
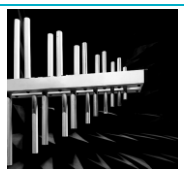
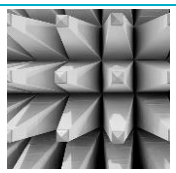

EST REPORT

Test Report No.: 1-6321/23-01-03-C

DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-01

Testing Laboratory

cetecom advanced GmbH
Untertürkheimer Straße 6 – 10
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Accredited Testing Laboratory:
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with
the registration number: D-PL-12076-01-01

Applicant

Schroff SAS
4 rue du Marais
67660 Betschdorf/FRANCE
Contact: Frédéric Hartmann
e-mail: Frederic.Hartmann@nVent.com

Manufacturer

Schroff SAS
4 rue du Marais
67660 Betschdorf/FRANCE
Contact: Frédéric Hartmann

Test Standard/s

EN 55032:2015 + AC:2016 + A11:2020 + A1:2020	Electromagnetic compatibility of multimedia equipment - Emission requirements
EN 55035:2017/A11:2020	Electromagnetic compatibility of multimedia equipment – Immunity requirements

Test Item

Kind of test item: **Rack**
Model name: **Varistar CP LHX+ 5/10KW**
detailed information see chapter 6.1 and 6.2 of this test report

This test report is electronically signed and valid without handwritten signature. The public keys can be requested at the test laboratory to verify the electronic signatures.

Test report authorised:

cn=Thomas Merten, o=cetecom advanced GmbH, ou=MET-230602, email=Thomas.Merten@cetecomadvanced.com, c=DE
2023.07.27 10:09:52 +02'00'

Thomas Merten
Lab Manager
Radio Communications & EMC

Test performed:

cn=Uli Kraus, o=cetecom advanced GmbH, ou=EMC-8459, email=uli.kraus@cetecomadvanced.com, c=DE
2023.07.27 10:02:10 +02'00'

Uli Kraus
Supervisor EMC Services
Radio Communications & EMC

1 Table of contents

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. Cetecom advanced GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of cetecom advanced GmbH.
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This test report is a new release and replaces all former versions of this report. Please refer to Annex C "Document history" for further information

2.2 Application details

Date of receipt of order:	2023-05-30
Date of receipt of test item:	2023-05-04
Start of test[1)]:	2023-05-31
End of test[1)]:	2023-06-05

[1)] Date of each measurement, if not shown in the plot, can be requested. Dates are stored in the measurement software.

3 Test standard/s:

EN 55032:2015 + AC:2016 + A11:2020 + A1:2020	Electromagnetic compatibility of multimedia equipment - Emission requirements
EN 55035:2017/A11:2020	Electromagnetic compatibility of multimedia equipment – Immunity requirements

4 Test environment

Temperature:	15 °C – 35 °C
Relative humidity content:	30 % – 60 %
Air pressure:	860 hPa – 1060 hPa
Power supply of measurement equipment:	230 V / 50 Hz

5 Test laboratories sub-contracted

---

6 Information about test conditions

6.1 Test item

Kind of test item :	**Rack**	
Type identification :	Varistar CP LHX+ 5/10KW	
Equipment classification:	Equipment for fixed use	
Environment classification:	Residential, commercial and light industry	
Supply voltage :	AC 230 V/ 50 Hz	
Ports :	**Description**	**Direction**
	AC power port	Input
	Telecommunication port: Ethernet 100Mbit/s; shielded	In / output
Mounting position:	Floor standing	
Additional information:		
Test set-up / cabling / operating modes of EUT during tests according to customer (see also the file: LHX-EMC test_v02.pptx dated. 2023-06-12). All conducted tests and ESD were already documented in test report 1-6321/23-01-02. The device was NOT grounded during the tests The device was modified using an additional EMI-Filter: Schaffner FN261-2-06 into AC line of Power supply/control unit. The lamp was disconnected during all tests		

6.2 EUT: Type, S/N etc. and short descriptions used in this test report

short descrip-tion*)	EUT	Type	S/N serial number	HW hardware status	SW software status
EUT A	Rack	Varistar CP LHX+ 10KW Cabinet	10630053-0001	Rev. A	63998256-52

*) EUT short description is used to simplify the identification of the EUT in this test report.

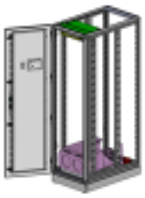
6.3 Auxiliary equipment (AE): Type, S/N etc. and short descriptions

AE descrip-tion*)	Auxiliary equipment	Type	S/N serial number	HW hardware status	SW software status
AE A	notebook	Dell Latitude 5430	51B0TT3	2022	WIN 10 64 bit
	notebook power supply	Dell LA65NM190LPS	CN-0V2TJ7-LOC00-28J-4W6K-A00	unknown	- / -

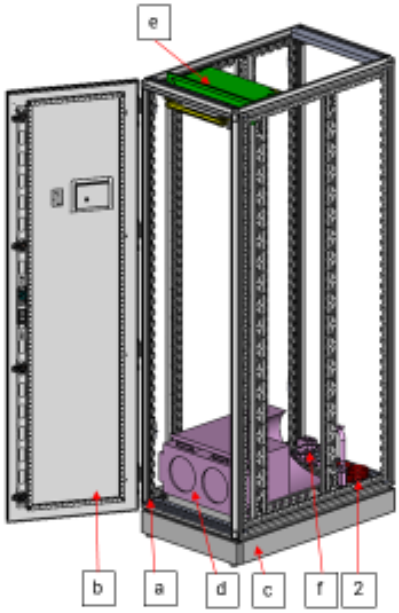
6.4 Description of EUT (acc. customer)

2nd Test – STANDARD version completely OPEN

10630-053, with option
23130-663 flow-t° sensor



1. **10630-053**
   a) 21630-102 : frame 2000H600W1000D
   b) 21630-529 : door with display 2000H600W
   c) 24630-034 : base plinth 600W1000D
   d) 29714-016 : heat exchange 10Kw
   e) 24130-556 : Controller
   f) 62150-713 : actuator
2. **23130-663** : flow-t° sensor



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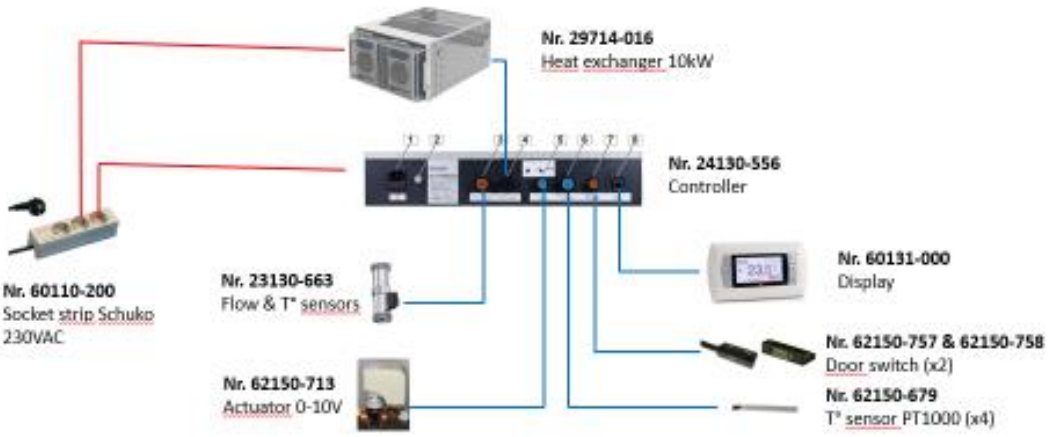
Cabling 2nd Test

First & second test



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6.5 EUT set-up(s)

EUT set-up no.*)	Combination of EUT and AE	Remarks
Set 1	EUT A + AE A	The walls of the rack were dismounted, the door was closed
Set 2	EUT A + AE A	All walls and the door of the rack are mounted and closed (only for ESD tests)

6.6 EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
op. 1	Standard mode, test mode	Manual mode, see also LHX-EMC.pptx dated. 2023-06-06.

7 Summary of measurement results

☒ All of the performed measurements are passed
☐ At least one or more of the performed measurements are failed

7.1 Emission

7.1.1 Enclosure

EMI phenomenon	Frequency range	Basic standard	Result
Radiated interference field strength	30 – 1000 MHz	EN 55032 Class B	passed
Radiated interference field strength	> 1000 MHz	EN 55032 Class B	passed

7.1.2 AC Mains power Input/Output ports

EMI Phenomenon	Frequency range	Basic standard	Result
Conducted interference voltage	0,15 – 30 MHz	EN 55032 Class B	passed
Harmonic current emission	0 – 2 kHz	EN 61000-3-2	NA1
Voltage fluctuations and flicker	---	EN 61000-3-3	NA1

7.1.3 Telecommunication port

EMI Phenomenon	Frequency range	Basic standard	Result
Conducted interference voltage	0,15 – 30 MHz	EN 55032 Class B	passed

7.1.4 Antenna port

EMI Phenomenon	Frequency range	Basic standard	Result
Conducted interference voltage	0,15 – 30 MHz	EN 55032 Class B	NA 2

7.2 Immunity

7.2.1 Enclosure

EMS phenomenon	Frequency range	Basic standard	Result
Electrostatic discharge (ESD)	---	EN 61000-4-2	passed
RF-electro-magnetic field	80 – 1000MHz + spot frequencies	EN 61000-4-3	passed
Immunity magnetic field	50 / 60 Hz	EN 61000-4-8	NA9

7.2.2 AC Mains power Input/Output ports

EMS phenomenon	Frequency range	Basic standard	Result
Fast transients, common mode BURST	---	EN 61000-4-4	passed
Surge	---	EN 61000-4-5	passed
Radio-frequency common mode	0,15 – 80 MHz	EN 61000-4-6	passed
Voltage dips, interruptions, and fluctuations	---	EN 61000-4-11	passed

7.2.3 Signal/Control port

EMS phenomenon	Frequency range	Basic standard	Result
Fast transients, common mode BURST	---	EN 61000-4-4	NA2
Radio-frequency common mode	0,15 – 80 MHz	EN 61000-4-6	NA 2

7.2.4 Telecommunication port

EMS phenomenon	Frequency range	Basic standard	Result
Fast transients, common mode BURST	---	EN 61000-4-4	passed
Surge	---	EN 61000-4-5	NA 10
Radio-frequency common mode	0,15 – 80 MHz	EN 61000-4-6	passed

Remarks:

NA1	Not tested because not required by used standard
NA2	Test not applicable because port does not exists
NA3	Test not applicable because port only for services
NA4	Test not applicable because port lengths not longer than 3m
NA5	Not tested because not required by customer
NA6	For equipment with a rated power of ≤75 W, other than lighting equipment, no limits are specified in this edition of the standard.
NA7	No test shall be made on equipment which is unlikely to produce significant voltage fluctuations or flicker.
NA8	Not performed, because highest internal clock frequency < 108 MHz
NA9	EUT doesn't contain devices intrinsically susceptible to magnetic fields
NA10	Not performed, because interface must not connected to outdoor cables

7.3 Performance assessment and reaction of the EUT

In case of Immunity testing (EMS): Observing or/and recording following functions:

Monitoring during continuous and transient phenomena

- The display was observed in a remote session:
  Fan speed, temperature of the device, differential air pressure

Reaction(s) of the EUT during immunity testing (EMS):

- R1
  - The device shows the following tolerances:
    Fan speed between 50-60 %
    Temperature: ±0,5K (the drift follows the ambient temperature)
    Air pressure ± 3Pa
  - The remote session is stable, no Ethernet failure:

- R2
  - Reboot of the device in previous mode
  - No loss of set-up data

The above mentioned criteria are NOT compulsory the criteria of the used standard. The assessment of the reaction according to the used standard is shown by the passed/failed column of each test in chapter 7.2.

7.4 Measurement and test set-up

Note: Test set-up / cabling / operating modes of EUT during tests according to customer.

7.5 Measurement uncertainty

The uncertainty of the measurement equipment fulfils CISPR 16 and the related European and national standards.

The semi anechoic chamber fulfils the requirements of CISPR 16-1 (ANSI C63.4) for a test volume of 4m ∅.

Measurement uncertainty calculations are on file and available from the test laboratory upon request.

The table below shows the measurement uncertainties for each measurement method. The expended uncertainty (k=2 or 95%) was calculated with worst case values.

