

Test report

Number T251-0098/24

Project file: C20232021

Date: 2024-03-18

Pages: 35

Product: Redundancy Module

Type reference: TIB-REM480

Ratings: Input 1: 11 – 56 V d.c.; 20 A
Input 2: 11 – 56 V d.c.; 20 A
Output: 11 – 56 V d.c.; 40 A

Trademark:  **TRACO POWER**

Applicant: Traco Power Solutions Ltd.
Whitemil Industrial Estate Wexford, Whitemill Road, Y35 YH66,
Wexford, Ireland

Manufacturer: Traco Power Solutions Ltd.
Whitemil Industrial Estate Wexford, Whitemill Road, Y35 YH66, Wexford,
Ireland

Place of manufacture: Information not provided by the applicant.

Summary of testing

Testing method: EN IEC 61000-6-2:2019

Testing location: SIQ Ljubljana
Mašera-Spasičeva ulica 10, SI-1000 Ljubljana, Slovenia

Remarks: Date of receipt of test items: 2023-10-06
Number of items tested: 1
Date of performance of tests: 2023-10-13 – 2024-01-09
The test results presented in this report relate only to the items tested.
The test items were tested in the condition as received.
The product complies with the requirements of the testing methods.

Tested by: Mitja Rozman

Approved by: Marjan Mak

The report shall not be reproduced except in full.

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1. General

Abbreviations and markings:

AC mains power port	Port used to connect to the mains supply network
DC network power port	Port, not powered by a dedicated AC/DC power converter and not supporting communication, that connects to a DC supply network
Signal/control port	Port intended for the interconnection of components of an EUT, or between an EUT and local AE and used in accordance with relevant functional specifications
Port	Physical interface through which electromagnetic energy enters or leaves the EUT
Wired network port	Point of connection for voice, data and signalling transfers intended to interconnect widely dispersed systems by direct connection to a single-user or multi-user communication network (for example CATV, PSTN, ISDN, xDSL, LAN and similar networks).
AE associated equipment	Equipment needed to exercise and/or monitor the operation of the EUT
EUT	Equipment Under Test
Highest internal frequency (F_x)	Highest fundamental frequency generated or used within the EUT or highest frequency at which it operates
ESD	Electrostatic Discharge
CDN	Coupling and Decoupling Network
RF	Radio Frequency

Possible test case verdicts:

Test does not apply to the tested sample:	N/A
Tested sample passed the requirements:	P (Pass)
Tested sample failed the requirements:	F (Fail)
Test was not performed:	N/P (Not performed)

Throughout this report a comma is used as the decimal separator. Numerical data taken from IEC standards are using a comma as the decimal separator.

History sheet:

Date:	Report No.:	Change:	Revision:
2024-03-18	T251-0098/24	Initial Test Report issued.	--

2. Measurement uncertainty

The following measurement uncertainty levels have been calculated according to the SIQ internal document EN208, as specified in CISPR 16-4-2 and EN 55016-4-2. The uncertainties represent an expanded uncertainty expressed at 95% confidence level using a coverage factor $k=2$.

The following measurement uncertainty has been included in test results as specified in each of the basic referenced standards as applicable.

Immunity:

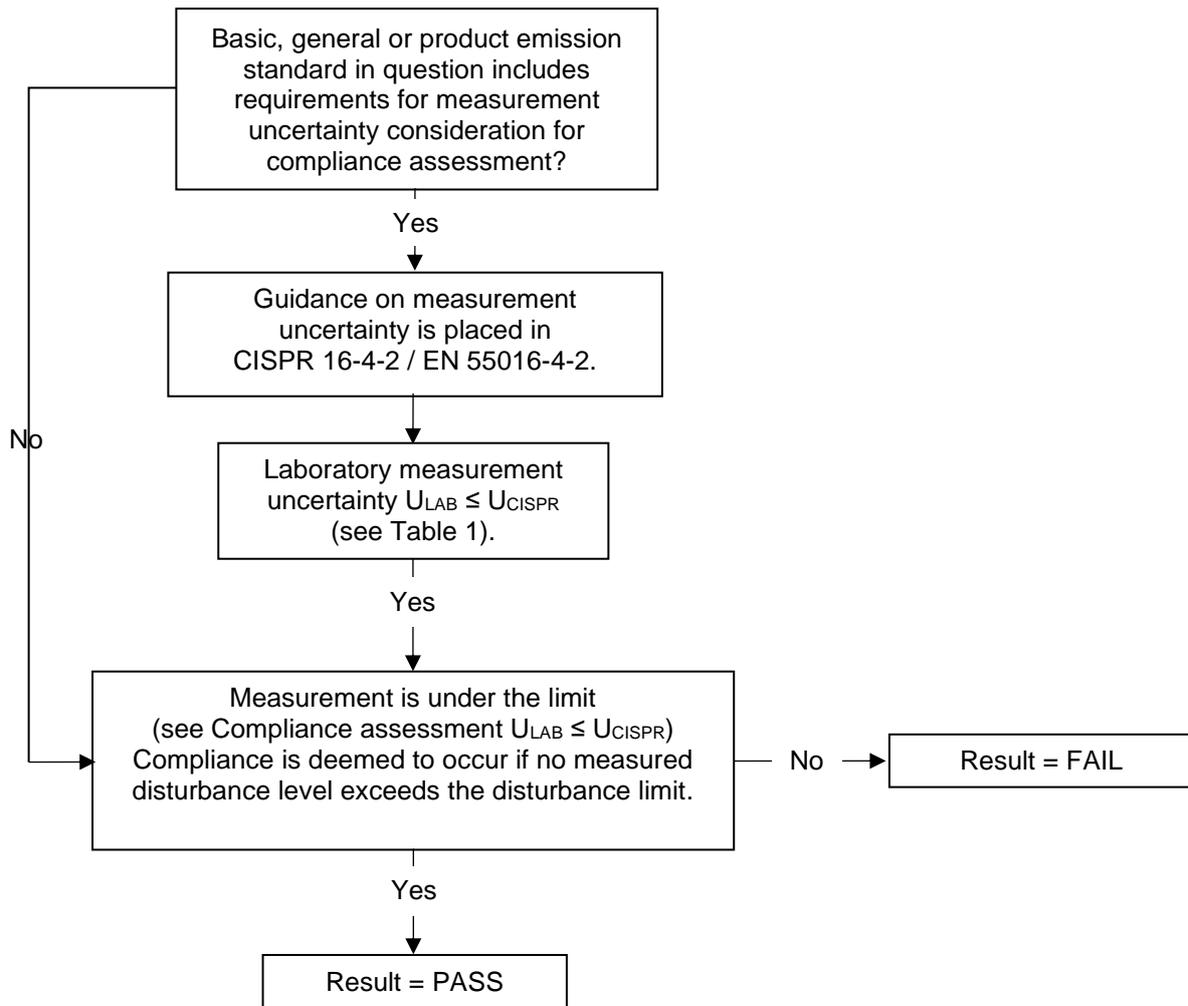
Measurement / test method	Parameter values
Electrostatic discharge immunity measurement	All required parameters comply with requirements of standard.
Radiated, RF electromagnetic field immunity measurement	2,2 dB
Electrical fast transients/burst immunity measurement	All required parameters comply with requirements of standard.
Surge immunity measurement	All required parameters comply with requirements of standard.
Conducted disturbances, induced by RF fields immunity measurement	3,2 dB
Power frequency magnetic field immunity measurement	All required parameters comply with requirements of standard.
Voltage dips, short interruptions, and voltage variations immunity measurement	All required parameters comply with requirements of standard.

