 MHz	3.3 dB	(1)
Conducted Disturbance	0.02 ÷ 150 kHz with AMN	3.8 dB	(1)
	150 kHz ÷ 30 MHz with AMN	3.4 dB	(1)
	150 kHz ÷ 30 MHz with AAN	4.6 dB	(1)
	9 kHz ÷ 30 MHz with voltage probe	2.9 dB	(1)
	150 kHz ÷ 30 MHz with current probe	2.9 dB	(1)
Clicks	9 ÷ 150 kHz	3.8 dB	(1)
	150 kHz ÷ 30 MHz	3.4 dB	(1)
Disturbance Power	30 MHz ÷300 MHz	4.5 dB	(1)
Frequency	10 Hz ÷ 1 kHz	0.2 %	(1)
	1 kHz ÷ 40 GHz	10^{-6}	(1)
Harmonic Current Emission	50 Hz ÷ 2 kHz	3 %	(1)
Fluctuation and Flickers	Fluctuation	0.05 %	(1)
	Flickers	5 %	(1)
Radiated Immunity Anechoic Chambers	20 MHz ÷ 6 GHz	3.4 dB	(1) (3)
Radiated Immunity TEM Cell	0.01 ÷ 200 MHz	3.0 dB	(1) (3)
Bulk Current	1 ÷ 200 MHz	3.0 dB	(1)
Immunity to conducted disturbances	9 kHz ÷ 230 MHz	3.0 dB	(1)
ESD Immunity	Voltage, Current, Rise time, Duration	(2)	(1)
Burst Immunity	Voltage, frequency, burst period and duration, rise time and pulse width	(2)	(1)
Surge Immunity	Voltage, Current, Rise time, Duration	(2)	(1)
DIPS, Interruption and Voltage duration Immunity	Amplitude	5 %	(1)
	Duration	5 %	
Impulse Magnetic Field Immunity	Peak Current	10 %	(1) (3)
	Rise time, Duration	20 %	
Power Frequency Magnetic Field Immunity	16.7 Hz, 50 Hz, 60 Hz	2.0 dB	(1) (3)
Damped Oscillatory Wave Immunity Ring Wave Immunity	Voltage, front time, frequency 100 kHz, 1 MHz	(2)	(1)
Damped Magnetic Field	Amplitude: 100 kHz, 1 MHz	3 dB	(1)
	Frequency: 100 kHz, 1 MHz	10 %	
Low Frequency Immunity	15 Hz ÷ 150 kHz	2.2 dB	(1)
Automotive transients Immunity	Voltage, rise time, duration time Impulses 1, 2a, 2b, 3a, 3b and 4	(2)	(1)
Automotive transients Emission	Amplitude, Time	10 %	(1)
EMF for Lighting Equipment	-	25 %	(1)
Electromagnetic fields (EMF)	Magnetic, Electric and Electromagnetic fields: 0 Hz ÷ 40 GHz	25 %	(1)
Electrical quantities (voltage, current, resistance)	AC/DC Voltage 10 mV ÷ 1000 V 0÷100 kHz AC/DC Current 0.1 mA ÷ 400 A 0÷1 kHz Resistance 100 mΩ ÷ 10 MΩ	2.5 %	(1)

NOTES:
(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95 %
(2) The instruments used for this immunity test is according to the tolerances requested by the applicable standard
(3) The reported expanded uncertainty of measurement is related to the stimulus quantity

5 TEST CONDITIONS AND RESULTS

5.1 Radiated disturbance in the frequency range 30 MHz to 1 000 MHz

5.1.1 Photo documentation of the test set-up

5.1.2 Test method

Measurements were made on a semi anechoic chamber. Preliminary measurements were performed at an antenna to EUT separation distance of 10 meters and 3 meters with the receive antenna located at a fixed height (from 1 to 4 meter) in both horizontal and vertical polarities. Final measurements were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.

5.1.3 Limits for enclosure

Frequency (MHz)	Limit (dBµV/m) – Quasi-Peak
30 TO 230	30
230 TO 1 000	37

5.1.4 Test result

Verdict:	☒ P ☐ F ☐ N
Frequency range:	30 MHz – 1 000 MHz
Kind of test site:	Semi anechoic chamber
Measurement distance:	10 m
Remarks:	

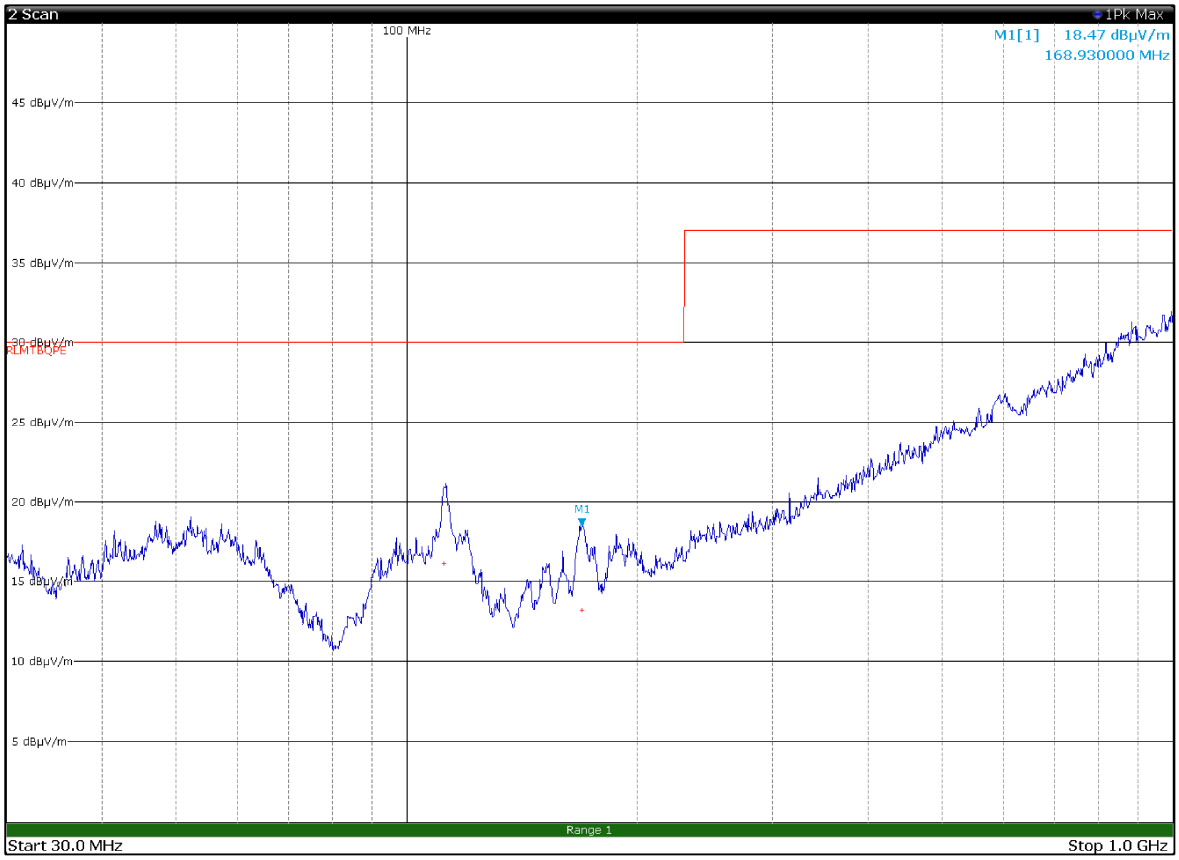
5.1.5 Test equipment used

Description	Manufacturer	Model	Identifier
Controller for turntable and antenna mast	Maturo	FCU3.0	10041
Tilt antenna mast	Maturo	TAM4.0-E	10042
Turntable 4.5 t	Maturo	TT4.0-5T	2.527
SAC	Nemko Spa	10m SAC	530
EMI receiver	Rohde & Schwarz	ESW44	101620
Common mode absorption device	Schwarzbeck	CMAD1614	00041
Antenna	Schwarzbeck	VULB9162	VULB9162-025
Shielded room	Siemens	10m control room	1947