	Measurement Method	Frequency area Impulse duration time	Description	Expanded uncertainty (k=2 or 95%)
Emission	**Radiated EN 55032/11, ANSI C63.4**	< 1 GHz > 1 GHz	Field strength [dBµV/m]	± 4.64 dB ± 4.92 dB
	Conducted EN 55032/11, ANSI C63.4	9 kHz – 30 MHz	Voltage [dBµV]	± 3.49 dB
	Power line communication apparatus used in low-voltage installations EN 50561-1	- / -	Voltage [dBµV]	± 3.49 dB
	Harmonic current EN 61000-3-2	2...40 x f_n f_n= 50 Hz	Voltage [V] Current [A]	± 0.05 % ± 0.06 %
	Voltage changes, voltage fluctuations and flicker EN 61000-3-3	f_n = 50 Hz	Voltage [V]	± 1 %
Immunity	**Electrostatic discharge EN 61000-4-2**	- / -	Voltage [kV]	± 39.40 %
	Radiated, radio-frequency, electromagnetic field EN 61000-4-3	20 MHz -6 GHz	Field strength [V/m]	± 1.78 dB
	Electrical fast transient/burst EN 61000-4-4	5kHz/50ns or 100kHz/50ns	Voltage [V]	± 4.95 %
	Surge EN 61000-4-5	- / -	Surge voltage [V] Surge current [A]	± 5.67 % ± 3.70 %
	Conducted disturbances, induced by radio-frequency fields EN 61000-4-6	150 kHz – 230 MHz	Voltage [V]	± 6.36 %
	Power frequency magnetic field EN 61000-4-8	DC ... 60 Hz	Field strength [A/m]	± 3.82 %
	Impulse magnetic field EN 61000-4-9	- / -	Field strength [A/m]	± 5.67 %
	Voltage dips, short interruptions and voltage variations EN 61000-4-11	- / -	Voltage [V]	± 0.17 %
	Conducted, common mode disturbances EN 61000-4-16	0 Hz – 150 kHz	Voltage [V]	± 1.32 %

8 Detailed test results - Emission

8.1 Conducted emission

8.1.1 Instrumentation for test (see equipment list)

G 1	G 2	G 5									

8.1.2 Test plan

EUT set-up	Set 1 (all cabinet walls open, door closed)			
Operating mode	**Port / Line**	**LCL factor**	**Limit**	**Result**
Op 1	AC power line	---	EN 55032 Class B	passed
Op 1	Ethernet	---	EN 55032 Class B	passed

Remark :	---

8.1.3 Conducted limits (power-line)

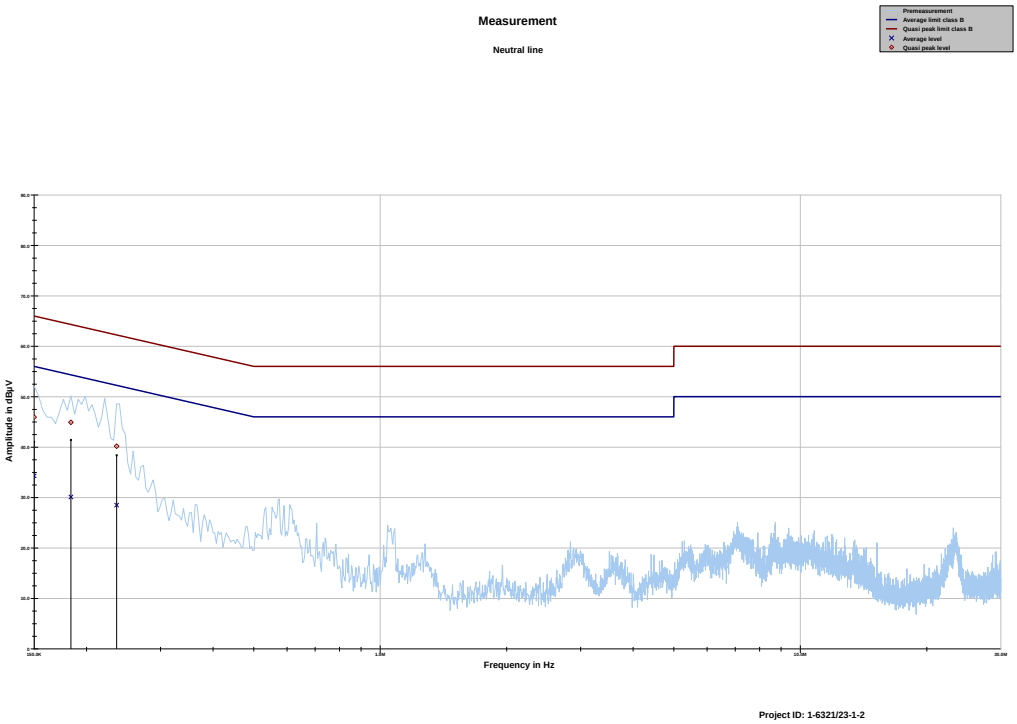
	CISPR 32 / EN 55032 Class B		CISPR 32 / EN 55032 Class A	
Frequency- range	**Quasi-Peak (dBµV)**	**Average (dBµV)**	**Quasi-Peak (dBµV)**	**Average (dBµV)**
0,15 MHz – 0,5 MHz	66-56	56-46	79	66
0,5 MHz -5 MHz	56	46	73	60
5 MHz -30 MHz	60	50	73	60

8.1.4 Conducted limits (communication-line)

	CISPR 32 / EN 55032 Class B				CISPR 32 / EN 55032 Class A			
Frequency- range	**Voltage limits (dBµV)**		**Current limits (dBµA)**		**Voltage limits (dBµV)**		**Current limits (dBµA)**	
	Quasi-Peak	**Average**	**Quasi-Peak**	**Average**	**Quasi-Peak**	**Average**	**Quasi-Peak**	**Average**
0,15 MHz – 0,5 MHz	84 – 74	74 – 64	40 – 30	30 – 20	97 – 87	84 – 74	53 – 43	40 – 30
0,5 MHz – 30 MHz	74	64	30	20	87	74	43	30

8.1.5 Test results of main

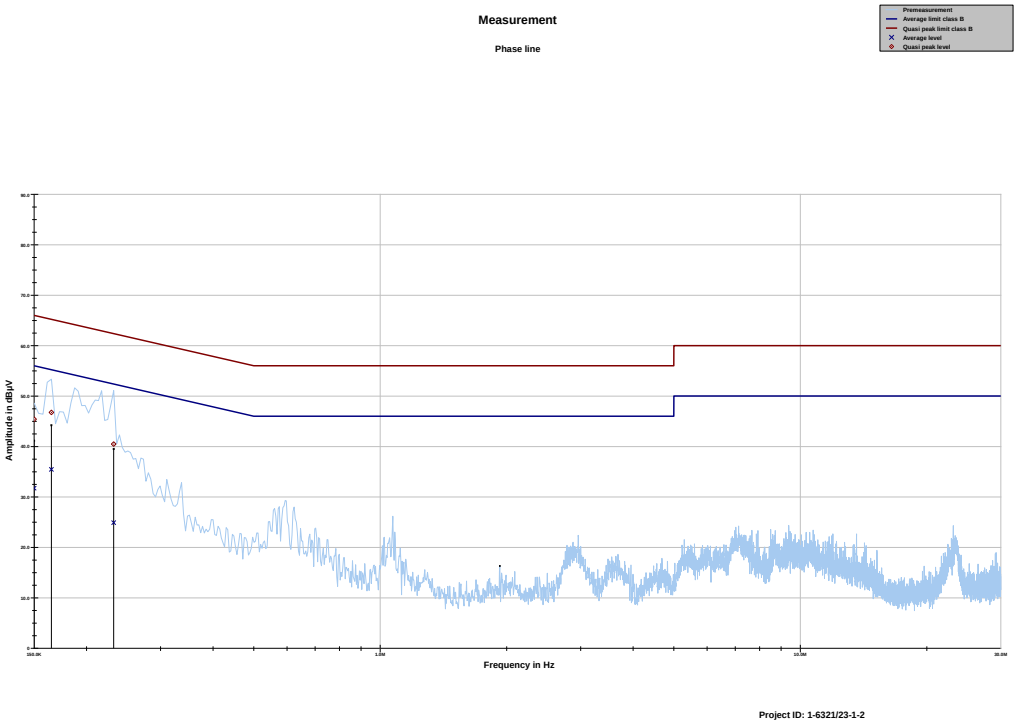
AC



Neutral line tbl
Project ID: 1-6321/23-1-2

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin Average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.150000	45.95	20.05	66.000	34.30	21.70	56.000
0.183581	44.90	19.42	64.322	30.10	24.94	55.041
0.235819	40.19	22.05	62.242	28.49	25.06	53.548

Project ID - 1-6321/23-1-2
EUT - Varistar CP LHX + 10kW Cabinet
Serial Number - Sample 01
Operating mode - all doors open, Lamp switched off



Phase line tbl
Project ID: 1-6321/23-1-2

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.150000	45.41	20.59	66.000	31.72	24.28	56.000
0.164925	46.75	18.46	65.212	35.45	20.12	55.574
0.232088	40.47	21.90	62.375	24.90	28.75	53.655

Project ID - 1-6321/23-1-2
EUT - Varistar CP LHX + 10kW Cabinet
Serial Number - Sample 01
Operating mode - all doors open, Lamp switched off

8.1.6 Test results (communication line)

ETH

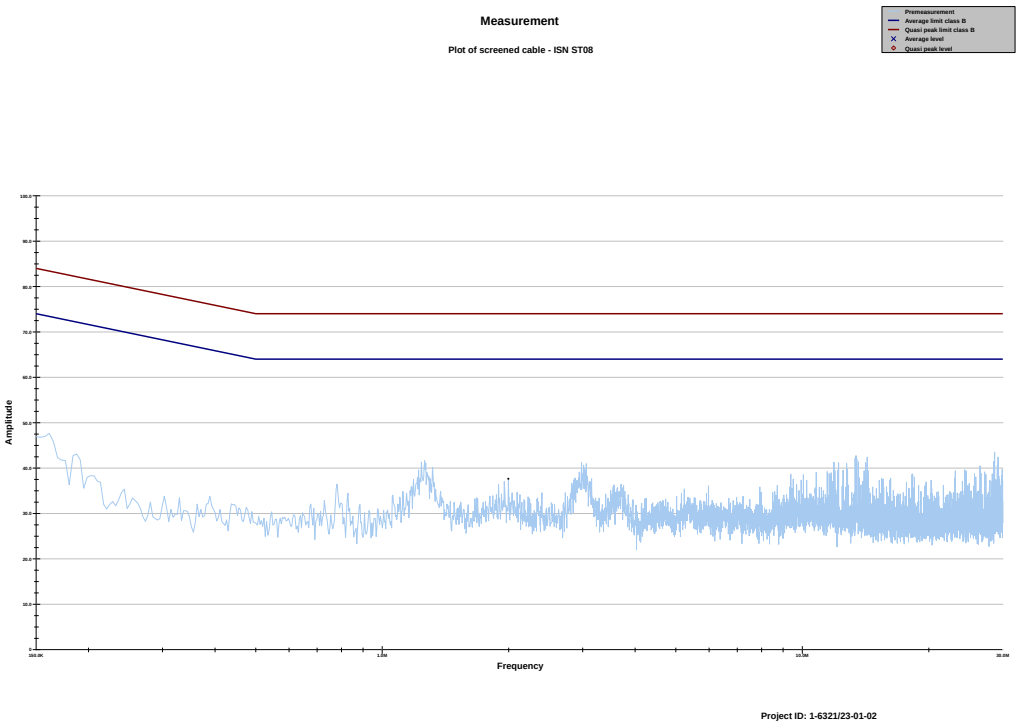


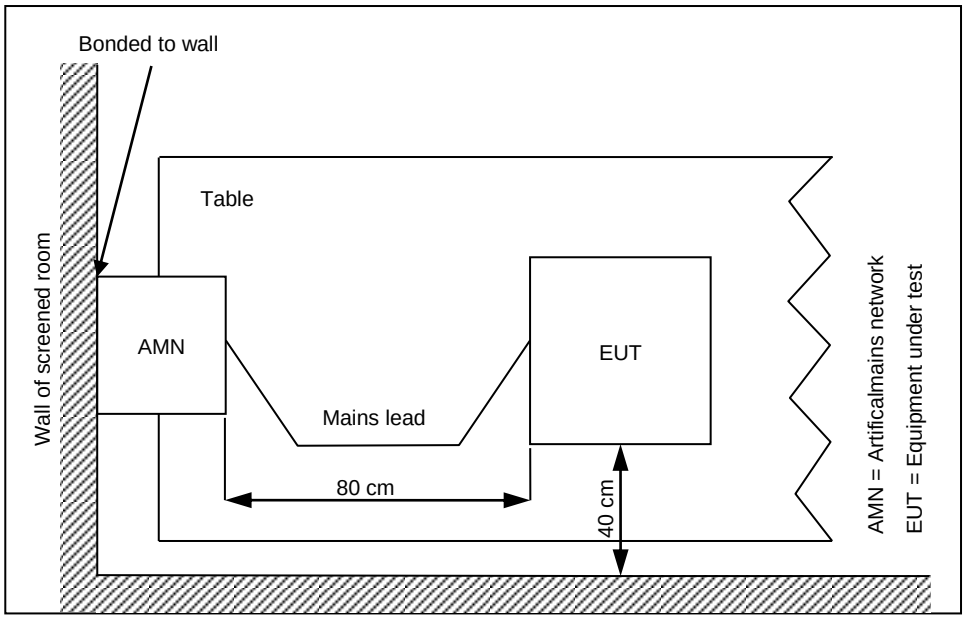
Table of screened cable - ISN ST08
Project ID: 1-6321/23-01-02

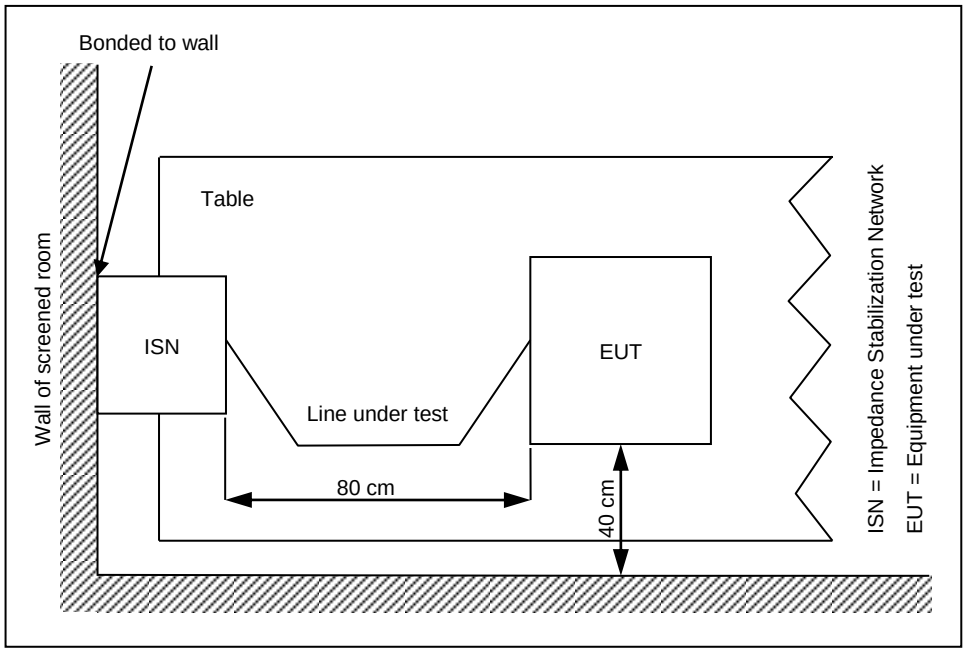
Project ID - 1-6321/23-01-02
EUT - Varistar CP LHX + 10kW Cabinet
Serial Number - Sample 01
Operating mode - all doors open, Lamp switched off

8.1.7 Test set-up

According to EMC basic standard **EN 55032**

A measurement with spectrum analyzer and peak-detector is performed. If no limit exceeding of specified limits occur, the measurement is concluded at this stage. If the limit exceeding occur, measurement are carried out with the quasi-peak detector at the frequencies at which the exceeding occur.





