
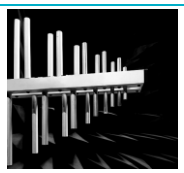
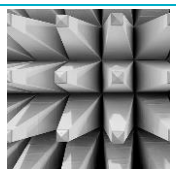

CTC advanced
member of RWTÜV group

TEST REPORT

Test Report No.: 1-1467/20-02-02

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

Testing Laboratory

CTC advanced GmbH
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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

Payter B.V.
Rozenlaan 115
3051 LP Rotterdam/NETHERLANDS
Contact: Stefan Schoenmaker
e-mail: Stefan@payter.nl
Phone: +31 8 54 01 23 80

Manufacturer

Payter B.V.
Rozenlaan 115
3051 LP Rotterdam/NETHERLANDS

Test Standard/s

EN 55032:2015	Electromagnetic compatibility of multimedia equipment - Emission requirements (CISPR 32)
EN 55035:2017	Electromagnetic compatibility of multimedia equipment – Immunity requirements (CISPR 35, modified)

Test Item

Kind of product:	**Payment Terminal**
Product name:	**Apollo Max**
Series:	**Apollo Terminal Series**
Serial number:	*see chapter 6.2*
Hardware version:	*see chapter 6.2*
Software version:	*see chapter 6.2*
Firmware version:	*see chapter 6.2*

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=Christopher Schramm, o=CTC advanced GmbH, ou=SRM-200513, email=Christopher.Schramm@ctcadvanced.com, c=DE
2021.05.18 07:10:55 +02'00'

Christopher Schramm
Lab Manager
Electromagnetic Compatibility & Acoustics

Test performed:

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Muhammad Faiq Khan
Testing Manager
Electromagnetic Compatibility & Acoustics

1 Table of contents

2 General information

2.1 Notes

The test results of this test report relate exclusively to the test item specified in this test report. CTC 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 CTC advanced GmbH.
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2.2 Application details

Date of receipt of order:	2021-03-25
Date of receipt of test item:	2021-03-29
Start of test:	2021-04-13
End of test:	2021-04-27
Person(s) present during the test:	- / -

3 Test standard/s:

Test standard	Test description
EN 55032:2015	Electromagnetic compatibility of multimedia equipment - Emission requirements (CISPR 32)
EN 55035:2017	Electromagnetic compatibility of multimedia equipment – Immunity requirements (CISPR 35, modified)

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 item

6.1 Test item

Radio Equipment EUT A

Kind of product	:	Payment Terminal		
Product name	:	Apollo Max		
Series	:	Apollo Terminal Series		
Equipment classification:		equipment for fixed use (according to EN 301 489-1, clause 3.1)		
Environment classification:		residential, commercial and light industry environment (according to EN 301 489-1, clause 1)		
Primary functions assessed during testing	:	Active reading of NFC card		
Intended functions	:	Payment Terminal		
Operating frequency range:		NFC 13.56 MHz		
Power supply	:	AC by external power supply unit		
Supply voltage	:	AC 100 - 240 V		
Ports (maximum cable lengths declared by manufacturer)	:	**Classification and description**	**Direction**	**Length**
		DC power port	input	< 3 m
		Signal/control port (USB C) Service port	in / output	< 3 m
		Signal/control port (Antenna port)	in / output	> 3 m
		Wired network port (Ethernet, Unscreened)	in / output	> 3 m
Is mounting position / usual operating position defined?			Yes, Wall mounted	
Set-up / Operating mode:				
--				
Additional information:				
--				

Power Supply EUT B

Kind of product	:	AC / DC Adaptor		
Product name	:	AC / DC Switching adapter		
Model	:	SYS1541-1812		
Equipment classification:		equipment for fixed use (according to EN 301 489-1, clause 5.5)		
Supply voltage	:	AC 100 - 240 V		
Ports (maximum cable lengths declared by manufacturer)	:	**Classification and description**	**Direction**	**Length**
		AC power port	input	> 3 m
		DC power port	output	< 3 m

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

	Radio equipment	Product name	Serial number	Hardware version	Software version
EUT A	Payment Terminal	Apollo Max	APM20204800009-28	APM01.BL.PAY V1	apollo-os-minimal-1.0.0-b7-prod
Note: EUT short description is used to simplify the identification of the EUT in this test report.					

	Ancillary equipment	Product name	Serial number	Hardware version	Software version
EUT B	AC / DC Power Supply	AC / DC Switching adapter	- / -	SYS1541-1812	- / -
Note: 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

	Auxiliary equipment	Type	Serial number	Hardware version	Software version
AE 1	Customer Laptop	Packard bell MS2384	NXC2CMH0043 3509E246600	--	Windows 8
NOTE: AE short description is used to simplify the identification of the auxiliary equipment in this test report.					

6.4 EUT set-up(s)

The EUT set-up(s) are described in detailed test results.

EUT set-up no.*)	Combination of EUT and AE	Remarks
set. 1	EUT A + EUT B + AE 1	AE1 was placed outside the measurement chamber.

*) EUT set-up no. is used to simplify the identification of the EUT set-up in this test report.

6.5 EUT operating modes

The EUT operating modes are described in detailed test results.

EUT operating mode no.*)	Description of operating modes	Additional information
op. 1	Active NFC mode	Continuous reading of NFC card. Communication with Laptop via Ethernet.

*) EUT operating mode no. is used to simplify the test report.

7 Summary of test results

☒ All of the performed measurements are passed
☐ At least one of the performed measurements is 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**
EMI Phenomenon	**Frequency range**	**Basic standard**	**Result**
Radiated interference field strength	1000 – 6000 MHz	EN 55032 Class B	**passed**

Note: The emission tests according to the EMC standard(s) do not replace necessary spurious emission tests according to the radio standard(s).

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	**NA6**
Voltage fluctuations and flicker	--	EN 61000-3-3	**NA7**

7.1.3 DC power Input/Output ports

EMI Phenomenon	Frequency range	Basic standard	Result
Conducted interference voltage	0,15 – 30 MHz	EN 55032 Class A	**NA4**

7.1.4 Wired network port

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

7.2 Immunity

7.2.1 Enclosure

EMS Phenomenon	Frequency range	Basic standard	Result
Electrostatic discharge	--	EN 61000-4-2	**passed**
Radio frequency electromagnetic field	80 – 6000 MHz	EN 61000-4-3	**passed**
Magnetic fields	50 Hz / 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	--	EN 61000-4-4	**passed**
Surges	--	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 DC power Input/Output ports

EMS Phenomenon	Frequency range	Basic standard	Result
Fast transients, common mode	--	EN 61000-4-4	**NA4**
Radio frequency, common mode	0,15 – 80 MHz	EN 61000-4-6	**NA4**
Transients and surges, vehicular environment	--	ISO 7637-2:2004	**NA1**

7.2.4 Signal/Control port

EMS Phenomenon	Frequency range	Basic standard	Result
Fast transients, common mode	--	EN 61000-4-4	**NA3**
Radio frequency, common mode	0,15 – 80 MHz	EN 61000-4-6	**NA3**

7.2.5 Wired network port

EMS Phenomenon	Frequency range	Basic standard	Result
Fast transients, common mode	--	EN 61000-4-4	**passed**
Surges	--	EN 61000-4-5	**NA10**
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 exist
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 frequency < 108 MHz
NA9	Not performed, because test only applicable to equipment containing devices intrinsically susceptible to magnetic fields.
NA10	Test not applicable because port lengths not longer than 30 m an only for indoor use.

7.3 Performance assessment and reaction of the EUT

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

Monitoring during continuous phenomena

- The NFC communication link was observed
- Continuous reading of NFC card observed
- Communication with Laptop via Ethernet observed
- Visual observation of blinking LEDs pattern (Red, Green, Blue, Off)

Monitoring during transient phenomena

- The NFC communication link was observed
- Continuous reading of NFC card observed
- Communication with Laptop via Ethernet observed
- Visual observation of blinking LEDs pattern (Red, Green, Blue, Off)

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

R1

-No change of state
-No unintended reaction of any indicating LEDs
-Continuous reading of NFC card
-No loss of communication link with Laptop via Ethernet

R2

-The EUT re-started itself. The EMC test loop had to be re-initialized to start the active reading of NFC card after the test.
-Ethernet communication was self-recoverable after the test.

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 Acceptance Criteria

Acceptance criteria defined by customer.

	Test item	Acceptance criteria	Comment	
	Modem Status	passed	The LTE Modem test checks if the internal modem responds to commands correctly. The test is performed each test iteration. If the communication is successful the result is: passed, when unsuccessful the result is: failed. If the modem device is not detected, the result becomes: DnP (device not present)(ttyACM0)	
	Tamper test	passed	The status of the internal tamper detection mechanisms is monitored each iteration. When no tamper event is detected the result is: passed. If a tamper event is detected the result is: failed.	
	PICC exchange test	passed	Each iteration an exchange test is performed with a Contactless bank card(test card 1). The outcome for a valid exchange is: passed, for a failed exchange: failed (!this test is only applicable for immunity testing!)	
	ICC exchange test	passed	Each iteration an exchange test is performed with a Contact Chip bank card(test card 2). The outcome for a valid exchange is: passed, for a failed exchange: failed	
	MMC R/W test	passed	This test performs random write sequences and compares indicates if the read/write test for the internal eMMC device is successful: passed or unsuccessful: failed	
	RS232 test	passed	This test performs a loopback test on the USB serial device, connected to the USB port on the back of the Apollo terminal. A successful loopback result: passed, otherwise: failed. If the USB serial device is not detected, the result becomes: DnP (device not present) (ttyUSB0)	
	Display test	Uninterrupted display test pattern update each iteration		
	LED test	The indicator LEDs change colour each iteration, repeating the following colour cycle red, green, blue and off.		
	Buzzer test	The buzzer must continue to sound one beep each iteration.		

7.5 Measurement and test set-up

Note: The test configuration is in accordance with the requirements given in the standards in point 3.

7.6 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%)
Radiated Emission EN 55032, ANSI C63.4	30 MHz – 18 GHz		± 4.28 dB
Conducted Emission EN 55032, ANSI C63.4	9 kHz – 30 MHz		± 3.49 dB
Harmonics EN 61000-3-2	2...40 x f_n f_n= 50 Hz	Voltage Current	± 0.05 % ± 0.06 %
Flicker EN 61000-3-3	f_n = 50 Hz	P_{st}	± 1 %
ESD EN 61000-4-2	1/30/60ns	Current Parameter Time Parameter	± 10.5 % ± 6.6 %
Radiated Immunity EN 61000-4-3	80 MHz -6 GHz		± 22.7 %
Fast Transients EN 61000-4-4	5/50ns	Voltage Parameter Time Parameter	± 3 % ± 4 %
Surge EN 61000-4-5	1,2/50 µs, 8/20 µs	Surge voltage Surge current Time Parameter	± 5.4 % ± 6.6 % ± 2.5 %
HF Injection EN 61000-4-6	150 kHz – 80 MHz		± 6.24 %
Voltage Dips, Interruptions EN 61000-4-11		Voltage Parameter Time Parameter	± 3 % ± 3 %

8 Emission – Detailed test results

8.1 Electromagnetic radiated emissions (distance 10 m)

8.1.1 Instrumentation for test (see equipment list)

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

8.1.2 Test plan

EUT set-up	Set. 1		
Operating mode	**Application**	**Limit**	**result**
Op. 1	Enclosure	EN 55032 Class B	passed

Remarks:	---

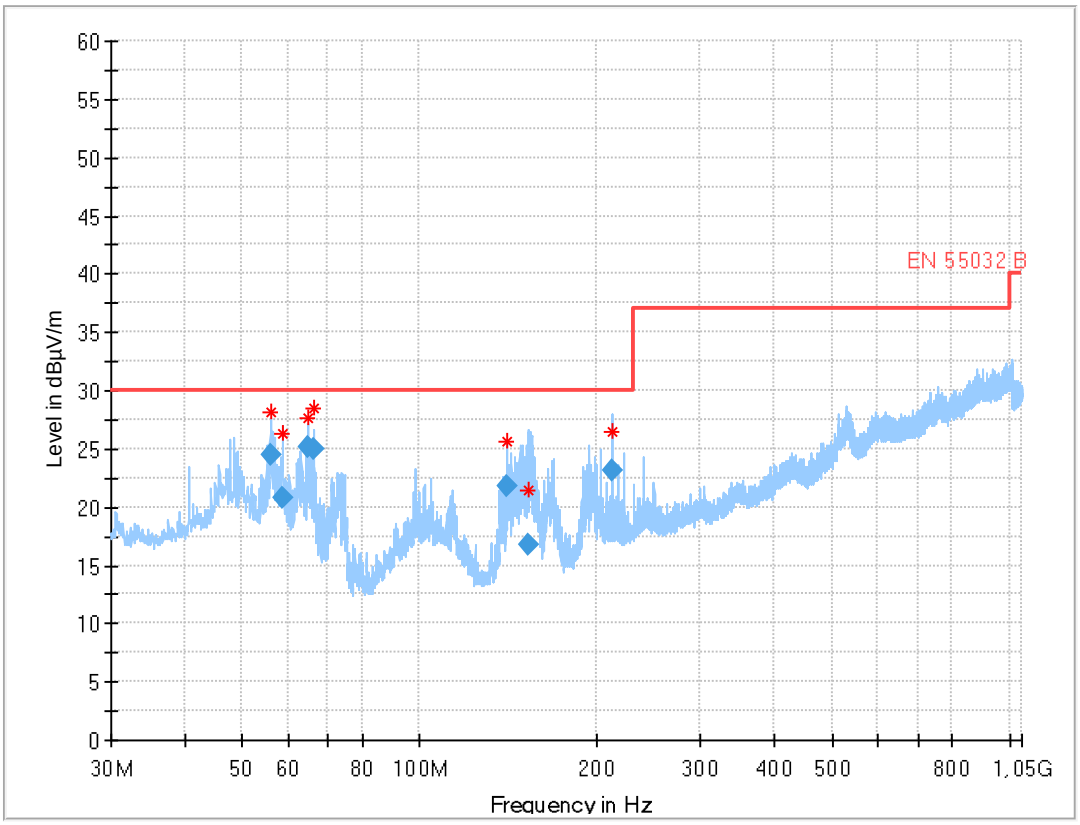
8.1.3 Radiated limits

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

8.1.4 Test results

Common Information

EUT:	Apollo Max
Test description:	EN 55032 class B @ 10 m
Operating condition:	Cont. reading of NFC tag and communication with laptop via Ethernet
Operator name:	MED