5.1.6 Test protocol

Antenna polarization: Horizontal
Operation mode: 1
Configuration mode: 1
Remarks: -

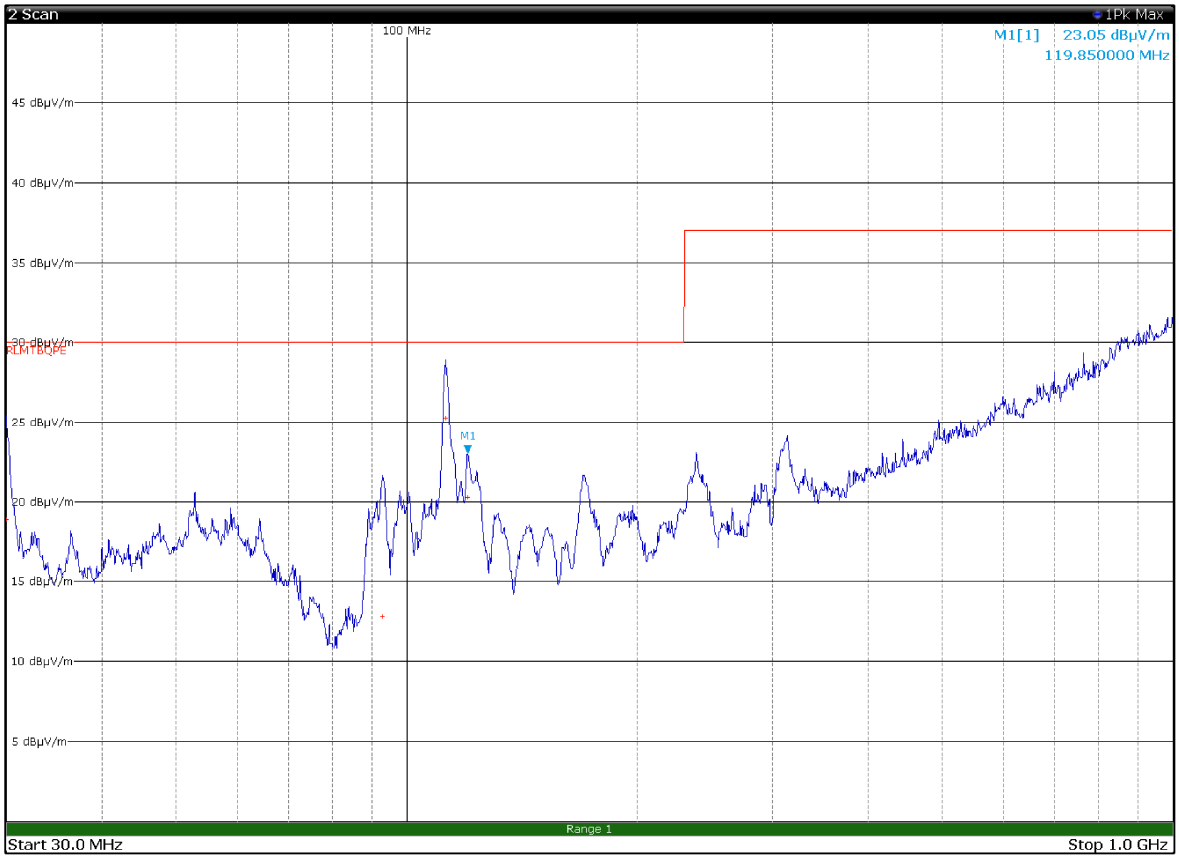
Verdict: Pass



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
111.7800	16.2	30.0	-13.8	QP
168.9300	13.3	30.0	-16.7	QP

Antenna polarization: Vertical
Operation mode: 1
Configuration mode: 1
Remarks: -

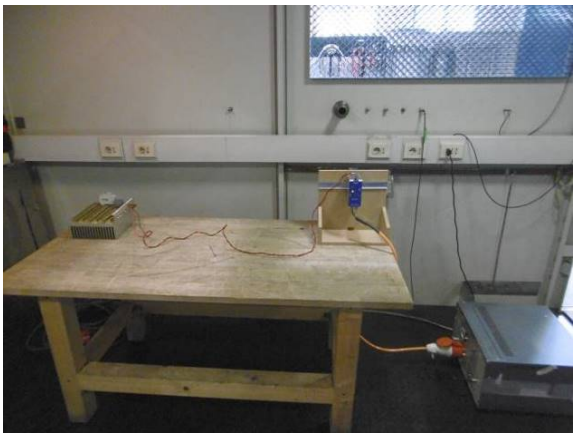
Verdict: Pass



Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.0000	18.9	30.0	-11.1	QP
92.8800	12.9	30.0	-17.1	QP
112.3500	25.3	30.0	-4.7	QP
119.8500	20.3	30.0	-9.7	QP

5.2 Terminal disturbance voltages in the frequency range 150 kHz to 30 MHz

5.2.1 Photo documentation of the test set-up



5.2.2 Test method

Measurements were made on a ground plane that extends one meter minimum beyond all sides of the system under test. All power was connected to the system through Line Impedance Stabilization Networks (LISN). Conducted voltage measurements on mains lines were made at the output of the LISN. All tested telecommunications lines were connected to an Impedance Stabilization Network (ISN) and conducted voltage measurements on telecommunications lines were made at the output of the ISN. Where an ISN was not appropriate or available measurements were made using a Capacitive Voltage Probe and Current probe.

