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TÜV NORD
Zertifizierung

EMC – Laboratory

Test Report

No. 20194-1-R00

Brodersen RTU32

CM02A, S/N: 2020-47-14154
PS24A, S/N: 2020-43-10913
MP32A, S/N: 2020-45-19070
DI20C, S/N: 2020-17-14127
DO08R, S/N: 2020-26-1666
AO02A, S/N: 2020-43-10910
AI08A, S/N: 2020-43-19000
DO20A, S/N: 2020-30-17587

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Customer: Brodersen A/S
Islevdalvej 187
DK-2610 Roedovre

Equipment under test: Brodersen RTU32
CM02A, S/N: 2020-47-14154
PS24A, S/N: 2020-43-10913
MP32A, S/N: 2020-45-19070
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DO20A: S/N: 2020-30-17587

Date of receipt: Dec. 04, 2020 **Date of test:** Dec. 07 - 11, 2020

Test site: TÜV NORD CERT GmbH, Department EMV Services, EMC-Laboratory

Test personnel:	**Phone**	**Fax**	**e-mail**
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Participant: Reza Harimi (Brodersen A/S)

Test results:

Item	Applied Standard	Scope	Result
Emission test	EN IEC 61000-6-4 (2019): Generic emission standard; Part 2: Industrial environments	fully applied	Complied
Immunity test	EN IEC 61000-6-2 (2019): Generic immunity standard; Part 2: Industrial environments	fully applied	Complied
Emission & Immunity test	EN 50121-4 (2016): Railway applications - Electromagnetic compatibility - Part 4: Emission and immunity of the signalling and telecommunications apparatus	fully applied	Complied

The results refer only to the equipment under test. Modifications of this test report or the publication of extracts require the written approval of TÜV NORD CERT GmbH.

Place & issue date: Hamburg, Jan. 26, 2021

Released:

TÜV NORD
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Deputy Laboratory Manager

Prepared:

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Datum: 2021.01.26 11:45:11 +01'00'

B.Eng. Tobias Löbner
Test Engineer

Emission test result summary:

Item	Applied Standard	Result
Conducted emission, d.c. power supply	EN 50121-4	Complied
Conducted emission, Network lines	EN IEC 61000-6-4	Complied
Radiated emission	EN IEC 61000-6-4 / EN 50121-4	Complied

Immunity test result summary:

Item	Test Procedure	Result
Electrostatic discharge	EN 61000-4-2 (2009)	Complied
Radio-frequency electromagnetic field	EN 61000-4-3 (2006) + A1 (2008) + A2 (2010)	Complied
Electrical fast transient / burst	EN 61000-4-4 (2012)	Complied
Surge	EN 61000-4-5 (2014) + A1 (2017)	Complied
Conducted disturbances, induced by radio-frequency fields	EN 61000-4-6 (2009)	Complied
Power frequency magnetic field	EN 61000-4-8 (2010)	Complied
Voltage dips, short interruptions and voltage variations	EN 61000-4-11 (2004)	N/A ①

①: This test was not performed, because the EUT does not contain a relevant port.

Note: The test parameters of the immunity tests were selected so that the maximum test levels of the cited standards on page 1 were covered.

Remark:
The tests have been carried out based on the referenced issues of the basic standards as stated above. These applied standards can have a newer issue date as given in the product standards as normative references. The newer editions include changes based on new scientific evidence and knowledge ("State of the art"). In a future new edition of the product standard these changes would most likely become mandatory.

As far as in this report statements on conformity are made, decision rules according to DIN EN ISO/IEC 17025:2018, 7.8.6 have been applied. If the report does not state otherwise, procedure 1 according to IEC Guide 115 ed.1.0 2007 (uncertainty of measurement calculated) has been applied on measurement and test procedures which are the base of this report.

Abbreviations: N/A ≙ not applicable

Table of contents

1 Document History

Revision	Date of issue	Prepared by	Description of Changes
00	Jan. 26, 202	B.Eng. Tobias Löbner	Initial Release
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Tab. 1-1: Table of revision

Please note: If document is subject to revision, older revisions are no longer valid and should be destroyed.

2 Equipment under test and operating conditions

2.1 Description

The Equipment Under Test (EUT) is a modular system with advanced RTU/PLC functionality for industrial use. Each system comprises of a CPU module, power supply module and the desired mix of IO modules and system modules, as required.

Name / Type:	Brodersen RTU32	
Part with S/N (Serial number):	CM02A, S/N: 2020-47-14154	
	PS24A, S/N:2020-43-10913	
	MP32A, S/N: 2020-45-19070	
	DI20C, S/N: 2020-17-14127	
	DO08R, S/N: 2020-26-1666	
	AO02A, S/N: 2020-43-10910	
	AI08A, S/N: 2020-43-19000	
	DO20A: S/N: 2020-30-17587	
Nominal voltage:	10 - 30 V_{DC}, tested with 24 V_{DC}	
Nominal frequency:	DC	
Nominal current:	< 1 A	
Nominal power:	< 15 W	
Reaction time:	< 1 s	
Highest internal/working frequency:	200 MHz	
Software version:	---	
Hardware version:	MP32A:	Hardware rev: A
	PS24A:	Hardware rev: A
	DI20C:	Hardware rev: A
	DO20A:	Hardware rev: A
	AI08A:	Hardware rev: A
	AO02A:	Hardware rev: A
	DO08R:	Hardware rev: A
	CM02A:	Hardware rev: A
Firmware version	MP32A:	Firmware rev: 1.65.5.204
	PS24A:	Firmware rev: 1.1.2.05
	DI20C:	Firmware rev: 1.1.2.03
	DO20A:	Firmware rev: 1.1.2.03
	AI08A:	Firmware rev: 1.1.2.06
	AO02A:	Firmware rev: 1.1.2.05
	DO08R:	Firmware rev: 1.1.2.03
	CM02A:	Firmware rev: N/A
Dimensions (HxWxD), all in mm:	20 x 100 x 20	
Housing material:	plastic	
External ground connection:	yes	
EUT category:	table top device	
AE (Additional Equipment):	Test box with an additional RTU as remote station device	
	V_{DC} Power supply (Rohde & Schwarz NGS 32/10)	

2.2 System setup

The following block diagram describes the tested system setup:

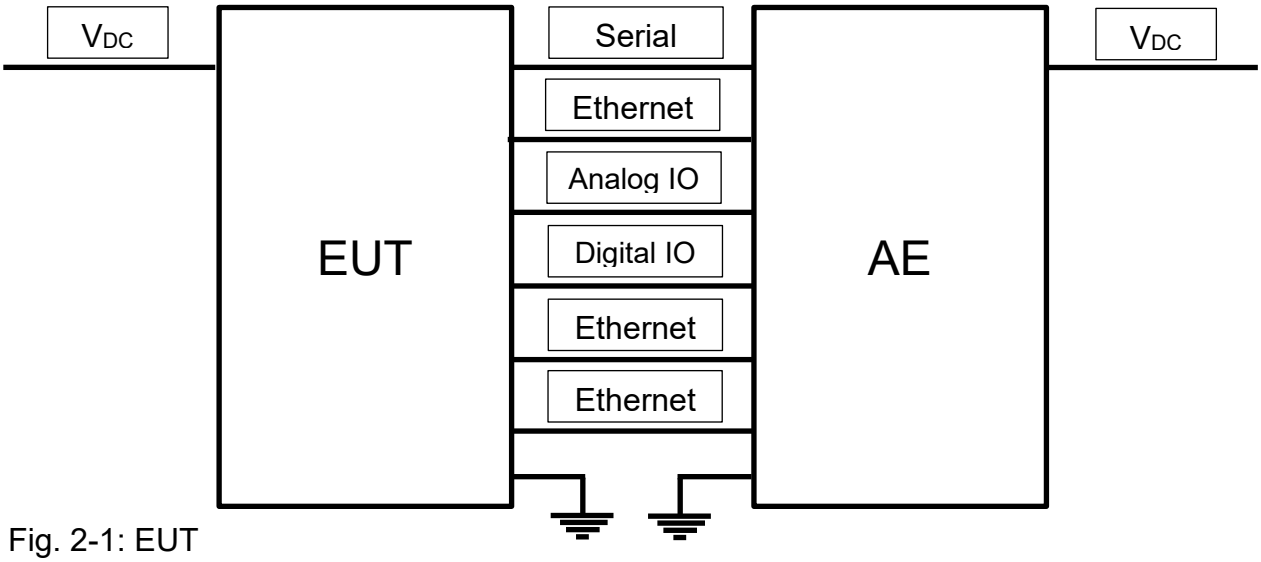

Fig. 2-1: EUT

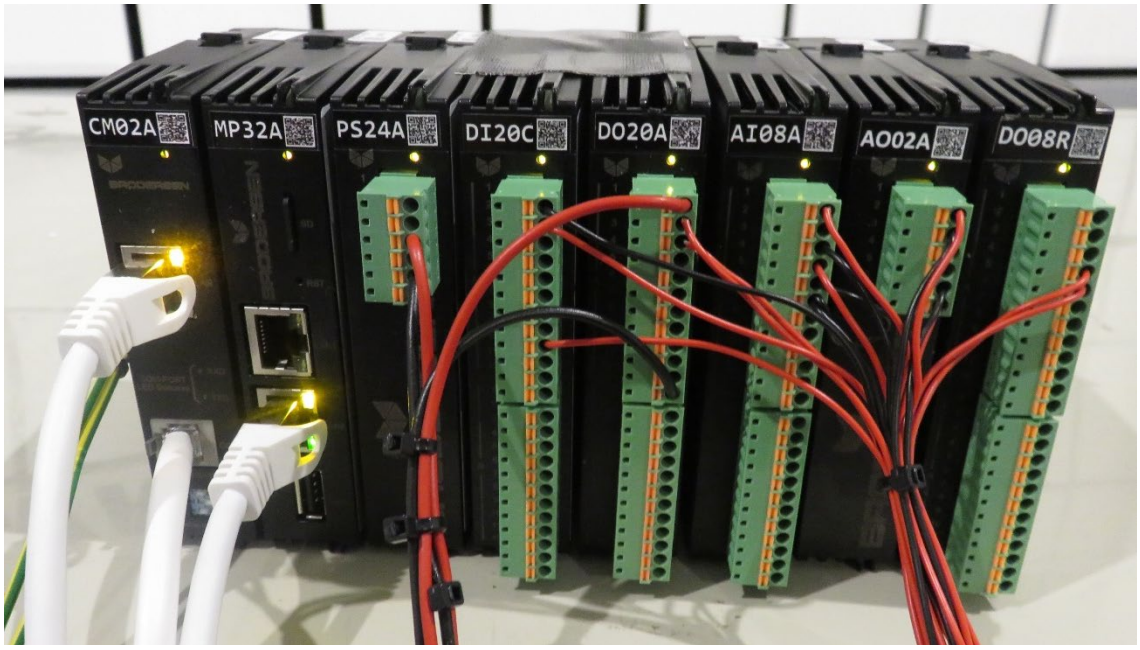

Fig. 2-2: EUT

The Equipment under test consists of these modules:

- MPU32A: Main Processor Unit (Standard), includes 2x 10/100 Ethernet & 1x USB
- PS24A: Power supply module (10-30 VDC Input)
- DI20C: 18 channels digital input module (10-30 VDC inputs) + 2 channels fast digital inputs/counter inputs (5-30 VDC inputs/5KHz)
- DO20A: 20 channels digital output module (10-30 VDC outputs / Smart high side switches)
- AI08A: 8 channels analog input module, voltage/current inputs, 16 bit (user configurable)
- AO02A: 2 channels analog output module, voltage/current outputs, 16 bit (user configurable)
- DO08R: 8 channels relay output module (SPDT relay contacts)
- CM02A: Communication module (1x 10/100 Ethernet, 1x RS485/RS232 serial port)

EMC tests have been applied to the following channels/ports of the above modules:

- MPU32A:
  - LAN1: 10/100 Ethernet port
  - LAN2: 10/100 Ethernet port
- PS24A:
  - +VDC: Positive power input
  - 0 VDC: Negative power input
- DI20C:
  - DI1: Common input
  - DI2: Digital input channel 0 (standard type)
  - DI9: Digital input channel 7 (high speed counter input)
- DO20A:
  - DO+: Common input (positive)
  - DO-: Common input (negative)
  - DO2: Digital output channel 0
  - DO3: Digital output channel 1
- AI08A:
  - AI1: Analog input channel 0 positive input (voltage mode)
  - AI3: Analog input channel 0 negative input (voltage mode)
  - AI4: Analog input channel 1 positive input (current mode)
  - AI6: Analog input channel 1 negative input (current mode)
- AO02A:
  - AO1: Analog output channel 0 positive output (voltage mode)
  - AO2: Analog output channel 0 negative output (voltage mode)
  - AO5: Analog output channel 1 positive output (current mode)
  - AO6: Analog output channel 1 negative output (current mode)
  - DO08R:
    - DO4: Digital (relay) output channel 1 (NO contact)
    - DO5: Digital (relay) output channel 1 (common)
  - CM02A:
    - LAN1: 10/100 Ethernet port
    - COM1: RS485/RS232 serial port