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)
55.996	24.54	30.0	5.5	1000	120.0	200.0	V	329	15
58.744	20.82	30.0	9.2	1000	120.0	148.0	V	26	14
64.789	25.20	30.0	4.8	1000	120.0	336.0	V	210	11
66.283	24.95	30.0	5.1	1000	120.0	340.0	V	273	11
141.200	21.78	30.0	8.2	1000	120.0	127.0	V	108	9
153.316	16.76	30.0	13.2	1000	120.0	172.0	V	103	9
212.477	23.09	30.0	6.9	1000	120.0	118.0	V	-30	12

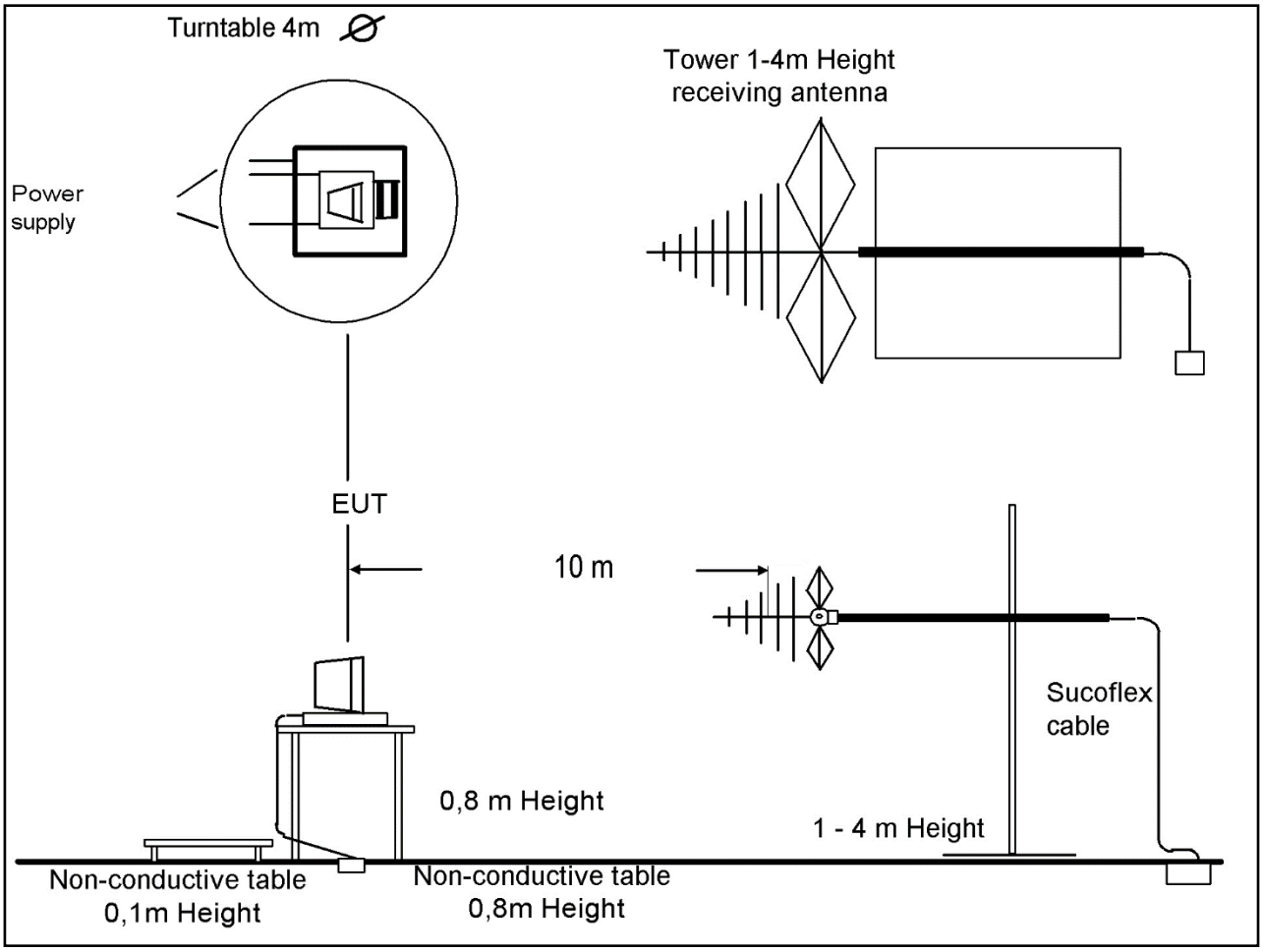
8.1.5 Hardware set-up

Subrange 1

Frequency Range:	30 MHz - 1 GHz
Receiver:	ESR 3 [ESR 3] @ GPIB0 (ADR 20), SN 1316.3003K03/102587, FW 3.46 SP1
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW ---
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

8.1.6 Test set-up



8.2 Electromagnetic radiated emissions (distance 5 m)

8.2.1 Instrumentation for test (see equipment list)

F 1	F 4	F 6	F 30	F 32	F 33						

8.2.2 Test Plan

EUT set-up	Set. 1		
Operating mode	**Application**	**Limit**	**Result**
Op. 1	Enclosure	EN 55032 Class B	passed

Remarks:	The measured values are recalculated from 5m to 3m distance.

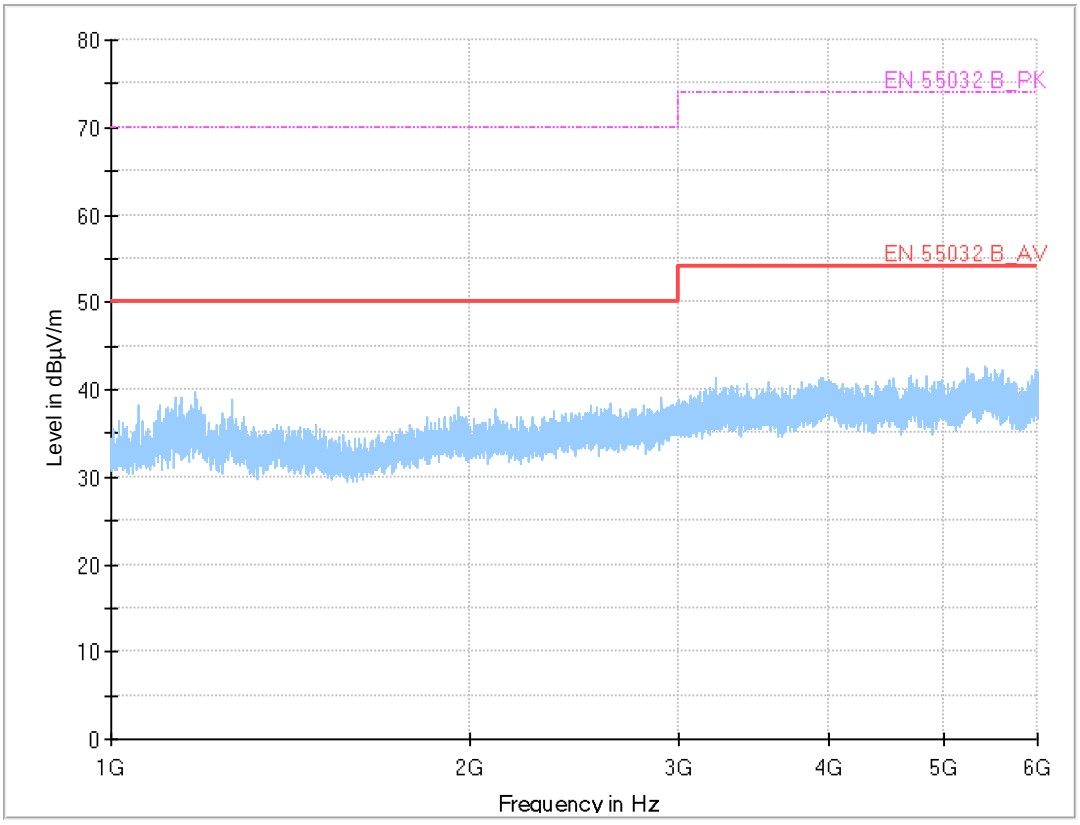
8.2.3 Radiated Limits

Frequency- range	**EN 55032 Class B**		**EN 55032 Class A**	
	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

8.2.4 Test results

Common Information

EUT:	Apollo Max
Test description:	EN 55032 class B @ 10 m
Operating condition:	Cont. reading of NFC tag and communication with laptop via Ethernet
Operator name:	MED



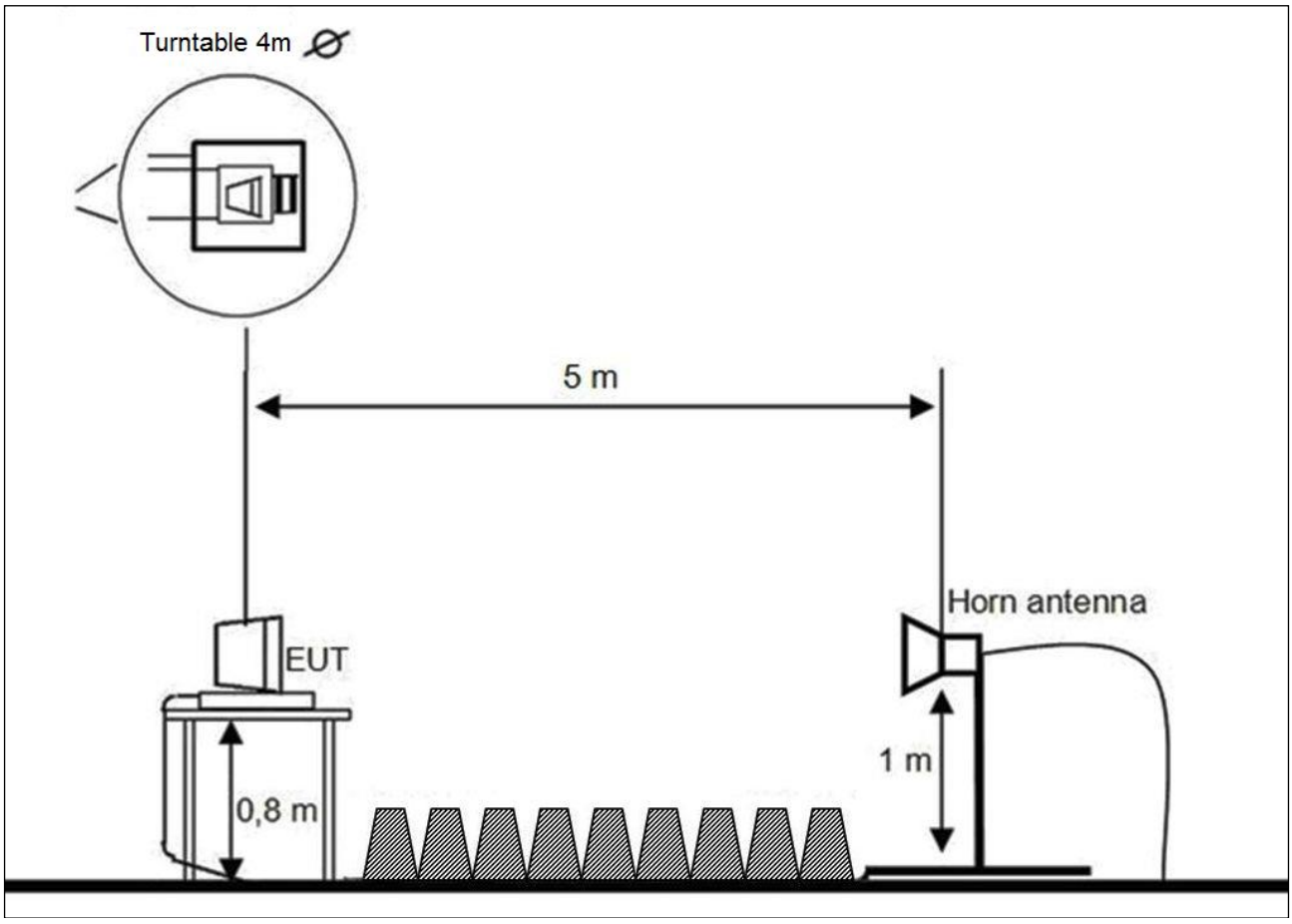
8.2.5 Hardware set-up

Subrange 1

Frequency Range:	1 GHz - 6 GHz
Receiver:	FSU 26 [FSU 26] @ GPIB0 (ADR 17), SN 200809/026, FW 4.71
Signal Path:	1_6_EN FW 1.0
Antenna:	EMCO 3115
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 Conducted emission