5.2.3 Limits for low voltage AC mains port

Frequency (MHz)	Limit (dBµV) – Quasi-Peak	Limit (dBµV) – Average
0.15 TO 0.50	66 to 56*	56 to 46*
0.50 TO 5	56	46
5 TO 30	60	50

*The limits decrease linearly with the logarithm of the frequency

5.2.4 Limits for DC mains port

Frequency (MHz)	Limit (dBµV) – Quasi-Peak	Limit (dBµV) – Average
0.15 TO 0.50	79	66
0.50 TO 30	73	60

5.2.5 Limits for telecommunication/network port

Frequency (MHz)	Limit (dBµV) – Quasi-Peak	Limit (dBµV) – Average
0.15 TO 0.50	84 to 74*	74 to 64*
0.50 TO 30	74	64

*The limits decrease linearly with the logarithm of the frequency

Frequency (MHz)	Limit (dBµA) – Quasi-Peak	Limit (dBµA) – Average
0.15 TO 0.50	40 to 30*	30 to 20*
0.50 TO 30	30	20

*The limits decrease linearly with the logarithm of the frequency

5.2.6 Test result

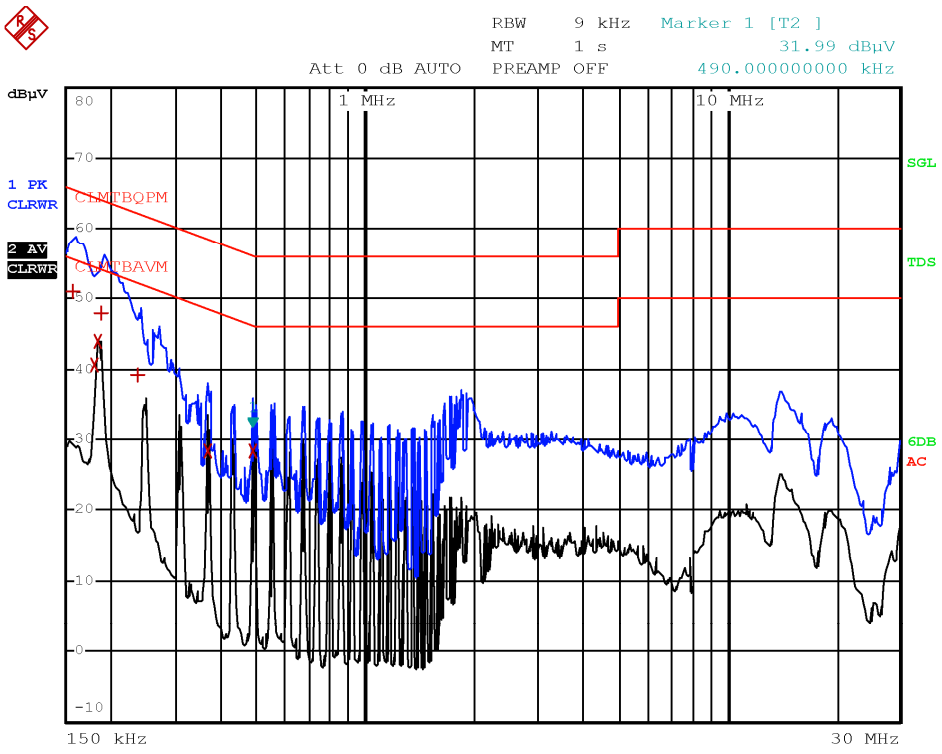
Verdict for AC mains port:	☒ P ☐ F ☐ N
Verdict for DC mains port:	☐ P ☐ F ☒ N
Verdict for TLC port:	☐ P ☐ F ☒ N
Frequency range:	0.15 MHz – 30 MHz
Kind of test site:	Shielded room
Remarks:	

5.2.7 Test equipment used

Description	Manufacturer	Model	Identifier
LISN 9 kHz ÷ 30 MHz	Rohde & Schwarz	ESH2-Z5	872 460/041
EMI receiver	Rohde & Schwarz	ESU8	100202
Shielded room	Siemens	Conducted emission test room	1862

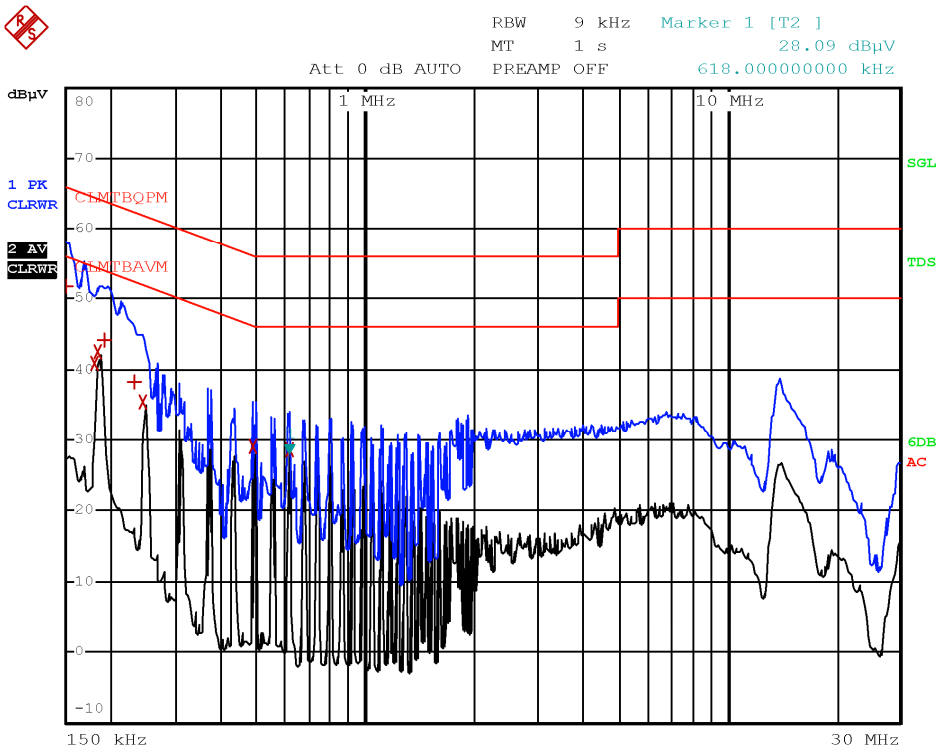
5.2.8 Test protocol

Test point:	Phase line 1	Verdict: Pass
Operation mode:	1	
Configuration mode:	1	
Remarks:	-	



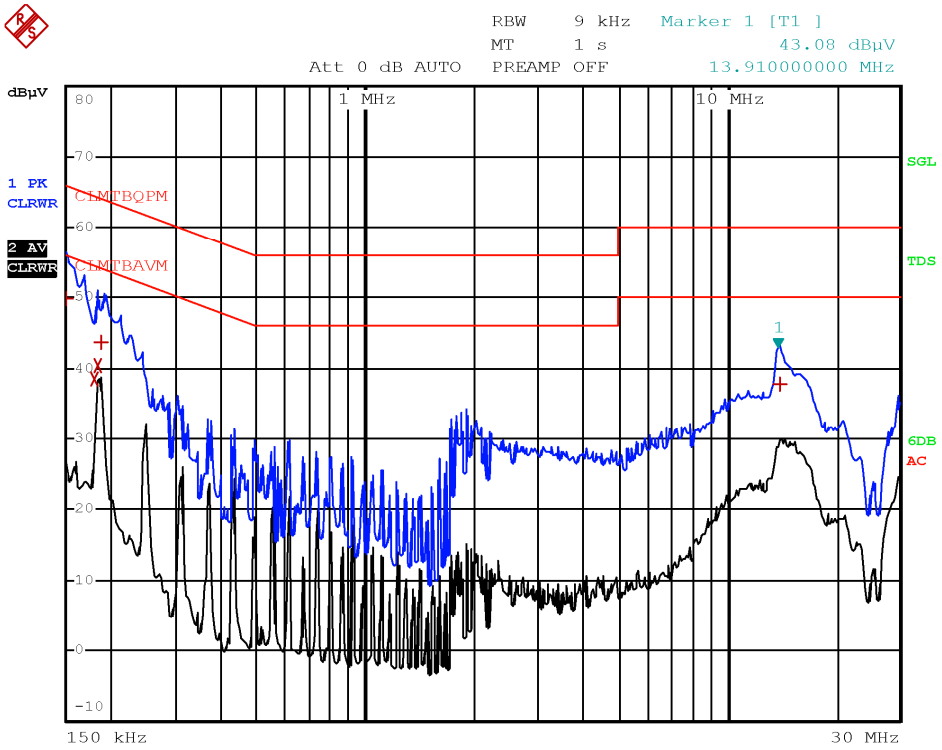
Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.1580	51.1	65.6	-14.4	QP
0.1820	40.8	54.4	-13.6	Av
0.1860	44.1	54.2	-10.1	Av
0.1900	48.0	64.0	-16.0	QP
0.2380	39.3	62.2	-22.8	QP
0.3660	28.5	48.6	-20.1	Av
0.4900	28.3	46.2	-17.8	Av