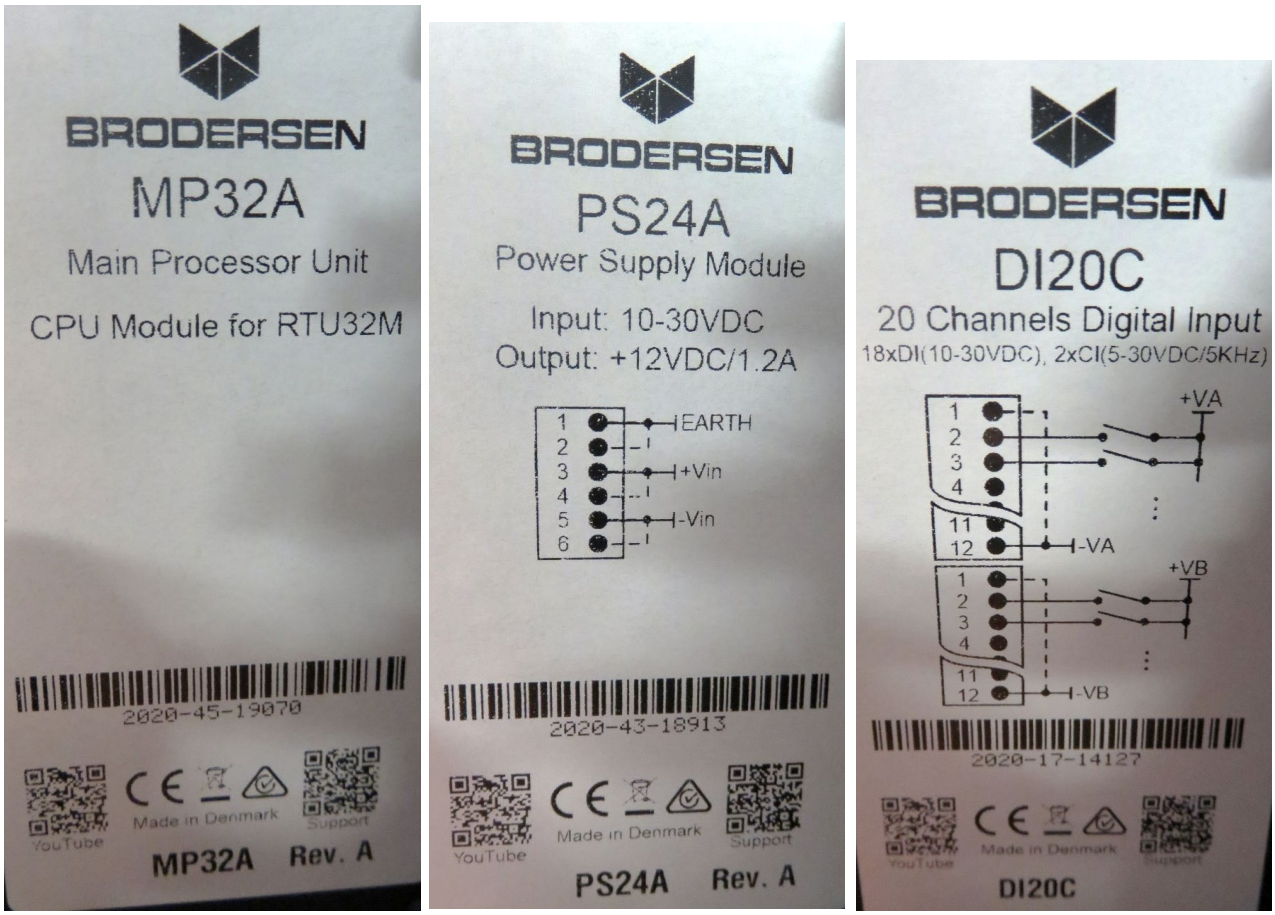

Fig. 2-3: Identification plate (EUT: Modules „MP32A“, „PS24A“, „DI20C“)

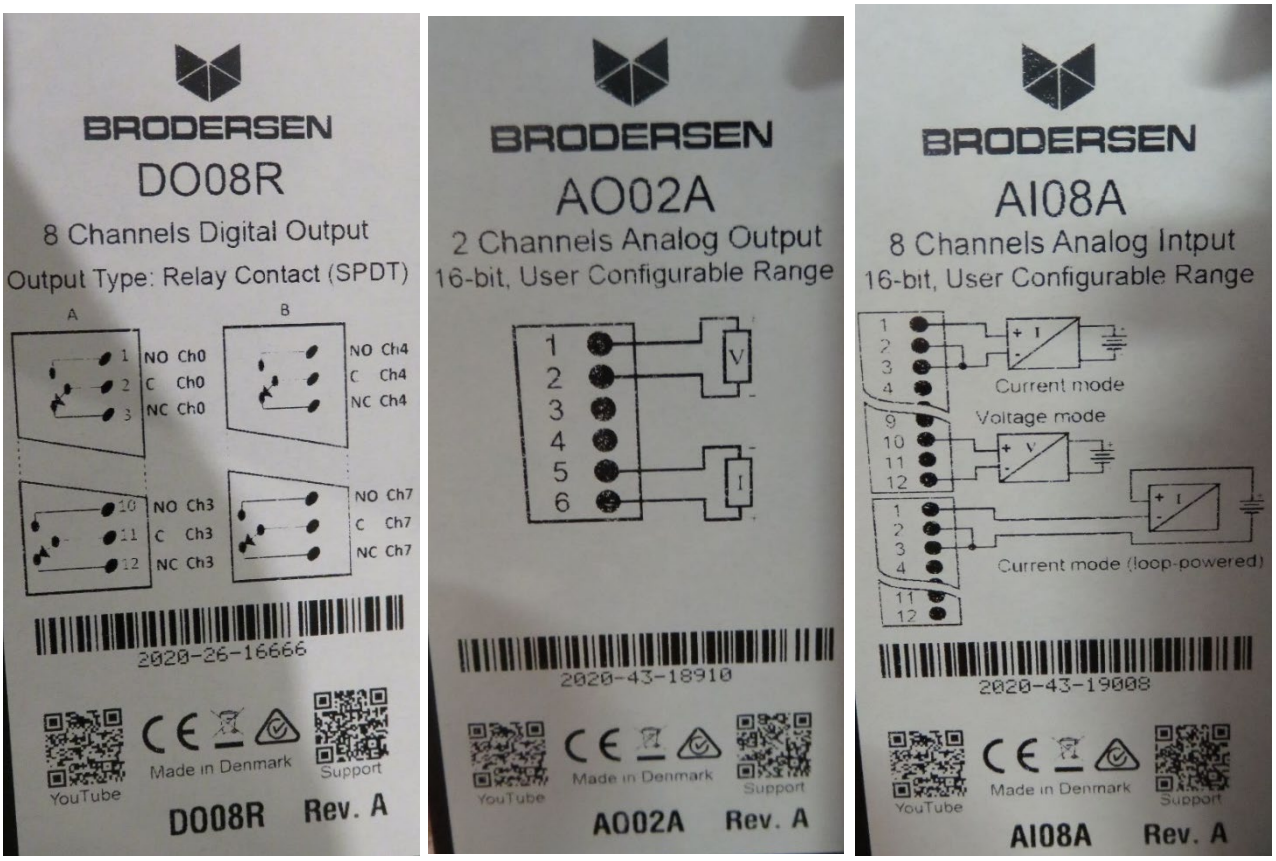

Fig. 2-4: Identification plate (EUT: Modules „DO08R“, „AO02A“, „AI08A“)

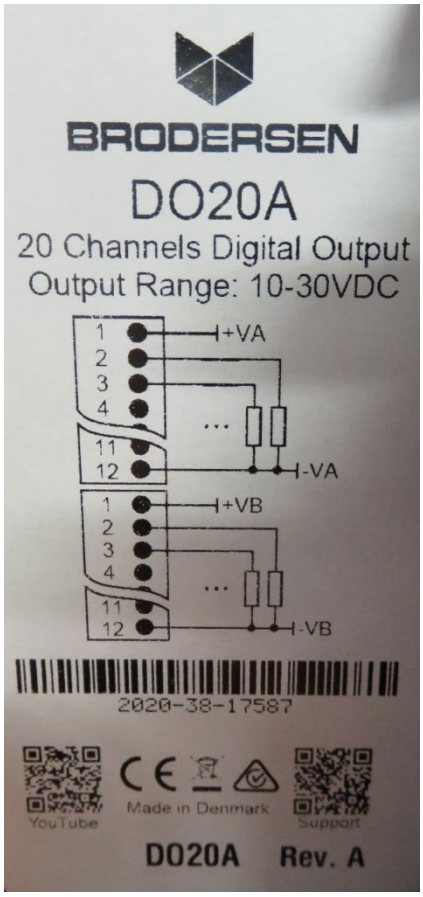

Fig. 2-5: Identification plate (EUT: Modules „DO20A“)

2.3 Ports

In the following table are the tested EUT ports listed. According to the EUT specification the USB port were not part of the test.

Port	Cable type	Length	Shield	Cable screen connection
V_{DC} power supply	2x 4 mm²	> 30 m	no	N/A
3x Ethernet	CAT6 S/FTP	> 30 m	yes	both side
Serial port	CAT6 S/FTP	< 30 m	yes	both side
Digital IO	2x 0.75 mm² (DO20A Module: DO+/DO-) & 7x 0.5 mm²	> 30 m	no	N/A
Analog IO	8x 0.5 mm²	> 30 m	no	N/A
USB	Not part of this test			

2.4 Operating modes

All tests are performed at test operation.

The EUT is supplied with 24 V_{DC}. All interfaces are active and connected to the AE. For each interface a communication link to the AE (identical RTU) established. All outputs switched except for the DO08R relay output which was static.

2.5 Performance monitoring

The function of the EUT was observed visually with the help of the status LED of the test box (AE) (e.g. occurring error messages) and by the light on the network ports indicating communication.
Additionally, the data communication was monitored using an external PC via a network connection to the EUT (see Fig. 2-6). Possible malfunctions were detected immediately.

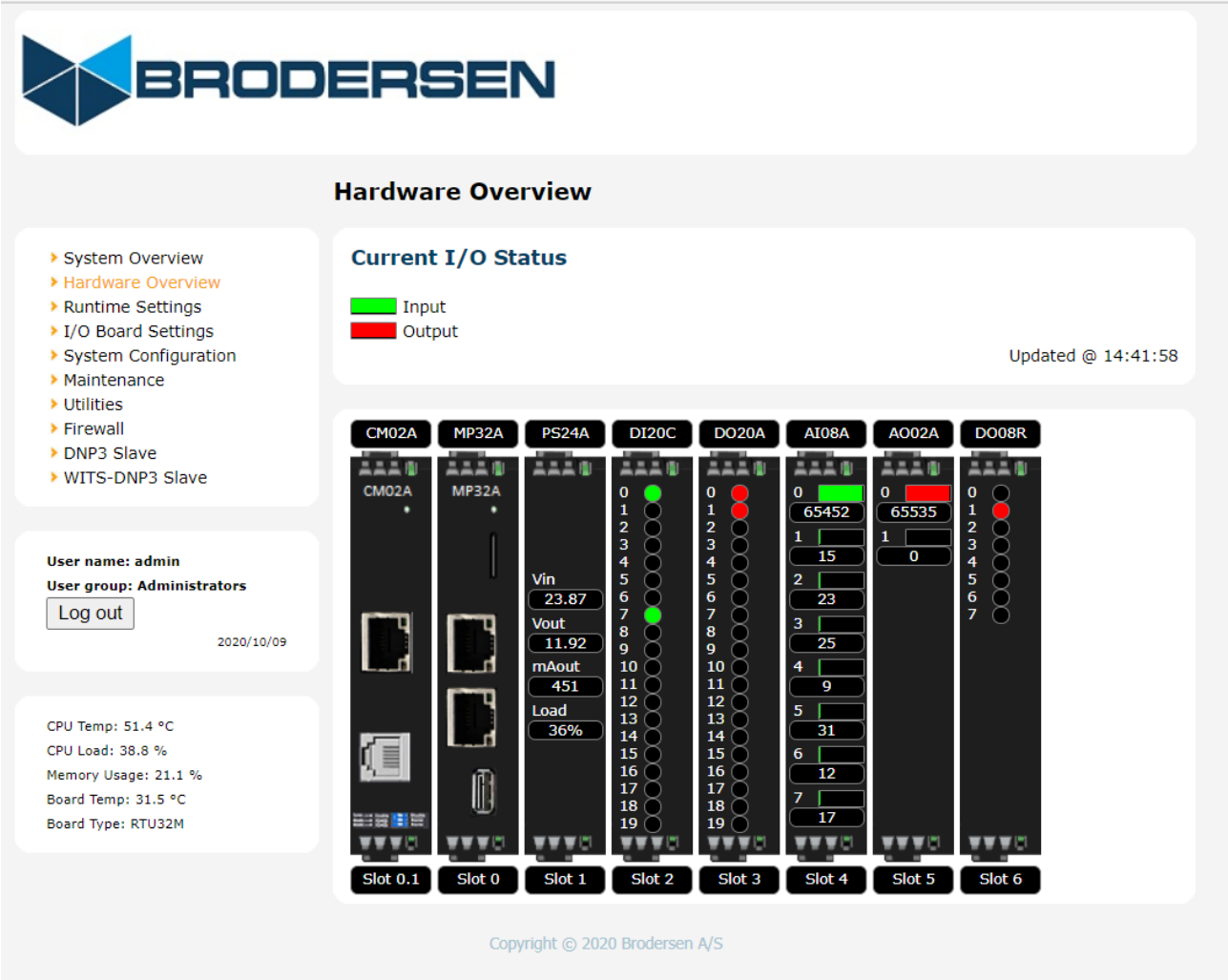

Fig. 2-6: “Hardware Overview”-interface of the RTU unit via network link

2.6 EUT classification

EN IEC 61000-6-2 / -6-4: The EUT is a device for industrial use.
EN 50121-4: The EUT is a device for railway application.

2.7 Customer specified performance criteria

Criterion A: No change of the status LED is allowed.
Criterion B: Temporary changes of the status LED are allowed. After the test, the EUT shall resume the intended operation without user interaction.

2.8 Performance criteria

For the immunity tests the following performance criteria are applicable:

Performance criterion A: The EUT 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 EUT is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

Performance criterion B: The EUT 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 EUT is used as intended. The performance level may be replaced by a permissible loss of performance. However, during the test degradation of performance is allowed but 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, either of these may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

Performance criterion C: Temporary loss of function is allowed during the test, provided the function is self-recoverable or can be restored by the operation of the controls.

3 Emission in accordance with EN IEC 61000-6-4 and EN 50121-4

3.1 Conducted emission – disturbing voltage

3.1.1 Test setup

The disturbing voltage of the EUT was measured by a measuring receiver and an artificial mains network.

Fig. 3-1: Test setup for the disturbing voltage measurement

3.1.2 Operating conditions

Please refer to chapter 2.

3.1.3 Test date and climatic conditions

Date:	Dec. 08, 2020
Ambient air temperature:	22 °C
Humidity:	32 %
Atmospheric pressure:	1005 hPa

3.1.4 Measuring equipment

Screened measuring room (large)

Receiver:	ESR7	No. 124
Artif. mains network:	NSLK 8127	No. 414
	NSLK 8127	No. 419
Pulse limiter:	ESH3-Z2	No. 418
Software:	EMC 32 V10.60.00, Rohde & Schwarz	

3.1.5 Limit values

The result figures show the limit values according to EN 50121-4 for the quasipeak- (QP) and average-detector (AV).

3.1.6 Measuring procedure and results

The disturbing voltages on the power supply lines were measured by means of an artificial mains network in the frequency range 150 kHz to 30 MHz.

The curves in the following figures show the peak values of the conducted emission using a 5 s measuring time in time-domain measuring mode. Quasipeak and average values were measured at local maximums using a 1 s measuring time. The results are marked by a "*" (quasipeak values) and by a "x" (average values).

No deviations with regard to the applied standard could be detected.