8.3.1 Instrumentation for test (see equipment list)

I 25	I 28	I 29	I 30	I 31	I 34	G 6					

8.3.2 Test plan

EUT set-up	Set. 1			
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 :	---

8.3.3 Conducted limits (power-line)

	EN 55032 Class B		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

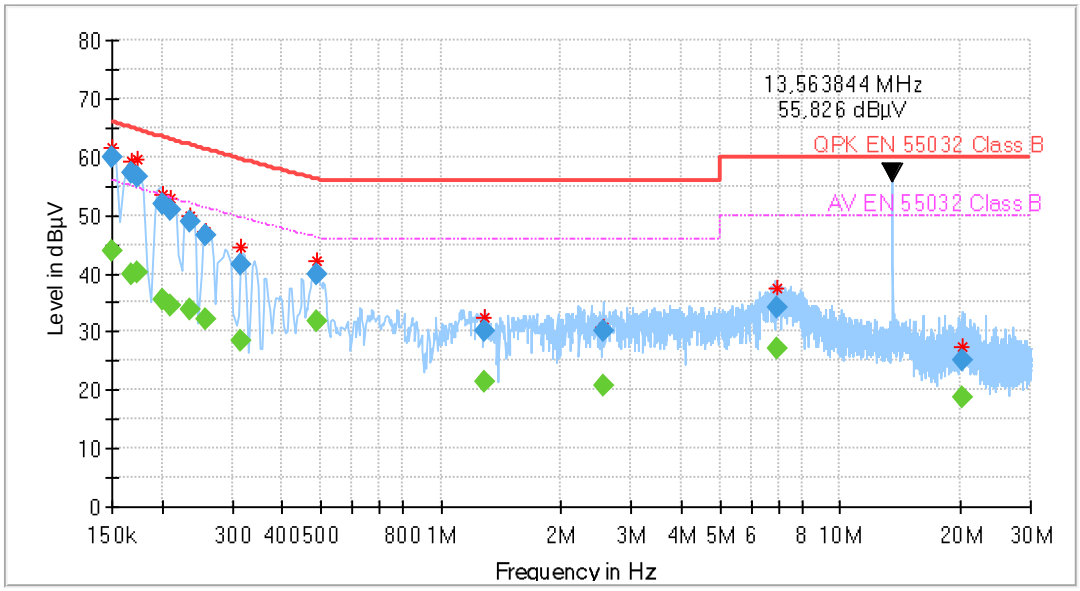
8.3.4 Conducted limits (wired network port)

	EN 55032 Class B				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

8.3.5 Test results of mains (phase L1)

EUT Information

EUT Name:	Apollo Max
Manufacturer:	Payter
Operator:	KHN
Operating Mode:	Cont. reading of NFC tag and communication with laptop via Ethernet
Comment:	AC 230 V / 50 Hz, The peak at 13.563 MHz is the carrier frequency



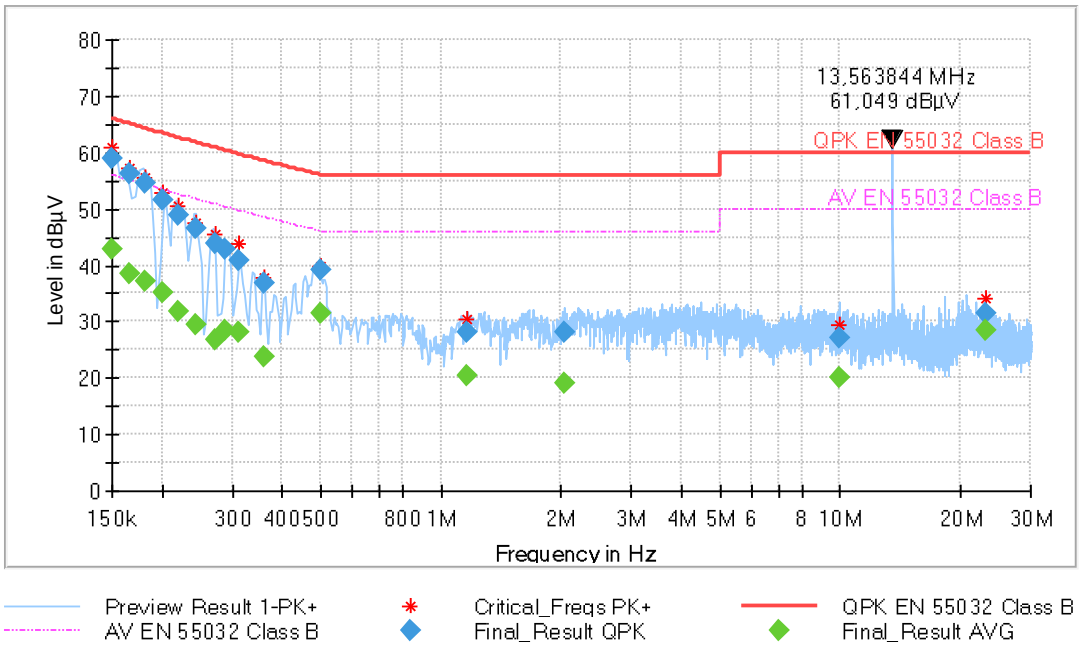
Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.150429	---	44.00	55.97	11.97	1000.0	9.000	L1	FLO	11.2
0.150429	60.07	---	65.97	5.90	1000.0	9.000	L1	FLO	11.2
0.168067	---	39.81	54.97	15.16	1000.0	9.000	L1	FLO	10.4
0.168067	57.27	---	64.98	7.71	1000.0	9.000	L1	FLO	10.4
0.173235	---	40.21	54.70	14.49	1000.0	9.000	L1	FLO	10.3
0.173235	56.52	---	64.72	8.20	1000.0	9.000	L1	FLO	10.3
0.200954	---	35.62	53.39	17.77	1000.0	9.000	L1	FLO	10.1
0.200954	52.03	---	63.42	11.39	1000.0	9.000	L1	FLO	10.1
0.210846	---	34.58	52.97	18.39	1000.0	9.000	L1	FLO	10.1
0.210846	51.01	---	63.00	11.99	1000.0	9.000	L1	FLO	10.1
0.233952	---	33.75	52.08	18.33	1000.0	9.000	L1	FLO	10.0
0.233952	48.99	---	62.12	13.13	1000.0	9.000	L1	FLO	10.0
0.257357	---	32.14	51.27	19.13	1000.0	9.000	L1	FLO	10.0
0.257357	46.61	---	61.31	14.70	1000.0	9.000	L1	FLO	10.0
0.313619	---	28.42	49.64	21.22	1000.0	9.000	L1	FLO	9.9
0.313619	41.48	---	59.68	18.20	1000.0	9.000	L1	FLO	9.9
0.490644	---	31.87	46.14	14.27	1000.0	9.000	L1	FLO	9.9
0.490644	39.90	---	56.15	16.24	1000.0	9.000	L1	FLO	9.9
1.292905	---	21.53	46.00	24.47	1000.0	9.000	L1	FLO	10.1
1.292905	30.08	---	56.00	25.92	1000.0	9.000	L1	FLO	10.1
2.544306	---	20.78	46.00	25.22	1000.0	9.000	L1	FLO	10.3
2.544306	30.21	---	56.00	25.79	1000.0	9.000	L1	FLO	10.3
6.914099	---	27.02	50.00	22.98	1000.0	9.000	L1	FLO	10.7
6.914099	34.08	---	60.00	25.92	1000.0	9.000	L1	FLO	10.7
20.221324	---	18.78	50.00	31.22	1000.0	9.000	L1	FLO	11.6
20.221324	25.10	---	60.00	34.90	1000.0	9.000	L1	FLO	11.6

8.3.6 Test results of mains (neutral N)

EUT Information

EUT Name:	Apollo Max
Manufacturer:	Payter
Operator:	KHN
Operating Mode:	Cont. reading of NFC tag and communication with laptop via Ethernet



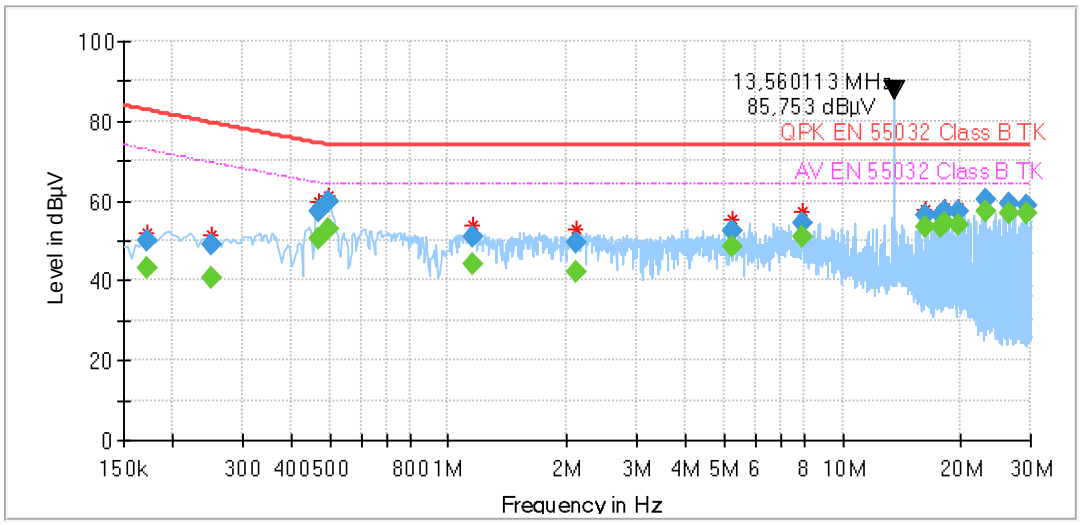
Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.150756	---	42.81	55.95	13.14	1000.0	9.000	N	FLO	11.2
0.150756	58.77	---	65.96	7.18	1000.0	9.000	N	FLO	11.2
0.166908	---	38.38	55.03	16.65	1000.0	9.000	N	FLO	10.4
0.166908	56.26	---	65.05	8.79	1000.0	9.000	N	FLO	10.4
0.180699	---	37.24	54.32	17.08	1000.0	9.000	N	FLO	10.3
0.180699	54.57	---	64.34	9.77	1000.0	9.000	N	FLO	10.3
0.199937	---	35.08	53.43	18.35	1000.0	9.000	N	FLO	10.2
0.199937	51.65	---	63.46	11.81	1000.0	9.000	N	FLO	10.2
0.218835	---	31.78	52.65	20.87	1000.0	9.000	N	FLO	10.1
0.218835	48.72	---	62.68	13.96	1000.0	9.000	N	FLO	10.1
0.243810	---	29.36	51.73	22.37	1000.0	9.000	N	FLO	10.0
0.243810	46.43	---	61.77	15.34	1000.0	9.000	N	FLO	10.0
0.272508	---	26.82	50.80	23.98	1000.0	9.000	N	FLO	9.9
0.272508	43.74	---	60.84	17.10	1000.0	9.000	N	FLO	9.9
0.289312	---	28.29	50.30	22.01	1000.0	9.000	N	FLO	9.9
0.289312	42.78	---	60.34	17.56	1000.0	9.000	N	FLO	9.9
0.312683	---	27.96	49.67	21.71	1000.0	9.000	N	FLO	9.9
0.312683	40.99	---	59.71	18.71	1000.0	9.000	N	FLO	9.9
0.361779	---	23.92	48.50	24.58	1000.0	9.000	N	FLO	9.9
0.361779	36.85	---	58.53	21.68	1000.0	9.000	N	FLO	9.9
0.497948	---	31.33	46.03	14.70	1000.0	9.000	N	FLO	9.9
0.497948	39.08	---	56.03	16.95	1000.0	9.000	N	FLO	9.9
1.165254	---	20.53	46.00	25.47	1000.0	9.000	N	FLO	10.0
1.165254	28.24	---	56.00	27.76	1000.0	9.000	N	FLO	10.0
2.035490	---	19.12	46.00	26.88	1000.0	9.000	N	FLO	10.2
2.035490	27.98	---	56.00	28.02	1000.0	9.000	N	FLO	10.2
9.996645	---	20.09	50.00	29.91	1000.0	9.000	N	FLO	10.8
9.996645	26.96	---	60.00	33.04	1000.0	9.000	N	FLO	10.8
23.128519	---	28.48	50.00	21.52	1000.0	9.000	N	FLO	11.7
23.128519	31.51	---	60.00	28.49	1000.0	9.000	N	FLO	11.7

8.3.7 Test results (wired network port)

EUT Information

EUT Name:	Apollo Max
Manufacturer:	Payter
Operator:	KHN
Operating Mode:	Cont. reading of NFC tag and communication with laptop via Ethernet