8.2 Electromagnetic radiated emissions (distance 10 m)

8.2.1 Instrumentation for test (see equipment list)

F 1	F 2	F 4b	F 5	F 6	F 7	F 8					

8.2.2 Test Plan

EUT set-up	set 1 (all cabinet walls open and door closed)		
Operating mode	**Application**	**Limit**	**Result**
op 1	Enclosure	EN 55032 Class B	passed

Remarks:	---

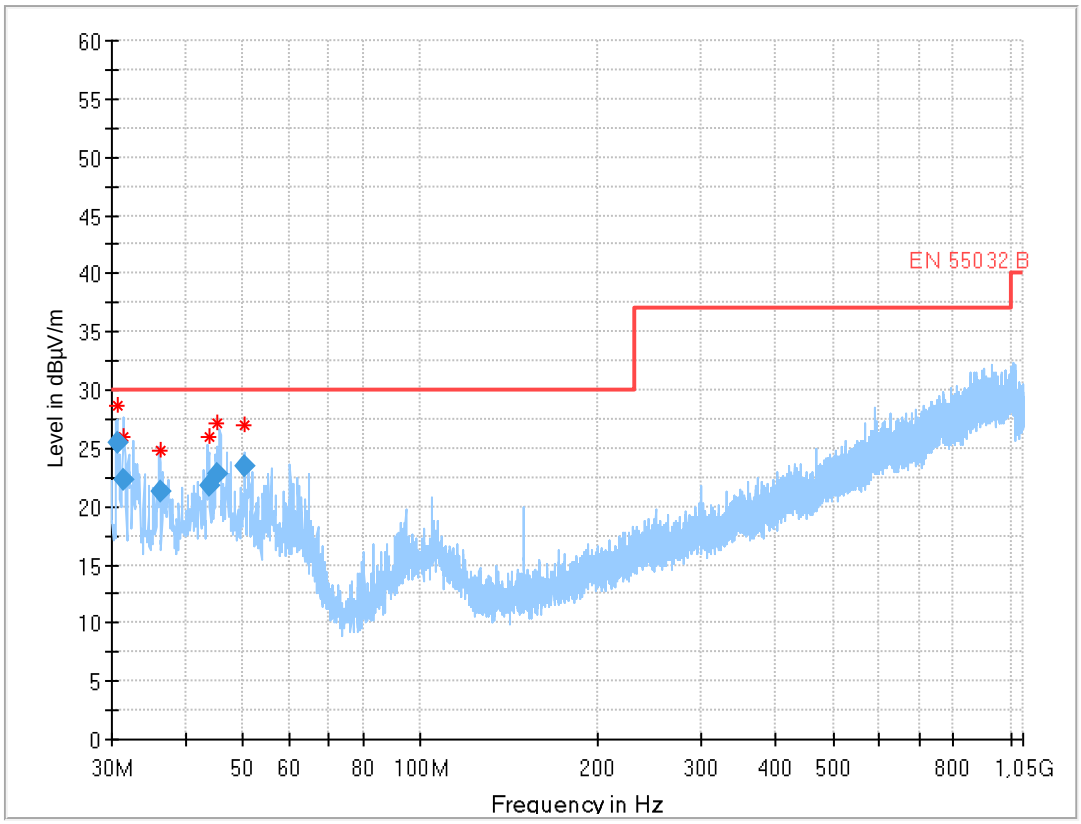
8.2.3 Radiated limits

Frequency- range	**CISPR 32 / EN 55032 Class B @ 10 m**	**CISPR 32 / EN 55032 Class A @ 10 m**
30 MHz - 230 MHz	30 dB(µV/m)	40 dB(µV/m)
230 MHz - 1000 MHz	37 dB(µV/m)	47 dB(µV/m)

8.2.4 Test results

Common Information

EUT:	Varistar CP LHX + 10kW Cabinet
Serial number:	Sample 1
Test description:	EN 55032 class B
Operating condition:	walls opened, door closed, Lamp switched off, 3 Ferrites added, AC Filter
Operator name:	Kraus
Comment:	230V / 50 Hz / ETH: screened 100MBit/s



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.653	25.46	30.0	4.5	1000	120.0	120.0	V	75	13
31.415	22.27	30.0	7.7	1000	120.0	252.0	V	195	13
36.163	21.26	30.0	8.7	1000	120.0	200.0	V	126	14
43.817	21.77	30.0	8.2	1000	120.0	104.0	V	255	16
45.295	22.73	30.0	7.3	1000	120.0	119.0	V	240	16
50.430	23.45	30.0	6.6	1000	120.0	200.0	V	-30	16

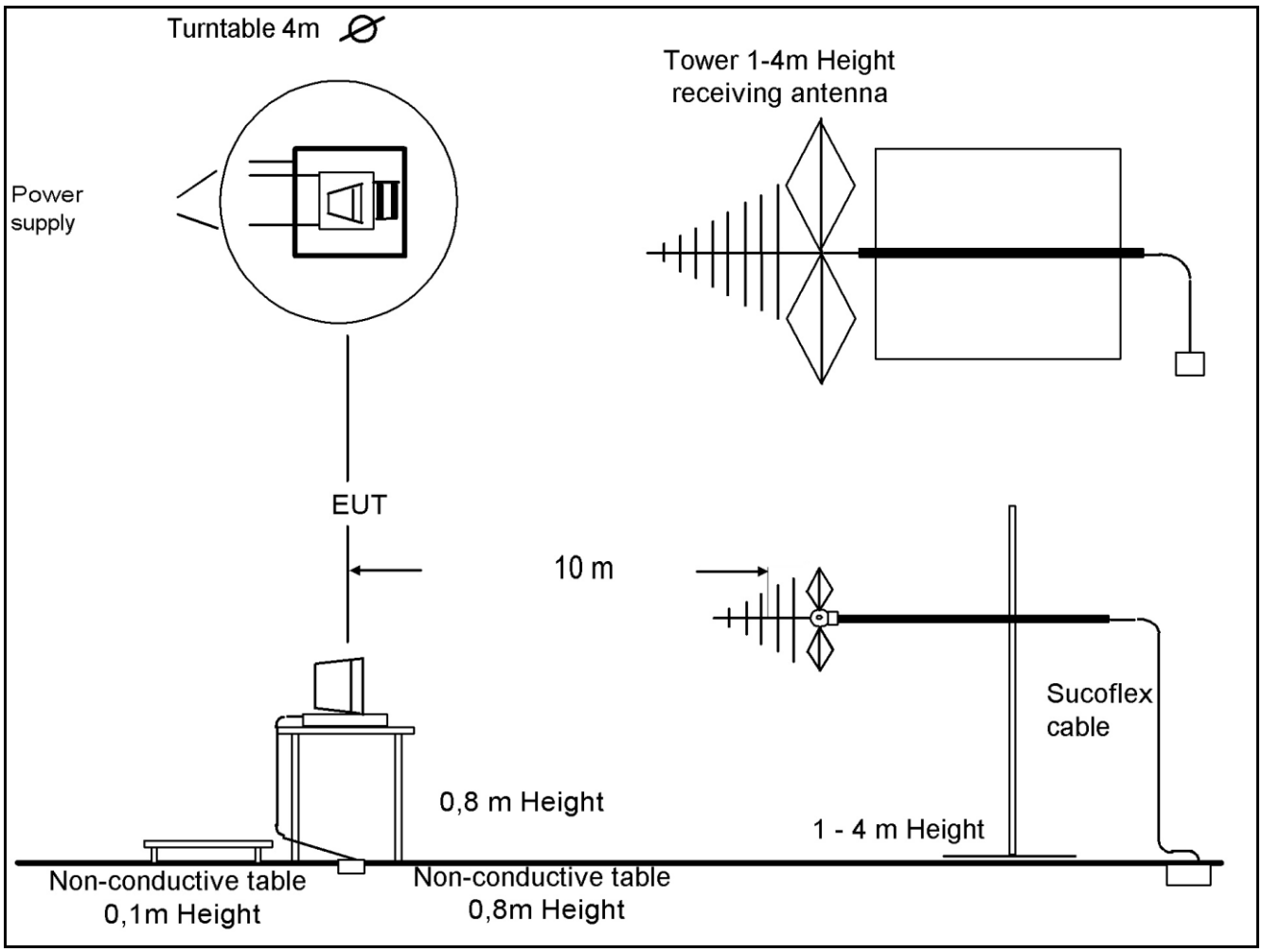
8.2.5 Hardware set-up

Hardware Setup: EMI radiated\VULP_10_m - [EMI radiated]

Subrange 1

Frequency Range:	30 MHz - 2 GHz
Receiver:	ESR 3 [ESR 3] @ GPIB0 (ADR 20), SN 1316.3003K03/102587, FW 3.66
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12
	Software version: EMC32 V10.59.0

8.2.6 Test set-up



8.3 Electromagnetic radiated emissions (distance 5 m)

8.3.1 Instrumentation for test (see equipment list)

F 1	F 4	F 6	F 29	F 30	F 33						

8.3.2 Test plan

EUT set-up	Set 1(all cabinet walls opened, door closed)		
Operating mode	**Application**	**Limit**	**Result**
Op 1	Enclosure	CISPR 32 / EN 55032 Class B	passed

Remarks:	The measured values are recalculated from 5m to 3m distance Due to the height of the EUT, the test was performed in two different antenna heights.

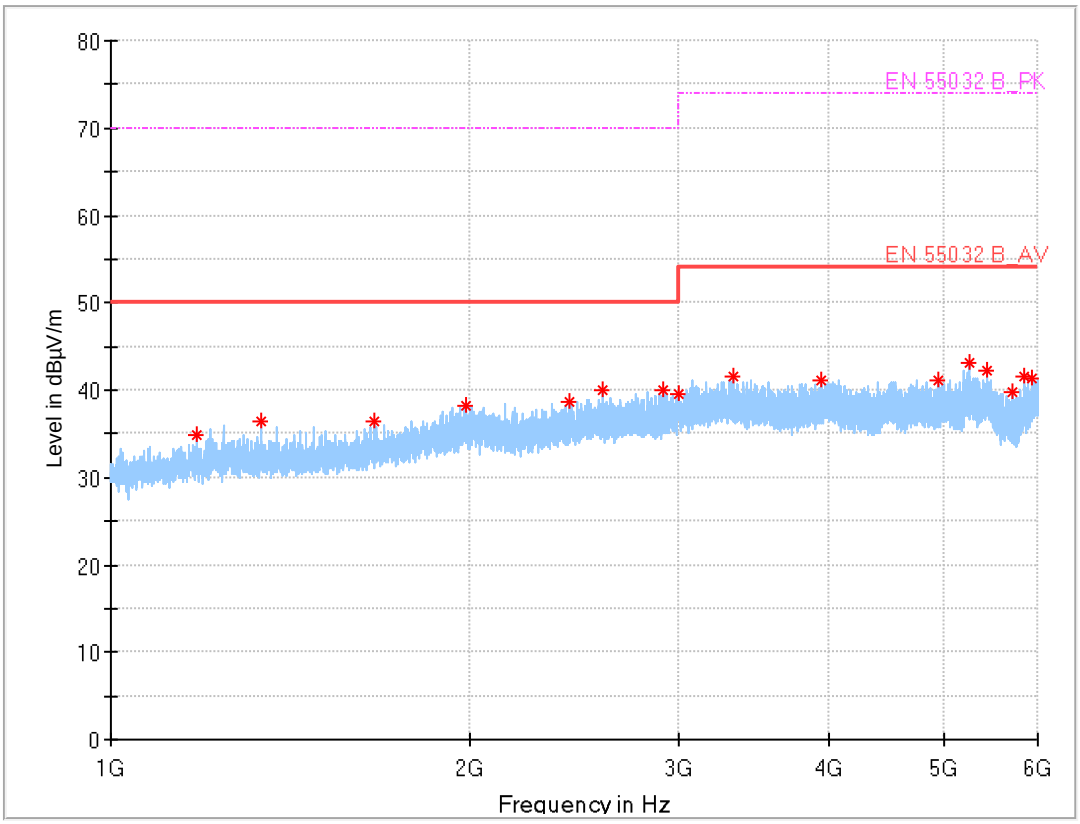
8.3.3 Radiated limits

Frequency- range	CISPR 32 / EN 55032 Class B @ 3 m		CISPR 32 / EN 55032 Class A @ 3 m	
	peak	**average**	**peak**	**average**
1 GHz – 3 GHz	70dBµV/m	50 dBµV/m	76 dBµV/m	56 dBµV/m
3 GHz – 6 GHz	74 dBµV/m	54 dBµV/m	80 dBµV/m	60 dBµV/m