Test point: Phase line 2 Verdict: Pass
Operation mode: 1
Configuration mode: 1
Remarks: -



Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.1500	51.8	66.0	-14.2	QP
0.1820	40.9	54.4	-13.4	Av
0.1860	42.6	54.2	-11.6	Av
0.1940	44.3	63.9	-19.6	QP
0.2300	38.3	62.4	-24.1	QP
0.2460	35.6	51.9	-16.3	Av
0.4900	29.2	46.2	-17.0	Av
0.6180	28.6	46.0	-17.4	Av

Test point: Phase line 3 Verdict: Pass
Operation mode: 1
Configuration mode: 1
Remarks: -



Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.1500	49.9	66.0	-16.1	QP
0.1820	38.5	54.4	-15.9	Av
0.1860	40.5	54.2	-13.7	Av
0.1900	43.8	64.0	-20.2	QP
13.9140	37.9	60.0	-22.1	QP

5.3 Harmonics of current

5.3.1 Photo documentation of the test set-up

5.3.2 Test method according to EN 61000-3-2

This test consists on the measurement of harmonics components of the input current which may be produced by equipment having an input current up to and including 16 A per phase, and intended to be connected to public low-voltage distribution systems. The equipment is tested under specified conditions of operation.

5.4.3 Limits for low voltage AC mains port - Class A equipment

Harmonic order (n)	Maximum permissible harmonic current (A)
Odd harmonics	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
15 ≤ n ≤ 40	0.15 x 15/n
Even harmonics	
2	1.08
4	0.43
6	0.30
8 ≤ n ≤ 40	0.23 x 8/n

5.3.5 Test result

Verdict:	☒ P ☐ F ☐ N
Frequency range:	0 kHz – 2 kHz
Kind of test site:	Laboratory
Class:	A
Remarks:	

5.3.6 Test equipment used

Description	Manufacturer	Model	Identifier
Mains analyzer	EMC Partner	Harmonics 1000 + HAR-EXT1000	016 + 103489

5.3.7 Test protocol

Operation mode:	1	Verdict:	Pass
Configuration mode:	1		
Remarks:	Test Time 5 min		

3ph - System [Phase L1]

Urms =	231.3V	Freq =	49.984	Range:	50 A
Irms =	0.708A	Ipk =	2.026A	cf =	2.862
P =	101.9W	S =	163.8VA	pf =	0.622
THDi =	118 %	THDu =	0.10 %	Class A	

Order	Freq. [Hz]	Iavg [A]	Irms [A]	Imax [A]	Limit [A]
1	50	0.4501	0.4517	63.793	
2	100	0.0000	0.0000	0.0000	0.0000
3	150	0.0617	0.0641	9.0517	2.7864
4	200	0.0000	0.0000	0.0000	0.0000
5	250	0.3698	0.3723	52.586	32.659
6	300	0.0000	0.0000	0.0000	0.0000
7	350	0.3010	0.3052	43.103	39.633
8	400	0.0000	0.0000	0.0000	0.0000
9	450	0.0288	0.0305	4.3103	7.6294
10	500	0.0000	0.0000	0.0000	0.0000
11	550	0.1460	0.1495	21.121	45.314
12	600	0.0000	0.0000	0.0000	0.0000
13	650	0.0783	0.0824	11.638	39.237
14	700	0.0000	0.0031	0.4310	2.3220
15	750	0.0124	0.0122	1.7241	8.1380
16	800	0.0000	0.0000	0.0000	0.0000
17	850	0.0437	0.0427	6.0345	32.281
18	900	0.0000	0.0000	0.0000	0.0000
19	950	0.0559	0.0549	7.7586	46.387
20	1000	0.0000	0.0000	0.0000	0.0000
21	1050	0.0209	0.0214	3.0172	19.938
22	1100	0.0000	0.0000	0.0000	0.0000
23	1150	0.0850	0.0885	12.500	90.468
24	1200	0.0000	0.0000	0.0000	0.0000
25	1250	0.0535	0.0549	7.7586	61.035
26	1300	0.0000	0.0000	0.0000	0.0000
27	1350	0.0140	0.0153	2.1552	18.311
28	1400	0.0000	0.0000	0.0000	0.0000
29	1450	0.0314	0.0366	5.1724	47.201
30	1500	0.0000	0.0000	0.0000	0.0000
31	1550	0.0096	0.0122	1.7241	16.819
32	1600	0.0000	0.0000	0.0000	0.0000
33	1650	0.0047	0.0061	0.8621	8.9518
34	1700	0.0000	0.0000	0.0000	0.0000
35	1750	0.0213	0.0214	3.0172	33.230
36	1800	0.0000	0.0000	0.0000	0.0000
37	1850	0.0156	0.0153	2.1552	25.092
38	1900	0.0000	0.0031	0.4310	6.3025
39	1950	0.0060	0.0061	0.8621	10.579
40	2000	0.0000	0.0031	0.4310	6.6343

3ph - System [Phase L2]

Urms =	231.5V	Freq =	49.984	Range:	50 A
Irms =	0.635A	Ipk =	2.002A	cf =	3.154
P =	92.03W	S =	146.9VA	pf =	0.626
THDi =	127 %	THDu =	0.20 %	Class A	