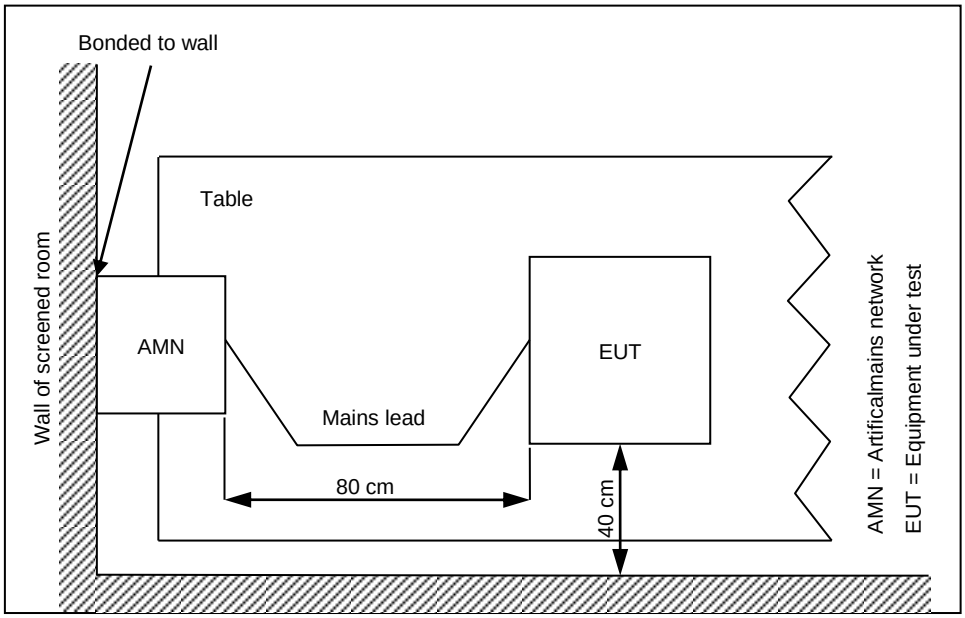


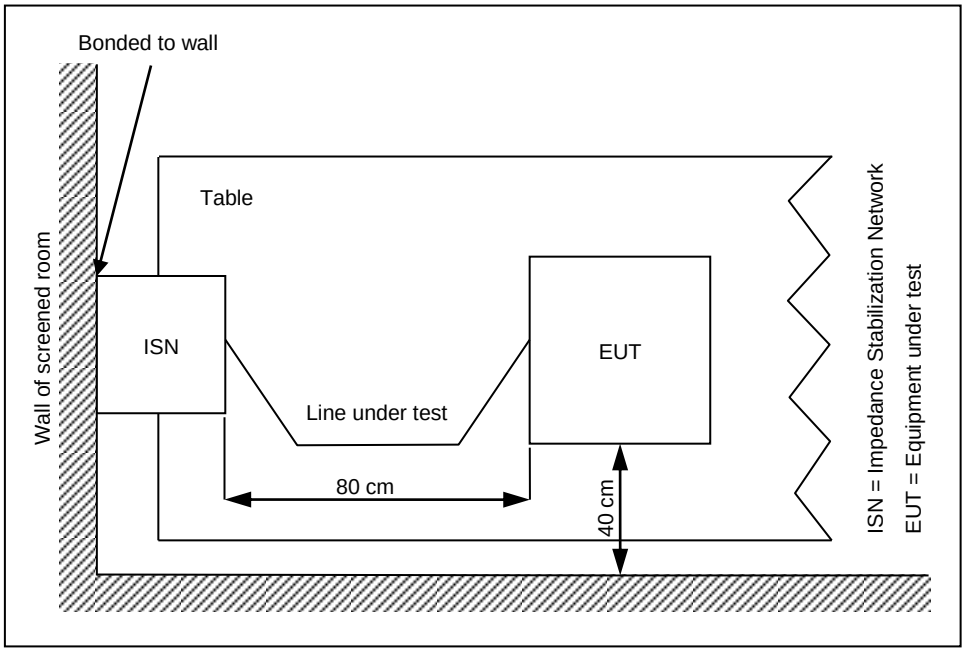
Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)
0.171574	---	43.20	72.81	29.61	1000.0	9.000	GND	20.2
0.171574	49.83	---	82.82	32.99	1000.0	9.000	GND	20.2
0.250394	---	40.53	69.57	29.04	1000.0	9.000	GND	19.7
0.250394	49.03	---	79.59	30.56	1000.0	9.000	GND	19.7
0.471177	---	50.25	64.46	14.21	1000.0	9.000	GND	19.6
0.471177	57.37	---	74.46	17.09	1000.0	9.000	GND	19.6
0.493689	---	53.16	64.10	10.94	1000.0	9.000	GND	19.5
0.493689	59.77	---	74.10	14.33	1000.0	9.000	GND	19.5
1.146713	---	44.17	64.00	19.83	1000.0	9.000	GND	19.8
1.146713	51.11	---	74.00	22.89	1000.0	9.000	GND	19.8
2.119572	---	42.13	64.00	21.87	1000.0	9.000	GND	19.6
2.119572	49.68	---	74.00	24.32	1000.0	9.000	GND	19.6
5.235062	---	48.37	64.00	15.63	1000.0	9.000	GND	19.7
5.235062	52.66	---	74.00	21.34	1000.0	9.000	GND	19.7
7.922995	---	50.75	64.00	13.25	1000.0	9.000	GND	19.8
7.922995	54.65	---	74.00	19.35	1000.0	9.000	GND	19.8
16.227741	---	53.33	64.00	10.67	1000.0	9.000	GND	20.3
16.227741	56.61	---	74.00	17.39	1000.0	9.000	GND	20.3
17.691652	---	53.27	64.00	10.73	1000.0	9.000	GND	20.4
17.691652	56.27	---	74.00	17.73	1000.0	9.000	GND	20.4
18.241910	---	54.47	64.00	9.53	1000.0	9.000	GND	20.5
18.241910	57.56	---	74.00	16.44	1000.0	9.000	GND	20.5
19.707517	---	54.07	64.00	9.93	1000.0	9.000	GND	20.6
19.707517	57.11	---	74.00	16.89	1000.0	9.000	GND	20.6
23.126809	---	57.48	64.00	6.52	1000.0	9.000	GND	20.9
23.126809	60.21	---	74.00	13.79	1000.0	9.000	GND	20.9
26.607823	---	57.00	64.00	7.00	1000.0	9.000	GND	21.2
26.607823	59.53	---	74.00	14.47	1000.0	9.000	GND	21.2
29.232778	---	56.89	64.00	7.11	1000.0	9.000	GND	21.4
29.232778	58.83	---	74.00	15.17	1000.0	9.000	GND	21.4

8.3.8 Test set-up

According to EMC basic standard **EN 55032**





9 Immunity – Detailed test results

9.1 Radio frequency electromagnetic field (80 MHz to 6 GHz)

9.1.1 Instrumentation for test (see equipment list)

D 1	D 2	D 3	D 4	D 5	D 6	D 8	D 9	D 10	D 11		

9.1.2 Test plan

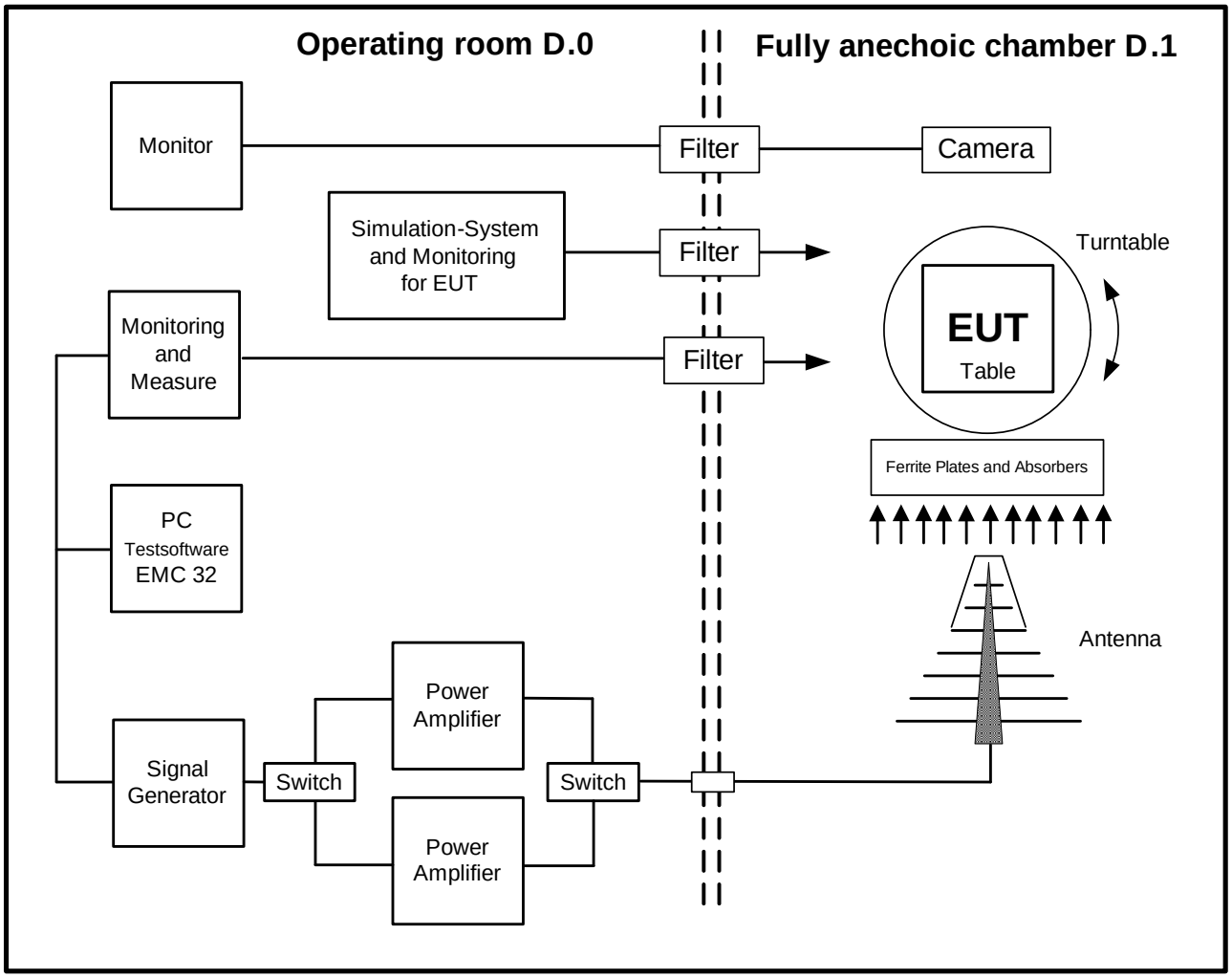
EUT set-up	Set. 1				
Operating mode	Op. 1				
Test condition					
Dwell time	**Field strength (unmod., rms)**	**Start frequency**	**Stop frequency**	**Frequency step**	**Modulation**
2 s	10 V/m	80 MHz	1000 MHz	log 1%	1 kHz, AM 80%
2 s	3 V/m	1000 MHz	6000 MHz	log 1%	1 kHz, AM 80%

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

Remarks:	According to customer request, the test was performed with higher values than required by the used standard. Spot frequencies according to EN 55035 Table 1 (1800, 2600, 3500, 5000) MHz were also performed.

9.1.3 Test set-up

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



9.2 Radio frequency, common mode (150 kHz to 80 MHz)

9.2.1 Instrumentation for test (see equipment list)

I 4	I 5	I 6	I 7	I 8	I 9	I 10	I 13	G 7			

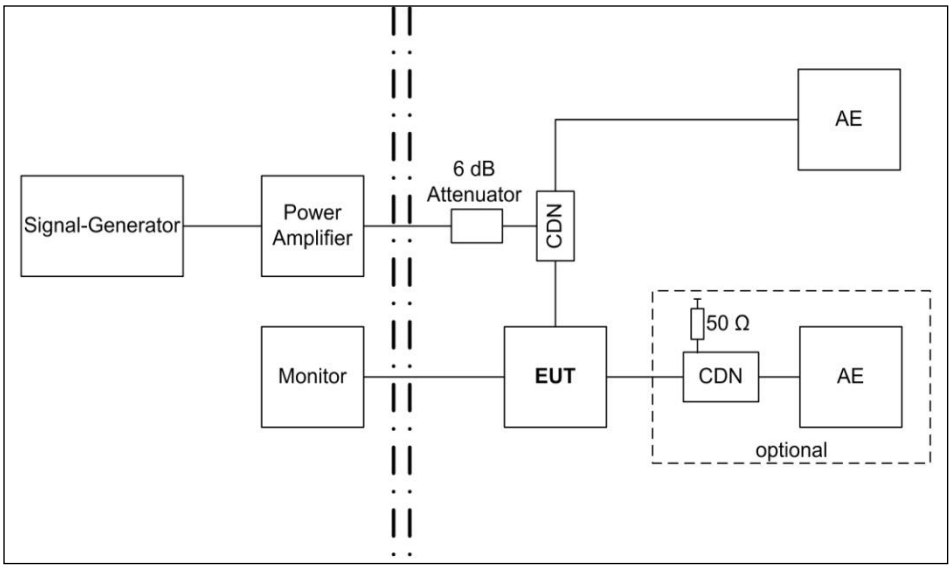
9.2.2 Test plan

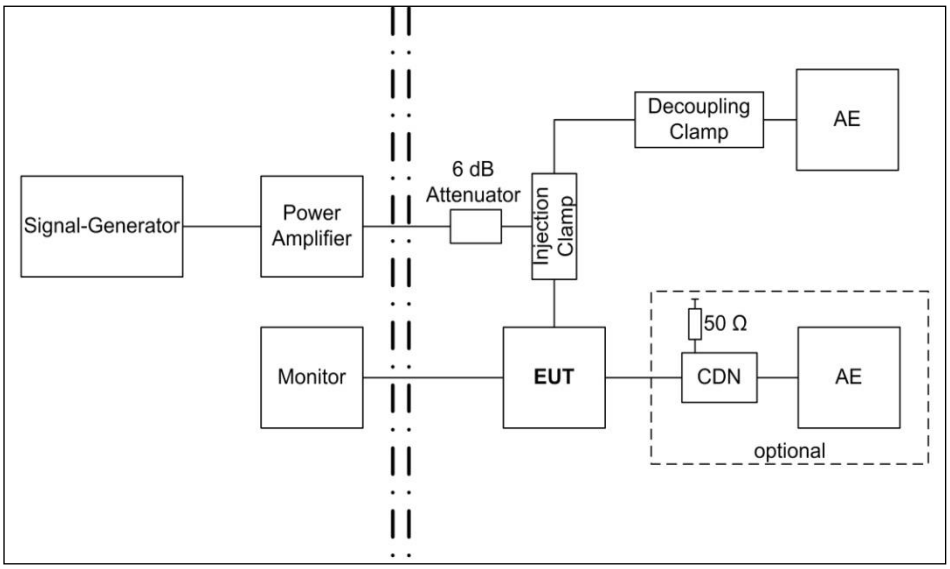
EUT set-up	Set. 1				
Operating mode	Op. 1				
Test conditions					
Dwell time	**Test level (unmod., rms)**	**Start frequency**	**Stop frequency**	**Frequency step**	**Modulation**
1 s	3 V	150 kHz	80 MHz	log 1%	1 kHz, AM 80%
Port	**Coupling device**		**Reaction of EUT (please refer to chapter 7.3)**		**Within specification(s) during and after test**
AC mains	CDN M2		R1		yes
Ethernet	ISN T8		R1		yes
Antenna port	Clamp		R1		yes

Remarks:	According to customer request, the test was performed with higher values than required by the used standard.