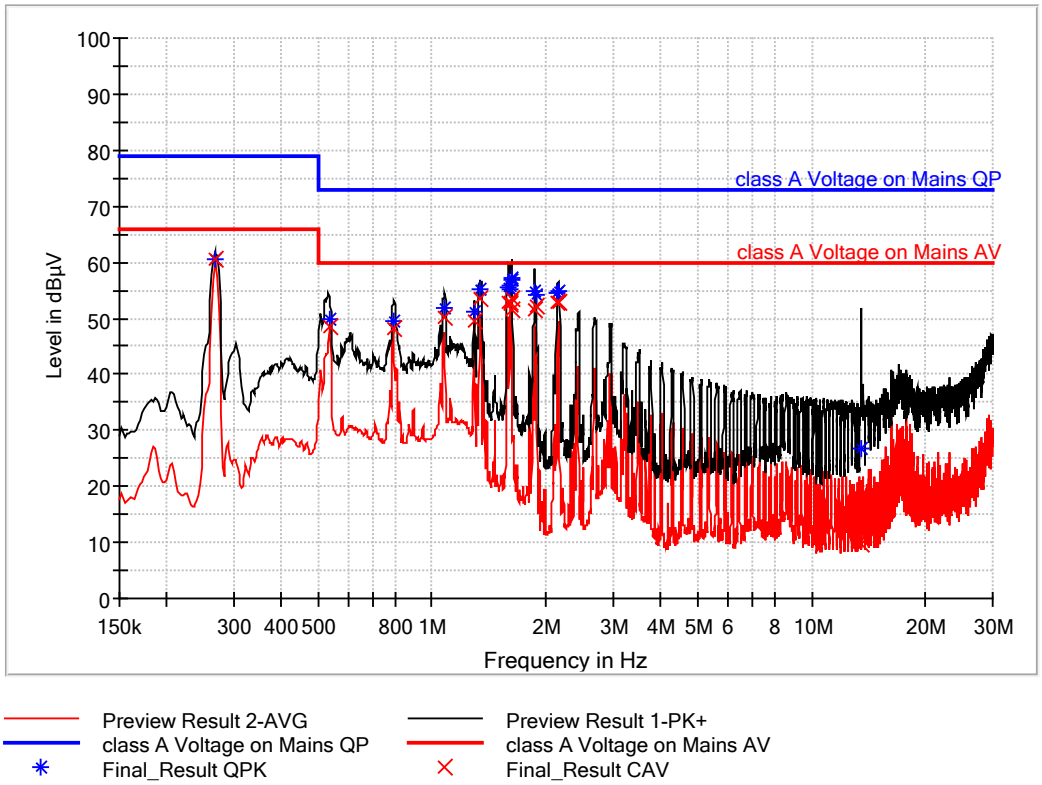

Fig. 3-2: Disturbing voltage on conductor +V_{DC} and 0 V_{DC}

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line
0.267050	---	60.40	66.00	5.60	1000.0	9.000	0 VDC
0.267050	60.54	---	79.00	18.46	1000.0	9.000	0 VDC
0.536200	---	48.66	60.00	11.34	1000.0	9.000	0 VDC
0.536200	49.79	---	73.00	23.21	1000.0	9.000	0 VDC
0.787400	49.53	---	73.00	23.47	1000.0	9.000	+VDC
0.787400	---	48.31	60.00	11.70	1000.0	9.000	+VDC
1.074950	---	50.01	60.00	9.99	1000.0	9.000	0 VDC
1.074950	51.77	---	73.00	21.23	1000.0	9.000	0 VDC
1.290550	51.04	---	73.00	21.96	1000.0	9.000	+VDC
1.290550	---	49.48	60.00	10.52	1000.0	9.000	+VDC
1.343950	---	53.55	60.00	6.45	1000.0	9.000	0 VDC
1.343950	55.29	---	73.00	17.71	1000.0	9.000	0 VDC
1.583050	55.40	---	73.00	17.60	1000.0	9.000	+VDC
1.583050	---	52.92	60.00	7.08	1000.0	9.000	+VDC
1.599100	---	52.48	60.00	7.52	1000.0	9.000	0 VDC
1.599100	55.07	---	73.00	17.93	1000.0	9.000	0 VDC
1.605100	55.93	---	73.00	17.07	1000.0	9.000	0 VDC
1.605100	---	52.91	60.00	7.09	1000.0	9.000	0 VDC
1.618350	57.23	---	73.00	15.77	1000.0	9.000	0 VDC
1.618350	---	53.55	60.00	6.45	1000.0	9.000	0 VDC
1.618900	56.86	---	73.00	16.14	1000.0	9.000	0 VDC
1.618900	---	51.60	60.00	8.40	1000.0	9.000	0 VDC
1.867100	54.94	---	73.00	18.06	1000.0	9.000	+VDC
1.867100	---	51.37	60.00	8.63	1000.0	9.000	+VDC
1.871650	---	52.14	60.00	7.86	1000.0	9.000	+VDC
1.871650	54.02	---	73.00	18.98	1000.0	9.000	+VDC
2.137800	54.52	---	73.00	18.48	1000.0	9.000	0 VDC
2.137800	---	52.77	60.00	7.23	1000.0	9.000	0 VDC
2.152700	54.91	---	73.00	18.09	1000.0	9.000	0 VDC
2.152700	---	52.97	60.00	7.03	1000.0	9.000	0 VDC
13.559350	26.65	---	73.00	46.35	1000.0	9.000	+VDC
13.559350	---	9.75	60.00	50.25	1000.0	9.000	+VDC

Tab. 3-1: Maximum of the conducted disturbances, quasipeak and average detector, conductor +V_{DC} and 0 V_{DC}

3.2 Conducted emission – disturbing current on data lines

3.2.1 Test setup

The disturbing current of the EUT was measured by a measuring receiver and a current clamp.

Fig. 3-3: Test setup for the disturbing current measurement

3.2.2 Operating conditions

Please refer to chapter 2.

3.2.3 Test date and climatic conditions

Date:	Dec. 08, 2020
Ambient air temperature:	22 °C
Humidity:	32 %
Atmospheric pressure:	1005 hPa

3.2.4 Measuring equipment

Screened measuring room (large)

Receiver:	ESR7	No. 124
Artif. mains network:	NSLK 8127	No. 414
	NSLK 8127	No. 419
Current clamp:	EZ 17	No. 406
Decoupling network:	ISN ST08	No. 545
Software:	EMC 32 V10.60.00, Rohde & Schwarz	

3.2.5 Limit values

The result figures show the limit values according to EN IEC 61000-6-4 (EN 55032 class A) for the quasipeak- (QP) and average-detector (AV).

3.2.6 Measuring procedure and results

The disturbing current on the signal interfaces were measured by means of a current clamp in the frequency range 150 kHz to 30 MHz.

The curves in the following figures show the peak values of the conducted emission using a 5 s measuring time in time-domain measuring mode. Quasipeak and average values were measured at local maximums using a 1 s measuring time. The results are marked by a "*" (quasipeak values) and by a "x" (average values).

No deviations with regard to the applied standard could be detected.

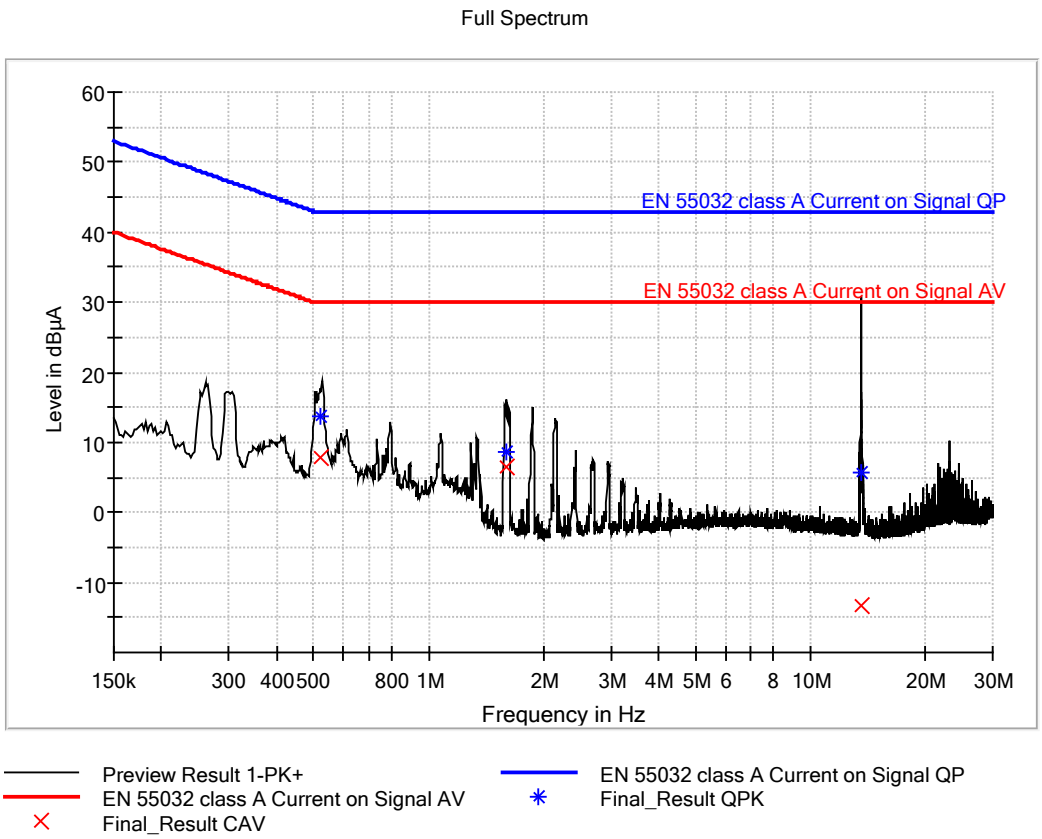

Fig. 3-4: Disturbing current on LAN1 (MP32A Module)

Frequency (MHz)	QuasiPeak (dBµA)	CAverage (dBµA)	Limit (dBµA)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)
0.520750	---	7.78	30.00	22.22	1000.0	9.000	-4.9
0.520750	13.68	---	43.00	29.32	1000.0	9.000	-4.9
1.601800	---	6.56	30.00	23.44	1000.0	9.000	-8.6
1.601800	8.74	---	43.00	34.26	1000.0	9.000	-8.6
13.558000	---	-13.41	30.00	43.41	1000.0	9.000	-9.3
13.558000	5.72	---	43.00	37.28	1000.0	9.000	-9.3

Tab. 3-2: Maximum of the conducted disturbances on LAN1 (MP32A Module), quasipeak and average detector

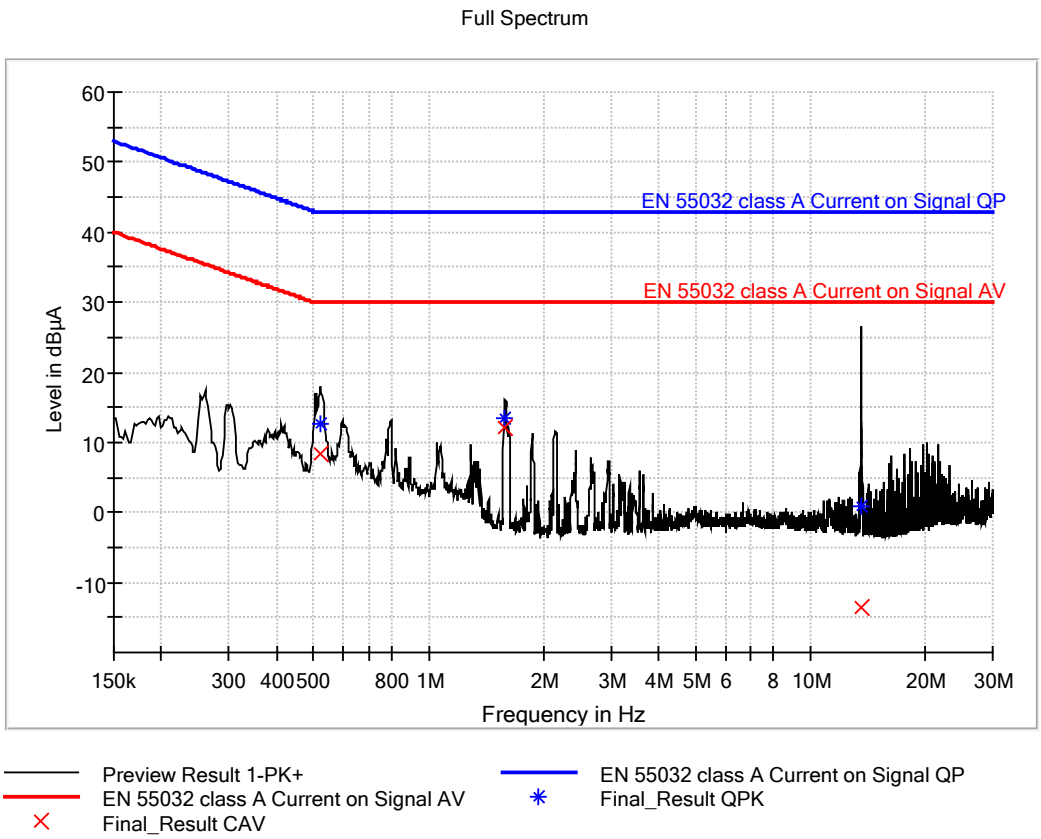

Fig. 3-5: Disturbing current on LAN2 (MP32A Module)

Frequency (MHz)	QuasiPeak (dBµA)	CAverage (dBµA)	Limit (dBµA)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)
0.520250	---	8.34	30.00	21.66	1000.0	9.000	-4.9
0.520250	12.71	---	43.00	30.29	1000.0	9.000	-4.9
1.578550	---	12.10	30.00	17.90	1000.0	9.000	-8.6
1.578550	13.40	---	43.00	29.60	1000.0	9.000	-8.6
13.557150	---	-13.69	30.00	43.69	1000.0	9.000	-9.3
13.557150	0.91	---	43.00	42.09	1000.0	9.000	-9.3

Tab. 3-3: Maximum of the conducted disturbances on LAN2 (MP32A Module), quasipeak and average detector