Order	Freq. [Hz]	Iavg [A]	Irms [A]	Imax [A]	Limit [A]
1	50	0.3980	0.3967	62.500	
2	100	0.0000	0.0031	0.4808	0.2826
3	150	0.1097	0.1129	17.788	4.9093
4	200	0.0000	0.0031	0.4808	0.7097
5	250	0.3306	0.3326	52.404	29.179
6	300	0.0000	0.0031	0.4808	1.0173
7	350	0.2855	0.2869	45.192	37.255
8	400	0.0000	0.0031	0.4808	1.3269
9	450	0.0517	0.0549	8.6538	13.733
10	500	0.0000	0.0031	0.4808	1.6586
11	550	0.1396	0.1434	22.596	43.464
12	600	0.0000	0.0031	0.4808	1.9903
13	650	0.0703	0.0732	11.538	34.877
14	700	0.0051	0.0092	1.4423	6.9660
15	750	0.0242	0.0244	3.8462	16.276
16	800	0.0000	0.0031	0.4808	2.6537
17	850	0.0154	0.0153	2.4038	11.529
18	900	0.0000	0.0031	0.4808	2.9854
19	950	0.0682	0.0671	10.577	56.695
20	1000	0.0000	0.0031	0.4808	3.3171
21	1050	0.0473	0.0488	7.6923	45.573
22	1100	0.0000	0.0031	0.4808	3.6488
23	1150	0.0398	0.0397	6.2500	40.554
24	1200	0.0000	0.0031	0.4808	3.9806
25	1250	0.0708	0.0732	11.538	81.380
26	1300	0.0000	0.0031	0.4808	4.3123
27	1350	0.0321	0.0366	5.7692	43.945
28	1400	0.0100	0.0061	0.9615	9.2880
29	1450	0.0116	0.0153	2.4038	19.667
30	1500	0.0001	0.0031	0.4808	4.9757
31	1550	0.0177	0.0214	3.3654	29.433
32	1600	0.0000	0.0031	0.4808	5.3074
33	1650	0.0143	0.0153	2.4038	22.380
34	1700	0.0001	0.0031	0.4808	5.6391
35	1750	0.0086	0.0092	1.4423	14.242
36	1800	0.0007	0.0031	0.4808	5.9708
37	1850	0.0208	0.0214	3.3654	35.129
38	1900	0.0030	0.0031	0.4808	6.3025
39	1950	0.0148	0.0153	2.4038	26.449
40	2000	0.0054	0.0061	0.9615	13.269

3ph - System [Phase L3]

Urms =	231.1V	Freq =	49.984	Range:	50 A
Irms =	0.562A	Ipk =	1.538A	cf =	2.739
P =	78.54W	S =	129.8VA	pf =	0.605
THDi =	122 %	THDu =	0.20 %	Class A	

Order	Freq. [Hz]	Iavg [A]	Irms [A]	Imax [A]	Limit [A]
1	50	0.3475	0.3448	61.413	
2	100	0.0000	0.0031	0.5435	0.2826
3	150	0.0453	0.0488	8.6957	2.1230
4	200	0.0000	0.0031	0.5435	0.7097
5	250	0.2916	0.2899	51.630	25.431
6	300	0.0000	0.0031	0.5435	1.0173
7	350	0.2334	0.2319	41.304	30.121
8	400	0.0000	0.0031	0.5435	1.3269
9	450	0.0212	0.0214	3.8043	5.3406
10	500	0.0000	0.0031	0.5435	1.6586
11	550	0.1259	0.1282	22.826	38.841
12	600	0.0000	0.0031	0.5435	1.9903
13	650	0.0669	0.0702	12.500	33.424
14	700	0.0047	0.0092	1.6304	6.9660
15	750	0.0140	0.0153	2.7174	10.173
16	800	0.0000	0.0031	0.5435	2.6537
17	850	0.0300	0.0305	5.4348	23.058
18	900	0.0000	0.0031	0.5435	2.9854
19	950	0.0352	0.0336	5.9783	28.347
20	1000	0.0000	0.0031	0.5435	3.3171
21	1050	0.0260	0.0275	4.8913	25.635
22	1100	0.0000	0.0031	0.5435	3.6488
23	1150	0.0743	0.0763	13.587	77.989
24	1200	0.0000	0.0031	0.5435	3.9806
25	1250	0.0422	0.0427	7.6087	47.472
26	1300	0.0000	0.0031	0.5435	4.3123
27	1350	0.0185	0.0214	3.8043	25.635
28	1400	0.0082	0.0061	1.0870	9.2880
29	1450	0.0335	0.0397	7.0652	51.134
30	1500	0.0000	0.0031	0.5435	4.9757
31	1550	0.0085	0.0092	1.6304	12.614
32	1600	0.0000	0.0031	0.5435	5.3074
33	1650	0.0091	0.0092	1.6304	13.428
34	1700	0.0000	0.0031	0.5435	5.6391
35	1750	0.0179	0.0183	3.2609	28.483
36	1800	0.0000	0.0031	0.5435	5.9708
37	1850	0.0113	0.0092	1.6304	15.055
38	1900	0.0005	0.0031	0.5435	6.3025
39	1950	0.0117	0.0122	2.1739	21.159
40	2000	0.0008	0.0031	0.5435	6.6343

5.4 Voltage changes, voltage fluctuations and flicker

5.4.1 Photo documentation of the test set-up

5.4.2 Test method according to EN 61000-3-3

This test consists on the measurement of voltage changes, voltage fluctuations and flicker which may be produced by equipment having an input current ≤ 16 A per phase, and intended to be connected to public low-voltage distribution systems. The equipment is tested under specified conditions of operation.

5.4.3 Limits for low voltage AC mains port

The value of Pst shall be not greater than 1.0.
The value of Plt shall be not greater than 0.65.
The value of d(t) during a voltage change shall not exceed 3.3 % for more than 500 ms.
The relative steady-state voltage change, dc shall not exceed 3.3 %.
The maximum relative voltage change dmax shall not exceed:

a) 4 % without additional conditions
b) 6 % for equipment which is switched manually, or switched automatically more frequently than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds), or manual restart, after a power supply interruption
c) 7 % for equipment which is attended whilst in use (for example : hair dryers, vacuum cleaners, kitchen equipment such as mixers, garden equipment such as mowers, portable tools such as electric drills), or switched on automatically, or is intended to be switched on manually, no more than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds) or manual restart, after a power supply interruption.

5.4.4 Test result

Verdict:	☒ P ☐ F ☐ N
Frequency:	50 Hz
Kind of test site:	Laboratory
Remarks:	

5.4.5 Test protocol

Operation mode:	1	Verdict:	Pass
Configuration mode:	1		
Remarks:	Test Time 10 min LIN (Line Impedance Network) : L: 0.24 ohm +j0.15 ohm N: 0.16 ohm +j0.10 ohm		

3ph - System [Phase L1]

Urms =	231.1V	Freq =	50.000	Range:	50 A
Irms =	0.684A	Ipk =	1.978A	cf =	2.893
P =	101.9W	S =	158.0VA	pf =	0.645

Pst	dmax [%]	dc [%]	dt>Lim [ms]
0.072	0.000	0.050	0.000

3ph - System [Phase L2]

Urms =	231.5V	Freq =	50.000	Range:	50 A
Irms =	0.635A	Ipk =	1.953A	cf =	3.077
P =	93.26W	S =	146.9VA	pf =	0.635

Pst	dmax [%]	dc [%]	dt>Lim [ms]
0.072	0.000	0.080	0.000

3ph - System [Phase L3]

Urms =	230.9V	Freq =	50.000	Range:	50 A
Irms =	0.537A	Ipk =	1.514A	cf =	2.818
P =	77.31W	S =	124.0VA	pf =	0.623

Pst	dmax [%]	dc [%]	dt>Lim [ms]
0.072	0.000	0.080	0.000

5.4.6 Test equipment used

Description	Manufacturer	Model	Identifier
Mains analyzer	EMC Partner	Harmonics 1000 + HAR-EXT1000	016 + 103489

5.5 Immunity to Power-Frequency Magnetic Fields

5.5.1 Photo documentation of the test set-up

5.5.2 Test method according to EN 61000-4-8

This test is intended to demonstrate the immunity of equipment when subjected to power frequency magnetic fields. The test magnetic field is obtained by a current flowing in an induction coil; the application of the test field to the EUT is by the immersion method.