8.3.4 Test results

1m

EUT:	Varistar CP LHX + 10kW Cabinet
Serial number:	Sample 1
Test description:	EN 55032 class B
Operating condition:	all open, Lamp switched off, 3 Ferrites added, AC Filter
Operator name:	Kraus
Comment:	230V / 50 Hz / ETH: screened 100MBit/s

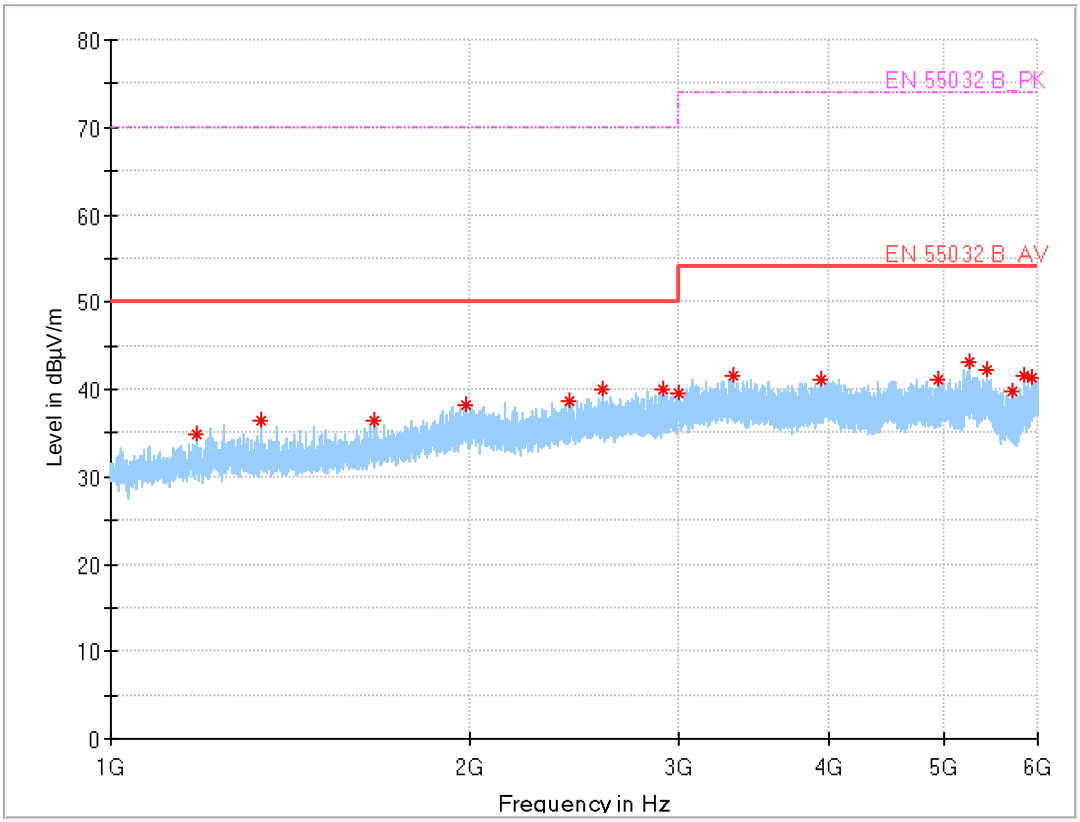


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
2910.250	40.04	---	50.0	10.0	---	---	V	0	-4	
2996.250	39.55	---	50.0	10.5	---	---	H	15	-3	
3330.000	41.65	---	54.0	12.3	---	---	H	32	-2	
1665.500	36.46	---	50.0	13.5	---	---	H	35	-7	
1179.250	34.77	---	50.0	15.2	---	---	H	71	-9	
4940.750	41.15	---	54.0	12.9	---	---	H	12	-1	
2584.000	39.99	---	50.0	10.0	---	---	H	14	-4	
5846.250	41.51	---	54.0	12.5	---	---	V	15	0	
1338.500	36.35	---	50.0	13.6	---	---	H	19	-8	
5940.000	41.37	---	54.0	12.6	---	---	V	22	1	
5713.750	39.80	---	54.0	14.2	---	---	H	24	0	
3947.000	41.20	---	54.0	12.8	---	---	V	25	-2	
2424.000	38.75	---	50.0	11.3	---	---	V	27	-5	
1984.250	38.27	---	50.0	11.7	---	---	V	27	-5	
5440.250	42.18	---	54.0	11.8	---	---	H	31	0	
5248.250	43.18	---	54.0	10.8	---	---	V	35	0	

1,5m

EUT:	Varistar CP LHX + 10kW Cabinet
Serial number:	Sample 1
Test description:	EN 55032 class B
Operating condition:	all open, Lamp switched off, 3 Ferrites added, AC Filter
Operator name:	Kraus
Comment:	230V / 50 Hz / ETH: screened 100MBit/s



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
2910.250	40.04	---	50.0	10.0	---	---	V	0	-4	
2996.250	39.55	---	50.0	10.5	---	---	H	15	-3	
3330.000	41.65	---	54.0	12.3	---	---	H	32	-2	
1665.500	36.46	---	50.0	13.5	---	---	H	35	-7	
1179.250	34.77	---	50.0	15.2	---	---	H	71	-9	
4940.750	41.15	---	54.0	12.9	---	---	H	12	-1	
2584.000	39.99	---	50.0	10.0	---	---	H	14	-4	
5846.250	41.51	---	54.0	12.5	---	---	V	15	0	
1338.500	36.35	---	50.0	13.6	---	---	H	19	-8	
5940.000	41.37	---	54.0	12.6	---	---	V	22	1	
5713.750	39.80	---	54.0	14.2	---	---	H	24	0	
3947.000	41.20	---	54.0	12.8	---	---	V	25	-2	
2424.000	38.75	---	50.0	11.3	---	---	V	27	-5	
1984.250	38.27	---	50.0	11.7	---	---	V	27	-5	
5440.250	42.18	---	54.0	11.8	---	---	H	31	0	
5248.250	43.18	---	54.0	10.8	---	---	V	35	0	

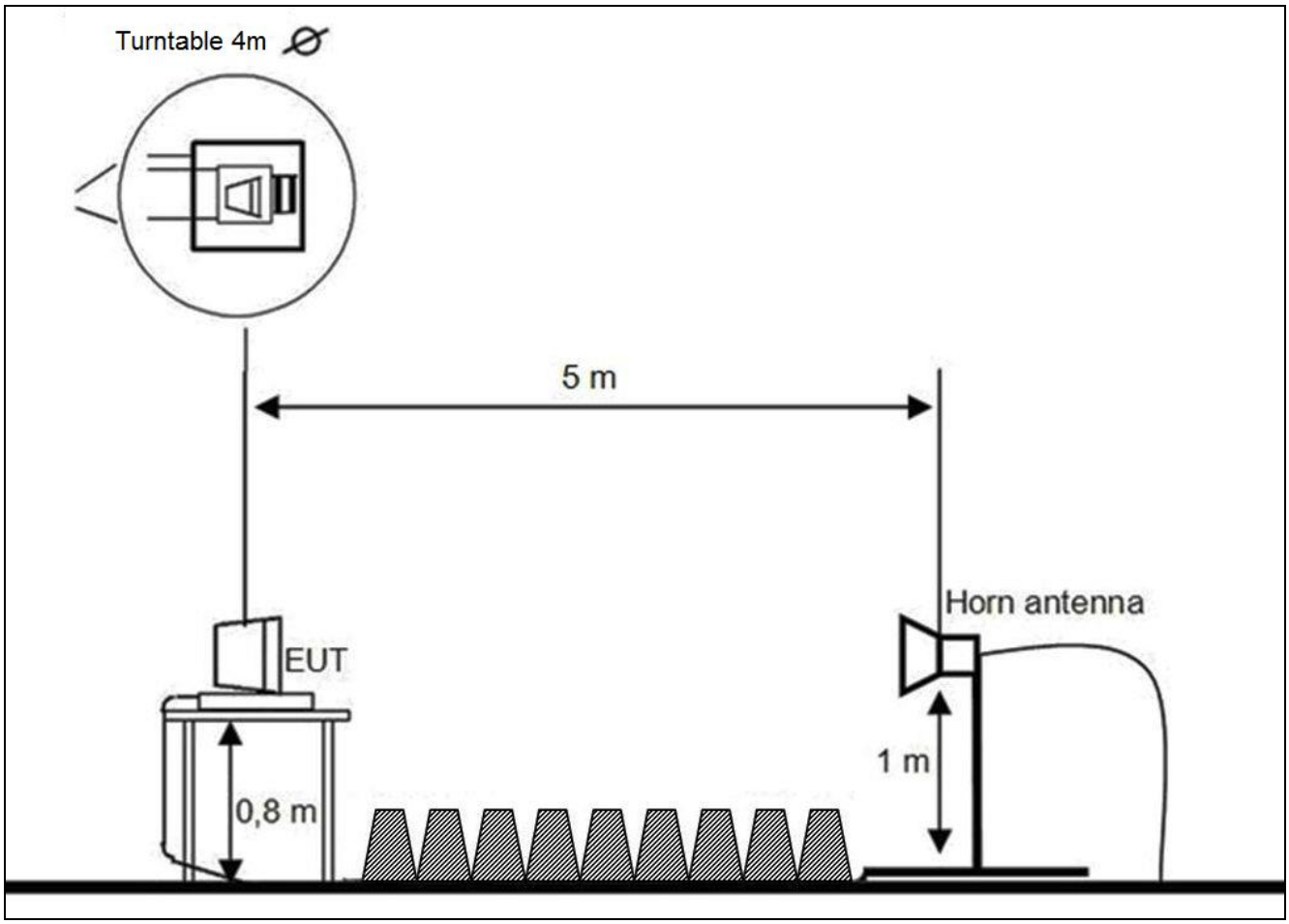
8.3.5 Hardware set-up

Hardware Setup: EMI radiated\BBHA_5m - [EMI radiated]

Subrange 1

Frequency Range:	1 GHz - 18 GHz
Receiver:	FSU 26 [FSU 26] @ GPIB0 (ADR 17), SN 200809/026, FW 4.71
Signal Path:	1_6_EN FW 1.0
Antenna:	Horn Antenna EMCO 3115
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12
	Software version: EMC32 V10.59.0

8.3.6 Test set-up



9 Detailed test results - Immunity

9.1 Radio-frequency, Common mode

9.1.1 Instrumentation for test (see equipment list)

G 11	G 12	G 13	G 14	G 15	G 16	G 8				

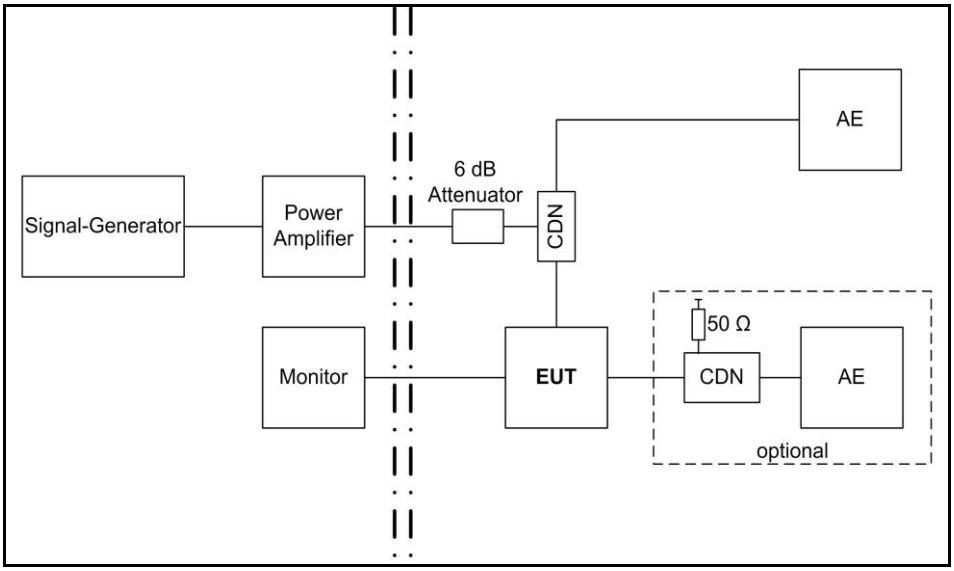
9.1.2 Test plan

EUT set-up	Set 1 (all cabinet walls open, door closed)				
Operating mode	Op 1				
Test conditions					
Dwell time	**Test level (unmod., rms)**	**Start frequency**	**Stop frequency**	**Frequency step**	**Modulation**
1 s	3V to 1V*	150 kHz	80 MHz	log 1%	1 kHz, AM 80%
Port	**Coupling device**		**Reaction of EUT (please refer to chapter 7.3)**		**Within specification(s) during and after test**
AC mains	CDN M3		R1		yes
Ethernet	ST08		R1		yes