9.2.3 Test set-up

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





9.3 Electrical fast transients (burst)

9.3.1 Instrumentation for test (see equipment list)

I 21	I 23										

9.3.2 Test plan

EUT set-up	Set. 1				
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
Antenna port	+0,5 kV -0,5 kV	clamp	5 kHz	R1	yes
Ethernet	+0,5 kV -0,5 kV	clamp	5 kHz	R1	yes

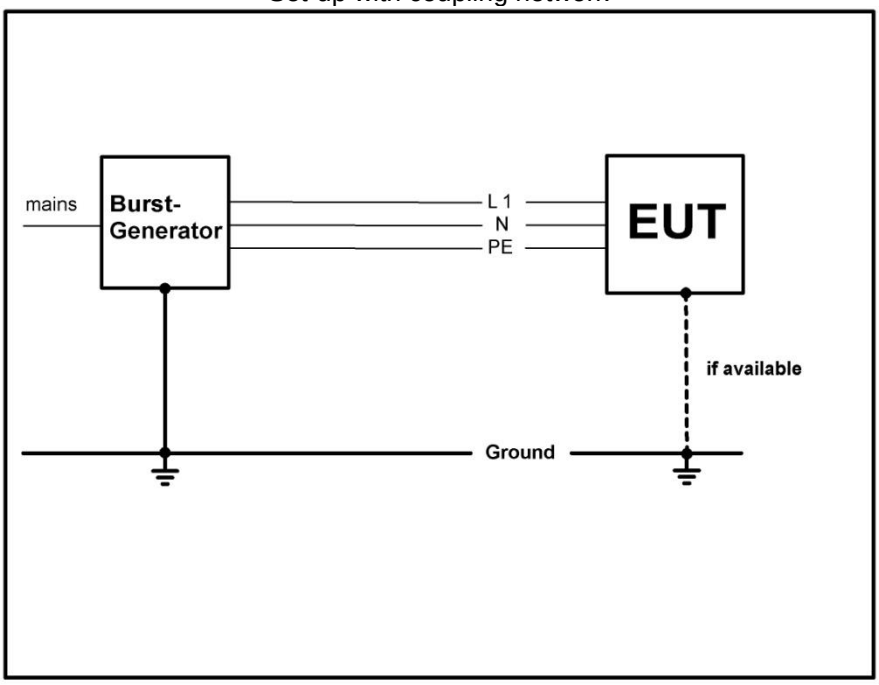
Remarks:	---

9.3.3 Test set-up

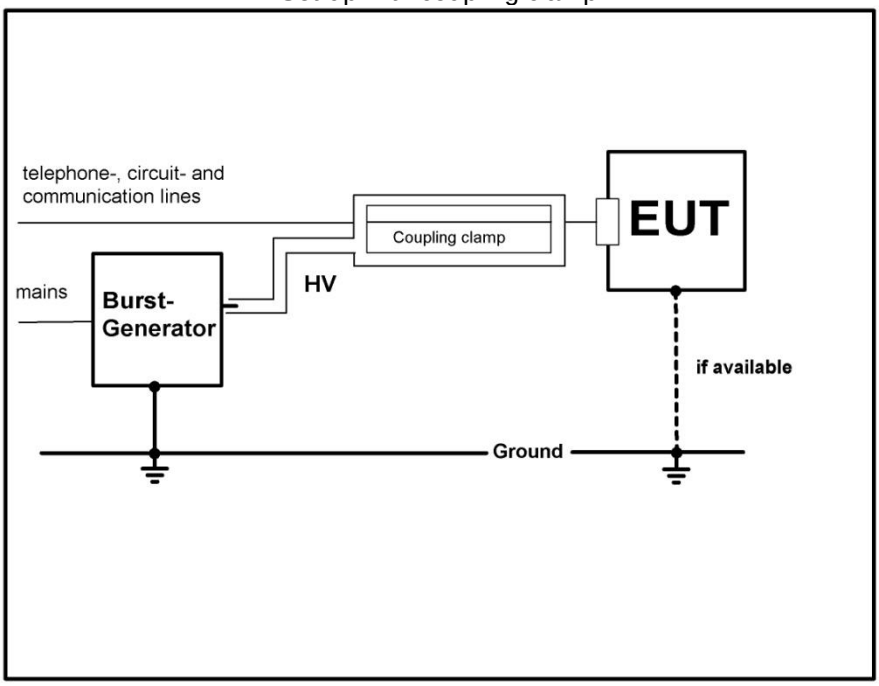
According to the requirements given in **EN 61000-4-4**

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)

I 21											

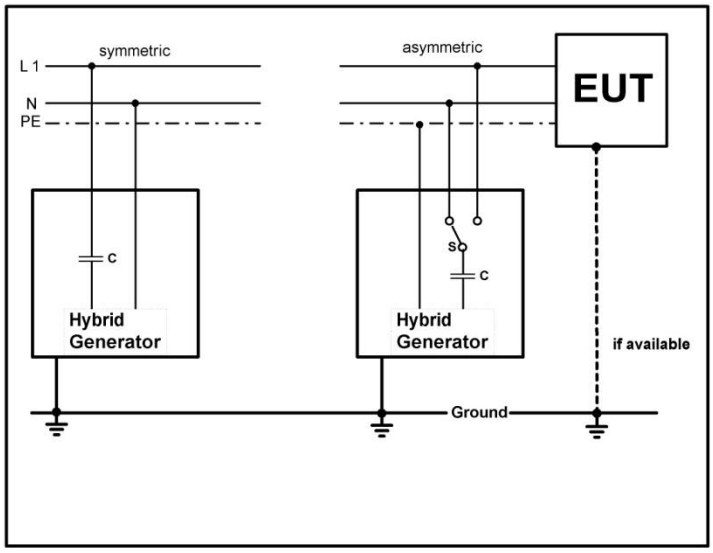
9.4.2 Test plan

EUT set-up	Set. 1				
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 angles: 0°, 90°, 180°, 270°.	Number: 5 Each + / -	R1	yes

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)

I 21	I 22										

9.5.2 Test plan

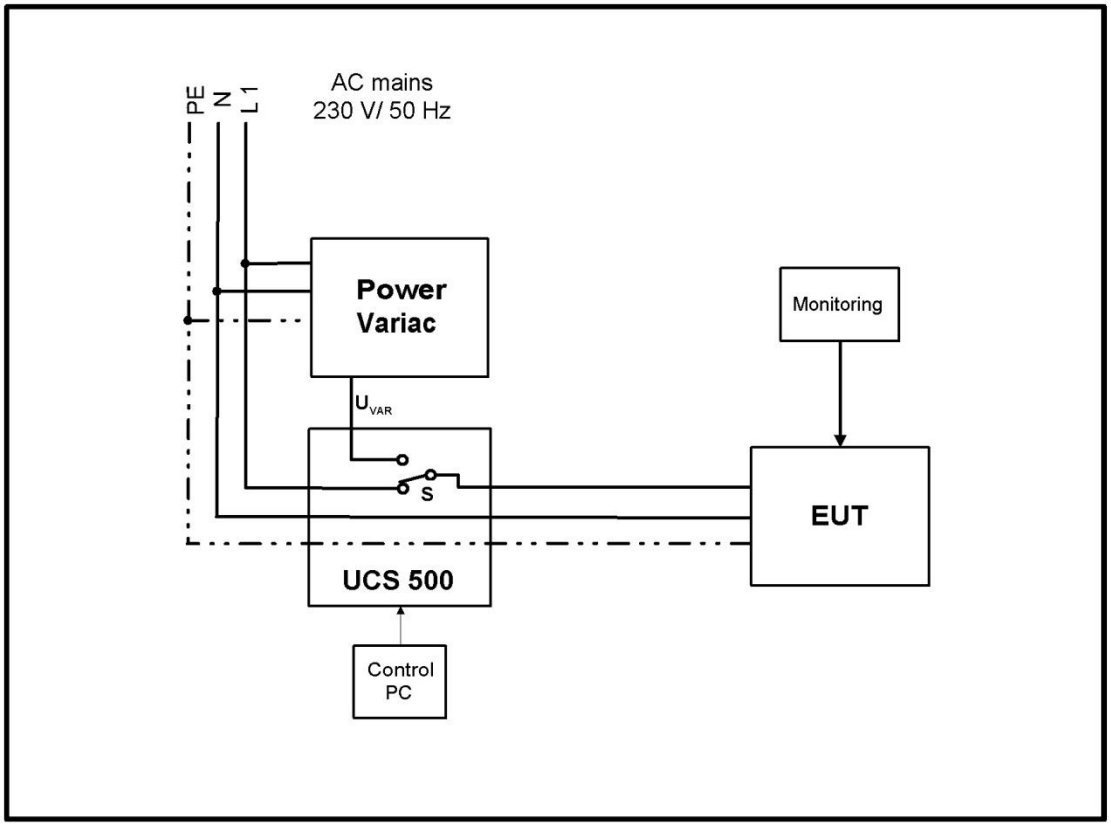
EUT set-up	Set. 1				
Operating mode	Op. 1				
Nominal supply voltage	**Reduction**	**Phase angle**	**Duration (ms)**	**Reaction of EUT (please refer to chapter 7.3)**	**Within specification(s) during and after test**
230 V	30% (161 V)	0° / 180 °	500	R1	yes
230 V	100% (0 V)	0° / 180 °	10	R1	yes
230 V	100% (0 V)	0° / 180 °	20	R1	yes
230 V	100% (0 V)	0° / 180 °	5000	R2	yes

Remarks:	--

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)

I 1	I 2	I 3									

9.6.2 Test plan

EUT set-up	Set. 1					
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.
	Direct contact discharge was performed to the Green Points on the pictures of the ESD test set-up. *Air discharge was performed to the Blue Points on the pictures of the ESD test set-up.*

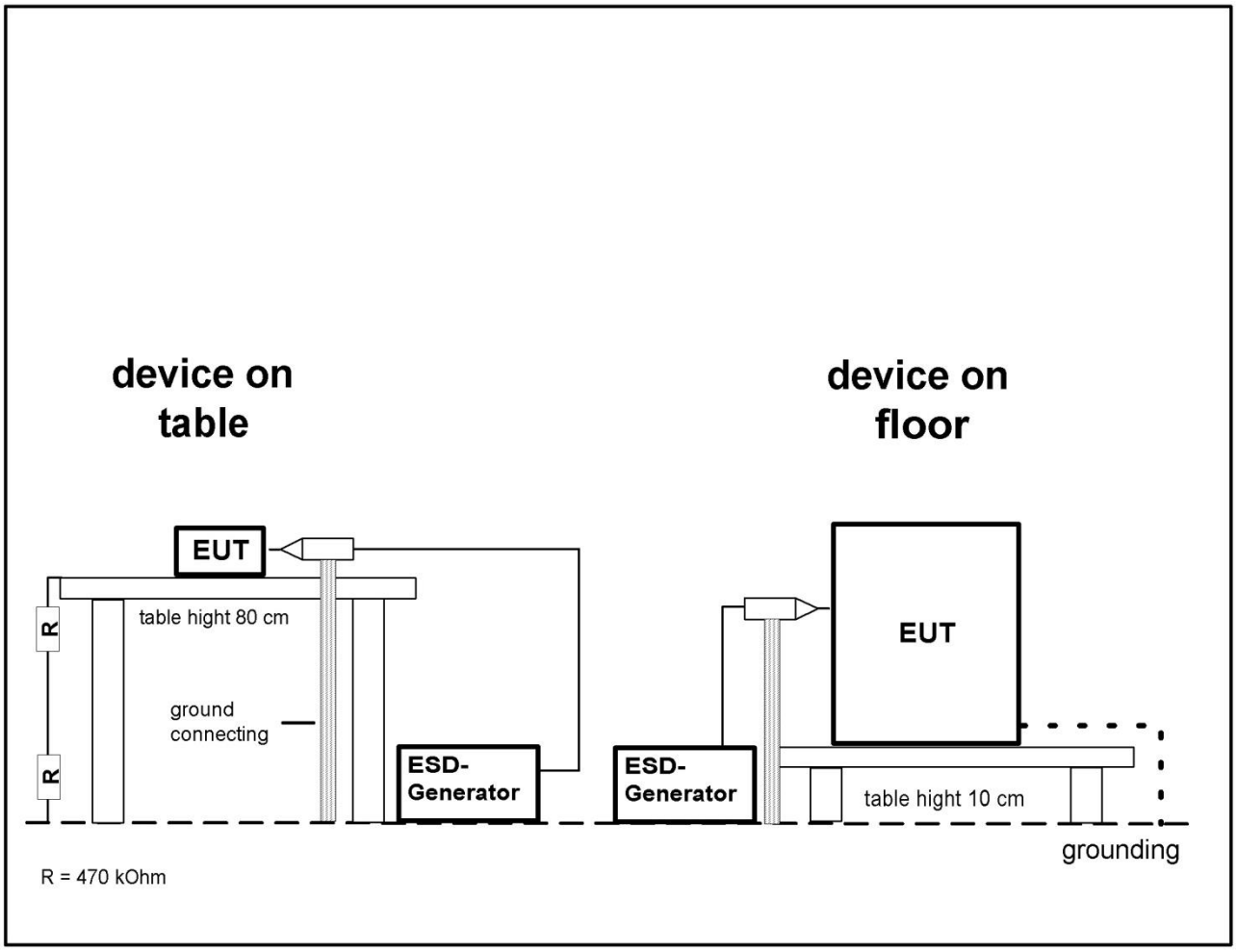
9.6.3 Climatic conditions

-	Ambient temperature:	24	°C	Ambient Temperature range:	15 °C to 35 °C
-	Relative humidity:	30	%	Relative humidity range:	30% to 60%
-	Atmospheric pressure:	1010	hPa	Atmospheric pressure range	860 hPa to 1060 hPa