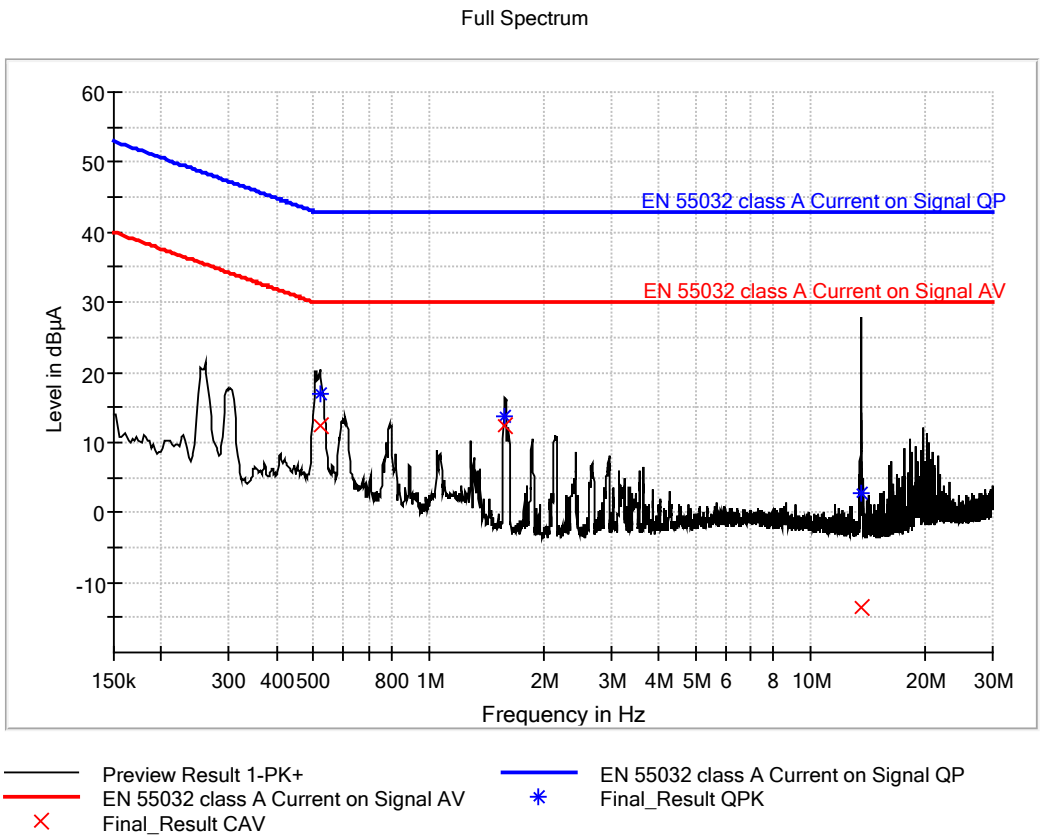

Fig. 3-6: Disturbing current on LAN1 (CM02A Module)

Frequency (MHz)	QuasiPeak (dBµA)	CAverage (dBµA)	Limit (dBµA)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)
0.520250	---	8.34	30.00	21.66	1000.0	9.000	-4.9
0.520250	12.71	---	43.00	30.29	1000.0	9.000	-4.9
1.578550	---	12.10	30.00	17.90	1000.0	9.000	-8.6
1.578550	13.40	---	43.00	29.60	1000.0	9.000	-8.6
13.557150	---	-13.69	30.00	43.69	1000.0	9.000	-9.3
13.557150	0.91	---	43.00	42.09	1000.0	9.000	-9.3

Tab. 3-4: Maximum of the conducted disturbances on LAN1 (CM02A Module), quasipeak and average detector

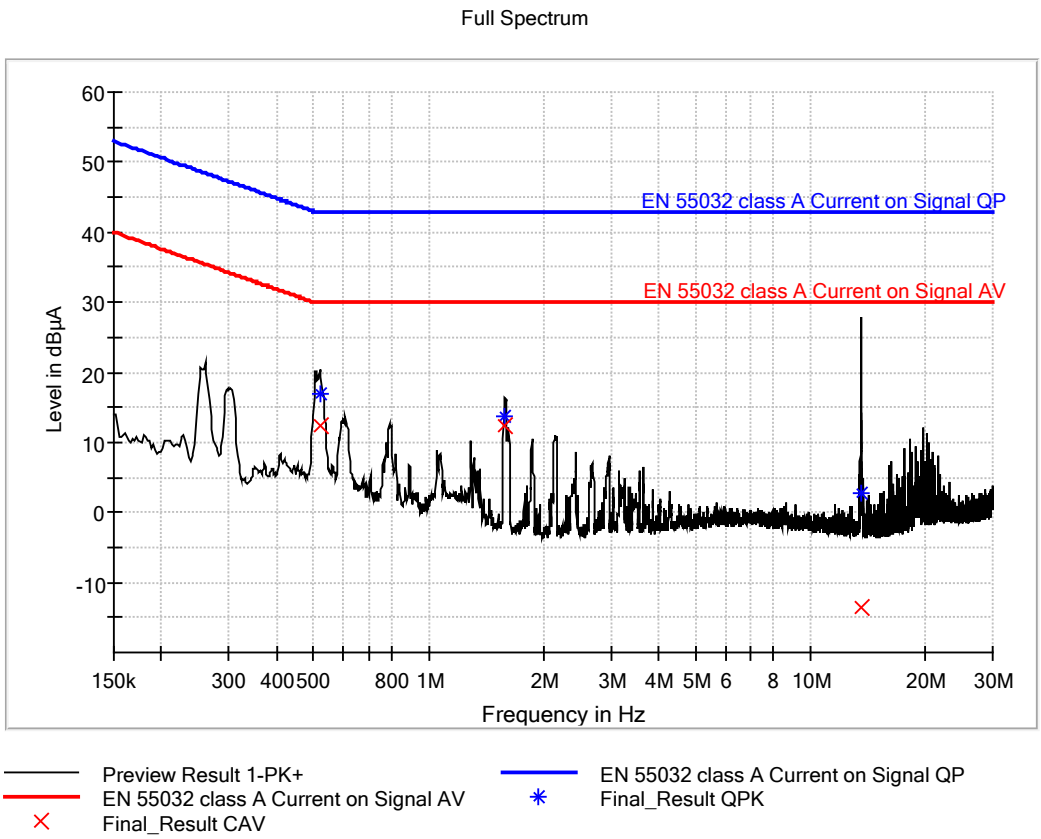

Fig. 3-7: Disturbing current on Serial (CM02A Module)

Frequency (MHz)	QuasiPeak (dBµA)	CAverage (dBµA)	Limit (dBµA)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)
0.520250	---	8.34	30.00	21.66	1000.0	9.000	-4.9
0.520250	12.71	---	43.00	30.29	1000.0	9.000	-4.9
1.578550	---	12.10	30.00	17.90	1000.0	9.000	-8.6
1.578550	13.40	---	43.00	29.60	1000.0	9.000	-8.6
13.557150	---	-13.69	30.00	43.69	1000.0	9.000	-9.3
13.557150	0.91	---	43.00	42.09	1000.0	9.000	-9.3

Tab. 3-5: Maximum of the conducted disturbances on Serial (CM02A Module), quasipeak and average detector

3.3 Radiated disturbance measurement (Frequency range: 30 - 1000 MHz)

3.3.1 Test setup

The radiated disturbance of the EUT was measured in an anechoic chamber, in a 10-m-distance.

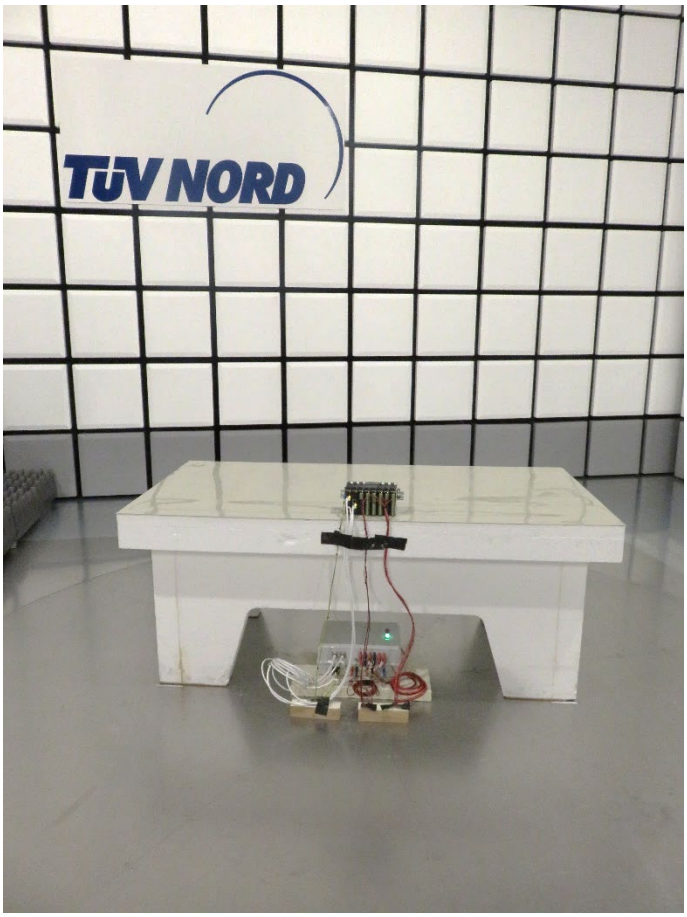

Fig. 3-8: Test setup for the radiated disturbance measurement

3.3.2 Operating conditions

Please refer to chapter 2.

3.3.3 Test date and climatic conditions

Date:	Dec. 07, 2020
Ambient air temperature:	23 °C
Humidity:	35 %
Atmospheric pressure:	997 hPa

3.3.4 Measuring equipment

Semi-anechoic-chamber

Receiver:	ESW44	No. 145
Antenna:	CBL 6112	No. 305
Software:	EMC 32 V10.60.15, Rohde & Schwarz	

3.3.5 Limit values

The result figures show the limit values according to EN IEC 61000-6-4 for the quasipeak detector (QP), for a 10-m-distance.

3.3.6 Measuring procedure and results

Initially a pre measurement with the peak detector in “maxhold” were done to detect the highest emission of the EUT. During this measurement the EUT was turned a full rotation at four antenna heights. The measurements were performed in horizontal and vertical antenna polarisation.
At local maximums final measurements with the quasipeak detector and 1 s measurement time has been made. For the final measurement the antenna height was varied and the EUT was turned.

The curves in the following figures show the peak values of the radiated emission. (pre measurement) and the quasipeak values (final measurement) marked by a „*“.

No deviations with regard to the applied standard could be detected.

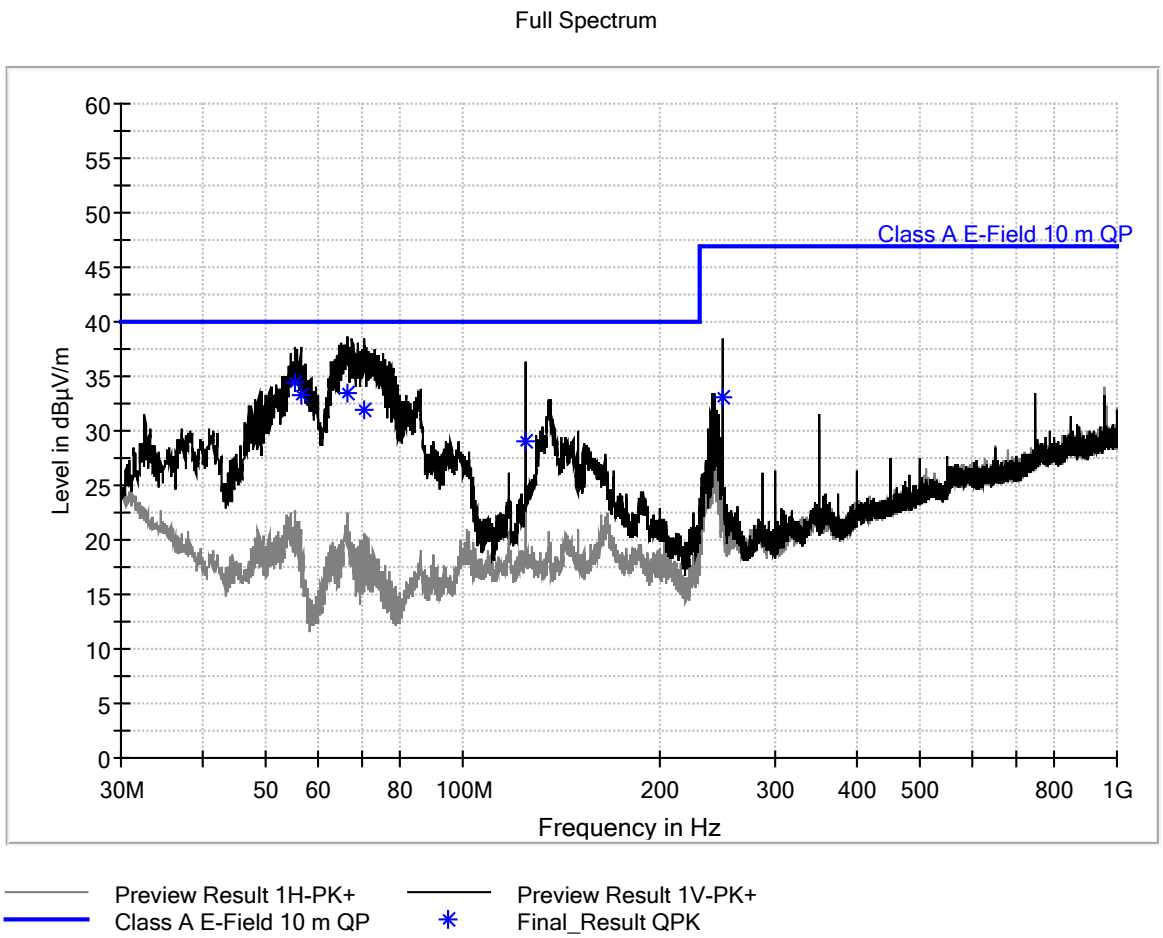

Fig. 3-9: Radiated emission (30 MHz to 1 GHz), horizontal and vertical antenna polarisation

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
55.230000	34.45	40.00	5.55	1000.0	120.000	381.0	V	-9.0
56.406000	33.20	40.00	6.80	1000.0	120.000	369.0	V	87.0
66.510000	33.44	40.00	6.56	1000.0	120.000	206.0	V	137.0
70.452000	31.85	40.00	8.15	1000.0	120.000	272.0	V	153.0
124.998000	28.98	40.00	11.02	1000.0	120.000	119.0	V	152.0
249.999000	33.00	47.00	14.00	1000.0	120.000	118.0	V	-42.0

Tab. 3-6: Maximum of the radiated disturbances, horizontal and vertical polarisation

3.5 Radiated disturbance measurement (Frequency range: 1 GHz - 6 GHz)

3.5.1 Test setup

The radiated disturbance of the EUT was measured in an anechoic chamber, in a 3-m-distance.