3. Decision rule

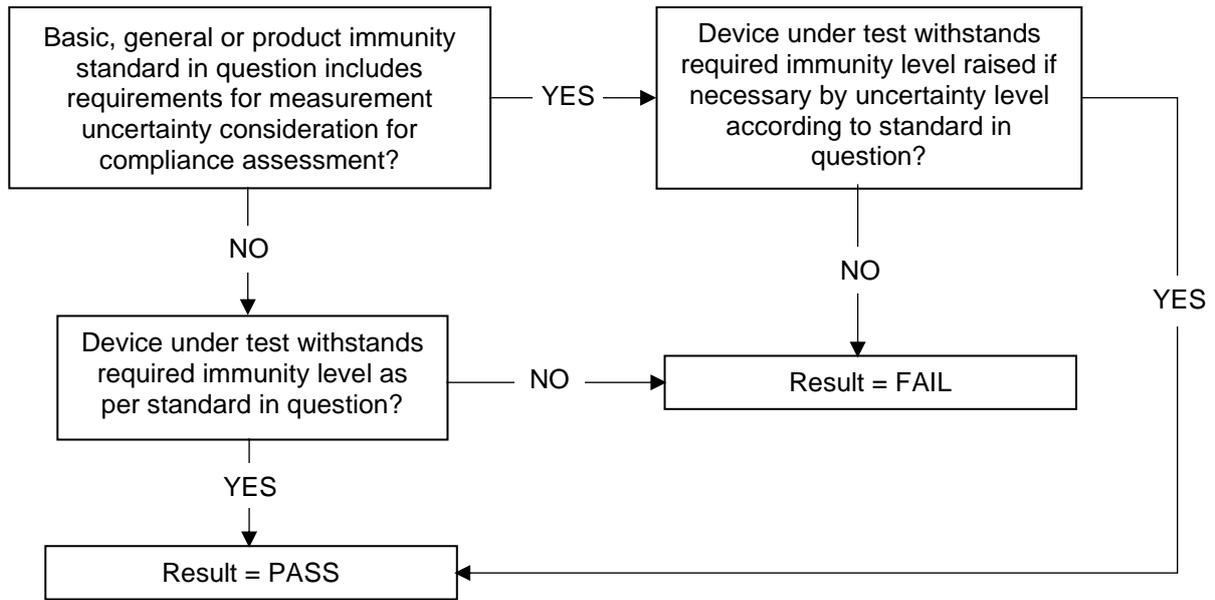
Application of decision rule and statement of conformity is defined in document TN023 Decision rule and measurement uncertainty.

As a general rule Pass/Fail decisions are based on simple acceptance rule and acceptance limits chosen based on simple acceptance ($w = 0$, $AL = TL$) except if a decision rule is governed by particular standard or guidance document.

Decision rule applicable for emission:



Decision rule applicable for immunity:



4. Product specific data

General description of test item:

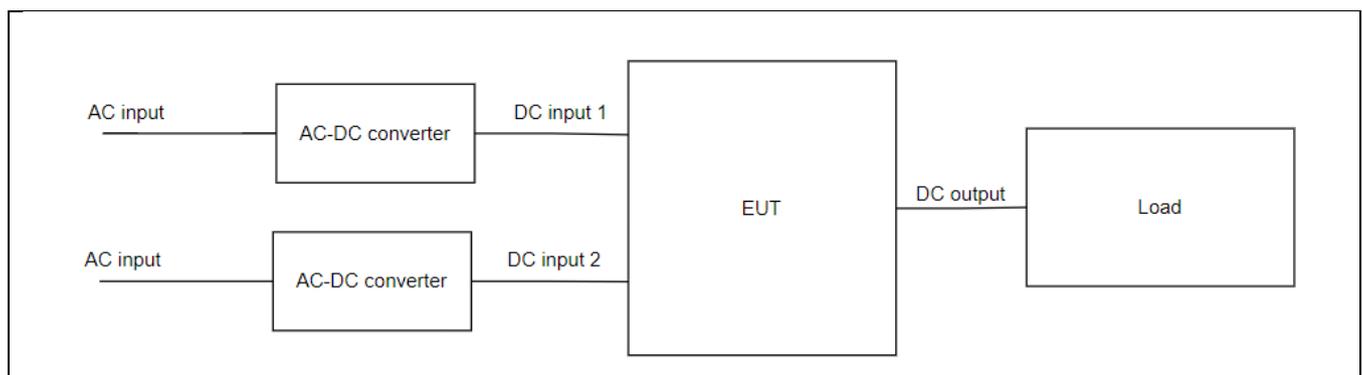
Product key: TIB-REM480

Power supply type:	DC supply (supplied from AC-DC converter)	
Firmware/software version:	N/A	
Mounting position:	<input checked="" type="checkbox"/>	Table-top equipment:
	<input type="checkbox"/>	Floor-standing equipment:
	<input type="checkbox"/>	Wall/ceiling mounted equipment:
	<input type="checkbox"/>	Hand-held equipment:
	<input checked="" type="checkbox"/>	Other: Din-Rail mounted
Highest Internal Operating Frequencies:	Name:	Frequency:
	/	/

Port(s):

Port No.	Name	Type	Cable Length / m	Cable Shielded
0	Enclosure	N/E	/	/
1	DC input 1	DC	/	NO
2	DC input 2	DC	/	NO
3	DC output	DC	<30	NO
Note:	AC = AC mains power port DC = DC network power port / input d.c. power port I/O = Signal/control port WNP = wired network port GND = grounding N/E = Non-Electrical			

Configuration diagram:



Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.



NOTE: The information in this section has been provided by the applicant.

5. Equipment under test (EUT)

Product Type	Device	Manufacturer	Model No.	Comments
EUT	Redundancy module	Traco Power	TIB-REM480	/
AE	Power supply	Traco Power	TIB240-148	2 units
Note: EUT = Equipment Under Test AE = Associated Equipment				

Pictures of EUT:







Pictures of associated equipment:

Operating conditions:

Clause	Test	Connection type	Operating conditions
9.1	Electrostatic discharge immunity measurement	DC	Input 1: 56 Vdc Input 2: 56 Vdc
9.2	Radiated, RF electromagnetic field immunity measurement	DC	Input 1: 56 Vdc Input 2: 56 Vdc
9.3	Electrical fast transients/burst immunity measurement	DC	Input 1: 56 Vdc Input 2: 56 Vdc
9.4	Surge immunity measurement	DC	Input 1: 56 Vdc Input 2: 56 Vdc
9.5	Conducted disturbances, induced by RF fields immunity measurement	DC	Input 1: 56 Vdc Input 2: 56 Vdc
9.6	Power frequency magnetic field immunity measurement	DC	Input 1: 56 Vdc Input 2: 56 Vdc
9.7	Voltage dips, short interruptions, and voltage variations immunity measurement	DC	N/A

Operating modes:

No.	Operating mode
1	Output: 56 Vdc; 10 A

Tested sample:

Sample number	Used for measurement
S202307986	All tests

6. Environmental conditions

The climatic conditions during the tests were within the following limits:

Ambient temperature: 15 °C to 35 °C

Relative humidity Electrostatic Discharges (ESD): 30 % to 60 %

Relative humidity all other testing except Electrostatic Discharges (ESD): 15 % to 75 %

Atmospheric pressure: 860 mbar to 1060 mbar

7. Verdict summary section

STANDARDS (details on first page)	PERFORMED ¹⁾	CONCLUSION ¹⁾
EN IEC 61000-6-2:2019 Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments	YES	P
¹⁾ See details in table(s) below		

Test (immunity)	Referenced standard	Required criteria	Achieved criteria	Conclusion
Electrostatic discharge immunity measurement	EN 61000-4-2:2009	B	A	P
Radiated, RF electromagnetic field immunity measurement	EN 61000-4-3:2006 + A1:2008 + A2:2010	A	A	P
Electrical fast transients/burst immunity measurement	EN 61000-4-4:2012	B	A	P
Surge immunity measurement	EN 61000-4-5:2014	B	A	P
Conducted disturbances, induced by RF fields immunity measurement	EN 61000-4-6:2014	A	A	P
Power frequency magnetic field immunity measurement	EN 61000-4-8:2010	A	A	P
Voltage dips, short interruptions, and voltage variations immunity measurement	EN 61000-4-11:2004	/	/	N/A
NOTE: for detailed description of achieved criteria refer to each test separately				

NOTE: no non-standard test method used

8. Performance/observation criteria

Criteria A: Output voltage shall remain inside of $\pm 5\%$ of initial voltage

Criteria B: Output voltage can deviate during the test. However after the test, output voltage shall return to initial value without user intervention.

Criteria C: Output voltage can deviate during the test. However after the test, output voltage shall return to initial value. User intervention is allowed.

Test	Observed function
Electrostatic discharge immunity measurement ^{NOTE}	Output voltage
Radiated, RF electromagnetic field immunity measurement ^{NOTE}	
Electrical fast transients/burst immunity measurement ^{NOTE}	
Surge immunity measurement ^{NOTE}	
Conducted disturbances, induced by RF fields immunity measurement ^{NOTE}	
Power frequency magnetic field immunity measurement ^{NOTE}	
NOTE: see section 7, referenced standards	

9. Immunity

9.1 Electrostatic discharge immunity measurement

9.1.1 Test specifications

Referenced Standard:	See clause 7.
Discharge Impedance:	330 Ω / 150 pF
Discharge Voltage:	Air Discharges – 8 kV (Direct) Contact Discharge- 4 kV (Indirect, Direct)
Polarity:	Positive / Negative
Number of Discharges:	Minimum 20 discharges (10 positive and 10 negative polarity)
Discharge Mode:	Single Discharge
Discharge Period:	1-second minimum

9.1.2 Test procedure

The discharges shall be applied in two ways:

- Contact discharges to the conductive surfaces and coupling planes:
The EUT shall be exposed to at least 20 discharges, 10 each at negative and positive polarity on each accessible metal part. If no direct contact points are available, then at least 20 indirect discharges shall be applied in the indirect mode. Test shall be performed at a maximum repetition rate of one discharge per second.
- Air discharges at slots and apertures and insulating surfaces:
On those parts of the EUT where it is not possible to perform contact discharge testing, the equipment should be investigated to identify user accessible points where breakdown may occur. Such points are tested using the air discharge method. This investigation should be restricted to those area normally handled by the user.

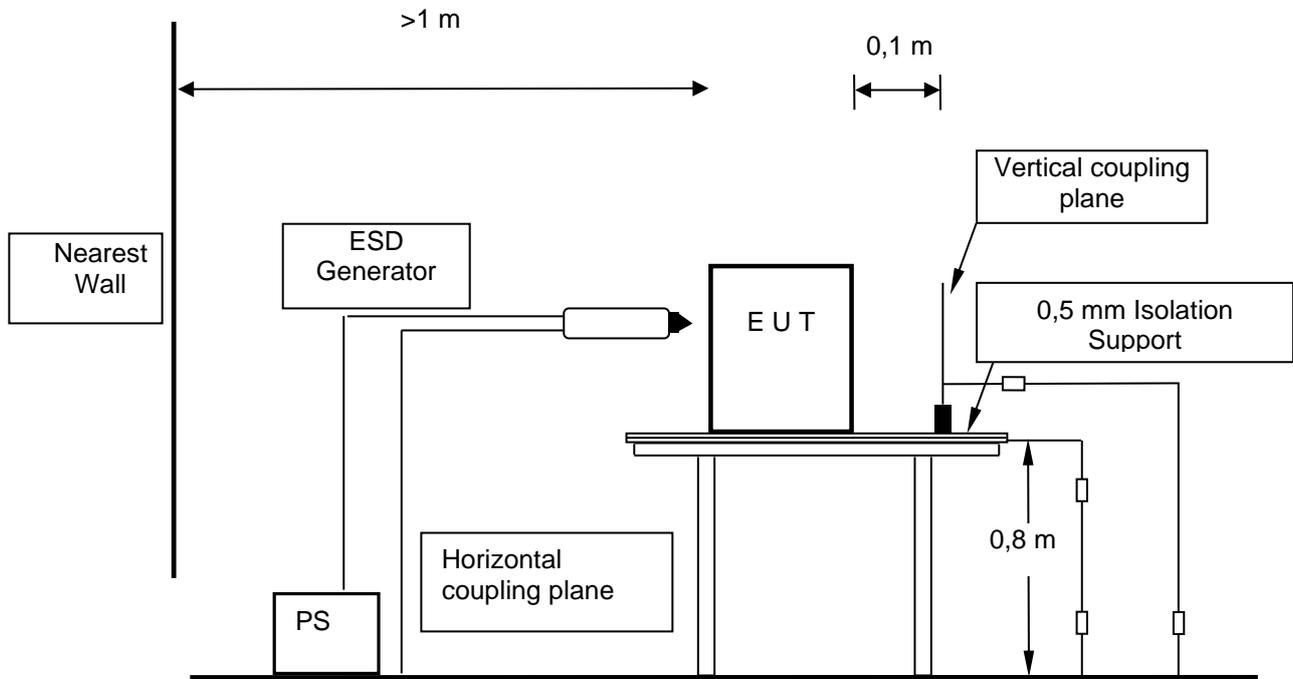
For air discharge testing, the test starts with 2 kV and continues with value multiplied by 2 up to and including the specified test level.

The test procedure is in accordance with referenced standard:

- Electrostatic discharges are applied only to those points and surfaces of the EUT that are accessible to users during normal operation.
- The test is performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.
- The time interval between two successive single discharges is at least 1 second.
- The ESD generator is held perpendicularly to the surface to which the discharge is applied, and the return cable is at least 0,2 meters from the EUT.
- Contact discharges are applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
- Air discharges are applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator is removed from the EUT and re-triggered for a new single discharge. The test is repeated until all discharges are complete.
- At least ten single discharges (in the most sensitive polarity) are applied to the Horizontal Coupling Plane at points on each side of the EUT. The ESD generator is positioned vertically at 0,1 meters from the EUT with the discharge electrode touching the Horizontal Coupling Plane.