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-No.
	Radiated immunity in chamber D				
D-1	Fully anechoic chamber B	Comtest			
D-2	Control computer	Exone		2986586v001	--
D-3	Software	Rohde & Schwarz	EMC 32 V10.50	200249	--
D-4	Position control unit	Maturo	FCU 3.0	10007	--
D-5	Antenna positioner	Maturo	EAS 1.0/2.0-10kg	10016	
D-6	Stacked Log.-Per. Antenna (70 MHz – 10 GHz)	Schwarzbeck	STLP 9129	9129 122	--
D-7	Isotropic Field Probe Laser Data Interface	ETS Lindgren	HI-6105USB HI-6113	00082705 00082790	300003906b 300003906
D-8	Amplifier 80 MHz-1GHz	BONN Elektronik	BLWA 0810-250/200	108105	300004136
D-9	Amplifier Rack 1- 6 GHz Amplifier 1,0-2,5 GHz Amplifier 2,5-6,0 GHz Power Meter Power Sensor A Power Sensor B	 BONN Elektronik BONN Elektronik Rohde & Schwarz Rohde & Schwarz Rohde & Schwarz	 BLMA 0825-60 BLMA 2060-50 NRVD NRV-Z1 NRP-Z1	 035491 097392A 835430/044 833894/012 833894/011	 300003210 300003210 300002681-0004 300002681-13 300002681-0010
D-10	Signal generator (9 kHz – 6 GHz)	Rohde & Schwarz	SMB 100A	114867	300005569
D-11	Relay matrix	Rohde & Schwarz	RSU	316790/001	300002236

No.	Instrument/Ancillary	Manufacturer	Type	Serial-No.	Internal-No.
	Radiated emission in chamber F				
F-1	Control Computer	F+W		FW0502032	300003303
F-2	Trilog-Antenna	Schwarzbeck	VULB 9163	9163-295	---
F-3a	Amplifier	Veritech Microwave Inc.	0518C-138	- / -	- / -
F-4b	Switch	HP	3488A	- / -	300000368
F-5	EMI Test receiver	R&S	ESCI	100083	300003312
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 (Ch. 62)	WRCD		9	
F-35	RF- Amplifier	Bonn	BLMA 2060-5	097392A	300003908
F-36	Stacked Microwave Log.-Per. Antenna	Schwarzbeck	STLP9149	9149-044	300003919
	Radiated emission in chamber F > 1GHz				
F-29	Horn antenna	Schwarzbeck	BBHA 9120B	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-No.
	ESD in room 006				
I-1	ESD- Generator	Schlöder	SESD 30000	402125	300003223
I-2	Pistol	Schlöder	SESD 30000	402125	300003223a
I-3	Module set	Schlöder	SESD 30000	402125	300003223b
	Conducted immunity (RF common mode) in room 006				
I-4	Signal generator	R&S	SMB100A	115311	300005612
I-5	Measurement Software	R&S	EMC 32 V10.35.02		
I-6	Milli voltmeter	R&S	URV5	831392/004	300002038
I-7	Power Sensor	R&S	URV5-Z4	830276/006	300002645.2
	Power Sensor	R&S	URV5-Z4	840310/071	300000906
I-8	Amplifier 9 kHz – 250 MHz	BONN Elektronik	BSA 0125-75	066502-02	300003544
I-9	6 dB RF attenuator	BNOS Electronics	AT 50-6-250	521013	300000842
I-10	Electromagnetic Injection clamp	Lüthi	EM 101	35197	300001708
I-11	Filter clamp	Lüthi	FTC101	4229	300000942
I-12	Filter clamp	Lüthi	FTC101	4374	300000942
I-13	CDN	MEB	M2	11145	300000889
I-14	CDN	MEB	M3	10723	300000837
I-15	CDN	MEB	T2	11402	400000197
I-16	CDN	MEB	S25	11309	300000902
I-17	CDN	MEB	S1/50	12261	300001739
I-18	CDN	MEB	S1/50	11243	300000899
I-19	CDN	MEB	AF2	11349	300000895
I-20	CDN	MEB	AF2	11350	300000897
I-60	CDN	TESEQ	S200	26825	300003853
I-61	CDN	TESEQ	USB/p	27029	300003852
I-62	RF Current probe (BCI clamp)	FCC	F-120-4	23	300000538
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	FCC	F-33-4	46	300003257
I-63	CDN	TESEQ	ST08	32282	300004397
	Conducted immunity (Burst, Surges, Voltage Dips) in room 006				
I-21	Ultra Compact Simulator	EM-TEST	UCS 500 N5	V1127110133	300004257
I-22	Motor Variac	EM-TEST	MV2616-V	0397-12	300003259
I-23	Capacitive Coupling Clamp	EM-TEST	HFK	P1413132719	300004995
I-24	Coupling Decoupling Network	EMC Partner	CDN-UTP	014	300003226
	Conducted emission in room 006				
I-25	RF receiver 9 kHz – 3 GHz	R&S	ESCI 1166.5950.03	101240/003	300004427
I-26	L.I.S.N. Artificial Mains Network	Schwarzbeck	NNBM 8125	8125401	300000567
I-27	L.I.S.N. Artificial Mains Network	Schwarzbeck	NNBM 8125	8125399	300000945
I-28	Measurement Software	R&S	EMC 32 V10.35.02		
I-29	Relay Matrix	R&S	PSU	879930/008	300001148
I-30	Relay Matrix	R&S	PSU	828628/007	300002475
I-31	Computer	F+W			300003330
I-33	DC power supply	HP	6032A	2743A-02600	300001498
I-34	Two Line V-Network	R&S	ESH3-Z5	893045/003	300000585
I-37	4-Wire T-Network	R&S	EZ-10	828757/001	300000611
I-38	Loop antenna	R&S	HFH2-Z2	881058/42	300001477
	Other observation equipment in room 006				
I-48	Voltmeter	R&S	UDS5	882752/004	300001495
I-49	PDH/SDH Test Set	HP	37717A		300002072
	Observation equipment, audio rack 2 in Room 006				
I-50	Control computer				400000209
I-51	Software	ICT			
I-52	Band pass	IMD	EWR-BF	2610100	300003507
I-53	Measurement amplifier	B&K	2636	1537486	300000190
I-54	Microphone	B&K	2669	2449486	400000207
I-55	Selective Level Meter	HP	3586A	2908A01917	300000409
I-56	Switch Control Unit	HP	3488A	none	300000135
I-57	Optical fibre microphone system	Sennheiser		keine	300003100
I-58	Artificial mouth with AF transformer	B&K	4227	1536875	300002314
I-59	sound calibrator	CR511F	CIRRUS	34688	400000206