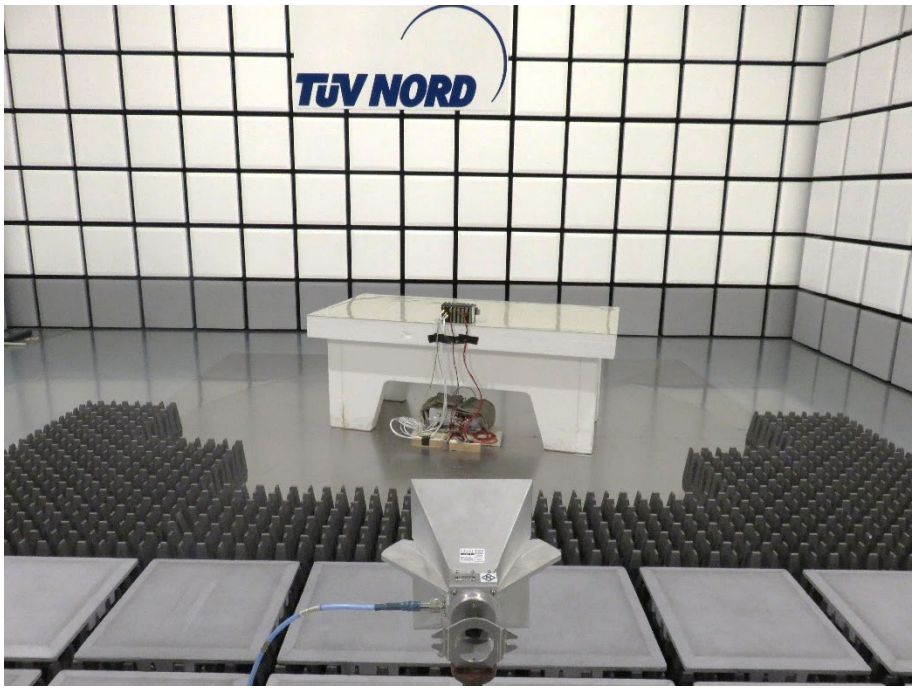

Fig. 3-10: Test setup for the radiated disturbance measurement (GHz range)

3.5.2 Operating conditions

Please refer to chapter 2.

3.5.3 Test date and climatic conditions

Date:	Dec. 07, 2020
Ambient air temperature:	23 °C
Humidity:	35 %
Atmospheric pressure:	997 hPa

3.5.4 Measuring equipment

Semi-anechoic-chamber

Receiver:	ESW44	No. 145
Antenna:	HF 907	No. 315
Software:	EMC 32 V10.60.15, Rohde & Schwarz	

In the following table the values for *w* (line tangent to the EUT) and Θ_{3dB} (3dB - beam width) of the used antenna for a 3-m-distance are listed:

Frequency [GHz]	Required minimum values		Measured result values	
	$\Theta_{3dB,min}$ [°]	w_{min} [m]	$\Theta_{3dB,min\ @\ 3m}$ [°]	$w_{min\ @\ 3m}$ [m]
1.0	60	1.15	68	4.05
1.5	---	---	55	3.12
2.0	35	0.63	51	2.86
2.5	---	---	55	3.12
3.0	---	---	44	2.42
3.5	---	---	47	2.61
4.0	35	0.63	49	2.73
4.5	---	---	49	2.73
5.0	---	---	51	2.86
5.5	---	---	50	2.80
6.0	27	0.48	45	2.49

Tab. 3-7: Minimum dimension for *w* (used antenna HF 907 / No. 315)

3.5.5 Limit values

The result figures show the limit values according to EN 61000-6-4 for the average detector (AV) and peak detector (PK), for a 3-m-distance.

3.5.6 Measuring procedure and results

The peak values of the disturbing field in the frequency range 1 GHz to 6 GHz were measured in horizontal and vertical antenna polarisations. The antenna was fixed 1.15 m above the ground. The maximum radiated emission was determined by turning the EUT 360° around.

The curves in the following figures show the peak values of the radiated emission. Peak values were measured at local maximums using a 1 s measuring time. The results are marked by a „*“.
Average values were measured at local maximums using a 1 s measuring time. The results are marked by a „x“.

No deviations with regard to the applied standard could be detected.

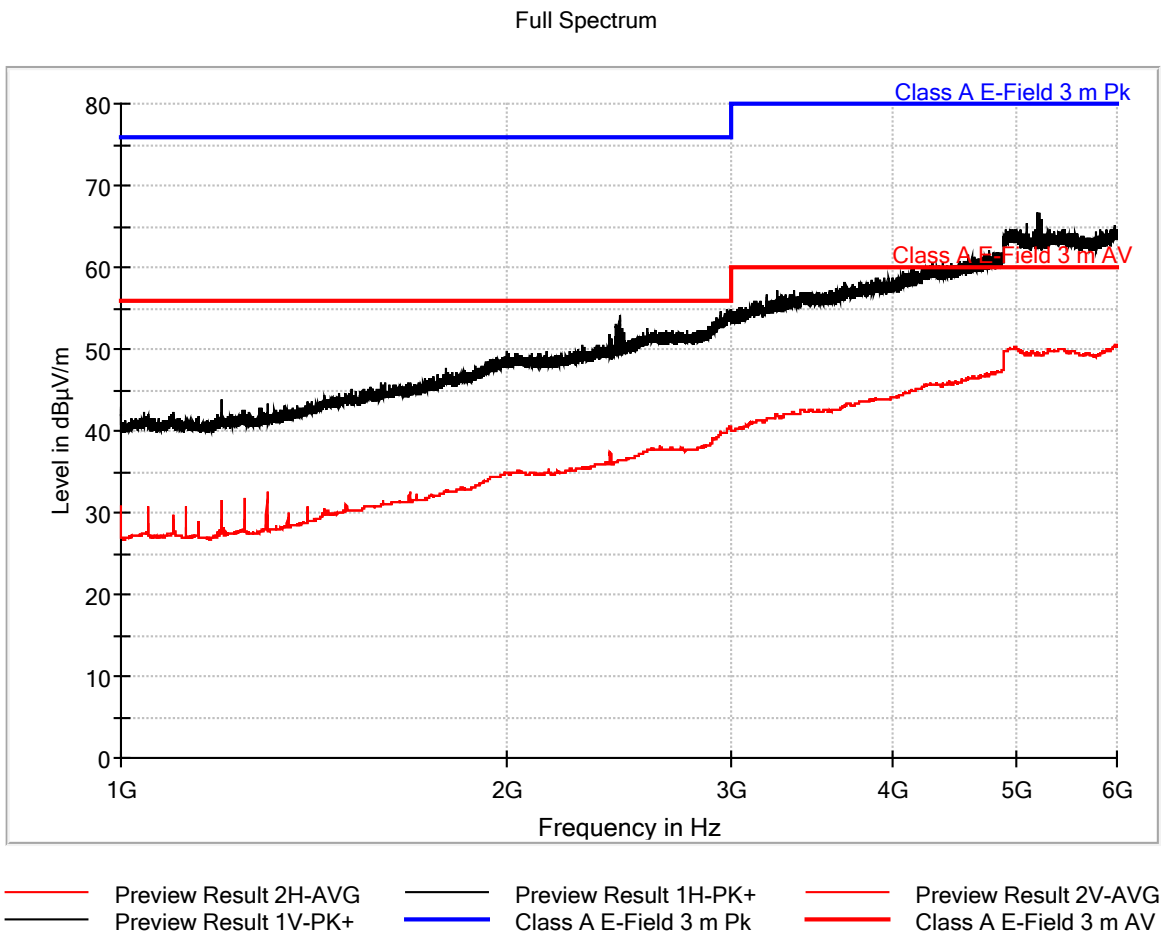

Fig. 3-11: Radiated emission (1 GHz to 6 GHz), horizontal and vertical polarisation, peak and average detector

4 Immunity in accordance with EN IEC 61000-6-2

4.1 ESD Test (EN 61000-4-2)

4.1.1 Test setup

Indirect contact discharges were performed on the vertical and horizontal coupling planes (table top device). The following figures show the test setup for the ESD test.

Remark: Due to the later installation position of the EUT, it will not be accessible during normal operation and therefore will not be exposed to electrostatic discharges according to chapter 8.3.2 EN 61000-4-2.

Fig. 4-1: Test setup for ESD testing

Fig. 4-2: Test setup for indirect ESD testing (CD on coupling planes, exemplary)

4.1.2 Test equipment

Screened measuring room (small)

Generator:	dito	No. 226

4.1.3 Parameters

The ESD was characterized by the following parameters:

Amplitude: 4 kV (contact discharge), indirect discharges on the horizontal (HCP) and vertical coupling plate (VCP)
Remark: Due to later installation, no direct discharges may be performed as the device wont
Polarity: ±
Pulse/s: 1
Ten discharges of each polarity were performed at each test point.

4.1.4 Operating conditions

Please refer to chapter 2.

4.1.5 Test date and climatic conditions

Date: Nov. 11, 2020
Ambient air temperature: 23 °C
Humidity: 30 %
Atmospheric pressure: 999 hPa

4.1.6 Required immunity performance criteria

Criterion B.

4.1.7 Test result

Test level	Contact discharges	Air discharges	Indirect discharges (HCP)	Indirect discharges (VCP)
± 2 kV	---	N/A ①	---	---
± 4 kV	---	N/A ①	---	---
± 6 kV	N/A ①	---	A	A
± 8 kV	---	N/A ①	---	---
± 15 kV	---	---	---	---

Tab. 4-1: Test result of the ESD test

①: Not applicable as stated in the remark.

No malfunctions or influences were detected. The EUT fulfils the demanded criterion.

4.2 Immunity against electromagnetic fields (EN 61000-4-3)

4.2.1 Test setup

The electromagnetic field was generated in an anechoic chamber using the reference field method according to EN 61000-4-3. The transmitting antenna was driven by a defined power at each frequency in order to generate the desired field strength without the EUT at the position, where the EUT has been placed (uniform area). The distance between antenna and EUT was 2 m (general setup in semi-anechoic-chamber, small). Between antenna and EUT absorbers (anechoic cones) were placed.

The EUT was irradiated by electromagnetic fields in the following **EUT positions**:
front (0°), left (90°), right (270°) and bottom side.

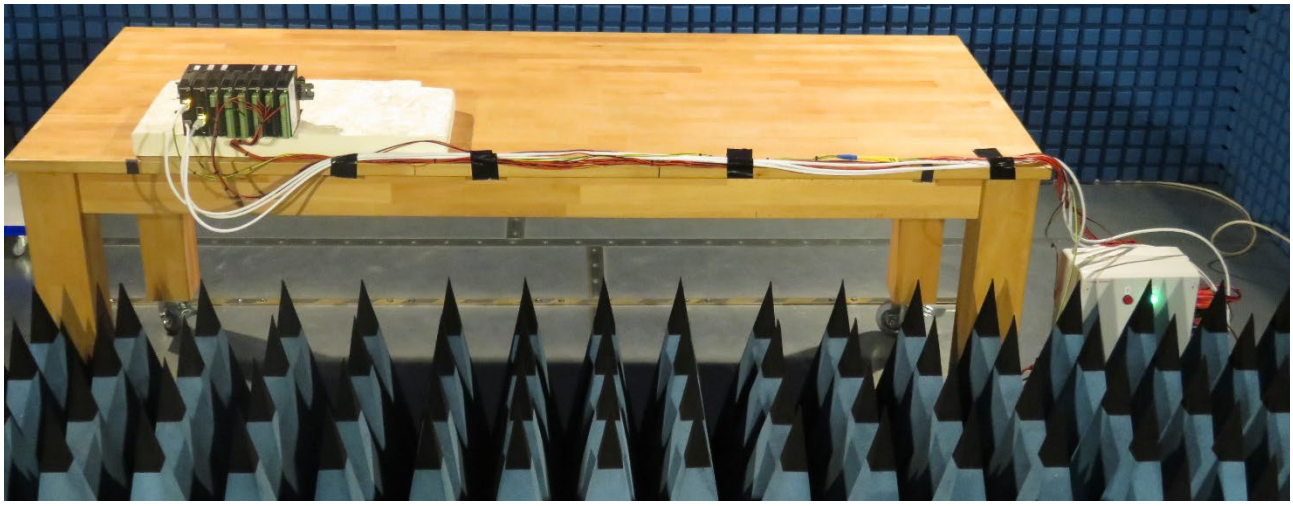

Fig. 4-3: Test setup for radiated susceptibility test (front side)

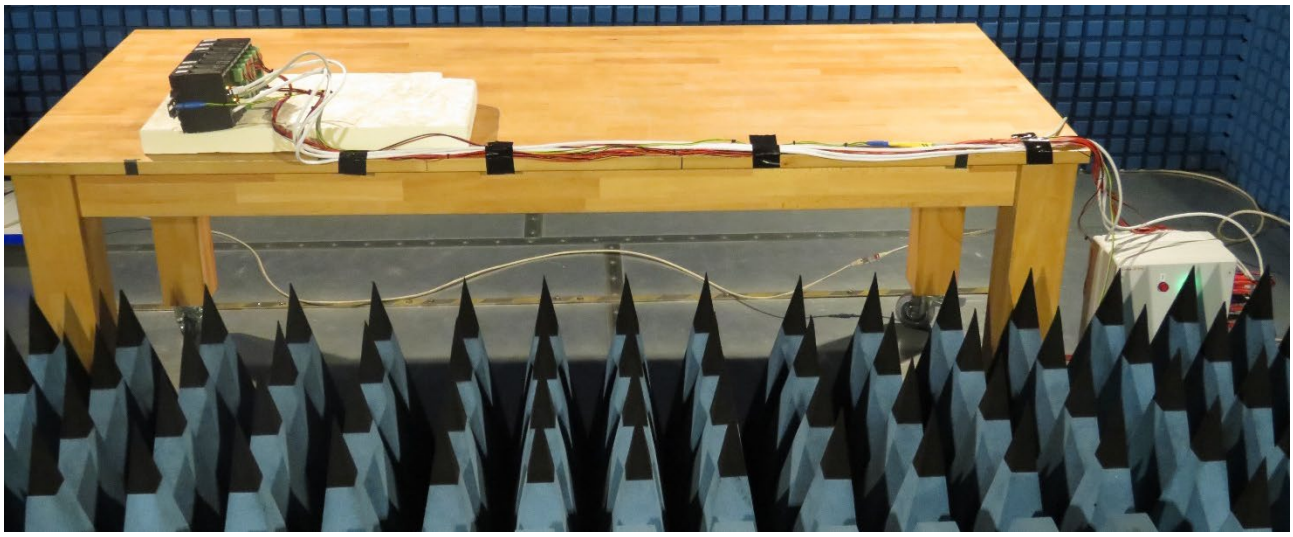

Fig. 4-4: Test setup for radiated susceptibility test (left side)