- At least ten single discharges (in the most sensitive polarity) were applied to the centre of one vertical edge of the Vertical Coupling Plane in sufficiently different positions that the four faces of the EUT were completely illuminated. The Vertical Coupling Plane (dimensions 0,5 m x 0,5 m) was placed vertically to and 0,1 meters from the EUT.

9.1.3 Test setup



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

The **GRP** is of a sheet of aluminium at least 0,25 mm thick, and it projects beyond the EUT by at least 0,5 meters and is connected to the protective grounding system. A **Horizontal Coupling Plane** (1,6 m x 0,8 m) is placed on the table and attached to the **GRP** by means of a cable with 940 kΩ total impedance. The equipment under test, is installed in a representative system as described in referenced standard on an insulating support 0,1 (floor equipment) or 0,8 (table-top equipment) meters in height, and its cables are placed on the **HCP** and isolated by an insulating support of 0,5 mm thickness. A distance of 0,8-meter minimum is provided between the EUT and the walls of the laboratory and any other metallic structure.

9.1.4 Test results

Operating mode(s):	1
---------------------------	---

Discharge Level (kV)	Polarity	Test Point	Contact Discharge	Air Discharge	Required criteria	Achieved criteria
2	+ / -			X	B	A
4	+ / -			X	B	A
8	+ / -			X	B	A
4	+ / -		X		B	A

Changes in operation observed during testing:

No changes observed.

No changes observed.

Legend:

- contact discharge points (including HCP and VCP)
- air discharge points



Figure 1: Electrostatic discharge immunity measurement

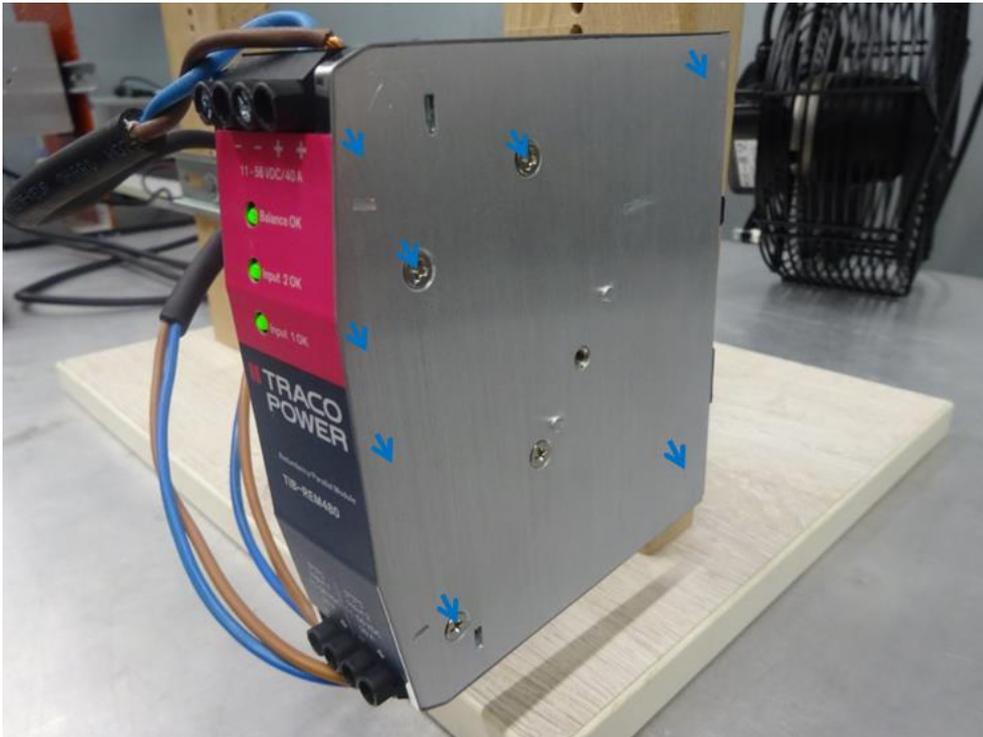


Figure 2: Electrostatic discharge immunity measurement

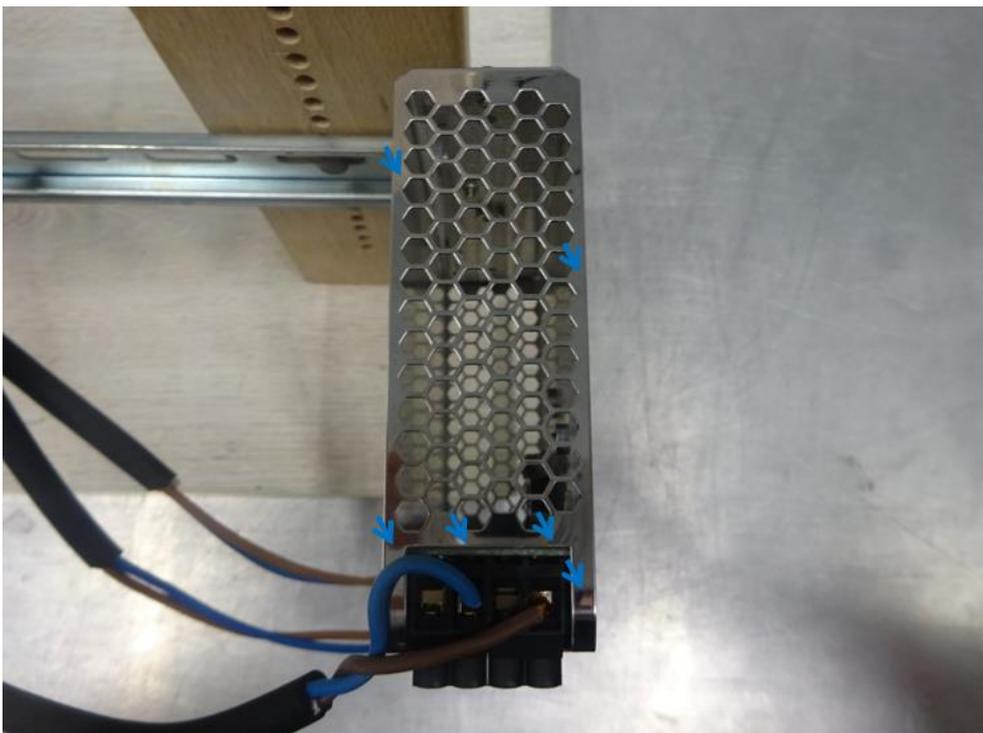


Figure 3: Electrostatic discharge immunity measurement



Figure 4: Electrostatic discharge immunity measurement

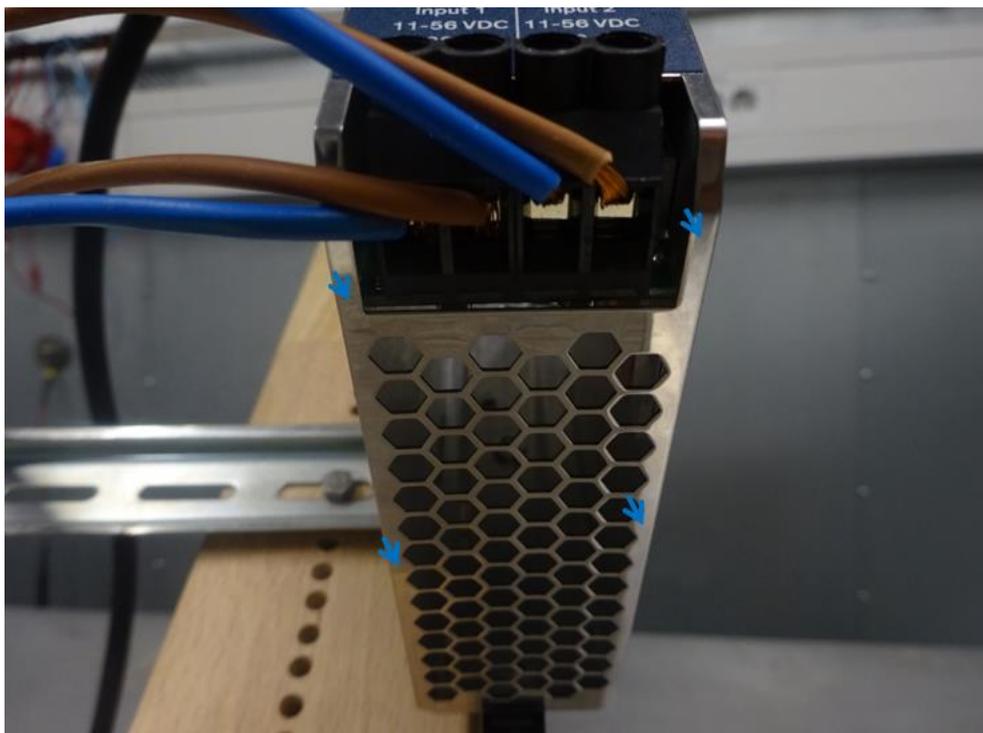


Figure 5: Electrostatic discharge immunity measurement



Figure 6: Electrostatic discharge immunity measurement

9.2 Radiated, RF electromagnetic field immunity measurement

9.2.1 Test specification

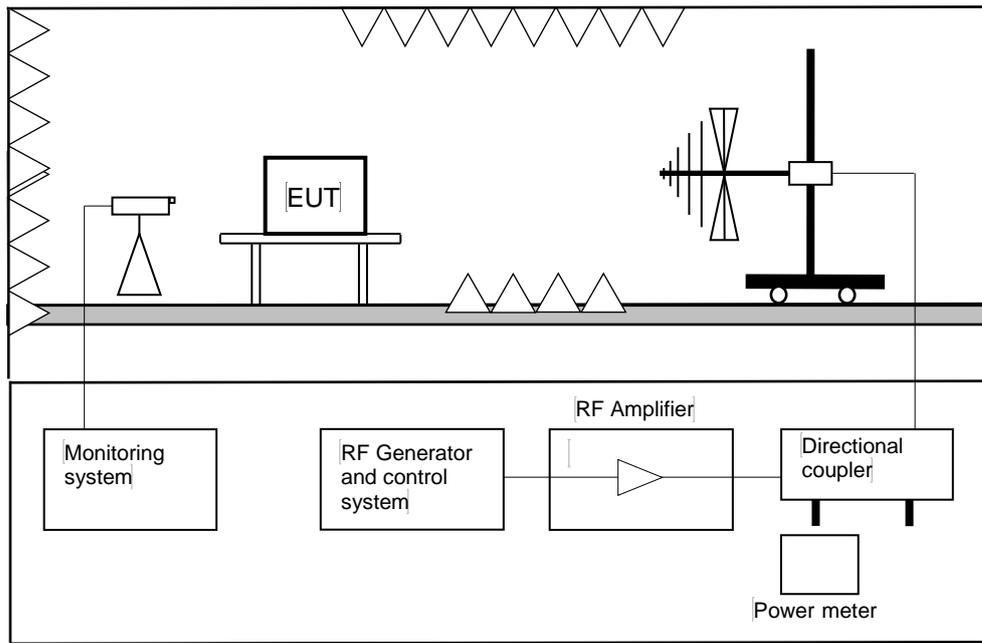
Referenced Standard:	See clause 7.
Frequency Range:	80 – 1000 MHz
Field Strength:	10 V/m
Frequency Range:	1400 – 6000 MHz
Field Strength:	3 V/m
Modulation:	1 kHz Sine Wave, 80 %, AM Modulation
Frequency Step:	1 % of fundamental
Polarity of Antenna:	Horizontal and Vertical
Illumination sides:	Front, Rear, Left and Right side
Test Distance:	80 MHz – 3 GHz: 2,2 m 3 GHz – 6 GHz: 2,5 m
Antenna Height:	80 MHz – 3 GHz: 1,75 m 3 GHz – 6 GHz: 1,55 m

9.2.2 Test procedure

The test procedure was in accordance with referenced standard.

- The testing is performed in an anechoic chamber. The transmit antenna is located at 2,2 and 2,5 meters from the EUT.
- The frequency range is swept from 80 MHz to 6000 MHz with the signal 80 % amplitude modulated with 1 kHz sine wave. The rate of sweep does not exceed $1,5 \times 10^{-3}$ decade/s. Where the frequency range is swept incrementally, the step size is 1% of fundamental.
- The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
- The field strength level is 10 and 3 V/m.
- The test is performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

9.2.3 Test setup



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

The EUT shall be installed in a representative system as described in referenced standard on an insulating support 0,1 (floor equipment) or 0,8 (table-top equipment) meters in height. The system under test is connected to the power and signal wire according to relevant installation instructions.

9.2.4 Test results

Operating mode(s):		1			
Frequency	Level	Dwell time	Illuminated side	Required criteria	Achieved criteria
80 MHz – 1000 MHz	10 V/m	1 s	Front	A	A
			Rear	A	A
			Left	A	A
			Right	A	A
1400 – 6000 MHz	3 V/m	1 s	Front	A	A
			Rear	A	A
			Left	A	A
			Right	A	A
Changes in operation observed during testing: No changes observed.					