Remarks:	**according EN 55035*

9.1.3 Test set-up

According to the requirements given in **EN 61000-4-6**



9.2 Radio-frequency electromagnetic field (80 MHz to 6.000 MHz)

9.2.1 Instrumentation for test (see equipment list)

F 10	F 11	F 13	F 14	F 18	F 19	F 20				

9.2.2 Test plan

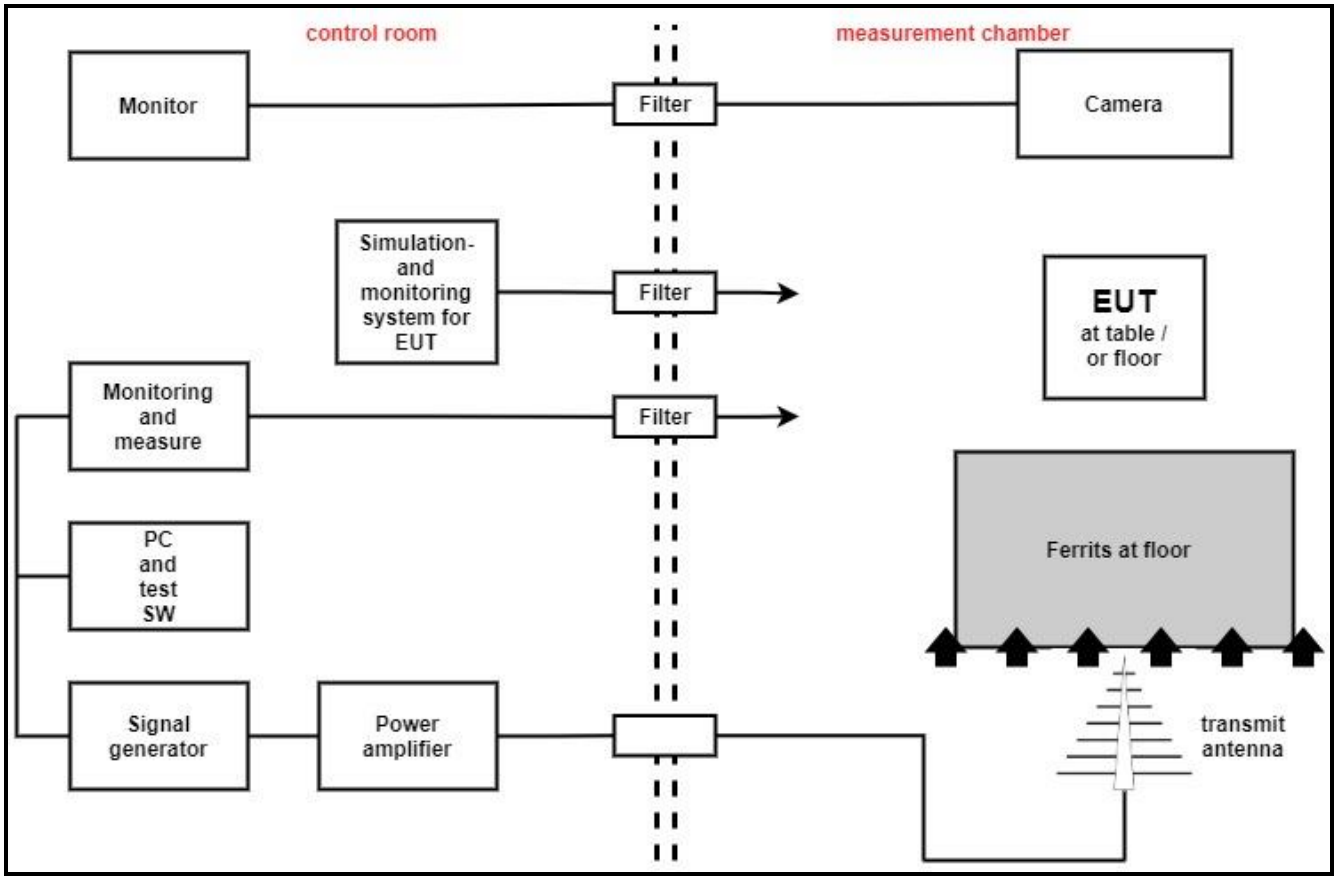
EUT set-up	Set 1 (all cabinet walls closed, door closed) and only front side additional all cabinet walls closed, door opened				
Operating mode	Op 1				
Test condition					
Dwell time	**Field strength (unmod., rms)**	**Start frequency**	**Stop frequency**	**Frequency step**	**Modulation**
1 s	3 V/m	80 MHz	1000 MHz	log 1%	1 kHz, AM 80%
2s	3 V/m	Spot frequencies according to EN 55035: 1800, 2600, 3500 and 5000 MHz			1 kHz, AM 80%

View to EUT surface	**Antenna position**	**Reaction of EUT (please refer to chapter 7.3)**	**Within specification(s) during and after test**
front side	vertical	R1	yes
	horizontal	R1	yes
left side	vertical	R1	yes
	horizontal	R1	yes
rear side	vertical	R1	yes
	horizontal	R1	yes
right side	vertical	R1	yes
	horizontal	R1	yes
front side (door opened)	vertical	R1	yes
	horizontal	R1	yes

Remarks:	- / -

9.2.3 Test set-up

According to EMC basic standard **EN 61000-4-3**



9.3 Electrical fast transients (Burst)

9.3.1 Instrumentation for test (see equipment list)

G 26	G 28										

9.3.2 Test Plan

EUT set-up	Set 1 (cabinet walls opened, door closed)				
Operating mode	Op 1				
Port	**Voltage peak**	**Coupling device**	**Repetition rate**	**Reaction of EUT (please refer to chapter 7.3)**	**Within specification(s) during and after test**
AC mains	+1,0 kV -1,0 kV	internal	5 kHz	R1	yes
Ethernet	+0,5 kV -0,5 kV	clamp	5 kHz	R1	yes

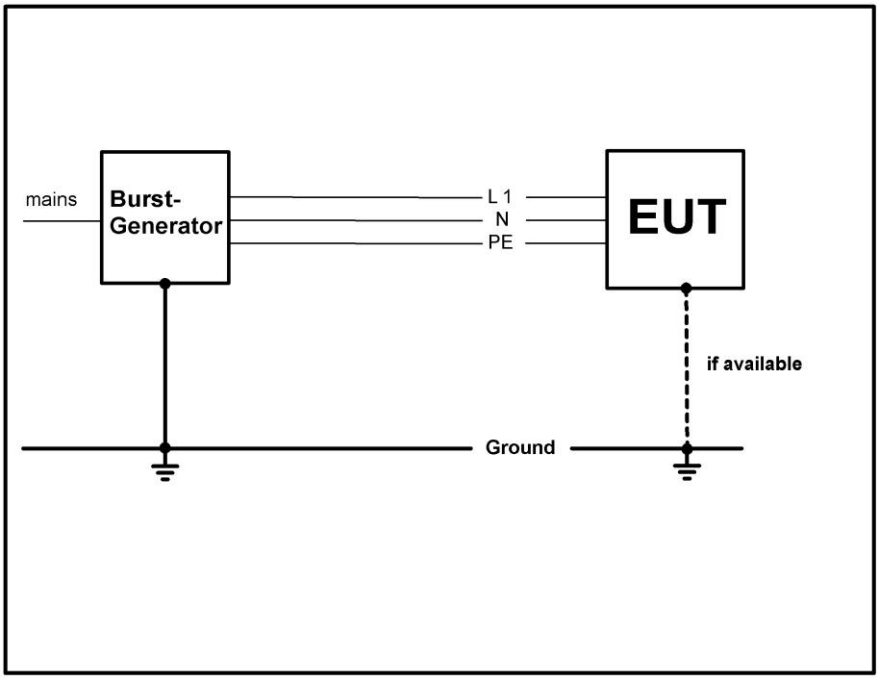
Remarks:	- / -

9.3.3 Test set-up

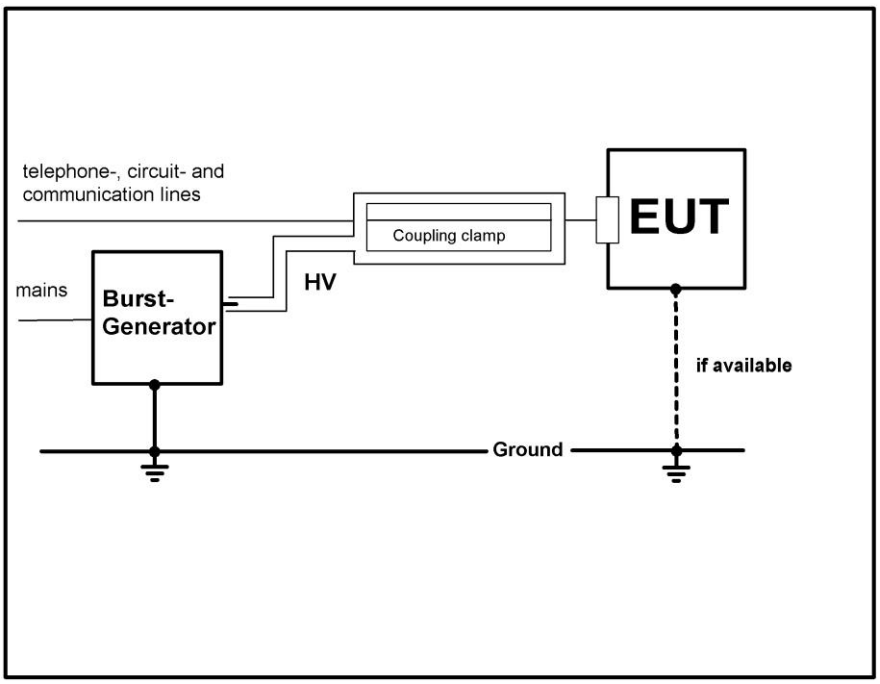
According to the requirements given in **EN 61000-4-4**

The test is intended to demonstrate the immunity of the device when subjected to types of transient interference such as that originating from switching transients (interruption of inductive loads etc.).

Set-up with coupling network



Set-up with coupling clamp



9.4 Surges (Impulse 1,2/50µs and 8/20µs)

9.4.1 Instrumentation for test (see equipment list)

G 26											

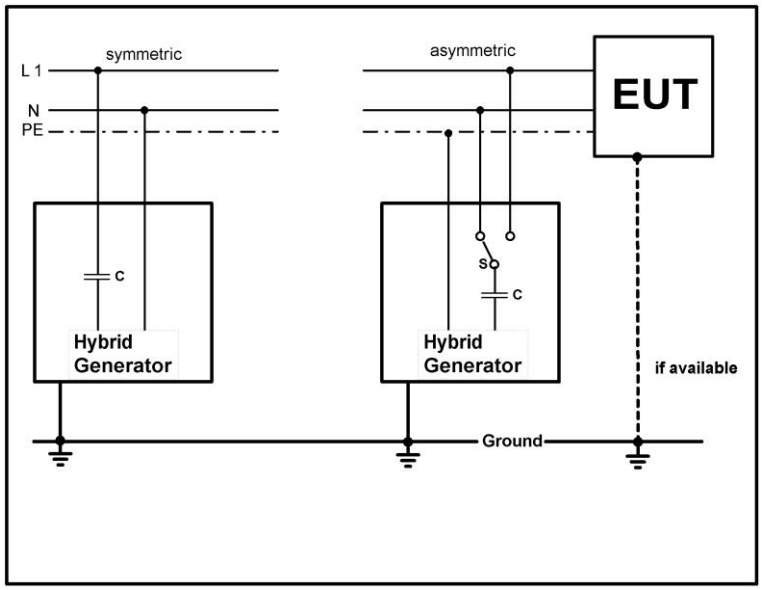
9.4.2 Test plan

EUT set-up	Set 1 (cabinet wall opened, door closed)				
Operating mode	op 1				
Port	**Coupling mode**	**Requirements**	**Polarity**	**Reaction of EUT (please refer to chapter 7.3)**	**Within specification(s) during and after test**
AC mains	L1 – N (Differential mode)	Voltage: 0,5 and 1 kV Time: 1,2/50 (8/20)µs Repetition: 1 pulse/min. Phase angle: 90 deg	Number: 5 Pos.	R1	yes
AC mains	L1 – N (Differential mode)	Voltage: 0,5 and 1 kV Time: 1,2/50 (8/20)µs Repetition: 1 pulse/min. Phase angle: 270 deg	Number: 5 Neg.	R1	yes
AC mains	L1 – PE N – PE (Common mode)	Voltage: 0.5, 1 and 2 kV Time: 1,2/50 (8/20)µs Repetition: 1 pulse/min. Phase angle: 90 deg	Number: 5 Pos.	R1	yes
AC mains	L1 – PE N – PE (Common mode)	Voltage: 0.5, 1 and 2 kV Time: 1,2/50 (8/20)µs Repetition: 1 pulse/min. Phase angle: 270 deg	Number: 5 Neg.	R1	yes
ETH (Shield)	Line to shield (Common mode)	Voltage: 0.5, 1 kV Time: 1,2/50 (8/20)µs Repetition: 1 pulse/min. Phase angle: - / -	Number: 5 Each + / -	---	Not performed