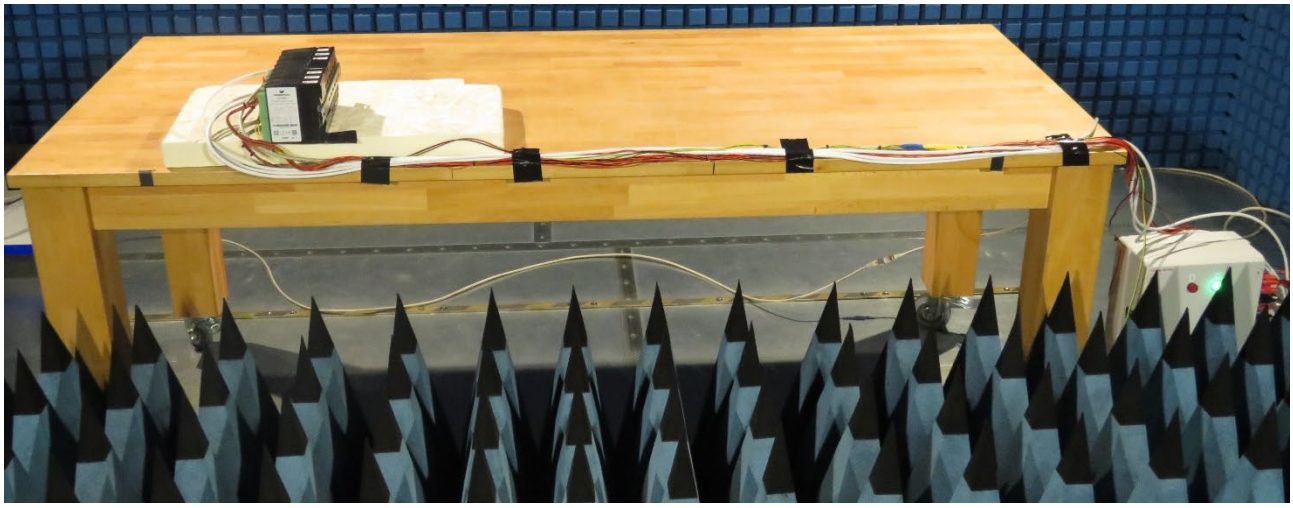

Fig. 4-5: Test setup for radiated susceptibility test (right side)

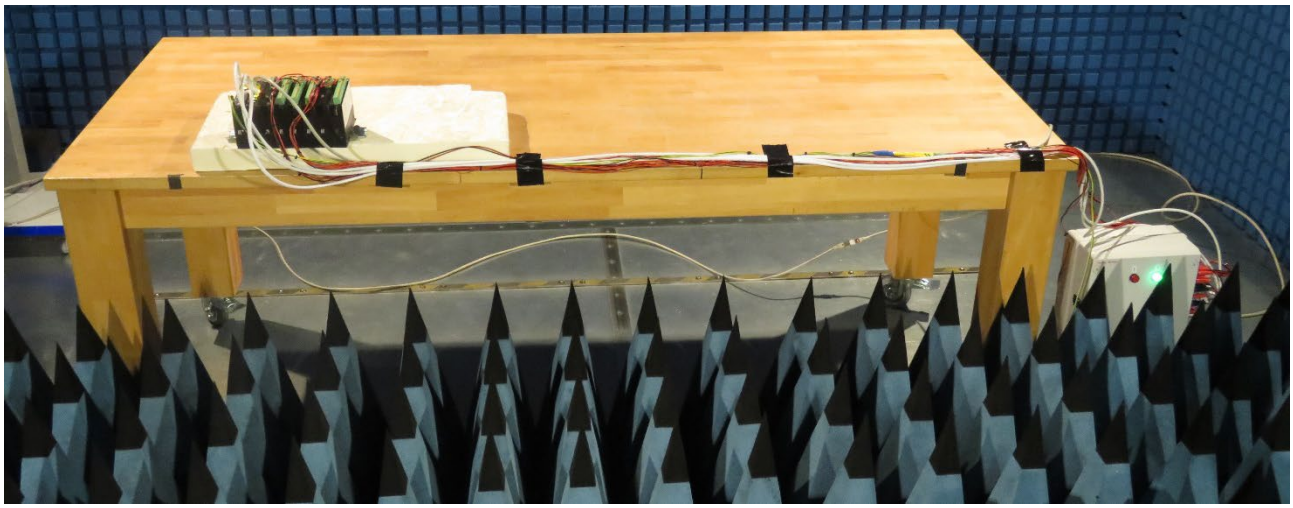

Fig. 4-6: Test setup for radiated susceptibility test (bottom side)

4.2.2 Test equipment

Semi-anechoic-chamber, small

Field probe:	EP601	No. 137
Signal generator:	SMB100A	No. 609
Power sensor:	NRP-Z211	No. 138
	PMU 6006 (FWD)	No. 134
	PMU 6006 (RWD)	No. 133
Amplifier:	CBA G-500, Teseq	
	AS 0860A 200-50, Milmega	
Antenna:	STLP 9128D special, Schwarzbeck	
	STLP 9149, Schwarzbeck	
High power coupler	MC4061-30	No. 135
	BCD-0810-50/2500	No. 147
Software:	EMC 32 V10.60.00, Rohde & Schwarz	

4.2.3 Parameters

Frequency range / Amplitude:	80 MHz to 800 MHz with 10 V/m
	800 MHz to 1000 MHz with 20 V/m
	1.4 GHz to 2.0 GHz with 10 V/m
	2.0 GHz to 2.7 GHz with 5 V/m
	2.7 GHz to 6.0 GHz with 3 V/m
Modulation:	80 % AM, 1 kHz
Frequency step:	1 %
Duration / step:	1 s
Polarization:	horizontal and vertical

4.2.4 Operating conditions

Please refer to chapter 2.

4.2.5 Test date and climatic conditions

Date:	Dec. 08, 2020
Ambient air temperature:	21 °C
Humidity:	35 %
Atmospheric pressure:	1005 hPa

4.2.6 Required immunity performance criteria

Criterion A.

4.2.7 Test result

Frequency [MHz]	Fieldstrength [V/m]	Polarisation	Test result			
			0°	90°	180°	bottom
80 - 800	10	horizontal	A	A	A	A
800 - 1000	20	horizontal	A	A	A	A
1400 - 2000	10	horizontal	A	A	A	A
2000 - 2700	5	horizontal	A	A	A	A
2700 - 6000	3	horizontal	A	A	A	A
80 - 800	10	vertical	A	A	A	A
800 - 1000	20	vertical	A	A	A	A
1400 - 2000	10	vertical	A	A	A	A
2000 - 2700	5	vertical	A	A	A	A
2700 - 6000	3	vertical	A	A	A	A

Tab. 4-2: Test result of the immunity test against electromagnetic fields

No malfunctions or influences were detected. The EUT fulfils the demanded criterion.

4.3 Burst (EN 61000-4-4)

4.3.1 Test setup

The test pulses were coupled into the power input port using a coupling network and into the data lines via coupling clamp.

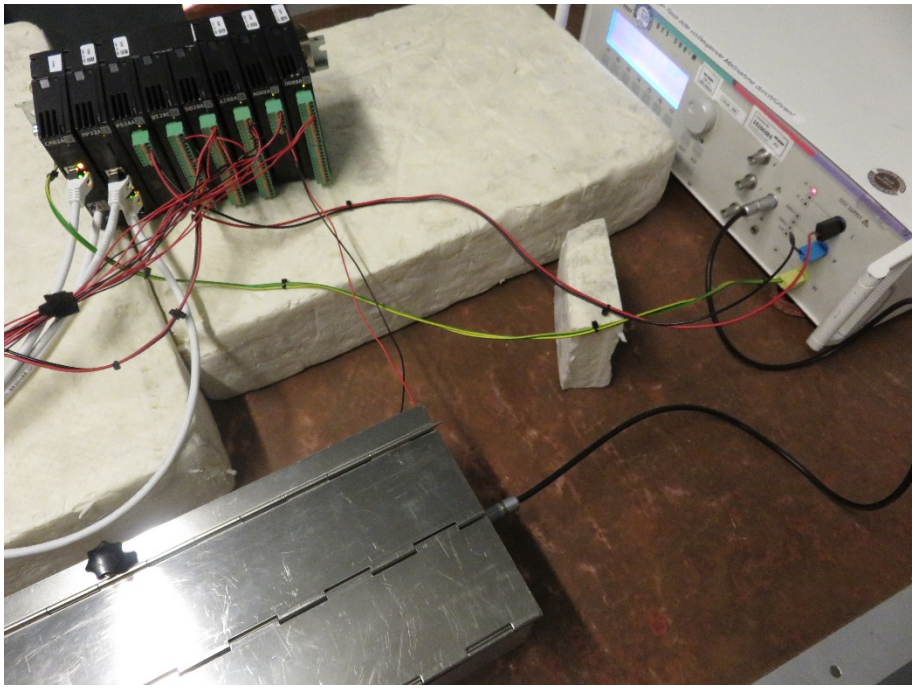

Fig. 4-7: Test setup for Burst test

4.3.2 Test equipment

Screened measuring room (small)

Burst Generator:	UCS-500 M4	No. 228
Coupling clamp:	MEB	
Software:	iec.control v6.0 (EMTEST)	

4.3.3 Parameters

The pulses were characterized by the following parameters:

Single pulse rise time/duration:	5 ns/ 50 ns
Amplitude:	2 kV
Polarity:	±
Repetition rate:	5 kHz
Burst duration:	15 ms
Burst frequency/ period:	3 Hz/ 300 ms
Test duration:	60 s (each)

4.3.4 Operating conditions

Please refer to chapter 2.

4.3.5 Test date and climatic conditions

Date: Dec. 10, 2020
Ambient air temperature: 23 °C
Humidity: 34 %
Atmospheric pressure: 1008 hPa

4.3.6 Required immunity performance criteria

Criterion A.

4.3.7 Test results

Amplitude	Port	Coupling	Test result
± 2 kV	Earth connection	UCS	A
± 2 kV	CM02A: LAN1	Clamp	A
± 2 kV	CM02A: Serial port	Clamp	A
± 2 kV	MP32A: LAN1	Clamp	A
± 2 kV	MP32A: LAN2	Clamp	A
± 2 kV	PS24A: V_{DC} power supply	UCS	A
± 2 kV	DI20C: Digital Inputs	Clamp	A
± 2 kV	DO20A: Digital Outputs	Clamp	A
± 2 kV	AI08A: Analog Inputs	Clamp	A
± 2 kV	AO02A: Analog Outputs	Clamp	A
± 2 kV	DO08R: Digital Outputs	Clamp	A

Tab. 4-3: Test result of the Burst test

No malfunctions or influences were detected. The EUT fulfils the demanded criterion.

4.4 Surge (EN 61000-4-5)

4.4.1 Test setup

The test pulses were coupled into the power input port and unscreened data lines using a coupling network. The test pulses into the shielded data lines were directly coupled to their shields.

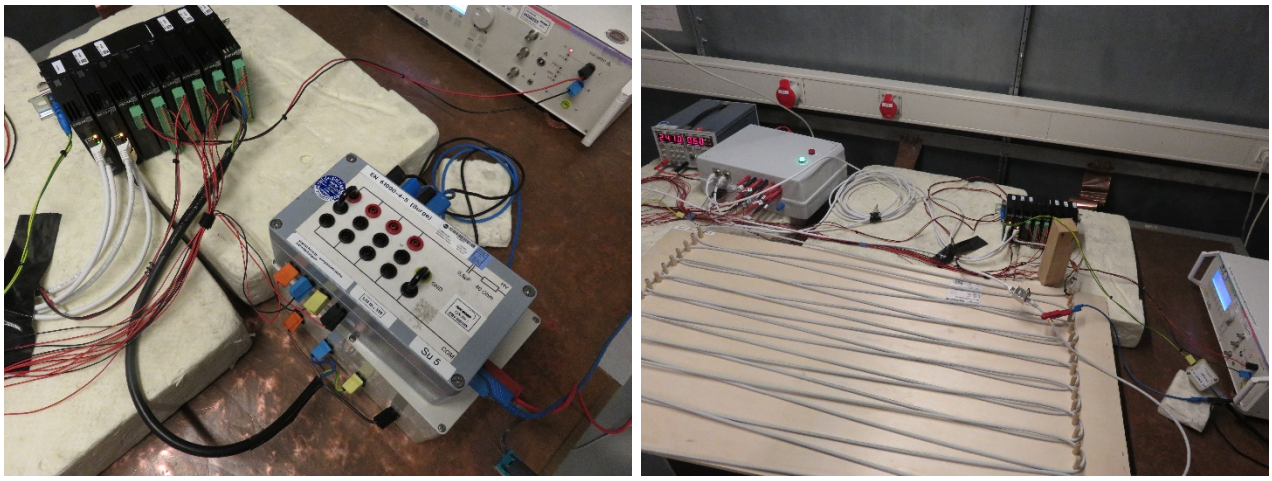

Fig. 4-8: Test setup for Surge test

4.4.2 Test equipment

Screened measuring room (small)

Surge Generator:	UCS-500 M4	No. 228
Coupling network:	40 Ω / 0.5 µF(TÜV NORD CERT)	
Software:	iec.control v.6.0	

4.4.3 Parameters

The pulses were characterized by the following parameters:

Tests with 2 Ω (UCS) + 40 Ω Coupling network according to EN 50121-4:

Amplitude:	0.5kV and 1 kV (line to line)
	0.5kV, 1 kV and 2 kV (line to earth, screened lines)
Polarity:	±
Rise time:	1.2 µs
Virtual time to half value:	50 µs
Pulses/polarity:	5
Pulse/min:	1
Synchronisation:	none

Additional tests with 2 Ω + 10 Ω (UCS) Coupling network according to EN IEC 61000-6-2 on V_{DC} power supply:

Amplitude:	0.5kV (line to line)
	0.5kV and 1 kV (line to earth)
Polarity:	±
Rise time:	1.2 µs
Virtual time to half value:	50 µs
Pulses/polarity:	5
Pulse/min:	1
Synchronisation:	none

4.4.4 Operating conditions

Please refer to chapter 2.

4.4.5 Test date and climatic conditions

Date:	Dec. 10, 2020	Date:	Dec. 11, 2020
Ambient air temperature:	24 °C	Ambient air temperature:	24 °C
Humidity:	31 %	Humidity:	30 %
Atmospheric pressure:	1007 hPa	Atmospheric pressure:	999 hPa

4.4.6 Required immunity performance criteria

Criterion B.