5.5.3 Test specification

Test frequency:	50 Hz		
Continuous field intensity:	30 A/m		
Duration (Continuous field):	60 s each Axis		
Axis:	x-axis	y-axis	z-axis

5.5.4 Test result

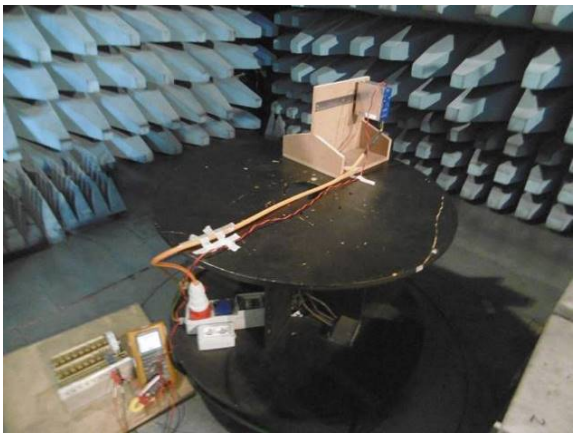
Verdict:	☒ P ☐ F ☐ N
Performance Criterion:	A
Operation mode:	1
Configuration mode:	1
Kind of test site:	Helmholtz coils
Remarks: the performance criterion achieved during test was A, nothing happened during test.	

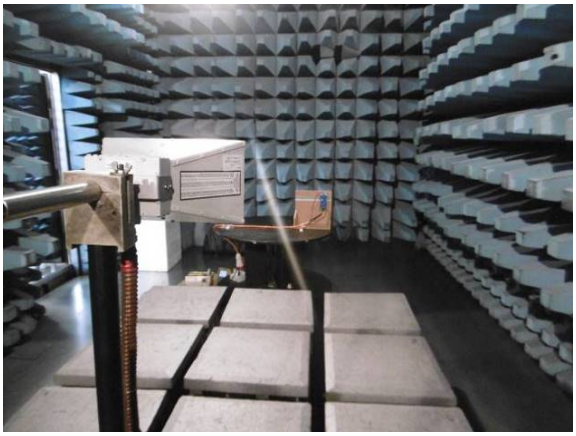
5.5.5 Test equipment used

Description	Manufacturer	Model	Identifier
Transformer 240/24 V 2.5 kVA	Eletras	220/24	2.459
Helmholtz induction coil antenna	G.I.E.	IEC 1000-4-8	111962
Field strength meter Vac	Holaday	HI-3604	86265
Induction coil antenna	Nemko	50 TURNS	--
Variac	RS	WCV 8E-1	3/122017

5.6 Immunity to radio frequency electromagnetic fields

5.6.1 Photo documentation of the test set-up





5.6.2 Test method according to EN 61000-4-3

The test allows estimating of the radiated immunity of electrical and electronic equipment to electromagnetic disturbances coming from intended radio-frequency (RF) transmitters in the frequency range 80 MHz to 6000 MHz. The interference is applied on the enclosure of the equipment by using transmitting antennas. Measurements are made in a fully anechoic chamber and the indicated field strength is pre-calibrated prior to placement of the system under test.

5.6.3 Test specification

Frequency range:	80 to 1 000 MHz		1400 to 6000 MHz	
Field strength:	10 V/m		3 V/m	
EuT - antenna separation:	2.5 m ± 0.3 m			
Modulation:	AM with 80 % in depth and 1 kHz sine wave			
Frequency step:	1 % with 3 s dwell time			
Antenna polarisation:	horizontal		vertical	
Antenna position:	front	rear	left	Right

5.6.4 Test result

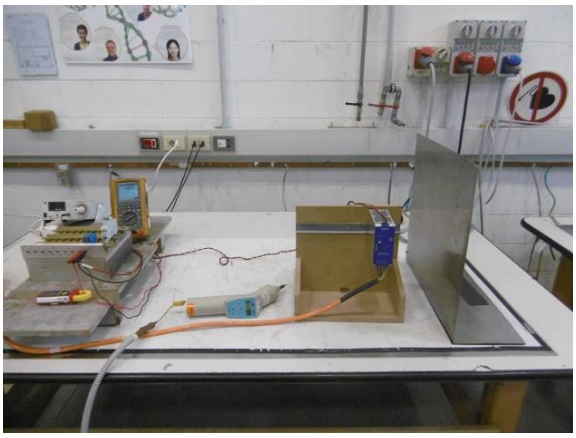
Verdict:	☒ P ☐ F ☐ N
Performance Criterion:	A
Operation mode:	1
Configuration mode:	1
Kind of test site:	Anechoic chamber
Remarks: the performance criterion achieved during test was A, nothing happened during test.	

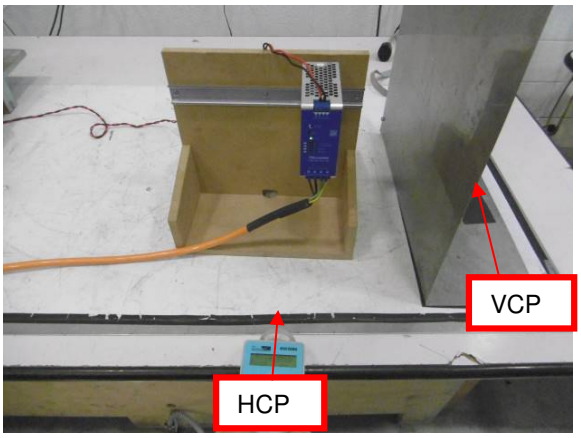
5.6.5 Test equipment used

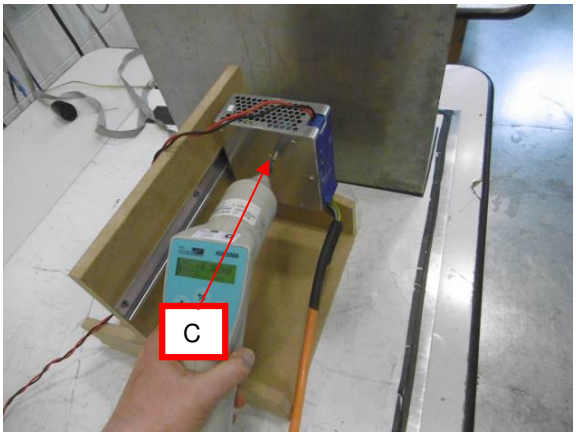
Description	Manufacturer	Model	Identifier
Biconilog antenna (20 ÷ 6000 MHz)	ETS Lindgren	3142E	00213197
Broad-Band Horn Antenna	Schwarzbeck Mess-Elektronik	BBHA9120D	01874
RF generator (8 kHz ÷ 67 GHz)	R&S	SMA100B	104075
Broadband amplifier (80 ÷ 1000 MHz)	R&S	BBA100	101163
Broadband amplifier	R&S	BBA150	102626
Power sensor	R&S	NRP18AN	100987
Semi-anechoic chamber	Nemko	3m semi-anechoic chamber	70
Shielded room	Siemens	3m control room	3