Remarks:	- / -

9.4.3 Test set-up

According to the requirements given in **EN 61000-4-5**



AC-Line

9.5 Voltage dips and interruptions

9.5.1 Instrumentation for test (see equipment list)

G 26	G 27										

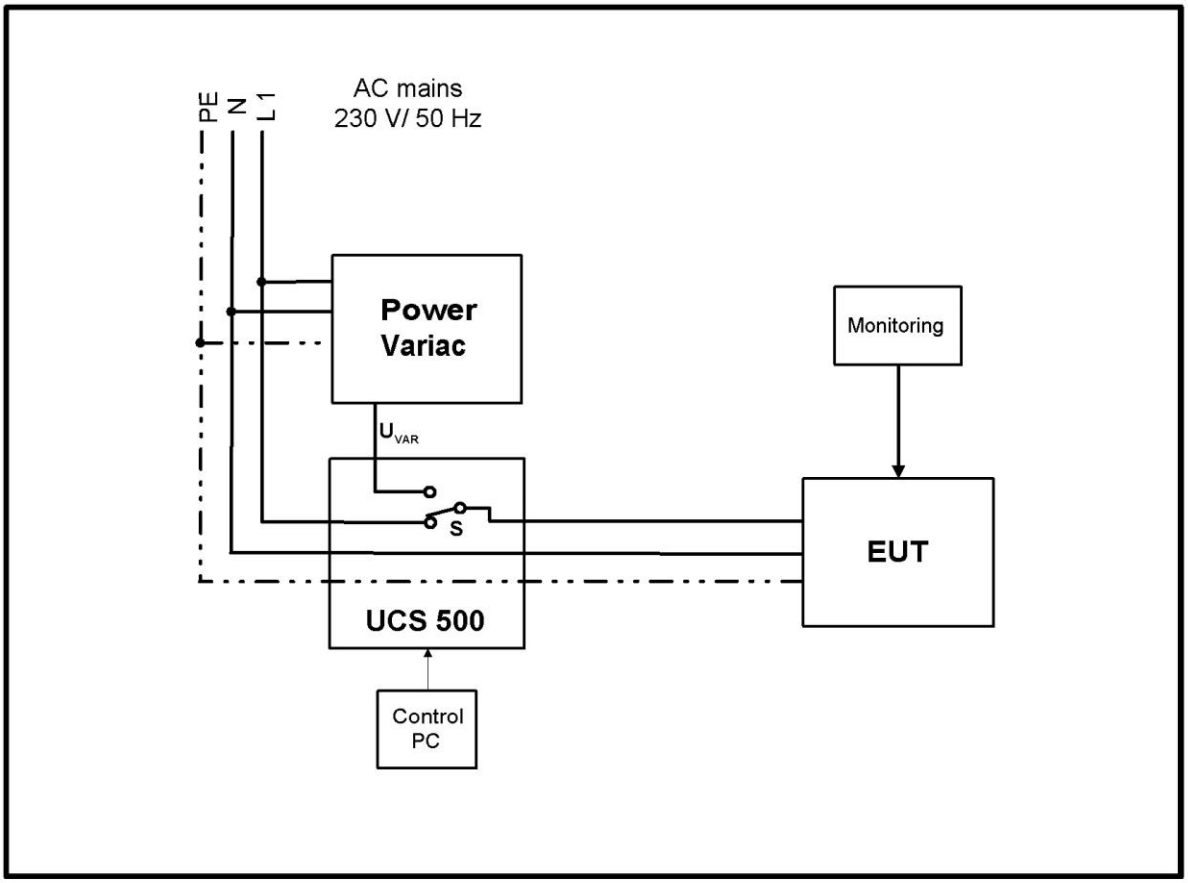
9.5.2 Test plan

EUT set-up	Set 1 (cabinet walls opened, door closed)				
Operating mode	Op 1				
Nominal supply voltage	**Reduction**	**Phase angle**	**Duration (ms)**	**Reaction of EUT (please refer to chapter 7.3)**	**Within specification(s) during and after test**
230 V	100 % (0 V)	0° - 180° 180° steps	10	R1	yes
230 V	30% (161 V)	0° - 180° 180° steps	500	R1	yes
230 V	100% (0 V)	0° - 180° 180° steps	5000	R2	yes

9.5.3 Test set-up

According to the requirements given in EN 61000-4-11

The test is intended to demonstrate the immunity against voltage dips and short interruptions of the AC mains.



9.6 Electrostatic discharge

9.6.1 Instrumentation for test (see equipment list)

G 30											

9.6.2 Climatic conditions

-	Ambient temperature:	25,7	°C	Ambient Temperature range:	15 °C to 35 °C
-	Relative humidity:	38	%	Relative humidity range:	30% to 60%
-	Atmospheric pressure:	1008	hPa	Atmospheric pressure range	860 hPa to 1060 hPa

9.6.3 Test plan

EUT set-up	Set 2 (cabinet walls and door closed)
Operating mode	Op 1

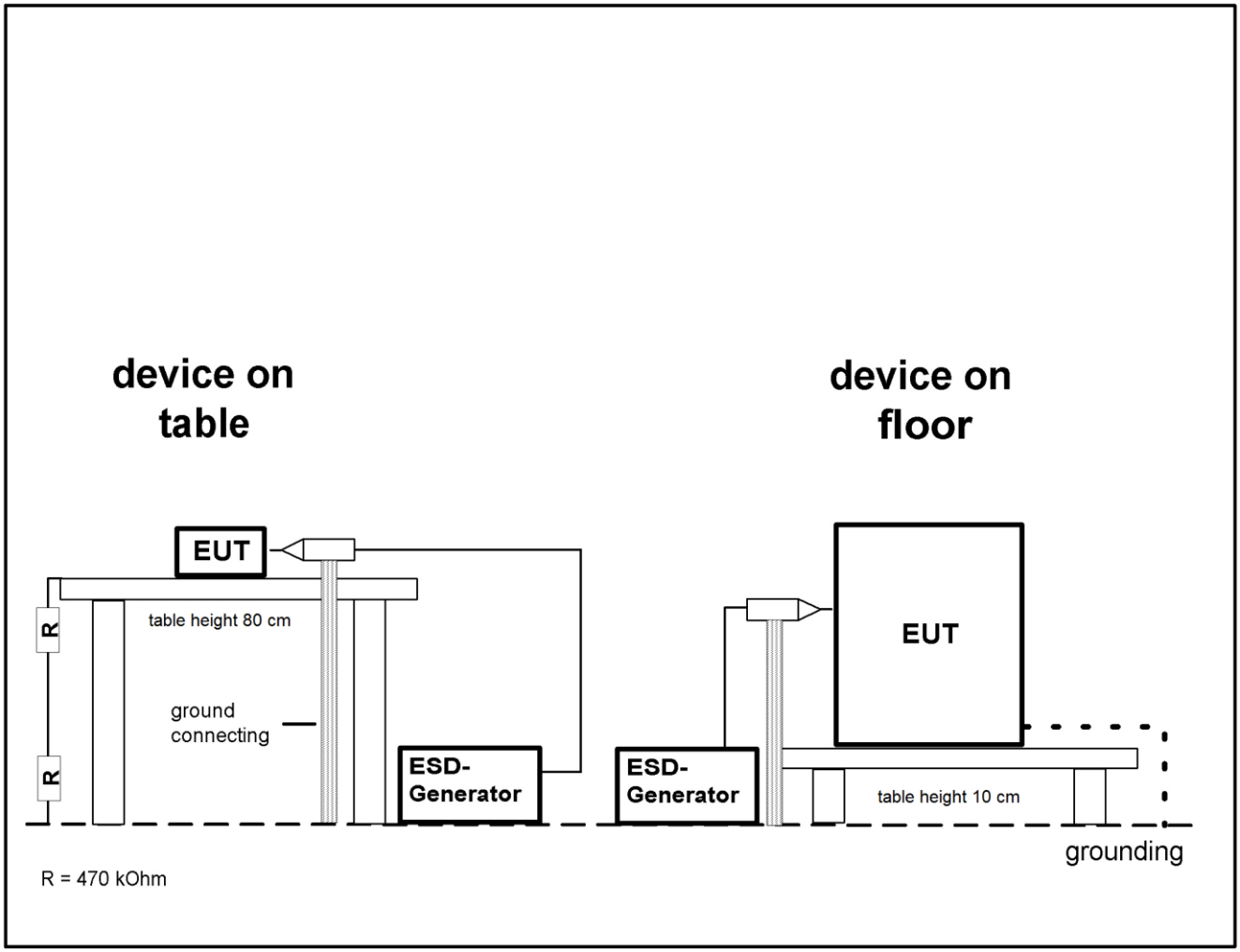
	Contact discharge to conducted surfaces and to coupling planes				**Air discharge to insulating surfaces**	
	Direct contact discharge		**Indirect contact discharge**			
Test voltage	**Reaction of EUT (please refer to chapter 7.3)**	**Within specification(s) during and after test**	**Reaction of EUT (please refer to chapter 7.3)**	**Within specification(s) during and after test**	**Reaction of EUT (please refer to chapter 7.3)**	**Within specification(s) during and after test**
+ 2 kV -2 kV	R1	yes	R1	yes	R1	yes
+ 4 kV - 4 kV	R1	yes	R1	yes	R1	yes
+ 8 kV - 8 kV	not applicable	- / -	not applicable	- / -	R1	yes

Remark:	10 Single impulses at each test point and for each test voltage.
Test points for direct discharge: see green dots at the photos in the photo documentation.	
Test points for air discharge: see light blue dots at the photos in the photo documentation.	

9.6.4 Test set-up

According to the requirements given in **EN 61000-4-2**

This test is intended to demonstrate the immunity of the device to a discharge caused by operators.



10 Test equipment and ancillaries used for tests

To simplify the identification of the test equipment and/or ancillaries which were used, the reporting of the relevant test cases only refer to the test item number as specified in the table below.

No.	Instrument/Ancillary	Manufacturer	Type	Serial-No.	Internal identification
	Radiated emission in chamber F				
F-1	Control Computer	F+W		2934939v001	300005258
F-2	Trilog-Antenna	Schwarzbeck	VULB 9163	9163-1029	300005379
F-4b	Switch	Netgear	GS108P	26V12A3H50336	300000368
F-5	EMI Test receiver	R&S	ESR	1316.3003K03-102587-ct	300005771
F-6	Turntable Interface-Box	EMCO / ETS-LINDGREN	Model 105637	44583	300003747
F-7	Tower/Turntable Controller	EMCO / ETS-LINDGREN	Model 2090	64672	300003746
F-8	Tower	EMCO / ETS-LINDGREN	Model 2175	64762	300003745
F-9	Ultra Notch-Filter Rejected band Ch. 62	WRCD		9	
	Radiated immunity in chamber F				
F-10	Control Computer	F+W		2934939v001	300005258
F-11	Signal Generator	R&S	SMB 100A	1406.6000k02-113856	300005266
F-13	RF-Amplifier	Bonn	BLWA 0860-250/100D	035491	300003210
F-14	Stacked Logper Antenna	Schwarzbeck	STLP 9129	200	300006249
F-14a	Bicon-Antenna	EMCO	3109	8906-2309	300000575
F-14b	Bicon-Antenna	Schwarzbeck	Balun VHBD 9134 elements BBFA 9146	3011 0057	300005385
F-15	RF-Amplifier	ar	1000LM20	20562	-/-
F-16	Directional Coupler	ar	DC7144A	312786	300003411
F-16a	Directional coupler	emv	DC 2000	9401-1677	300000592
F-18	Power Meter	R&S	NRP2	104973	300005114
F-19	Power sensor	R&S	NRP-Z91	103332	300005114-1
F-20	Power sensor	R&S	NRP-Z91	103333	300005114-2
F-35	RF- Amplifier	Bonn	BLMA 2060-5	097392A	300003908
F-36	Stacked Microwave Log.-Per. Antenna	Schwarzbeck	STLP9149	9149-044	300003919
	Harmonics and flicker in front of chamber F				
F-21	Flicker and Harmonics Test System	Spitzenberger & Spies	PHE4500/B I PHE4500/B II	B5983 B5984	300003314
F-21a	Power Supply	HBS Electronic	ACS-1600-PS	2002-001247-0	300006074
F-28	Power Supply	Hewlett Packard	6032 A	2920 A 04466	300000580
	Radiated emission in chamber F > 1GHz				
F-29	Horn antenna	Schwarzbeck	BBHA 9120 B	188	300003896
F-30	Amplifier	ProNova	0518C-138	005	F 024
F-31	Amplifier	Miteq	42-00502650-28-5A	1103782	300003379
F-32	Horn antenna	EMCO	3115	9709-5289	300000213
F-33	Spectrum Analyzer	R&S	FSU26	200809	300003874
F-34	Loop antenna	EMCO	6502	8905-2342	300000256