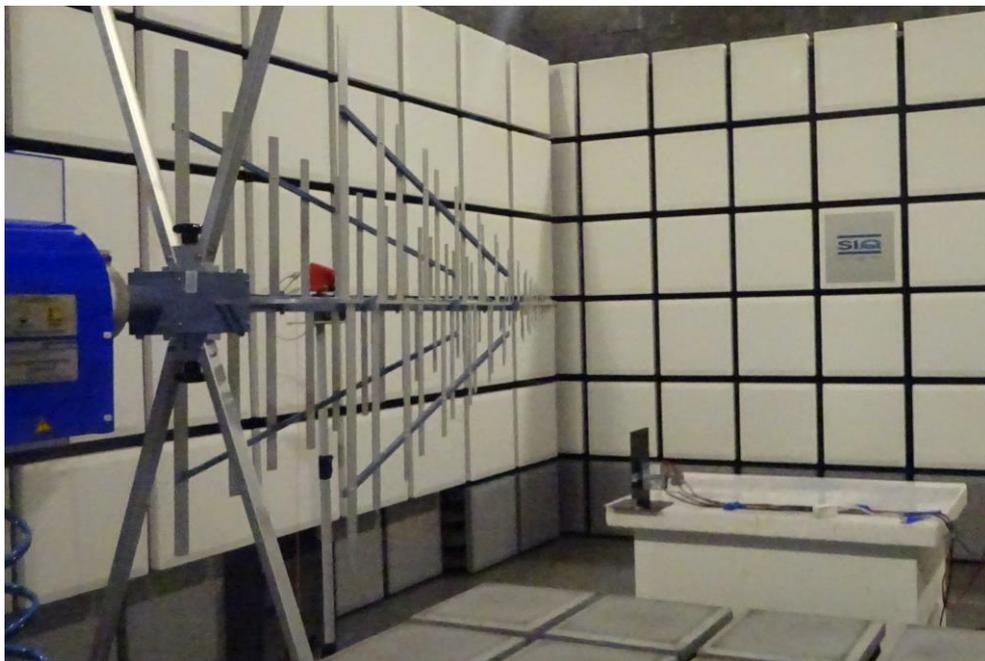


Figure 7: Radiated, RF electromagnetic field immunity measurement



Figure 8: Radiated, RF electromagnetic field immunity measurement

9.3 Electrical fast transients/burst immunity measurement

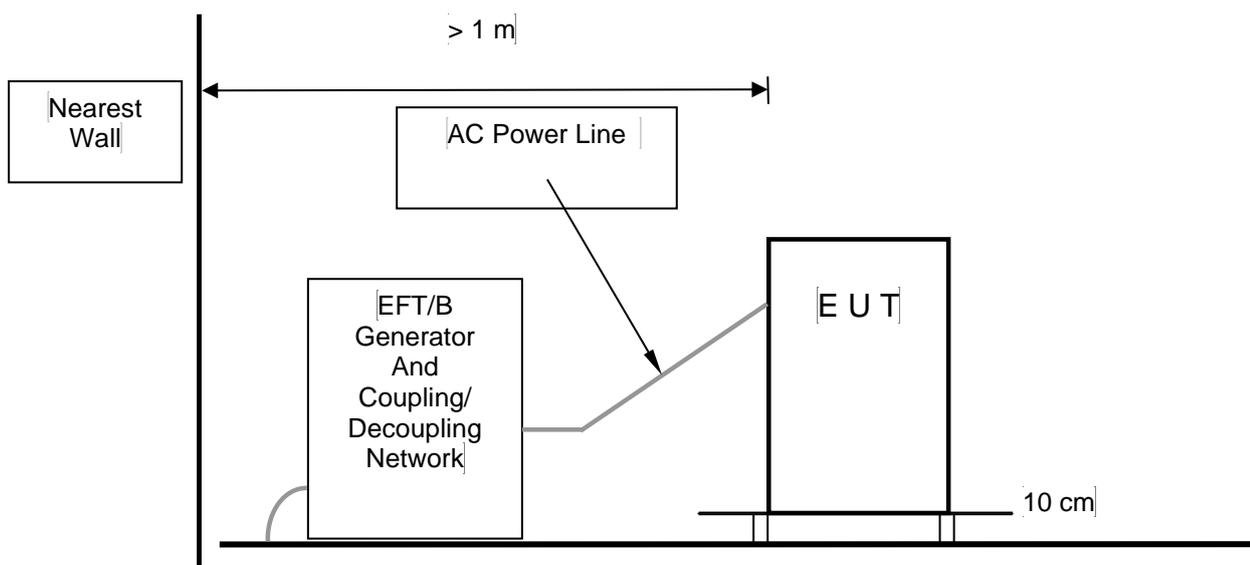
9.3.1 Test specification

Referenced Standard:	See clause 7.
Test Voltage:	DC input – 1 kV DC output – 1 kV
Polarity:	Positive/Negative
Impulse Frequency:	5 kHz
Impulse Waveshape:	5/50 ns
Burst Duration:	15 ms
Burst Period:	300 ms
Test Duration:	not less than 1 min.

9.3.2 Test procedure

- The EUT is tested with 1000 Volt discharges to the DC input and output leads.
- Both positive and negative polarity discharges are applied.
- The cable length between the EUT and the coupling device shall be as intended for installation.
- The duration time of each test sequential is 1 minute.
- The transient/burst waveform is in accordance with referenced standard, 5/50 ns.
- Artificial hand is not applied.

9.3.3 Test setup



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

The EUT is installed in a representative system as described in referenced standard on an insulating support 0,1 meters in height and its cables are isolated from the Ground Reference Plane. The GRP consists of a sheet of aluminium (at least 0,25 mm thick and 2,5 m square) connected to the protective grounding system.

9.3.4 Test results

Operating mode(s):	1
---------------------------	----------

	Test Point	Polarity	Test Level (kV)	Required criteria	Achieved criteria
1)	DC input	+/-	1	B	A
2)	DC output	+/-	1	B	A

Changes in operation observed during testing:

- 1) No changes observed.
- 2) No changes observed.

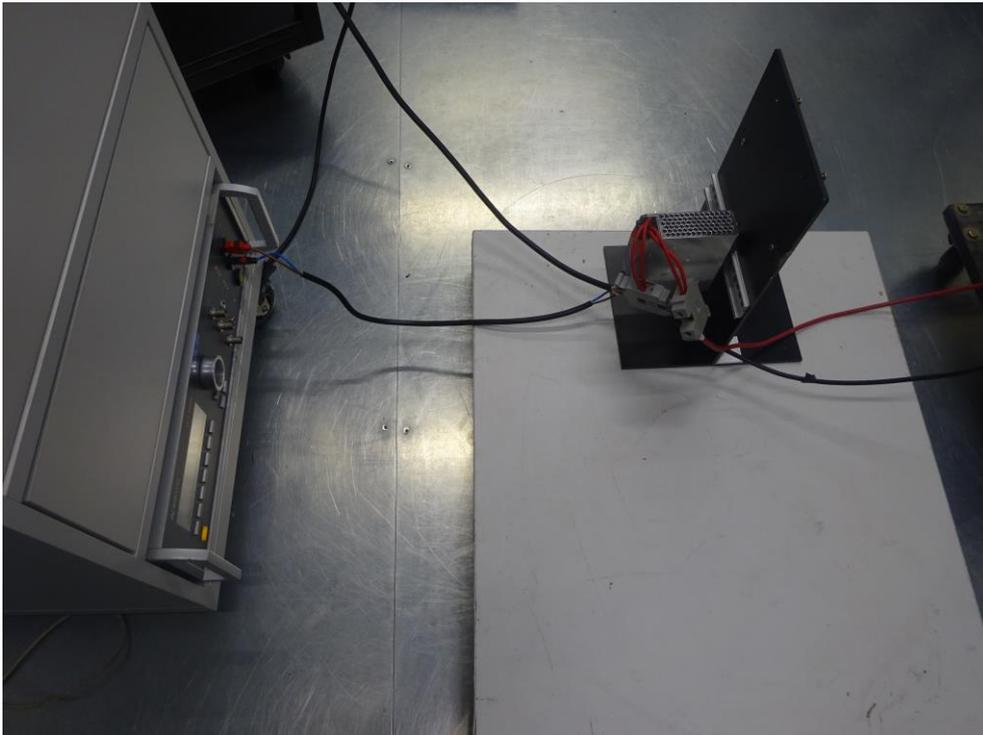


Figure 9: Electrical fast transient/burst immunity test



9.4 Surge immunity measurement

Test is not applicable. EUT ports do not directly connect to DC power port and are so treated as signal ports. Device has no grounding, Line-earth surge pulses are not applicable.