4.4.7 Test result

Polarity / Coupling		Amplitude / Phase		
		500 V	1000 V	2000 V
Screen	+	5x	5x	5x
	-	5x	5x	5x

Tab. 4-4: Test procedure (CM02A: LAN1), Screen

Polarity / Coupling		Amplitude / Phase		
		500 V	1000 V	2000 V
Screen	+	5x	5x	5x
	-	5x	5x	5x

Tab. 4-5: Test procedure (CM02A: Serial), Screen

Polarity / Coupling		Amplitude / Phase		
		500 V	1000 V	2000 V
Screen	+	5x	5x	5x
	-	5x	5x	5x

Tab. 4-6: Test procedure (MP32A: LAN1), Screen

Polarity / Coupling		Amplitude / Phase		
		500 V	1000 V	2000 V
Screen	+	5x	5x	5x
	-	5x	5x	5x

Tab. 4-7: Test procedure (MP32A: LAN2), Screen

Polarity / Coupling		Amplitude / Phase		
		500 V	1000 V	2000 V
$+V_{DC}$ – 0 V_{DC}	+	5x	---	---
	-	5x	---	---
$+V_{DC}$ – PE	+	5x	5x	---
	-	5x	5x	---
0 V_{DC} – PE	+	5x	5x	---
	-	5x	5x	---

Tab. 4-8: Test procedure (PS24A: V_{DC} power supply), 2 Ω Coupling network

Polarity / Coupling		Amplitude / Phase		
		500 V	1000 V	2000 V
$+V_{DC}$ – 0 V_{DC}	+	5x	5x	---
	-	5x	5x	---
$+V_{DC}$ – PE	+	5x	5x	5x
	-	5x	5x	5x
0 V_{DC} – PE	+	5x	5x	5x
	-	5x	5x	5x

Tab. 4-9: Test procedure (PS24A: V_{DC} power supply), 40 Ω Coupling network

Polarity / Coupling		Amplitude / Phase		
		500 V	1000 V	2000 V
DI1 – DI2	+	5x	5x	---
	-	5x	5x	---
DI1 – DI9	+	5x	5x	---
	-	5x	5x	---
DI2 – DI9	+	5x	5x	---
	-	5x	5x	---
DI1 – PE	+	5x	5x	5x
	-	5x	5x	5x
DI2 – PE	+	5x	5x	5x
	-	5x	5x	5x
DI9 – PE	+	5x	5x	5x
	-	5x	5x	5x

Tab. 4-10: Test procedure (DI20C: Digital Inputs), 40 Ω Coupling network

Polarity / Coupling		Amplitude / Phase		
		500 V	1000 V	2000 V
DO+ – DO-	+	5x	5x	---
	-	5x	5x	---
DO+ – DO1	+	5x	5x	---
	-	5x	5x	---
DO+ – DO2	+	5x	5x	---
	-	5x	5x	---
DO- – DO2	+	5x	5x	---
	-	5x	5x	---
DO- – DO3	+	5x	5x	---
	-	5x	5x	---
DO2 – DO3	+	5x	5x	---
	-	5x	5x	---
DO+ – PE	+	5x	5x	5x
	-	5x	5x	5x
DO- – PE	+	5x	5x	5x
	-	5x	5x	5x
DO2 – PE	+	5x	5x	5x
	-	5x	5x	5x
DO3 – PE	+	5x	5x	5x
	-	5x	5x	5x

Tab. 4-11: Test procedure (DO20A: Digital Outputs), 40 Ω Coupling network

Polarity / Coupling		Amplitude / Phase		
		500 V	1000 V	2000 V
AI1 – AI3	+	5x	5x	---
	-	5x	5x	---
AI1 – AI4	+	5x	5x	---
	-	5x	5x	---
AI1 – AI6	+	5x	5x	---
	-	5x	5x	---
AI3 – AI4	+	5x	5x	---
	-	5x	5x	---
AI3 – AI6	+	5x	5x	---
	-	5x	5x	---
AI3 – AI6	+	5x	5x	---
	-	5x	5x	---
AI1 – PE	+	5x	5x	5x
	-	5x	5x	5x
AI3- – PE	+	5x	5x	5x
	-	5x	5x	5x
AI4 – PE	+	5x	5x	5x
	-	5x	5x	5x
AI6 – PE	+	5x	5x	5x
	-	5x	5x	5x

Tab. 4-12: Test procedure (AI08A: Analog Inputs), 40 Ω Coupling network

Polarity / Coupling		Amplitude / Phase		
		500 V	1000 V	2000 V
AO1 – AO2	+	5x	5x	---
	-	5x	5x	---
AO1 – AO5	+	5x	5x	---
	-	5x	5x	---
AO1 – AO6	+	5x	5x	---
	-	5x	5x	---
AO2 – AO5	+	5x	5x	---
	-	5x	5x	---
AO2 – AO6	+	5x	5x	---
	-	5x	5x	---
AO5 – AO6	+	5x	5x	---
	-	5x	5x	---
AO1 – PE	+	5x	5x	5x
	-	5x	5x	5x
AO2- – PE	+	5x	5x	5x
	-	5x	5x	5x
AO5 – PE	+	5x	5x	5x
	-	5x	5x	5x
AO6 – PE	+	5x	5x	5x
	-	5x	5x	5x

Tab. 4-13: Test procedure (AO02A: Analog Outputs), 40 Ω Coupling network

Polarity / Coupling		Amplitude / Phase		
		500 V	1000 V	2000 V
DO4 – DO5	+	5x	5x	---
	-	5x	5x	---
DO4 – PE	+	5x	5x	5x
	-	5x	5x	5x
DO5 – PE	+	5x	5x	5x
	-	5x	5x	5x

Tab. 4-14: Test procedure (DO08R: Digital Outputs), 40 Ω Coupling network

No malfunctions or influences were detected. The EUT fulfils the demanded criterion.

4.5 Immunity to conducted disturbances, induced by radio frequency fields (EN 61000-4-6)

4.5.1 Test setup

The coupling was performed with the coupling network into the power input port and with the coupling clamp / coupling network into the data lines.

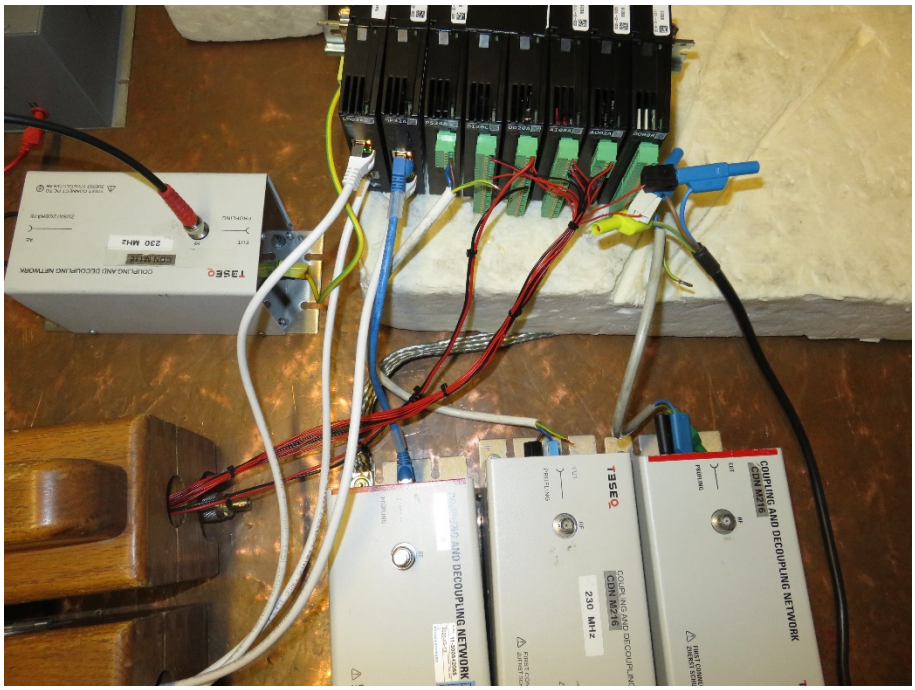

Fig. 4-9: Test setup for the immunity test against induced radio frequency fields

4.5.2 Test equipment

Screened measuring room (small)

Coupling network:	M2	No. 506
	M3	No. 514
	M1	No. 522
	M2	No. 523
	M1	No. 540
	M2	No. 541
	ISN ST08	No. 545
	M416	No. 524
Injection Clamp:	F-2031	No. 509
Decoupling Clamp:	F-2031-DCN	No. 510
Signal generator:	SMY01	No. 604
Amplifier:	SCCX100 (IFI)	
EMI Test Receiver:	ESR 7	No. 124
Power sensor:	NRP-Z91	No. 127
Bidirectional Coupler:	BCD 0100-40/100-12	No. 140
Software:	EMC 32 V10.60.00, Rohde & Schwarz	

4.5.3 Parameters

Amplitude: 10 V
Frequency range: 150 kHz to 80 MHz
Modulation: 80 % AM, 1 kHz
Frequency step: 1 %
Duration / step: 1 s

4.5.4 Operating conditions

Please refer to chapter 2.

4.5.5 Test date and climatic conditions

Date:	Dec. 08, 2020	Date:	Dec. 09, 2020
Ambient air temperature:	22 °C	Ambient air temperature:	23 °C
Humidity:	46 %	Humidity:	42 %
Atmospheric pressure:	1005 hPa	Atmospheric pressure:	1007 hPa

4.5.6 Required immunity performance criteria

Criterion A.

4.5.7 Test results

Amplitude	Port	Coupling	Test result
10 V	Earth connection	M1	A
10 V	CM02A: LAN1	ISN ST08	A
10 V	CM02A: Serial port	Clamp	A
10 V	MP32A: LAN1	ISN ST08	A
10 V	MP32A: LAN2	ISN ST08	A
10 V	PS24A: V_{DC} power supply	M2	A
10 V	DI20C: Digital Inputs	M3	A
10 V	DO20A: Digital Outputs	M4	A
10 V	AI08A: Analog Inputs	M4	A
10 V	AO02A: Analog Outputs	M4	A
10 V	DO08R: Digital Outputs	M2	A

Tab. 4-15: Test result of the immunity test against induced radio frequency fields

No malfunctions or influences were detected. The EUT fulfils the demanded criterion.

Power frequency magnetic field immunity test (EN 61000-4-8)

4.5.8 Test setup

The test was performed with the frame-coil in all spatial directions.

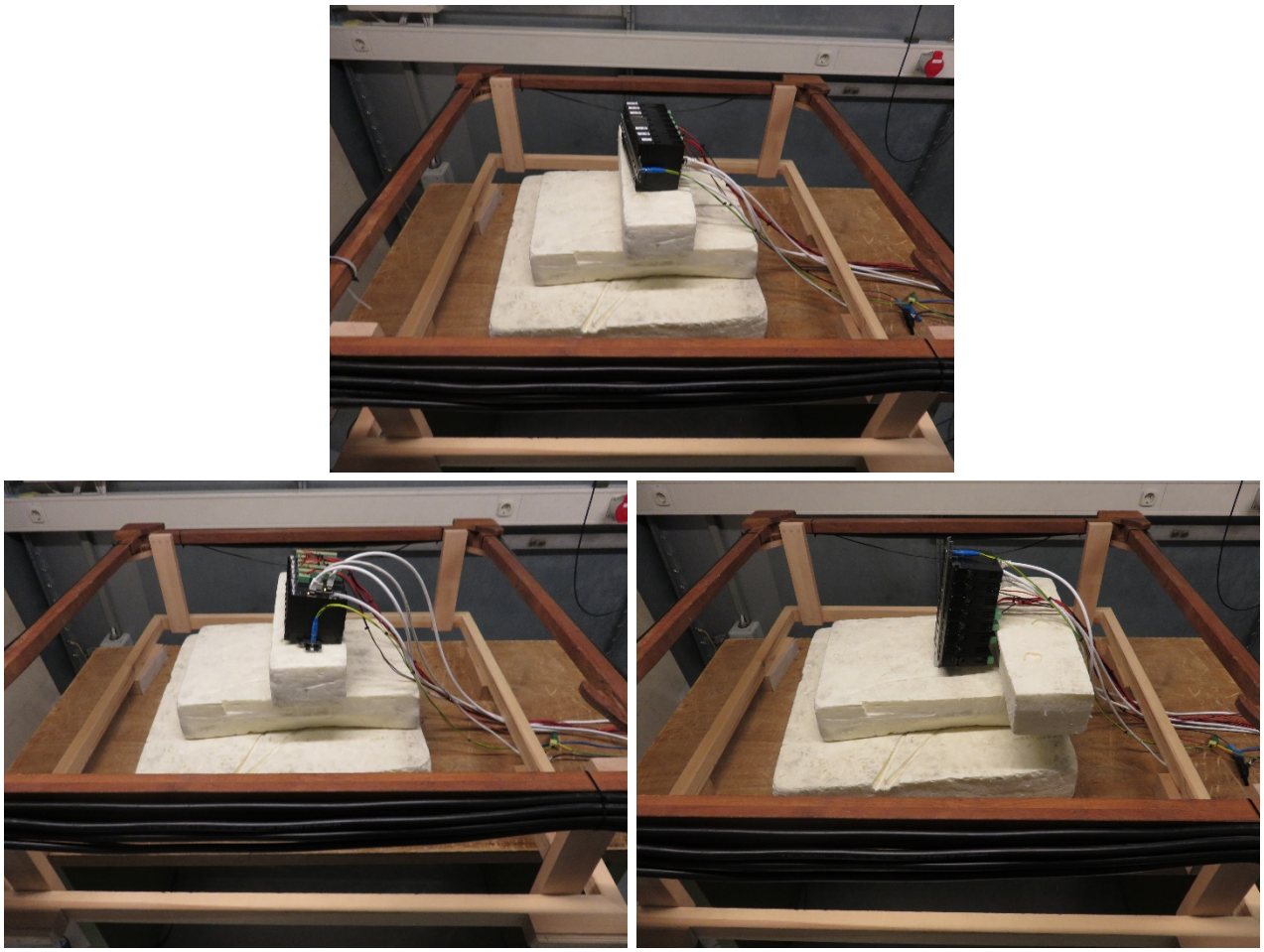

Fig. 4-10: Test setup for the test against magnetic fields (axis: X / Y / Z)

4.5.9 Test equipment

Screened measuring room (small)
Frame-coil (TNC)

DC/AC Power supply:	Carlifornia Instruments model 5001iX	
Field measurement system:	SMP2	No. 142

4.5.10 Parameters

Frequency:	DC
Amplitude:	300 A/m
Frequency:	16 2/3 Hz, 50 Hz
Amplitude:	100 A/m

Axes: X / Y / Z

4.5.11 Operating conditions

Please refer to chapter 2.

4.5.12 Test date and climatic conditions

Date: Dec. 10, 2020
Ambient air temperature: 23 °C
Humidity: 35 %
Atmospheric pressure: 1008 hPa

4.5.13 Required immunity performance criteria

Criterion A.

4.5.14 Test results

Amplitude	Frequency	Orientation	Test result
300 A/m	DC	X	pass
		Y	pass
		Z	pass
100 A/m	50 Hz	X	pass
		Y	pass
		Z	pass
	60 Hz	X	pass
		Y	pass
		Z	pass

No malfunctions or influences were detected. The EUT fulfils the demanded criterion.