No.	Instrument/Ancillary	Manufacturer	Type	Serial-No.	Internal identification
	Conducted emission in chamber G				
G-1	EMI Receiver	R&S	ESR3	102981	300006318
G-2	V-ISN	Rohde & Schwarz	ESH 3-Z5	892475/017	300002209
G-2a	V-ISN	Rohde & Schwarz	ESH 2-Z5	892602/024	300000587
G-3	2-Wire ISN	Schaffner	ISN T200	19075	300003422
G-4	4-Wire ISN	Schaffner	ISN T400	22325	300003423
G-5	Shielded wire ISN	Schaffner	ISN ST08	22583	300003433
G-6	Unshielded 8 wire ISN	Teseq	ISN T800	26113	300003833
G-7	Unshielded 8 wire ISN	Teseq	ISN T8-Cat. 6	26374	300003851
G-8	RF Current probe	Solar	9134-1	100254	300004163
G-9	V-ISN	Schaffner	ISN PLC-150	21579	300003318
G-10	V-ISN	Schaffner	ISN PLC-25-30	21584	300003319
G 10a	PLC Filter	TESEQ	Filter PLC	23436	300003598
G 10b	Coupling unit 75 Ohm	Fiedler	AC	----	300003272.04
	Conducted immunity in chamber G				
G-11	Signal generator	R&S	SMG	8610647025	300000204.01
G-12	RF-Amplifier	BONN	BSA 0125-75	066502-01	300003545
G-13	Power Meter	R&S	URV 5	837723/025	300002844.01
G-14	Power Sensor	R&S	URV 5-Z2	832874/021	300002239
G-15	Directional coupler	emv	DC 2000	9401-1677	300000592
G-16	Attenuator 6dB	Alan	50HP6-100 N	121048 0348	300003148
G-17	EM-Injection Clamp	FCC	203i	232	300000626
G-18	CDN	FCC	FCC-801-M3-16	237	300000627
G-19	CDN	FCC	FCC-801-T2	78	300000629
G-20	CDN	FCC	FCC-801-AF 2	62	300000630
G-21	CDN	FCC	FCC-801-AF 4	61	300000631
G-22	CDN	FCC	FCC-801-M1	2027	300002761
G-23	CDN	TESEQ	CDN M016S	38741	300004847
G-23a	Clamp	FCC	F-130A-1	14	300003220
G-24	transformer for 50Hz Loop Antenna	EM-Test	MC2630	0200-10	300002659.01
G-25	50Hz Loop Antenna	EM-Test	MS 100	none	300002659
	Surge, Burst, Dips and Interruptions in chamber G				
G-26	Hybrid-Generator	EM-Test	UCS 500N7	P1506148835	300005070
G-27	Motor Variac	EM-Test	MV 2616	0600-01	300002658
G-28	Capacitive Coupling Clamp	MWB	KKS 100	---	300000589
G-29a	Coupling Decoupling Network	EMC-Partner	CDN-2000-06-32	158	300004108
G-29	Coupling Decoupling Network	EMC-Partner	CDN-UTP8 ED3	1503	300004752
	ESD in chamber G				
G-30	ESD generator	Schlöder	SESD 30000	511333	300005097
	Emission on bench in chamber G				
G-31	Absorbing Clamp	R&S	MDS-21	832 231/006	300000527
	generic in chamber G				
G-32	power supply	Hewlett Packard	6038A	2848A06673	300001512
G 45	Waveform Generator	Keysight	33500B	MY52500745	300005409
	Conducted interference in chamber G				
G 33	Arbitrary Function Generator	33521B	Keysight	MY52702534	300005023

11 Observations

No observations, exceeding those reported with the single test cases, have been made.