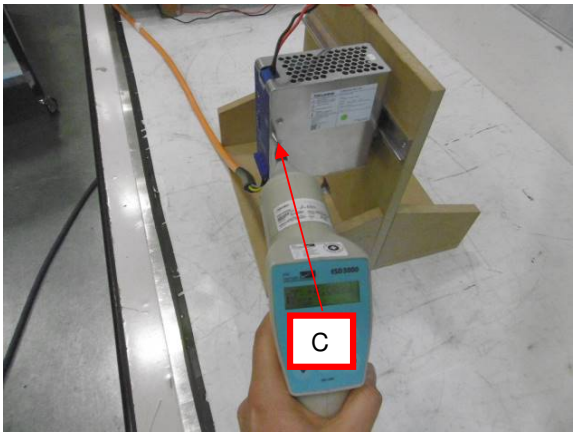
5.7 Immunity to electrostatic discharges

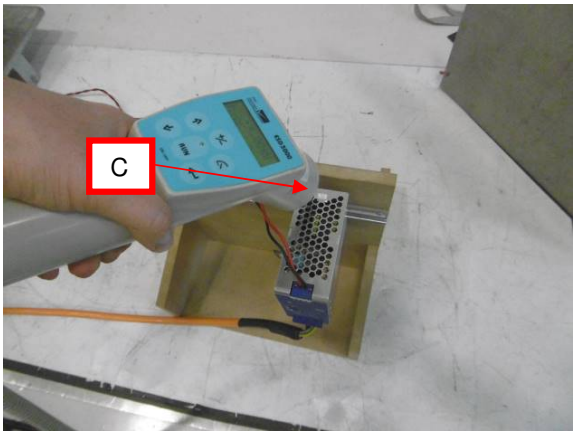
5.7.1 Photo documentation of the test set-up

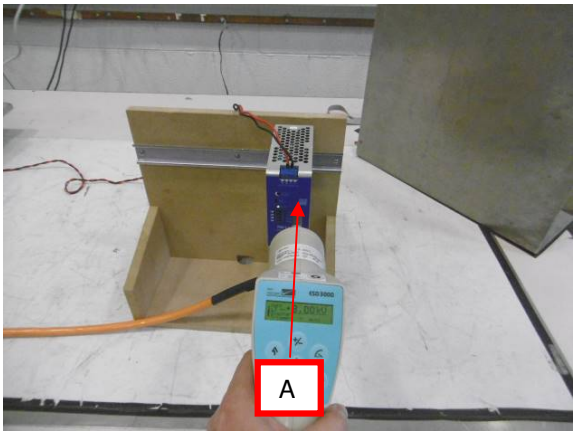












C = Contact Discharge / A = Air Discharge

5.7.2 Test method according to EN 61000-4-2

The test is intended to demonstrate the immunity of equipment subjected to static electricity discharges from operators directly and to adjacent objects. The table-top equipment under test is placed on a wooden table, 0.8 m high, standing on the ground reference plane. A horizontal coupling plane (HCP) is placed on the table. The EUT and the cables are isolated from the coupling plane by an insulating support 0.5 mm thick. The floor standing equipment is isolated from the ground reference plane by an insulating support about 0.1 m thick. The vertical coupling plane (VCP) of dimensions 0.5 m x 0.5 m is placed parallel to, and positioned at a distance of 0.1 m from, the EUT. Air discharges are applied to non-metallic parts of the system. Contact discharges are applied to all accessible metallic parts. Discharges are also applied to the Horizontal and Vertical Coupling Planes.

5.7.3 Test specification

Contact discharge voltage:	4 kV	
Air discharge voltage:	8 kV	
Discharge impedance:	330 Ω / 150 pF	
Time between successive discharges:	≥ 1 s	
Number of discharges:	≥ 10	
Type of direct discharge:	air discharge	contact discharge
Type of indirect discharge:	contact discharge	
Polarity:	positive	negative

5.7.4 Test result

Discharge location	Type of discharge
Horizontal coupling plane (HCP)	Contact
Vertical coupling plane (VCP)	Contact
Metallic parts of the enclosure	Contact

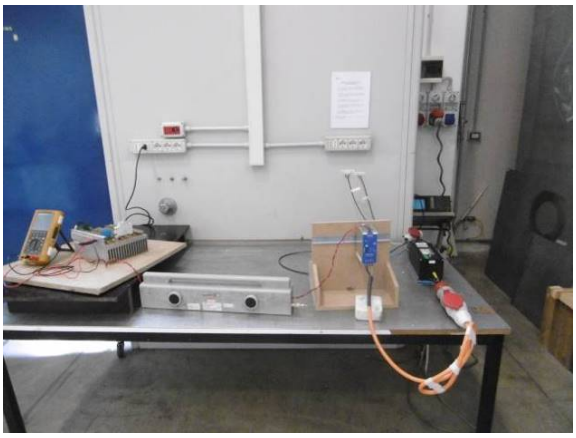
Verdict:	☒ P ☐ F ☐ N
Performance Criterion:	B
Operation mode:	1
Configuration mode:	1
Kind of test site:	Laboratory
Remarks: the performance criterion achieved during test was A, nothing happened during test.	

5.7.5 Test equipment used

Description	Manufacturer	Model	Identifier
ESD Test system	EMC Partner	ESD3000	252

5.8 Immunity to injected currents up to 80 MHz

5.8.1 Photo documentation of the test set-up



5.8.2 Test method according to EN 61000-4-6

The test allows estimating of the conducted immunity of electrical and electronic equipment to electromagnetic disturbances coming from intended radio-frequency (RF) transmitters in the frequency range 150 kHz to 80 MHz. The interference is applied on mains supply, signal line and earth connection ports by using coupling decoupling networks or a clamp. Measurements are made on a ground plane. The EUT was located 10cm above the reference ground plane and any associated I/O cables attached to the EUT are located between 30mm and 50mm above the ground plane. The indicated field is pre-calibrated prior to placement of the system under test.

5.8.3 Test specification

Frequency range:	0.15 MHz to 80 MHz
Test voltage:	10 V
Modulation:	AM with 80 % in depth and 1 kHz sine wave
Frequency step:	1 % with 3 s dwell time

5.8.4 Test result

Coupling point	Coupling and decoupling devices	Verdict
AC mains	M4	P
DC power ports	M2	N
Signal	Clamp	N

Verdict:	☒ P ☐ F ☐ N
Performance Criterion:	A
Operation mode:	1
Configuration mode:	1
Kind of test site:	Laboratory
Remarks: the performance criterion achieved during test was A, nothing happened during test.	