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 test setup

Photo 2: Radiated Emission test setup <1 GHz

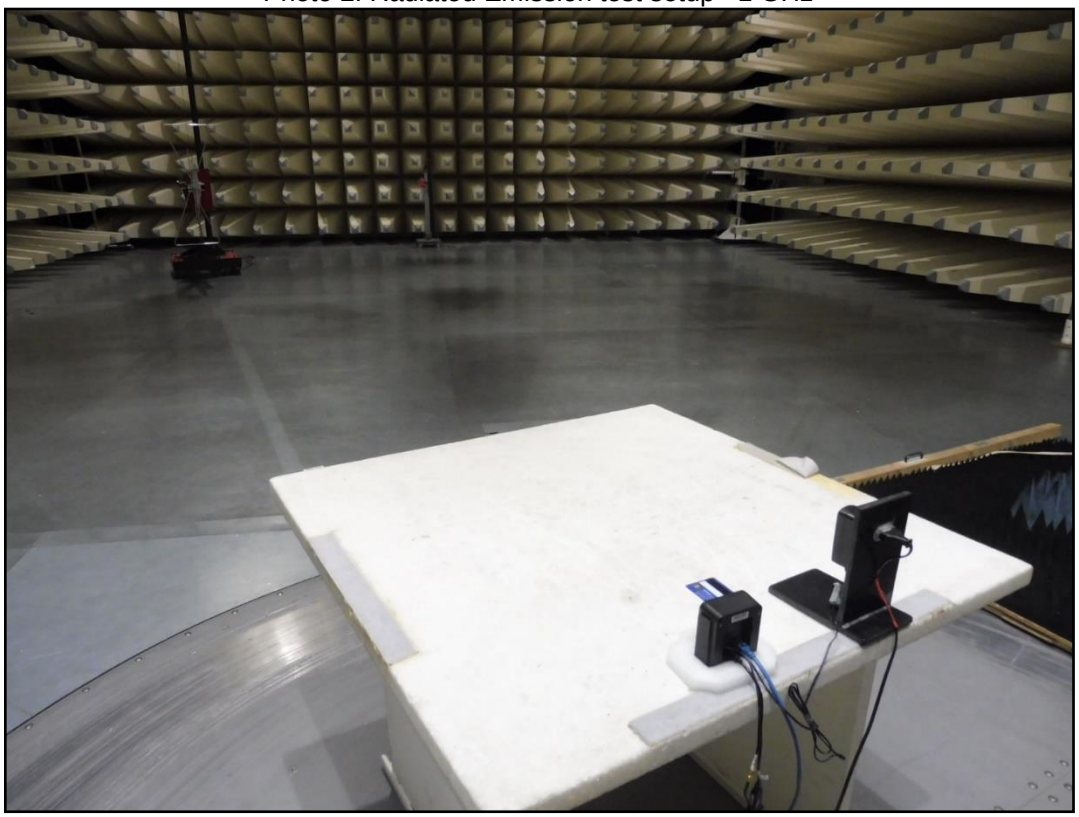


Photo 3: Radiated Emission test setup >1 GHz

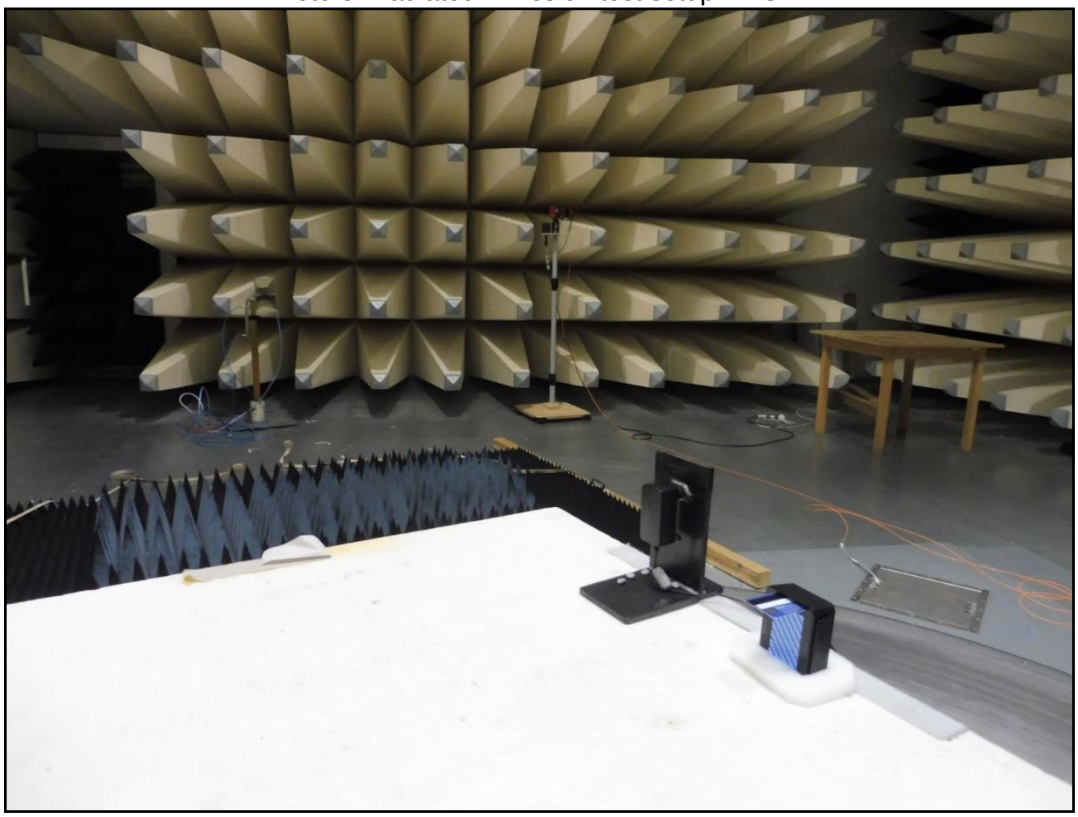


Photo 4: Radiated immunity test setup

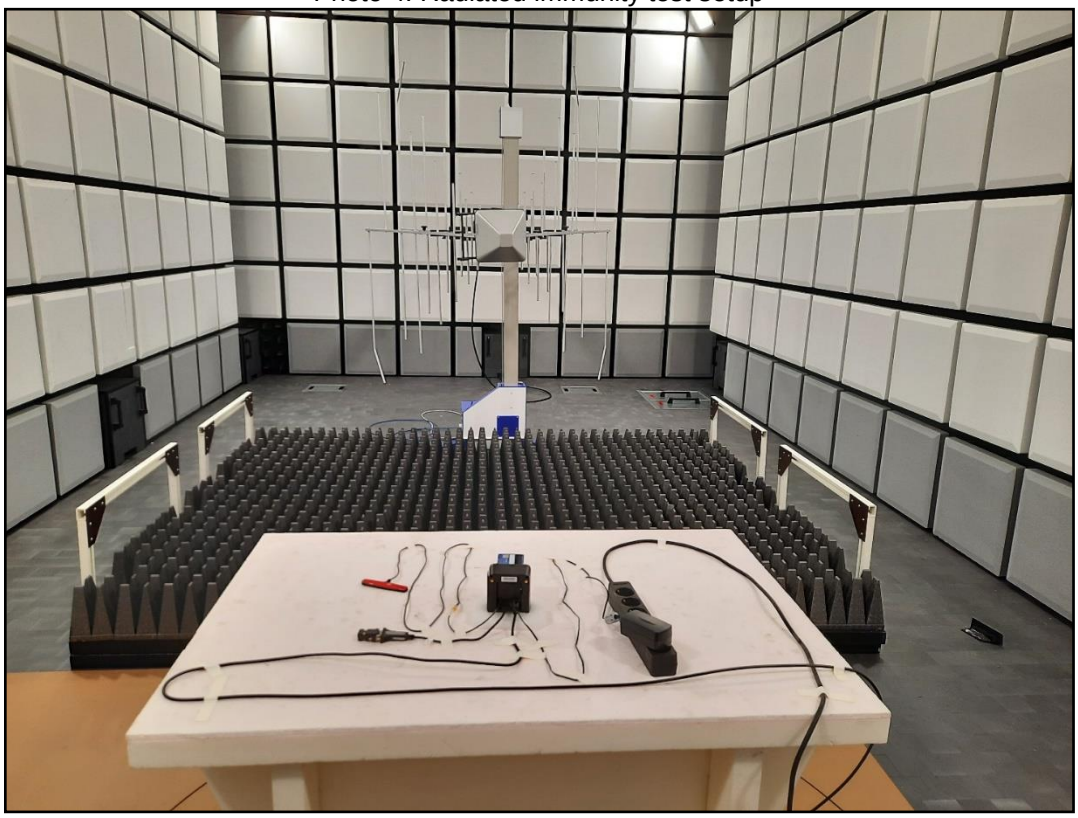


Photo 5: Radiated immunity test setup

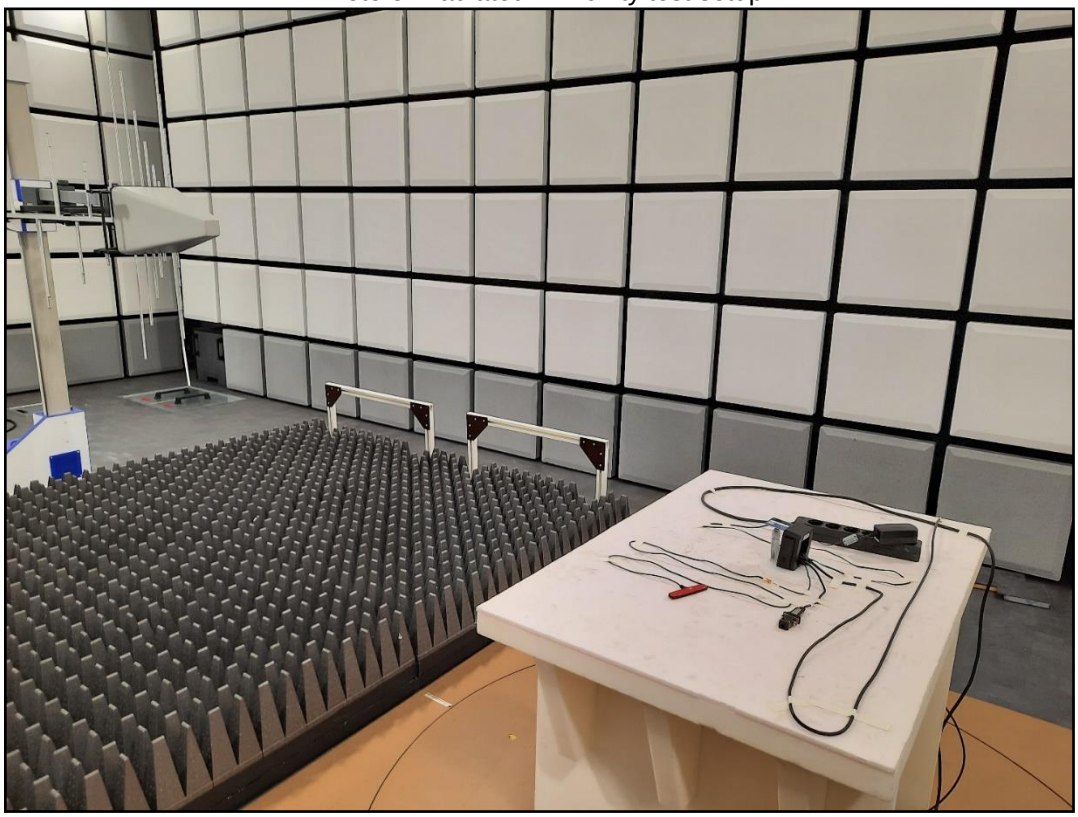


Photo 6: Radiated immunity test setup

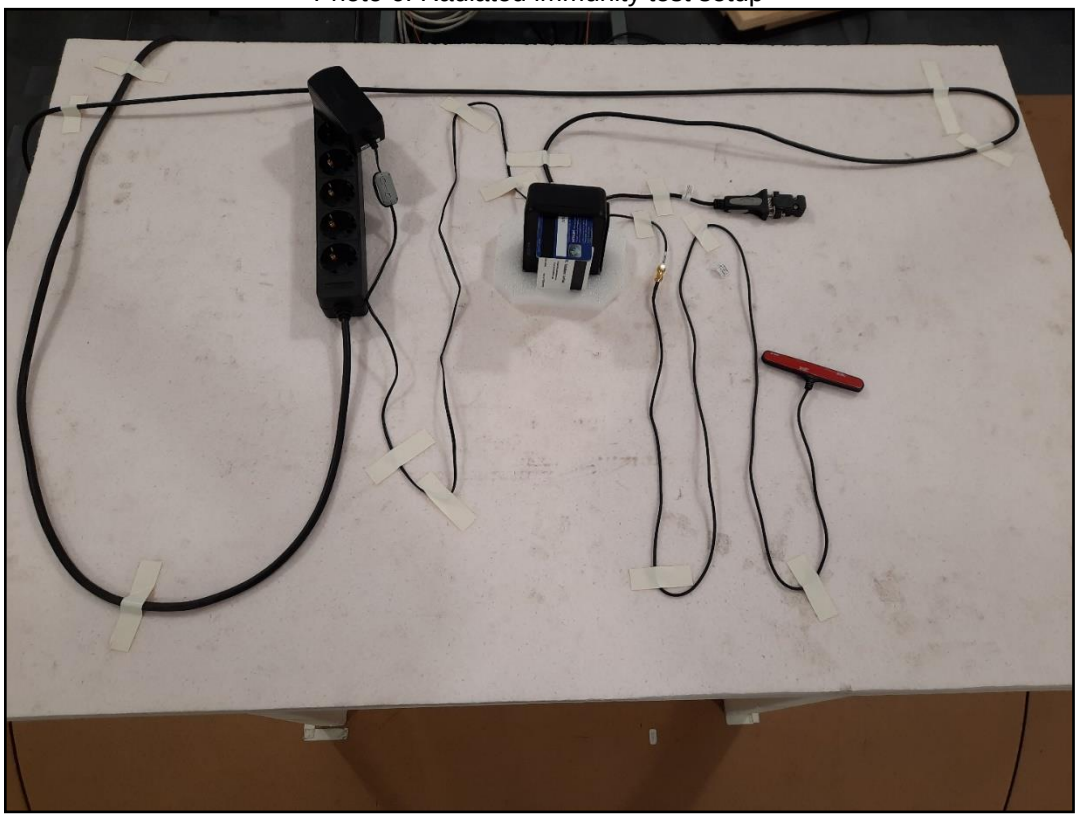


Photo 7: Conducted emission test setup