Annex A Photographs of the test set-up

Photo 1: radiated emission

Photo 2: radiated emission

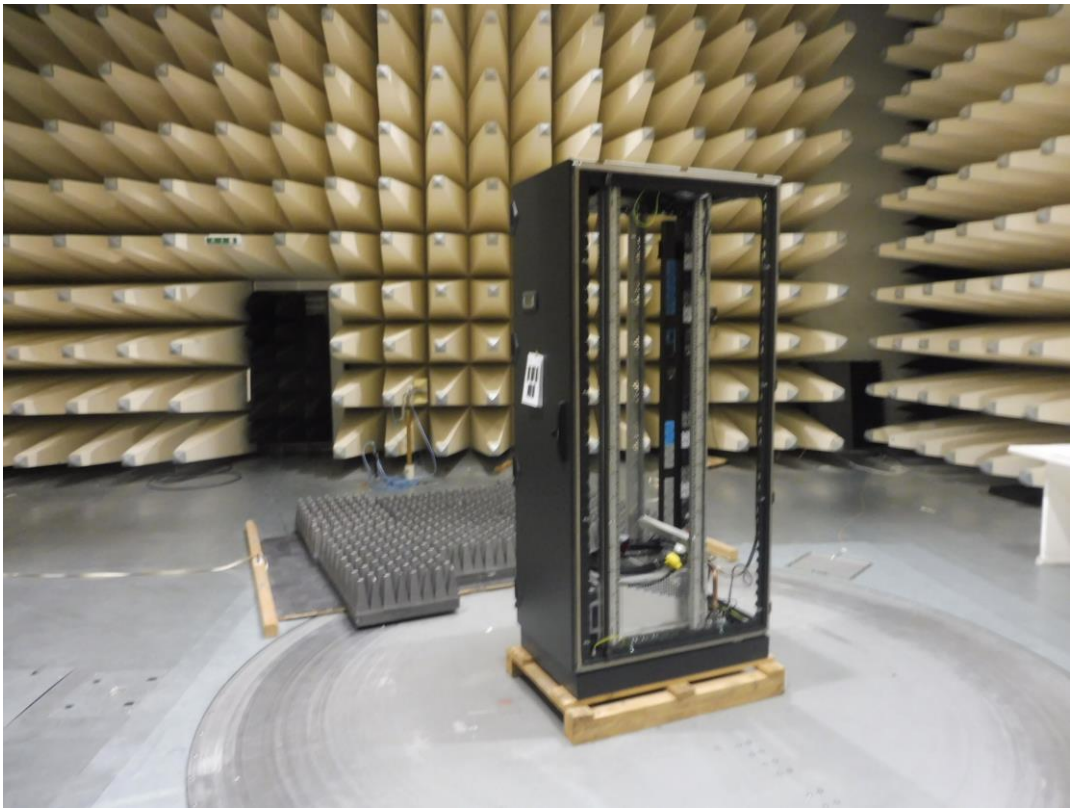


Photo 3: radiated immunity

Photo 4: radiated immunity

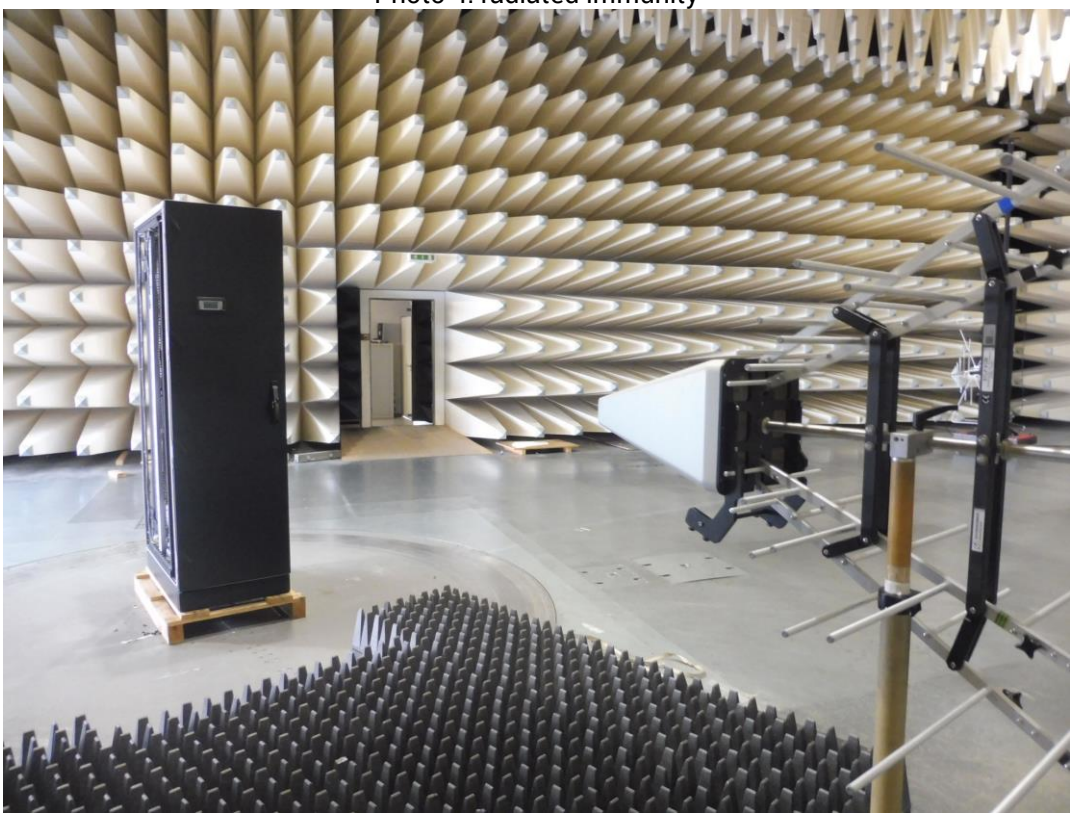


Photo 5: radiated immunity

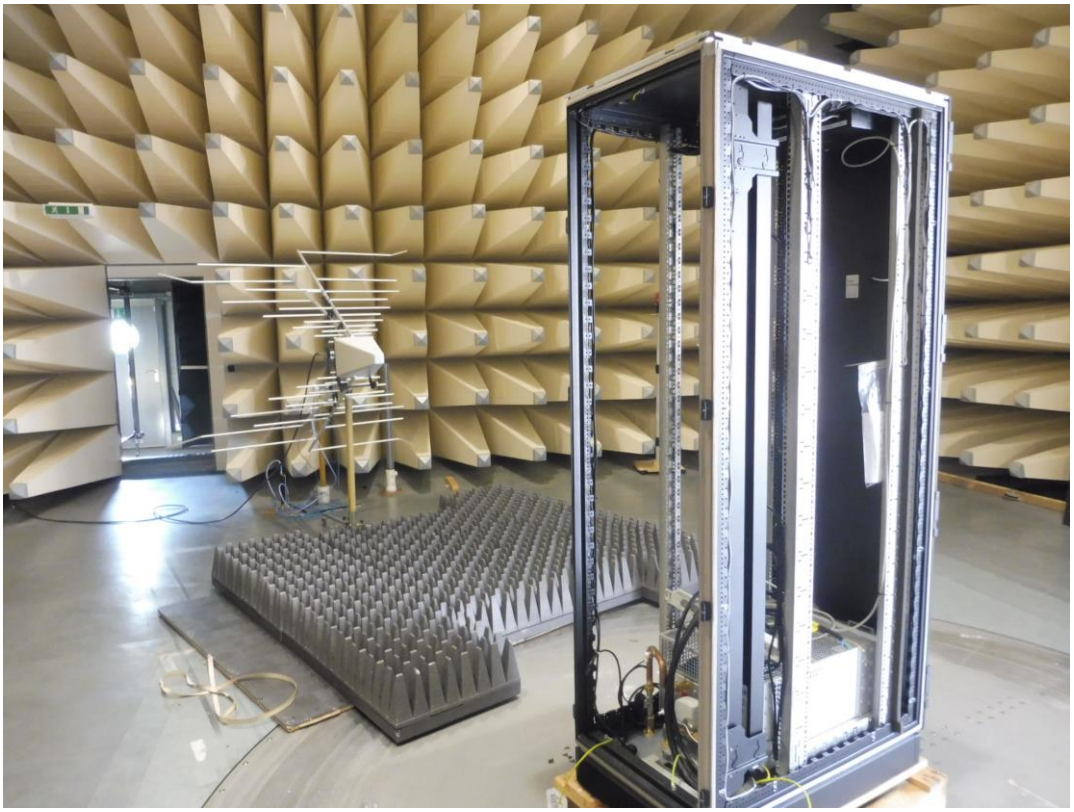


Photo 6: radiated immunity

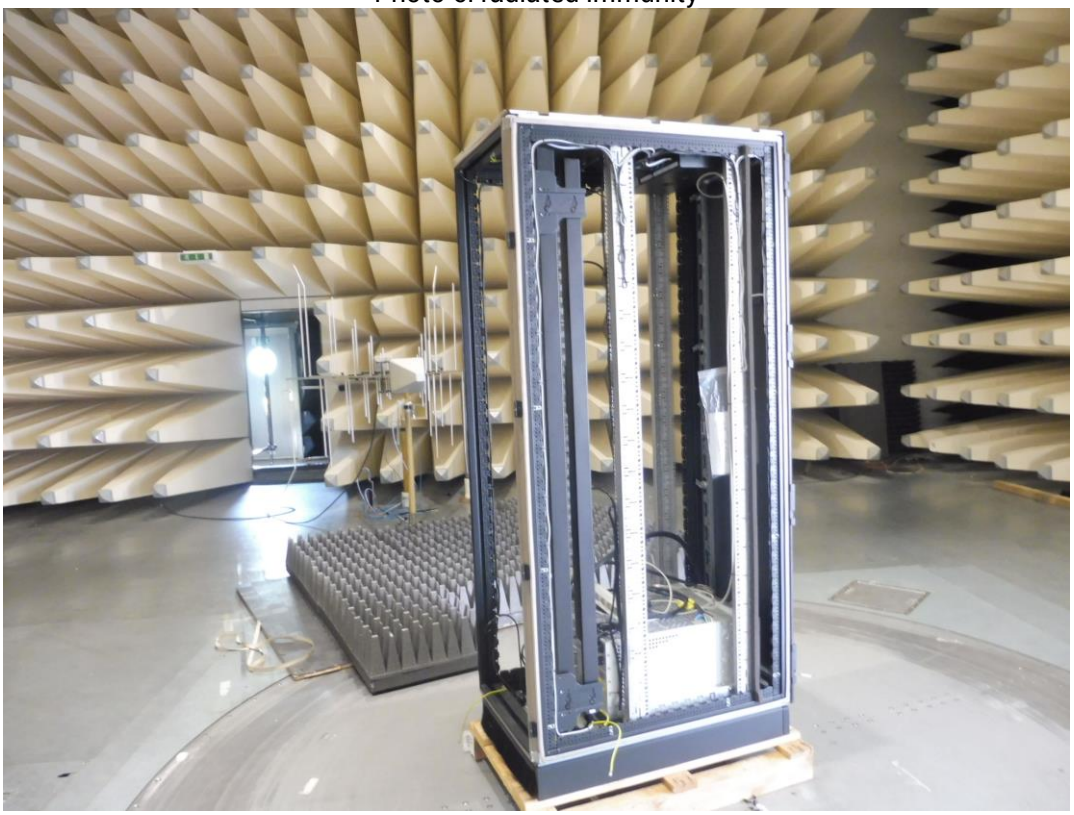


Photo 7: conducted emission

Photo 8: conducted emission

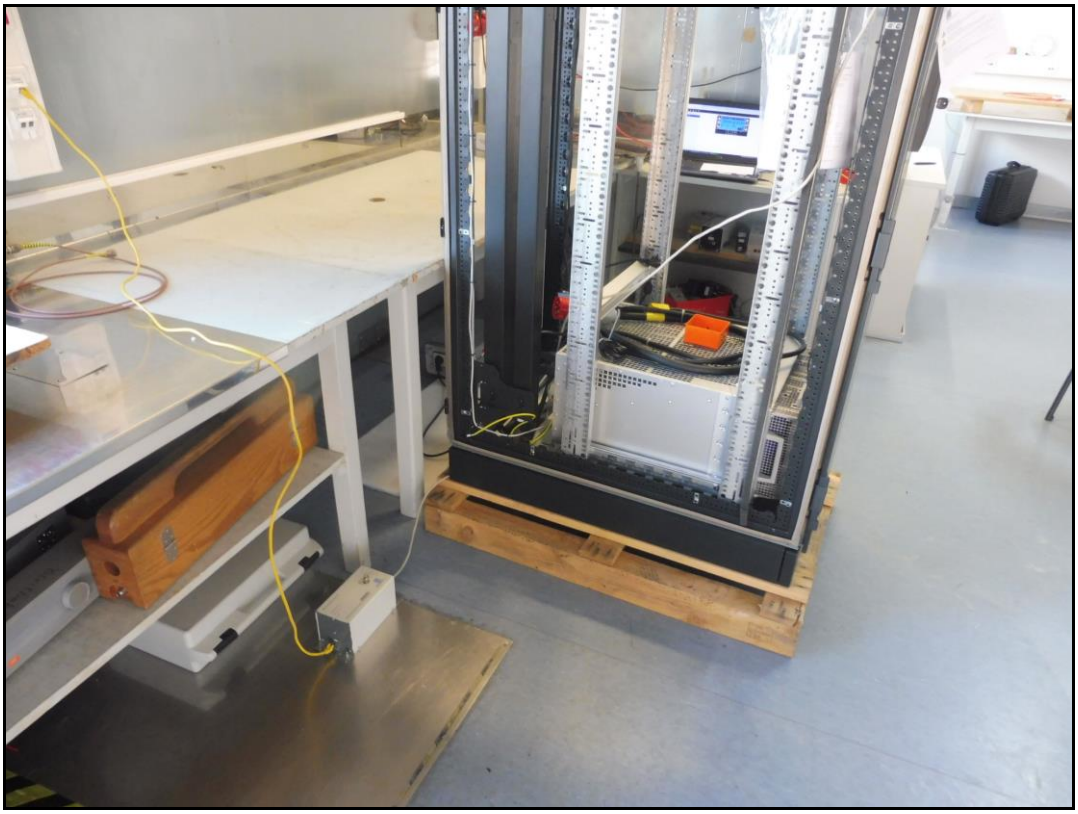


Photo 9: conducted immunity

Photo 10: conducted immunity

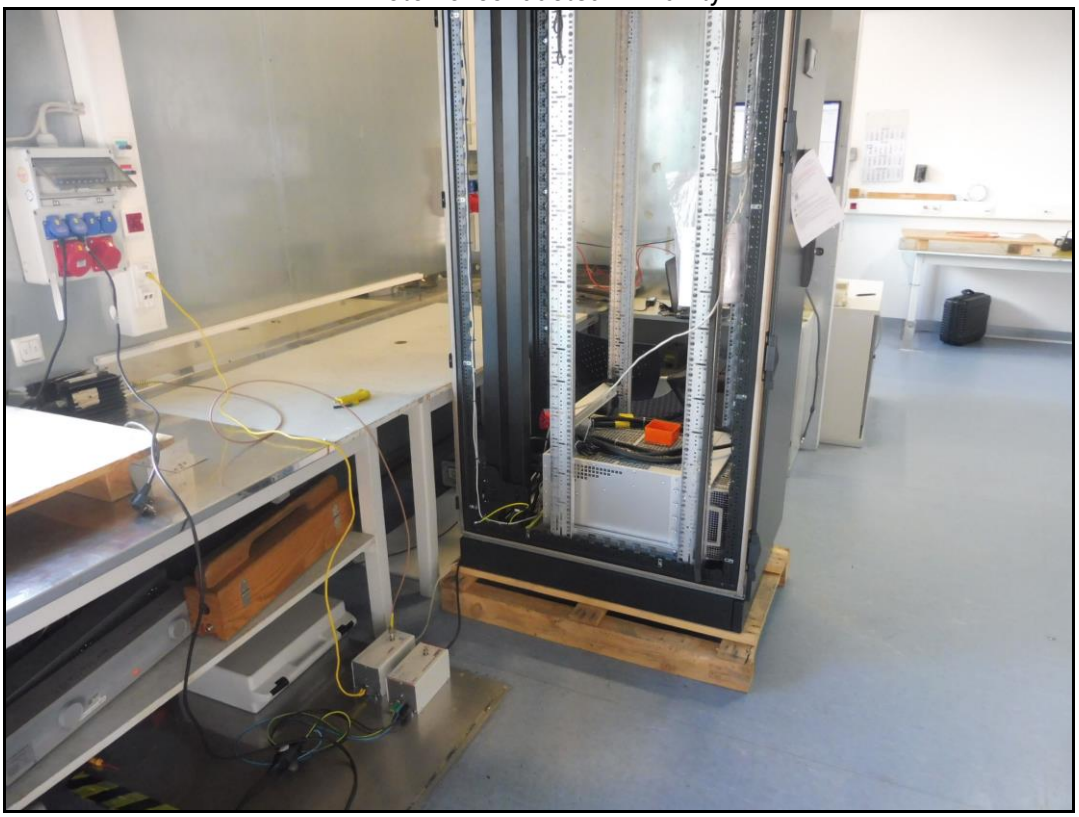


Photo 11: burst, surge, voltage dips and interruptions

Photo 12: burst

Photo 13: ESD

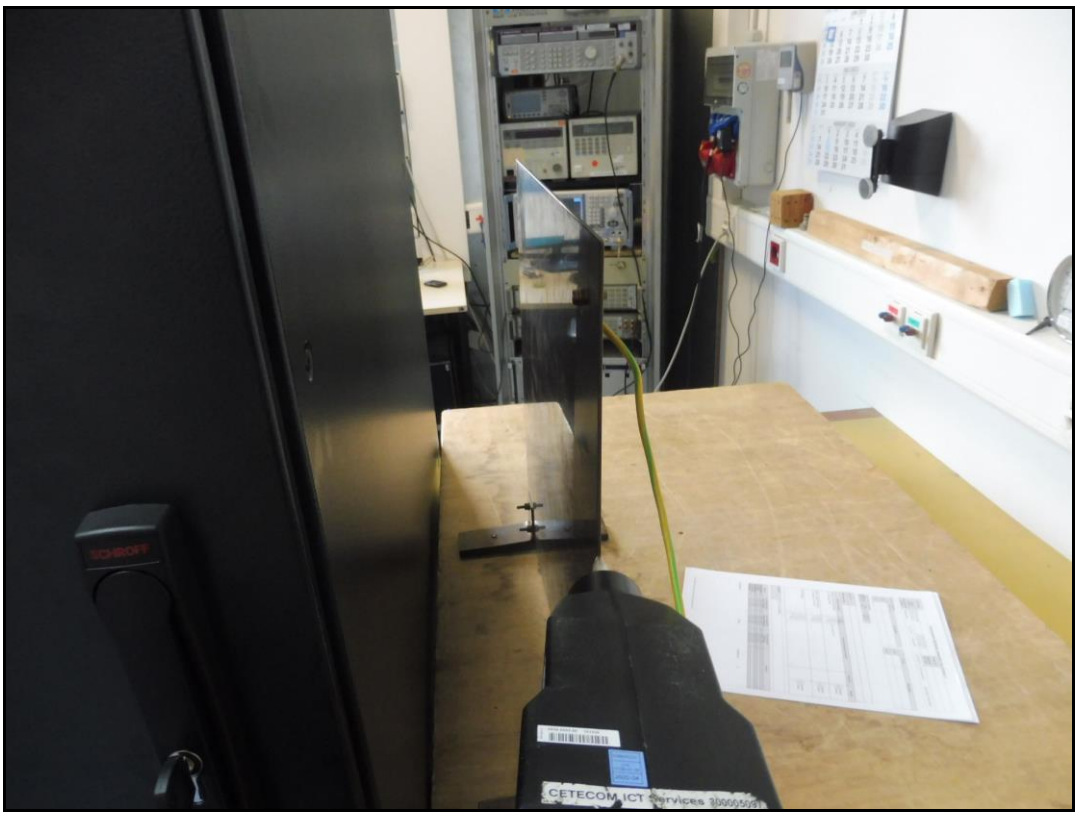


Photo 14: ESD

Photo 15: ESD

Photo 16: ESD

Photo 17: ESD

Annex B Photographs of the EUT

Photo 18: EUT

Photo 19: EUT

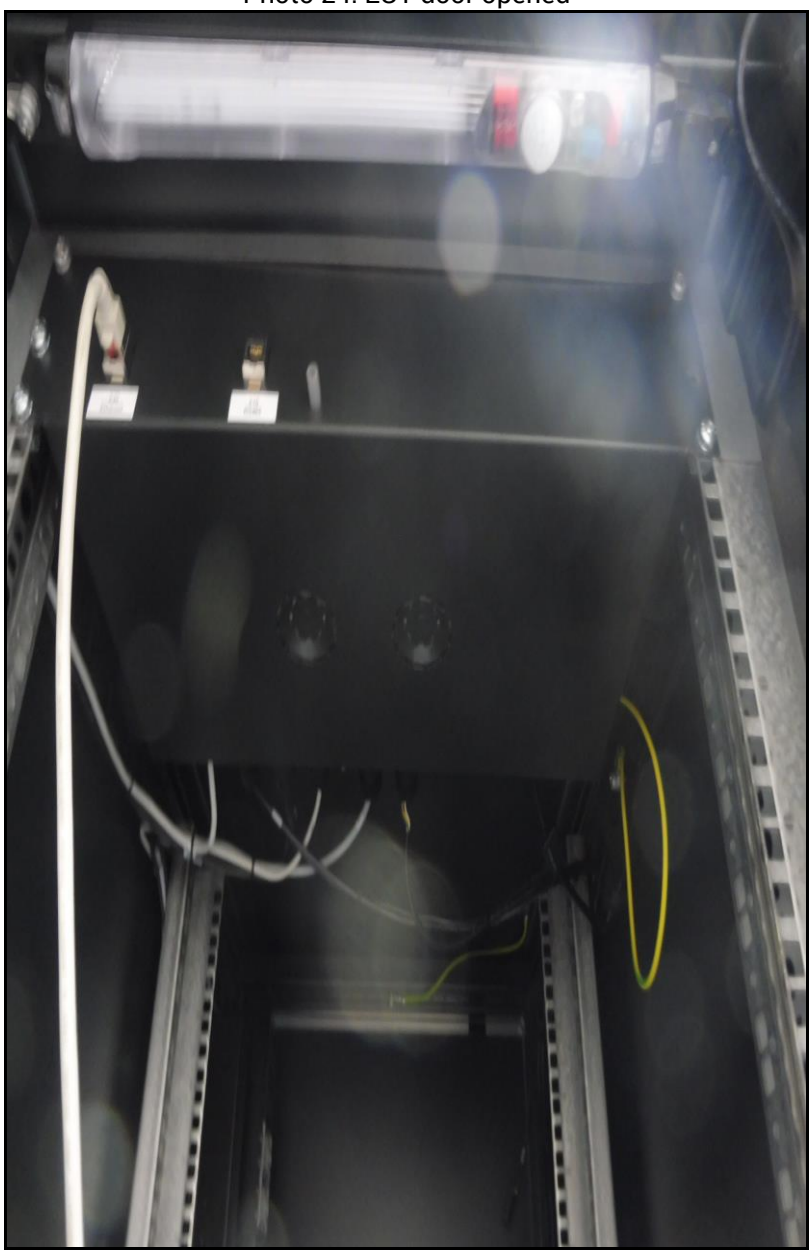
Photo 20: EUT (display)

Photo 21: EUT

Photo 22: EUT door opened

Photo 23: EUT door opened

Photo 24: EUT door opened



Annex C Document history

Version	Applied changes	Date of release
- / -	Initial release	2023-06-29
-A	Chapter 6.4 added	2023-07-07
-B	Editorial changes	2023-07-18
-C	Editorial changes	2023-07-27

This test report replaces the test report 1-6321/23-01-03-B and dated 2023-07-18

Annex D Further information

Glossary

DUT	-	Device under Test
EMC	-	Electromagnetic Compatibility
EUT	-	Equipment under Test
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
N/A	-	not applicable
S/N	-	Serial Number
SW	-	Software