5.8.5 Test equipment used

Description	Manufacturer	Model	Identifier
Attenuator 6dB	EM Test	ATT6/75	0206-18
Coupling/decoupling network	EM Test	CDN M4 PE 32A	P1428136828
Shielded room	Siemens	Conducted immunity test room	68
Test system for conducted and radiated immunty	Teseq + Ametek	NSG4070C-80	540126

5.9 Immunity to fast transients/bursts

5.9.1 Photo documentation of the test set-up

5.9.2 Test method according to EN 61000-4-4

The test is intended to demonstrate the immunity of equipment subjected to types of transient disturbances such as those originating from switching transients (interruption of inductive loads, relay contact bounce….). The bursts are applied on the mains supply port by using a coupling decoupling network and on signal and control lines ports by using a capacitive clamp. Measurements are made on a ground plane.

5.9.3 Test specification

Voltage level for I/O AC power ports:	2 kV	
Voltage level for I/O DC power ports:	2 kV	
Voltage level for signal ports:	1 kV	
Burst frequency:	5.0 kHz	
Coupling duration:	≥ 60 s	
Polarity:	positive	negative

5.9.4 Test result

Coupling point	Level	Coupling devices	Verdict
AC mains	4 kV[1]	Network	P
DC power port	2 kV	Network	P
Signal	2 kV[1]	Clamp	P

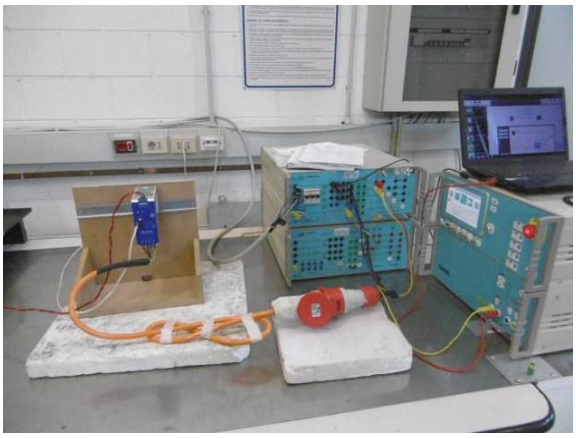
Verdict:	☒ P ☐ F ☐ N
Performance Criterion:	B
Operation mode:	1
Configuration mode:	1
Kind of test site:	Laboratory
Remarks: [1] levels requested by the applicant the performance criterion achieved during test was A, nothing happened during test.	

5.9.5 Test equipment used

Description	Manufacturer	Model	Identifier
Coupling clamp	EMC partner	CDN	CNEFT1000-120
Coupling/Decoupling network	EMC partner	CDN2000-06-32	1537
Pulse generator	EMC partner	IMU3000	F5-S-D-V-1505

5.10 Immunity to surges

5.10.1 Photo documentation of the test set-up



5.10.2 Test method according to EN 61000-4-5

The test allows estimating of the conducted immunity of electrical and electronic equipment to unidirectional surges caused by over voltages from switching and lighting transients. The interference is applied on symmetrical and unsymmetrical modes on mains supply port by using coupling decoupling network. Five positive surges and five negative surges are applied at each of phases of the a.c. waveform: 0°, 90°, 180° and 270°. Each surge was applied 60 seconds after the previous surge. Signal and Telecommunications ports were subject to five positive and five negative surges applied through the appropriate Coupling/Decoupling Network (CDN).

5.10.3 Test specification for AC power ports

Pulse amplitude for line to line surge:	1 kV with a source impedance of 2 Ω + 18 µF			
Pulse amplitude for line to earth surge:	2 kV with a source impedance of 12 Ω + 9 µF			
Number of surges:	5 Surges/Phase angle			
Phase angle:	0°	90°	180°	270°
Repetition rate:	60 s			
Rise time:	1.2 µs			
Time to half value:	50 µs			
Polarity:	positive		negative	

5.10.4 Test specification for DC power ports

Pulse amplitude for line to line surge:	0.5 kV with a source impedance of 2 Ω + 18 µF	
Pulse amplitude for line to earth surge:	0.5 kV with a source impedance of 12 Ω + 9 µF	
Number of surges:	5 Surges/Polarity	
Repetition rate:	60 s	
Rise time:	1.2 µs	
Time to half value:	50 µs	
Polarity:	positive	negative

5.10.5 Test specification for signal ports

Pulse amplitude for line to earth surge:	1 kV with a source impedance of 42 Ω + 0.5 µF	
Pulse amplitude for shield to earth surge:	1 kV (direct on the shield)	
Number of surges:	5 Surges/Polarity	
Repetition rate:	60 s	
Rise time:	1.2 µs	
Time to half value:	50 µs	
Polarity:	positive	negative

5.10.6 Test result

Coupling point	Level	Coupling network	Verdict
AC mains – line to line	2 kV[1]	2 Ω + 18 µF	P
AC mains – line to earth	4 kV[1]	12 Ω + 9 µF	P
DC power port – line to line	0.5 kV	2 Ω + 18 µF	P
DC power port – line to earth	1 kV[1]	12 Ω + 9 µF	P
Signal ports	1 kV	42 Ω + 0.5 µF	N
Signal ports	1 kV	direct	N

Verdict:	☒ P ☐ F ☐ N
Performance Criterion:	B
Operation mode:	1
Configuration mode:	1
Kind of test site:	Laboratory
Remarks: [1] levels requested by the applicant The performance criterion achieved during test was A, nothing happened during test.	

5.10.7 Test equipment used

Description	Manufacturer	Model	Identifier
Coupling/Decoupling network	EMC partner	CDN2000-06-32	1537
Pulse generator	EMC partner	IMU3000	F5-S-D-V-1505

5.11 Immunity to voltage dips and interruptions

5.11.1 Photo documentation of the test set-up

5.11.2 Test method according to EN 61000-4-11 - EN 61000-4-34

The test allows estimating of the conducted immunity of electrical and electronic equipment connected to low-voltage power supply networks for voltage dips and short interruptions. Testing is performed with the product connected directly to a generator capable of simulating the voltage drops and interrupts as described.

5.11.3 Test specification

Nominal Mains Voltage	400 Vac
Rated frequency	50 Hz
Number of voltage dips and interruptions	3
Sync Angle	0°

5.11.4 Test result

	Level of reduction	Residual voltage	Duration	Performance criterion	Verdict
1	100%	0%	1 cycle	B[1]	P
2	60%	40%	200 ms	C[1]	P
3	30%	70%	500 ms	C[1]	P
4	100%	0%	5 s	C[2]	P

Verdict:	☒ P ☐ F ☐ N
Operation mode:	1
Configuration mode:	1
Kind of test site:	Laboratory
Remarks: [1] The performance criterion achieved during test was A, nothing happened during test. [2] During the test, the EUT stop with self-recovering of the normal working after the test.	

5.11.5 Test equipment used

Description	Manufacturer	Model	Identifier
Coupling/Decoupling network	EMC partner	CDN2000-06-32	1537
Pulse generator	EMC partner	IMU3000	F5-S-D-V-1505

6 EUT PHOTOS


OUTPUT 48VDC/5A
OUTPUT
45-56V
DC OK
DC OK
24V/1A
INHIBIT +
INHIBIT –
TDK·Lambda
DRB240-48-3-A0


TDK·Lambda
DRB240-48-3-A0

End of report