5 Uncertainty of measurements

The total uncertainty of measurement is the result of the mathematically-statistically distribution of the individual measurement uncertainty of the used measurement equipment. It is supposed that all individual deviations accidentally but not inevitable normally distributed. The total deviation is supposed to be normally distributed (RSS=Root-Sum-of-the-Squares deviation corresponds to a measurement uncertainty which will be not exceeded with a probability of 68%). Measurement uncertainty Δ which will be not exceeded with a probability of 95% is 2 x RSS. For the following measurements and tests are the values as from the laboratory given:

Measurement /Test	Frequency Range	Value of 2 x RSS	State
Conducted emission Disturbing voltage	9 kHz to 150 kHz	± 3.54 dB ①	Mar 16, 2018
	150 kHz to 30 MHz	± 3.32 dB ①	Mar 16, 2018
Conducted emission disturbing current	150 kHz to 30 MHz	± 2.39 dB ①	Mar 16, 2018
Radiated emission	150 kHz – 30 MHz	± 2.58 dB	Mar 16, 2018
	30 MHz – 1 GHz	± 4.64 dB ①	Mar 16, 2018
	1 GHz – 6 GHz	± 4.85 dB ①	Mar 16, 2018
Interference power	30 MHz – 300 MHz	± 2.95 dB ①	Mar 16, 2018
Harmonic current	50 Hz – 2 kHz	± 5.82%	Mar 16, 2018
Flicker	-----	± 7.25%	Mar 16, 2018
ESD	Amplitude	± 6.34%	Apr 20, 2018
Radiated susceptibility	80 MHz – 6.0 GHz	± 2.62 dB	Apr 20, 2018
Burst	-----	± 9.72%	Apr 20, 2018
Surge	-----	± 11.76%	Apr 20, 2018
Induced radio frequency fields (CDN)	150 kHz – 80 MHz	± 2.07dB	Apr 20, 2018
Induced radio frequency fields (Clamp)	150 kHz – 80 MHz	± 3.39dB	Apr 20, 2018
Magnetic field	50 Hz / 60 Hz	± 3.19dB	Apr 20, 2018
Voltage dips short interruptions and voltage variations	-----	± 5.01%	Apr 20, 2018

Tab. 5-1: Uncertainty of measurement

①: Therefore, the EMC laboratory of TÜV NORD CERT GmbH falls below the maximum value of the expanded measurement uncertainty given by EN 55016-4-2 (2011 + A1 2014) for these measurements. The measurement values on and below the limit are rated *passed* (valid for these four procedures as given in EN 55016-4-2).

6 Measuring instrument list

Status / State Dec. 09, 2020						
Bezeichnung/ Marking	Hersteller/ Manufacturer	Typ/ Type	Seriennummer/ Serial-No.	Letzte Kal./ Last Cal.	**Nächste Kal./ Next Cal. (±1 Monat/ Month)**	**Nr. / No.**
1 Messgeräte / Measuring Instruments						
Power sensor	Rohde & Schwarz	NAP-Z6	830262/014	Apr 20	Sep 21	115
Power sensor	Rohde & Schwarz	NRT-Z44	101718	Jul 19	Dez 20	116
EMI-Test Receiver	Rohde & Schwarz	ESU8	100172	Dec 19	May 21	118
Field measurement system	Narda	EFA 300	J-0021	Jun 20	Nov 21	123
EMI-Test Receiver	Rohde & Schwarz	ESR7	101239	Dec 19	May 21	124
Power sensor	Rohde & Schwarz	NRP-Z91	100881	Apr 20	Sep 21	125
Power sensor	Rohde & Schwarz	NRP-Z91	101091	Jun 19	Nov 20	126
Power sensor	Rohde & Schwarz	NRP-Z91	102086	Jun 19	Nov 20	127
DC Field measurement system	Wuntronic	Koshava 5	K141119	Jul 19	Dec 20	128
Digital Power Analyzer	EM-Test	DPA 503N	P1517154650	Dec 19	May 21	129
Flicker Impedance	EM-Test	AIF 503N32.1	P1540164837	Dec 19	May 21	130
DMM	HP / Agilent	34401A	3146A05639	Mar 19	Aug 20	131
DMM	HP / Agilent	34401A	3146A27935	Sep 20	Feb 22	132
DMM	HP / Agilent	34401A	MY47051047	Oct 20	Mar 22	144
Power sensor	Teseq	PM 6006	74544	Apr 20	Sep 21	133
Power sensor	Teseq	PM 6006	74545	Apr 20	Sep 21	134
High Power Coupler	Fairview Microwave	MC 4061-30	74651	Nov 17	Dec 20	135
High Power Coupler	Fairview Microwave	MC 4061-30	74652	Nov 17	Dec 20	136
Fieldstrength Probe	Narda STS	EP601	511WX51131	Okt 20	Mar 22	137
Power sensor	Rohde & Schwarz	NRP-Z211	101461	Sep 20	Feb 22	138
Bidirectional Coupler	Bonn Elektronik	BCD 0100-40/100	118447-01	May 19	Apr 22	139
Bidirectional Coupler	Bonn Elektronik	BCD 0100-40/100	118447-02	May 19	Apr 22	140
Bidirectional Coupler	Bonn Elektronik	BCD 0100-40/100	139291	May 19	Apr 22	141
Field measurement system	Wavecontrol	SMP2	16SN0313	Jul 19	Dec 20	142
Oszilloscope	Rohde & Schwarz	RTM1052	101587	Jan 20	Jun 21	143
EMI-Test Receiver	Rohde & Schwarz	ESW44	101704	Feb 20	Jul 21	145
Bidirectional Coupler	Werlatone	C6047-12	107338	May 19	Apr 22	146
Bidirectional Coupler	Bonn Elektronik	BCD 0810-50/2500	128899	May 19	Apr 22	147
DC Field measurement system	Narda/Metrolab	ETM-1	P-0054	Jul 19	Dec 20	128
Power sensor	Rohde & Schwarz	NRP-Z211	101549	Aug 20	Jan 22	138

Bezeichnung/ Marking	Hersteller/ Manufacturer	Typ/ Type	Seriennummer/ Serial-No.	Letzte Kal./ Last Cal.	Nächste Kal./ Next Cal. (±1 Monat/ Month)	Nr. / No.
2 Generatoren / Generators						
Pulse-Generator	EM-Test	VDS-200	0195-01	Jan 20	Jun 21	219
Power Fail Simulator	EM-Test	PFS-503	0101-01	Jan 20	Jun 21	225
ESD-Generator	EM-Test	dito	0303/33	Jul 20	Dec 21	226
Pulse-Generator	EM-Test	OCS-500 M6	1003-02	Jan 20	Jun 21	227
Pulse-Generator	EM-Test	UCS-500 M4	V0726102639	Jan 20	Jun 21	228
Electronic switch	EM-Test	BS 200 N	V1037107353	Jan 20	Jun 21	230
Pulse-Generator	EM-Test	UCS-500 N7	P1506148837	Jan 20	Jun 21	232
Pulse-Generator	EM-Test	TSurge7	P1506148853	Jan 20	Jun 21	233
Electronic power source	EM-Test	NetWave 30.2-400	P1540164825	Dec 19	May 21	234
Power Generator	Dr. Hubert	GA1240-16	124A1222	Dec 19	May 21	235
Test Generator Short Term	Dr. Hubert	GA1330	133A1109	Dec 19	May 21	236
Pulse-Generator	EM-Test	UCS-200	P1646187185	Jan 20	Jun 21	237
ESD-Generator	AMETEK CTS	ESD NX30.1	11817	Aug 20	Jan 22	238
Impuls-Generator	AMETEK CTS	LD 200N	P1905226598	Aug 19	Jan 21	239
3 Antennen/ Antennas						
Log.-per. Antenna	Schwarzbeck	UHALP 9108	9003	May 20	Apr 23	302
active Loop Antenna	Rohde & Schwarz	HFH2-Z2	8360077/012	Nov 19	Apr 21	303
3 Loop Antenna	Rohde & Schwarz	HM 020	839610/001	Feb 18	Jan 21	304
Bilog Antenna	CHASE Electronics	CBL6112	2082	Feb 20	Jan 23	305
Bilog Antenna	CHASE Electronics	CBL6111	1568	Mar 20	Feb 23	306
active Rod Antenna	ETS Lindgren	ETS3301C	156310	May 19	Oct 20	312
Biconical Antenna	Schwarzbeck	VHBB 9124 / BBA 9106	9124-796	May 20	Apr 23	313
Double-Ridged Waveguide	Rohde & Schwarz	HF906	100428	Feb 20	Jan 23	314
Double-Ridged Waveguide	Rohde & Schwarz	HF907	1102763	Feb 19	Jan 22	315

Bezeichnung/ Marking	Hersteller/ Manufacturer	Typ/ Type	Seriennummer/ Serial-No.	Letzte Kal./ Last Cal.	Nächste Kal./ Next Cal. (±1 Monat/ Month)	Nr. / No.
4 Messhilfsmittel / Facilities						
V-LISN	Schwarzbeck	NSLK 8128	-	Sep 20	Aug 23	402
Current clamp	Solar	6741-1	922657	Jul 20	Jun 23	405
Current clamp	Rohde & Schwarz	EZ-17	835989/002	Jul 20	Jun 23	406
LISN	Rohde & Schwarz	ESH3-Z6	835273/015	Oct 20	Sep 23	408
LISN	Rohde & Schwarz	ESH3-Z6	840522/006	Oct 20	Sep 23	409
Voltage Probe	Schwarzbeck	TK 9421	9421-127	Jul 20	Jun 23	410
Voltage Probe	Rohde & Schwarz	ESH2-Z3	No. 2	Jul 20	Jun 23	411
V-LISN	Rohde & Schwarz	ESH2-Z5	835490 / 006	Jun 20	May 23	412
V-LISN	Schwarzbeck	NSLK 8127	8127-463	Oct 20	Sep 23	414
LISN	Schwarzbeck	NNBM 8125 BCI	8125-1200	Sep 20	Aug 23	415
LISN	Schwarzbeck	NNBM 8125 BCI	8125-1201	Sep 20	Aug 23	416
Pulse limiter	Rohde & Schwarz	ESH3-Z2	No. 1	Mar 18	Feb 21	417
Pulse limiter	Rohde & Schwarz	ESH3-Z2	No. 2	Oct 20	Sep 23	418
V-LISN	Schwarzbeck	NSLK 8127	8127-603	Jul 20	Jun 23	419
Pulse limiter	Rohde & Schwarz	ESH3-Z2	No. 3	Jan 18	Dec 20	420
V-LISN	Schwarzbeck	NNLK 8121	8121-150	Oct 20	Sep 23	421
CMAD	Teseq	CMAD 20A	42359	Nov 20	Oct 23	425
CMAD	Teseq	CMAD 20A	42360	Nov 20	Oct 23	426
CMAD	Teseq	CMAD 20A	42364	Nov 20	Oct 23	427
Capacitive Voltage Probe	Teseq	CVP 2200A	45512	Dec 19	May 21	428
Current clamp	Solar	9123-1N	985007	Nov 17	Oct 20	429
High Pass Filter	Schwarzbeck	HPF 150kI	00009	Dec 17	Nov 20	430

Bezeichnung/ Marking	Hersteller/ Manufacturer	Typ/ Type	Seriennummer/ Serial-No.	Letzte Kal./ Last Cal.	Nächste Kal./ Next Cal. (±1 Monat/ Month)	Nr. / No.
5 Koppelnetzwerke / CDN						
CDN	MEB	T4	10840	Jan 19	Dec 21	501
CDN	MEB	M3	11181	Jan 19	Dec 21	502
CDN	MEB	T2	11398	Jan 19	Dec 21	503
CDN	FCC	M5	103	Jan 19	Dec 21	504
CDN	FCC	C1	35	Jan 19	Dec 21	505
CDN	FCC	M2	57	Jan 19	Dec 21	506
CDN	FCC	AF8	17	Jan 19	Dec 21	508
EM Injection Clamp	FCC	F-203I	107	Nov 20	Oct 23	509
CDN	FCC	F-203I-DCN	40	Nov 20	Oct 23	510
CDN	MEB	S9	12341	Jan 19	Dec 21	511
CDN	MEB	S15	11300	Jan 19	Dec 21	512
CDN	MEB	S25	11342	Jan 19	Dec 21	513
CDN	MEB	M3	12192	Jan 19	Dec 21	514
CDN	MEB	M1	12028	Jan 19	Dec 21	515
CDN	MEB	M5	12245	Jan 19	Dec 21	516
EM Injection Clamp	FCC	F-203I	364	Nov 20	Oct 23	517
CDN	MEB / Schaffner	T400	16914	Jan 19	Dec 21	518
CDN	Teseq	S751	26559	Jan 19	Dec 21	519
CDN	Teseq	USB/p	27032	Jan 19	Dec 21	520
CDN	Teseq	ISN ST08	26574	Jan 19	Dec 21	521
CDN	Teseq	M116	29876	Jan 19	Dec 21	522
CDN	Teseq	M216	30289	Jan 19	Dec 21	523
CDN	Teseq	M416	28045	Jan 19	Dec 21	524
CN	Dr. Hubert	CN-19-Fig4	B9100001		Not calibrated	525
CN	Dr. Hubert	CN1240-32	124CN1107	May 18	Apr 21	526
Isolation transformer	Dr. Hubert	IT-16	B0020019	Mar 18	Apr 21	527
CN	Dr. Hubert	AF2	B1010006	Sep 19	Aug 22	528
CN	Dr. Hubert	AF4	B1210007	Jul 19	Jun 22	529
CN	Dr. Hubert	AF8	B1310006	Jul 19	Jun 22	530
CN	Dr. Hubert	M2AC	B2110012	Jul 19	Jun 22	531
CN	Dr. Hubert	M3AC	B2310015	Jul 19	Jun 22	532
CN	Dr. Hubert	T2	B6010008	Jul 19	Jun 22	533
CN	Dr. Hubert	T2	B6010009	Sep 19	Aug 22	534
CN Surge	TNC EMV Services	SU1	---		Not calibrated	535
CN Surge	TNC EMV Services	SU2	---		Not calibrated	536
CN Surge	TNC EMV Services	SU3	---		Not calibrated	537
CN Surge	TNC EMV Services	SU4	---		Not calibrated	538
CN Surge	TNC EMV Services	SU5	---	Mar 18	Feb 21	539
CDN	Teseq	M116	44743	Apr 20	Mar 23	540
CDN	Teseq	M216	45320	Apr 20	Mar 23	541
CDN	Teseq	M316	45292	Apr 20	Mar 23	542
CDN	Teseq	M532	43512	Apr 20	Mar 23	543
CDN	Teseq	M4-100-750V	44524	Apr 20	Mar 23	544
CDN	Teseq	ISN ST08	45255	Mar 20	Feb 23	545

Bezeichnung/ Marking	Hersteller/ Manufacturer	Typ/ Type	Seriennummer/ Serial-No.	Letzte Kal./ Last Cal.	Nächste Kal./ Next Cal. (±1 Monat/ Month)	Nr. / No.
6 Signalgeneratoren / Signal Generators						
Signal Generator	Rohde & Schwarz	SMY 01	840703/016	Dec 19	May 21	604
Signal Generator	Rohde & Schwarz	SML 03	103132	Nov 20	Apr 22	606
Signal Generator	Rohde & Schwarz	SMB100A	103875	Dec 19	May 21	607
Signal Generator	Agilent	33210A	MY48010984	Jun 19	Nov 20	608
Signal Generator	Rohde & Schwarz	SMB100A	179730	Oct 20	Mar 22	609

End of the Test Report