9.5 Conducted disturbances, induced by RF fields immunity measurement

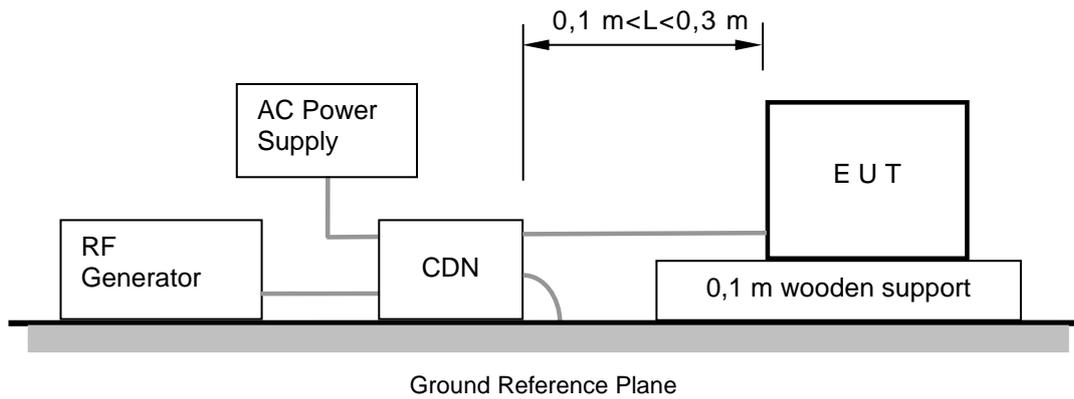
9.5.1 Test specification

Referenced Standard:	See clause 7.
Frequency Range:	0,15 MHz – 80 MHz
Field Strength:	10 V rms
Modulation:	1 kHz Sine Wave, 80 %, AM Modulation
Frequency Step:	1 % of fundamental
Coupled Cable:	DC input, DC output

9.5.2 Test procedure

- The EUT shall be tested within its intended operating and climatic conditions.
- The test shall be performed with the test generator connected to each of the coupling and decoupling devices in turn, while the other non-excited RF input ports of the coupling devices are terminated by a 50 Ω load resistor.
- The frequency range is swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80 % amplitude. The signal is modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. The sweep rate shall not exceed $1,5 \times 10^{-3}$ decades/s. The step size shall not exceed 1 % of the start and thereafter 1 % of the preceding frequency value where the frequency is swept incrementally.
- The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised, and able to respond. Sensitive frequencies such as clock frequency(ies) and harmonics or frequencies of dominant interest, shall be analysed separately.
- Attempts should be made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility.
- Artificial hand is not applied.

9.5.3 Test setup



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

The equipment to be tested is placed on an insulating support 0,1 meters in height on a ground reference plane. All relevant cables shall be provided with the appropriate coupling and decoupling devices at a distance between 0,1 meters and 0,3 meters from the projected geometry of the EUT on the ground reference plane.

9.5.4 Test results

Operating mode(s):	1
---------------------------	---

Test point	Level	Dwell time	Frequency	CDN type	Port with terminated CDN	Required criteria	Achieved criteria
1) DC input	10 V	1 s	150 kHz – 80 MHz	M2	DC output	A	A
2) DC output	10 V	1 s	150 kHz – 80 MHz	M2	DC input	A	A

Changes in operation observed during testing:

- 1) No changes observed.
- 2) No changes observed.

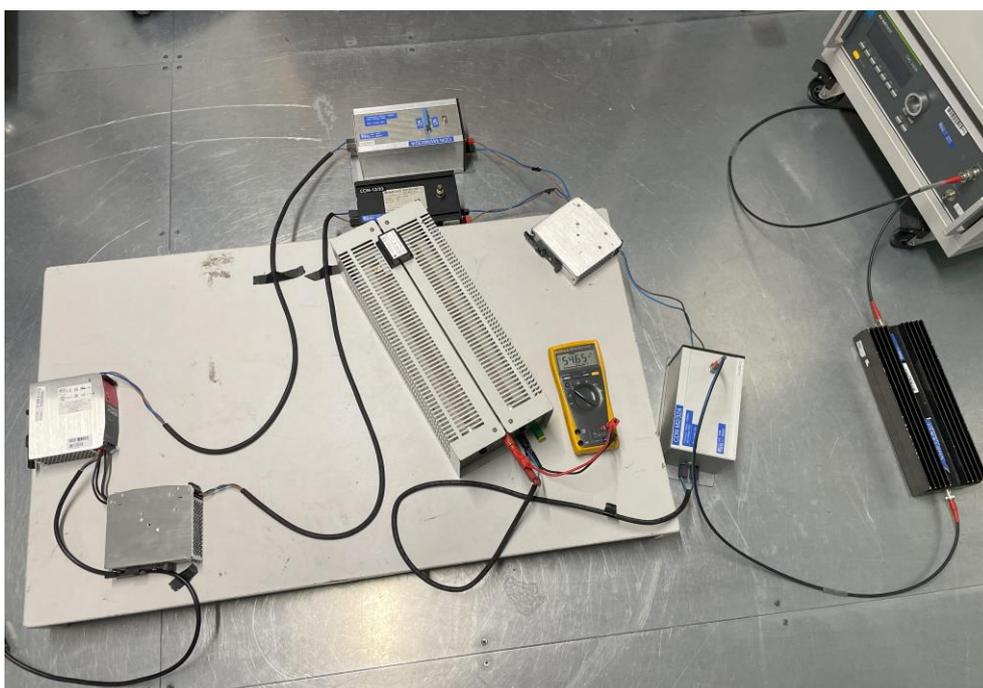


Figure 10: Conducted disturbances, induced by RF fields immunity measurement

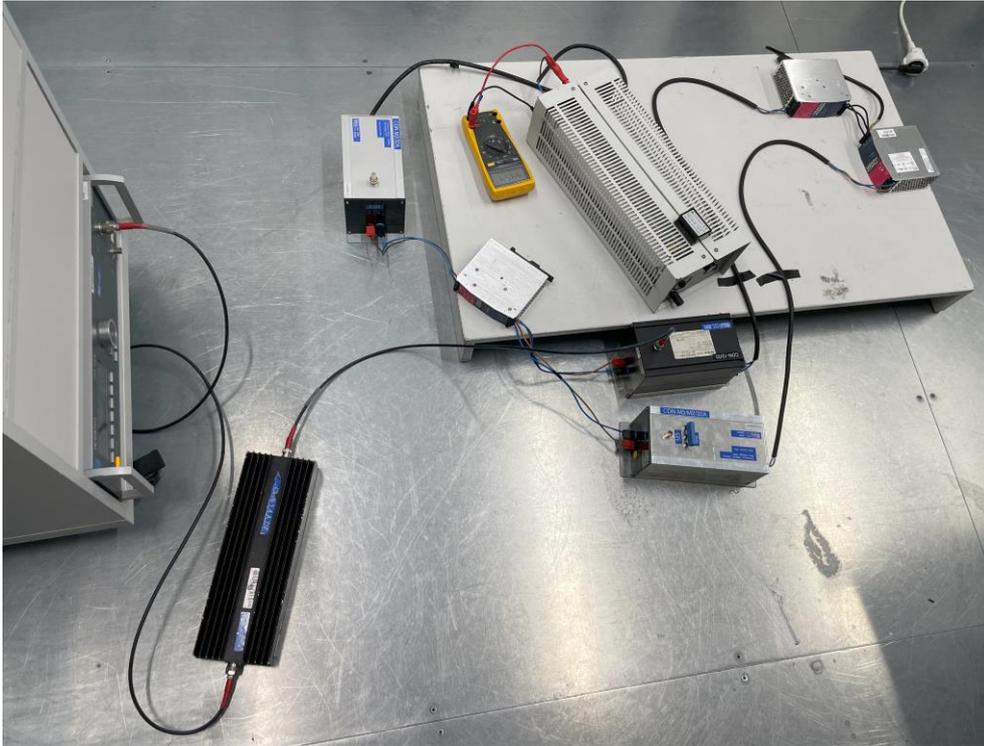


Figure 11: Conducted disturbances, induced by RF fields immunity measurement

9.6 Power frequency magnetic field immunity measurement

9.6.1 Test specification

Referenced Standard:	See clause 7.
Frequency Range:	50 and 60 Hz
Field Strength:	30 A/m

9.6.2 Test procedure

- The test procedure is in accordance with referenced standard.
- The EUT is tested with magnetic field antenna.
- The frequency is set to 50 and 60 Hz.
- The field strength level is 30 A/m.
- The test is performed with the EUT exposed to all three directions (X, Y, Z).

9.6.3 Test setup

The EUT installed in a representative system as described in referenced standard is placed on non-conductive table 0,1 (floor equipment) or 0,8 (table-top equipment) meters in height. The system under test is connected to the power and signal wire according to relevant installation instructions.

9.6.4 Test results

Operating mode(s):	1				
Frequency (Hz)	Polarity	Field Strength (A/m)	Test point	Required criteria	Achieved criteria
50	X, Y, Z	30	Enclosure	A	A
60	X, Y, Z	30	Enclosure	A	A
Changes in operation observed during testing: No changes observed.					

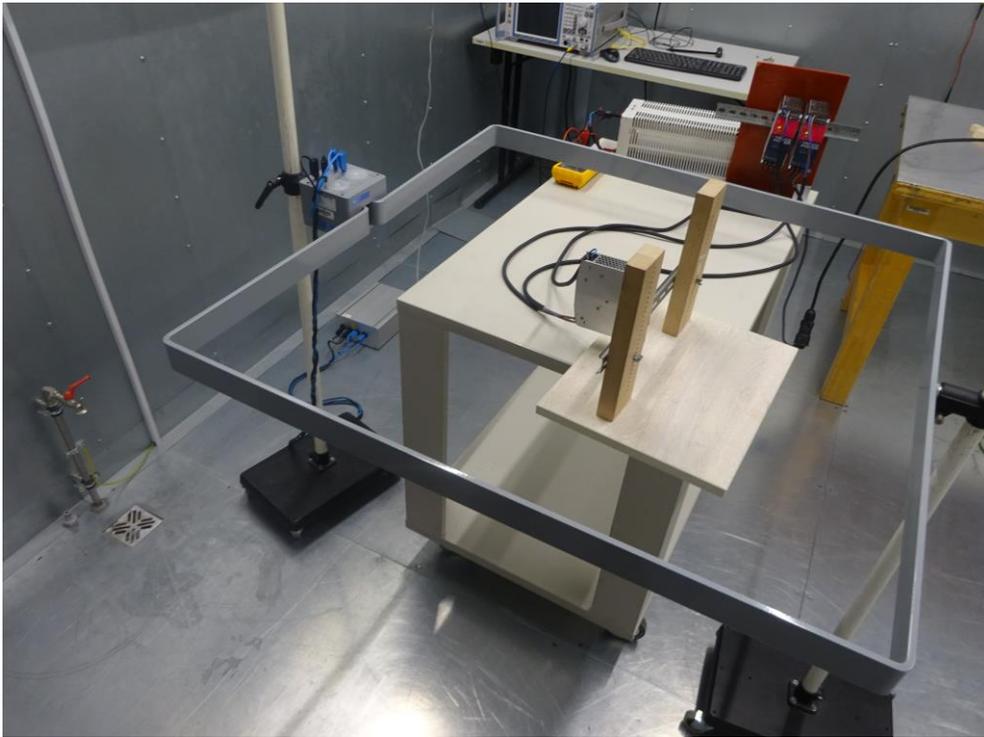


Figure 12: Power frequency magnetic field immunity measurement



9.7 Voltage dips, short interruptions, and voltage variations immunity measurement

Test is not applicable. Device is DC powered apparatus.

10. Used test equipment

9.1 Electrostatic discharge immunity measurement

Equipment	Manufacturer	Type	SIQ Number	Last calibration date	Last due date
ESD Generator	EM TEST	Dito	108227	2023-03-09	2024-03-09

9.2 Radiated, RF electromagnetic field immunity measurement

Equipment	Manufacturer	Type	SIQ Number	Last calibration date	Last due date
SAC 2	Comtest Engineering	SAC 3m	109072	N/A	N/A
Signal Generator (SAC2)	R&S	SMBV100A	109070	2022-08-10	2024-02-10
3-Path Diode Power Sensor (SAC2)	R&S	NRP8SN	109087	2022-08-04	2024-02-04
3-Path Diode Power Sensor (SAC2)	R&S	NRP8SN	109088	2022-08-04	2024-02-04
Broadband Amplifier (SAC2)	R&S	BBA150 / BC250	109058	N/A	N/A
Broadband Amplifier (SAC2)	R&S	BBA150 / D110E100	109059	N/A	N/A
Field Uniformity (SAC2, HL562E)	SIQ	UFA	/	2022-08-08	2024-02-08
Ultra Broadband Antenna (SAC2)	R&S	HL562E	109056	N/A	N/A

9.3 Electrical fast transients/burst

Equipment	Manufacturer	Type	SIQ Number	Last calibration date	Last due date
Ultra Compact Simulator	EM Test	UCS 500 N5	106887	2023-03-24	2024-03-24
Capacitance coupling clamp	EM TEST	HFK	106889	2022-12-05	2025-12-05

9.5 Conducted disturbances, induced by RF

Equipment	Manufacturer	Type	SIQ Number	Last calibration date	Last due date
Continuous Wave Simulator	EM Test	CWS500N2	107832	2023-03-27	2024-09-27
Attenuator	EM TEST	ATT 6/80	103326	N/A	N/A
Coupling/Decoupling Network	EM TEST	CDN-M2/32A	/	2023-08-28	2024-08-28
CDN M2/32A	SIQ	M2/32A	SN: SIQ20075	2022-04-26	2025-04-26
Coupling/Decoupling Network	SIQ	CDN M3/M2/32A	SN: SIQ20047	2023-05-17	2026-05-17

9.6 Power frequency

Equipment	Manufacturer	Type	SIQ Number	Last calibration date	Last due date
Current transformer	EM TEST	MC 2630	106893	N/A	N/A
Magnetic field coil	EM Test	MS100N	106892	N/A	N/A

-----END OF TEST REPORT-----