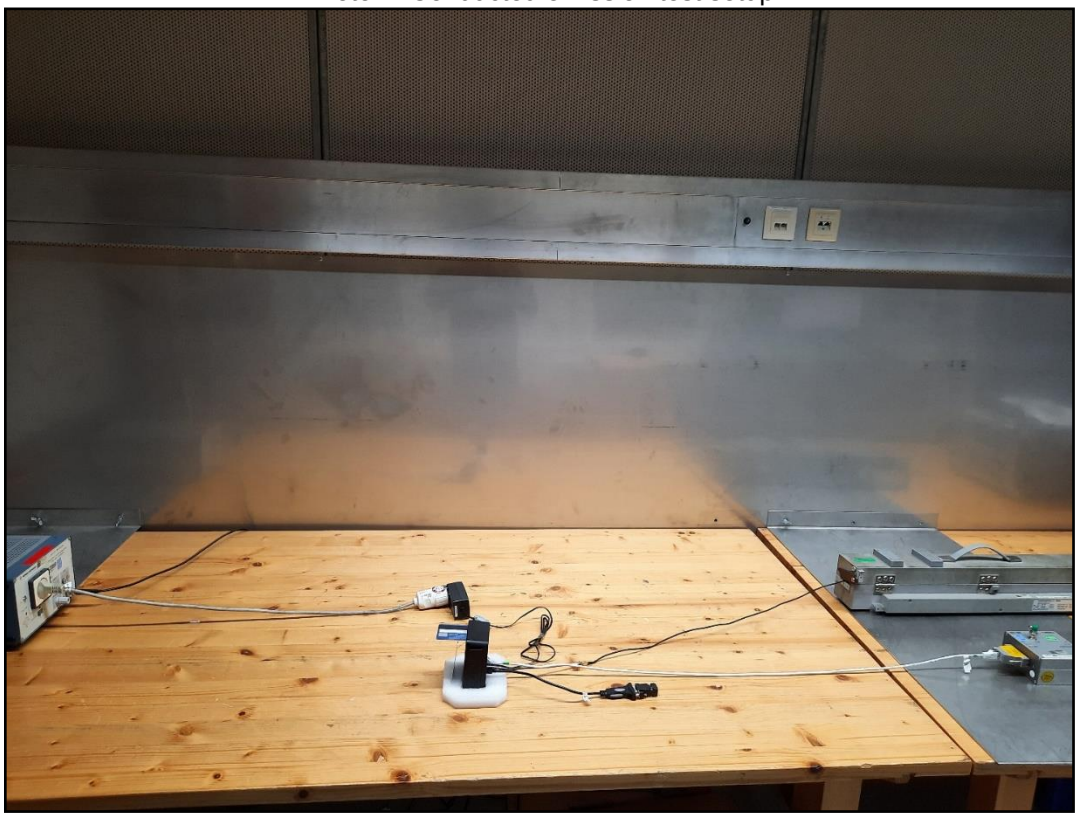


Photo 8: Conducted emission test setup

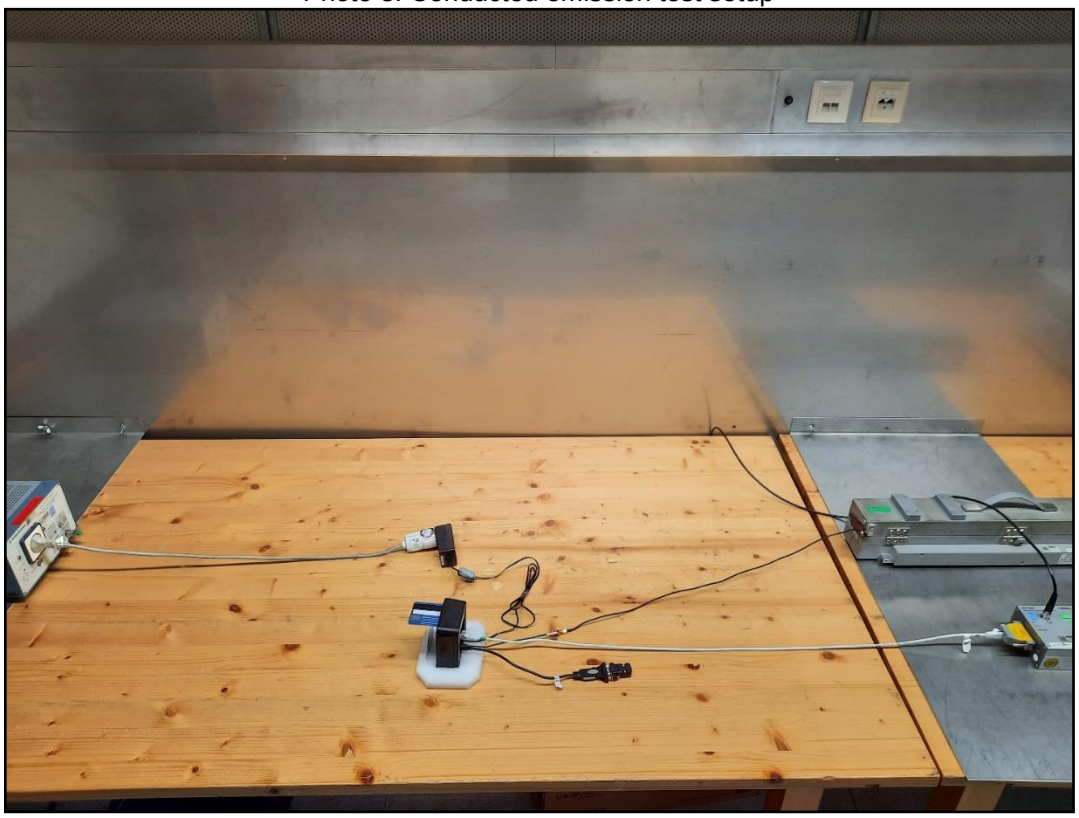


Photo 9: Conducted immunity test setup

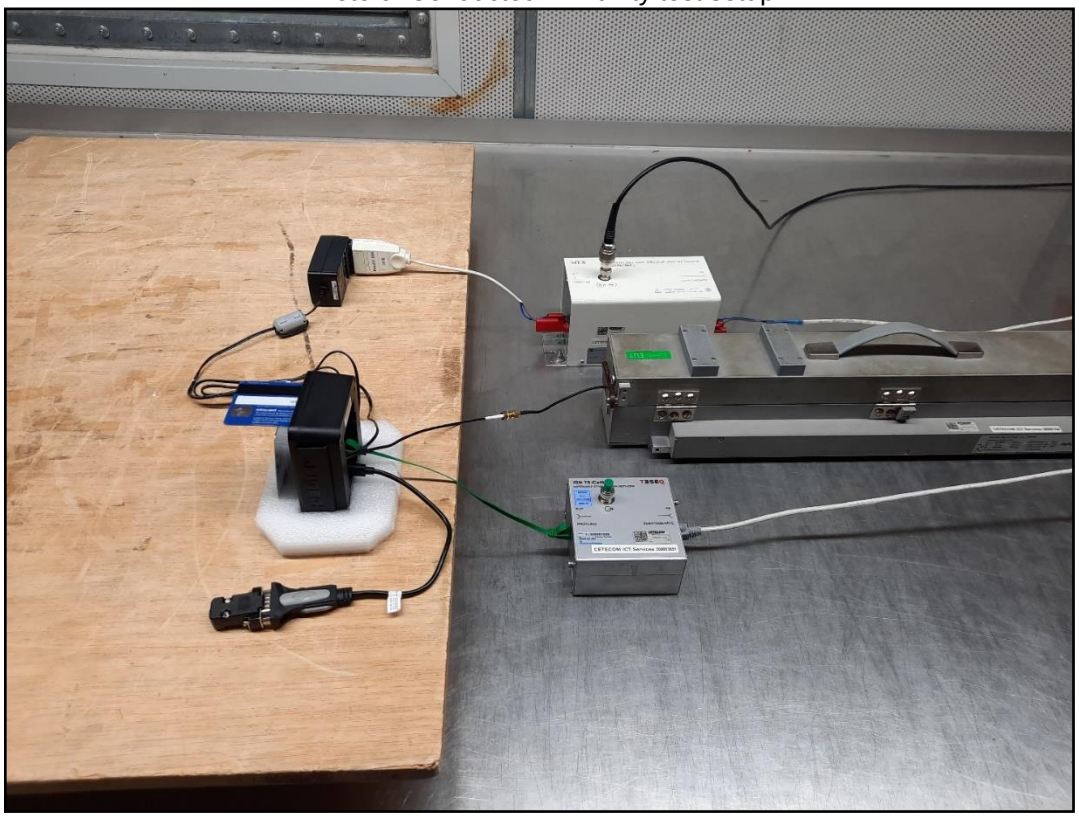


Photo 10: Conducted immunity test setup

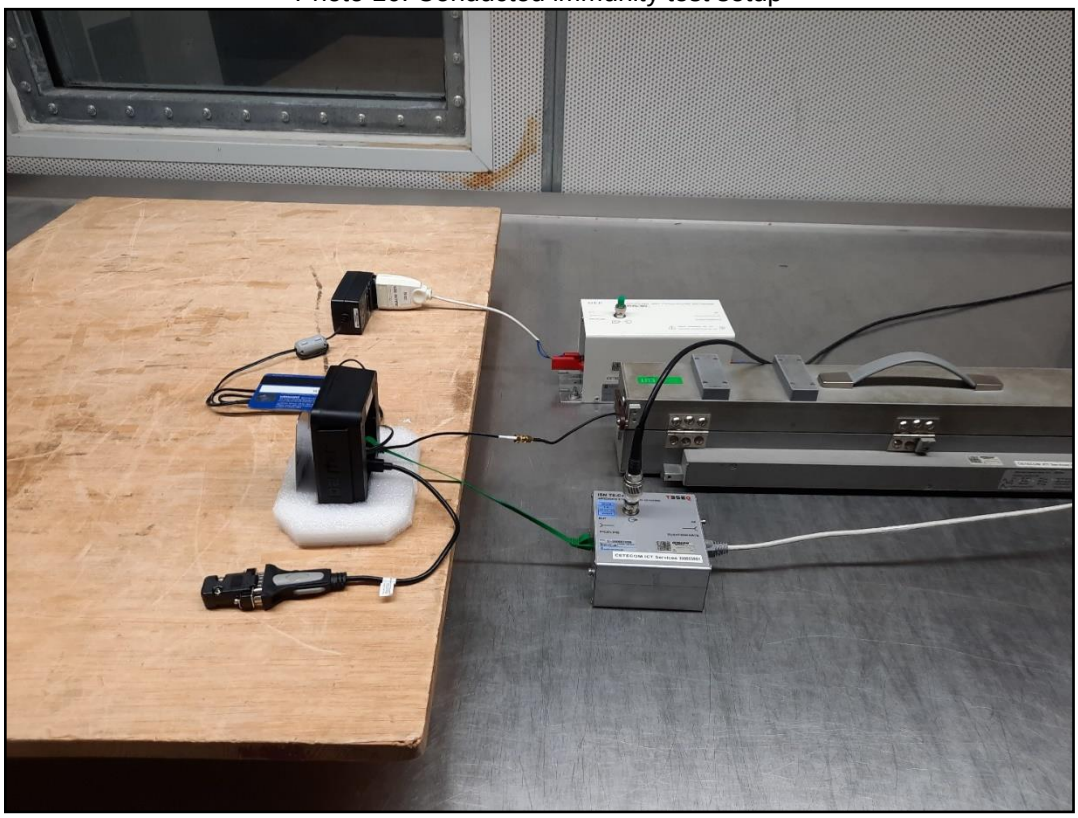


Photo 11: Conducted immunity test setup

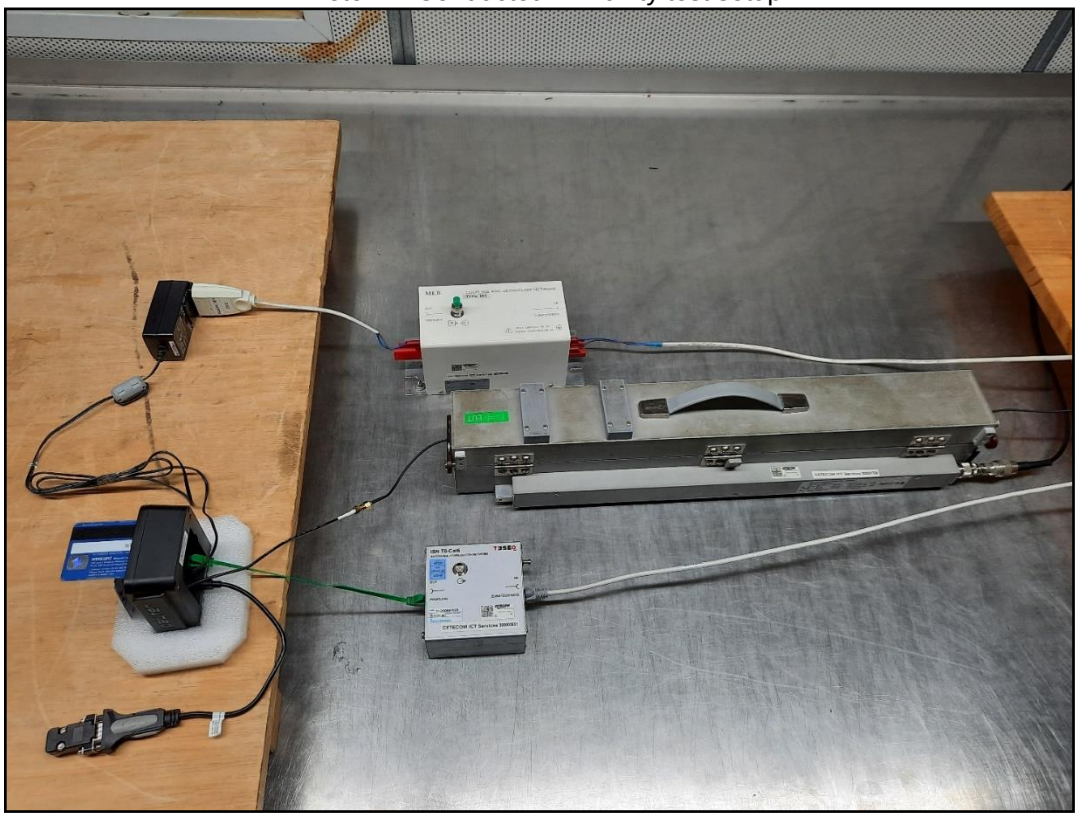


Photo 12: Burst, Surge and Voltage dips test setup

Photo 13: Burst test setup – Antenna port

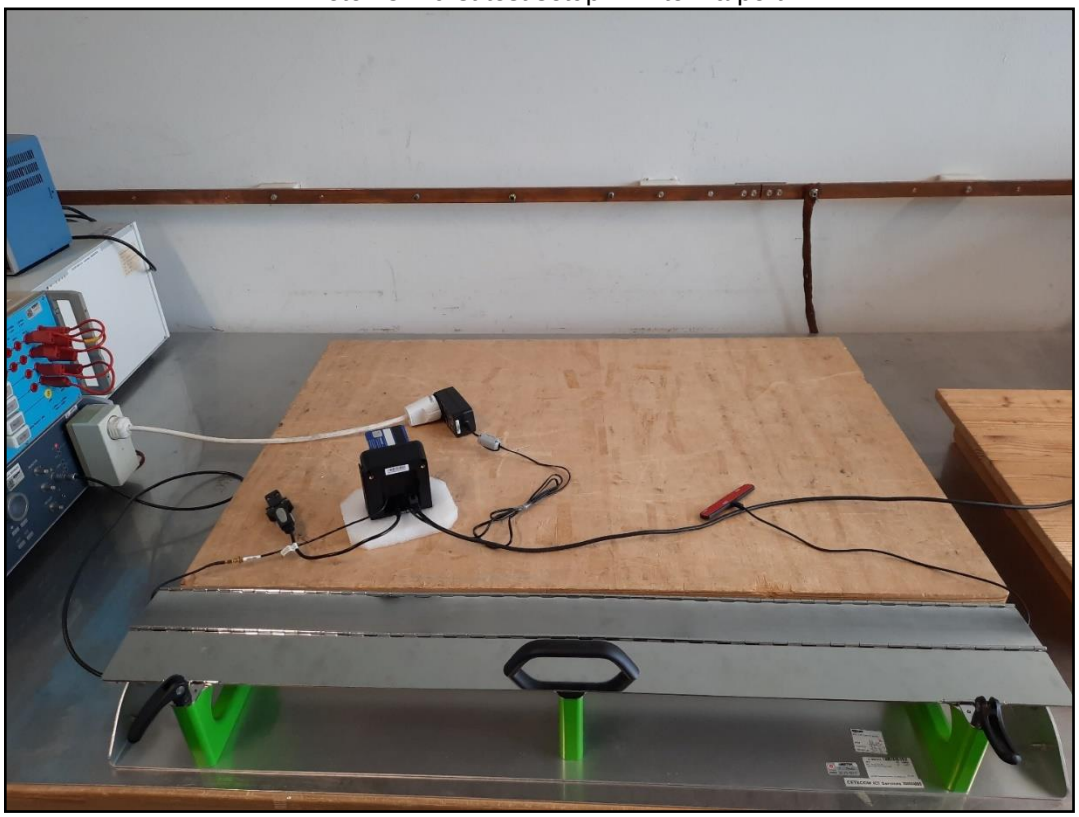


Photo 14: Burst test setup- Ethernet

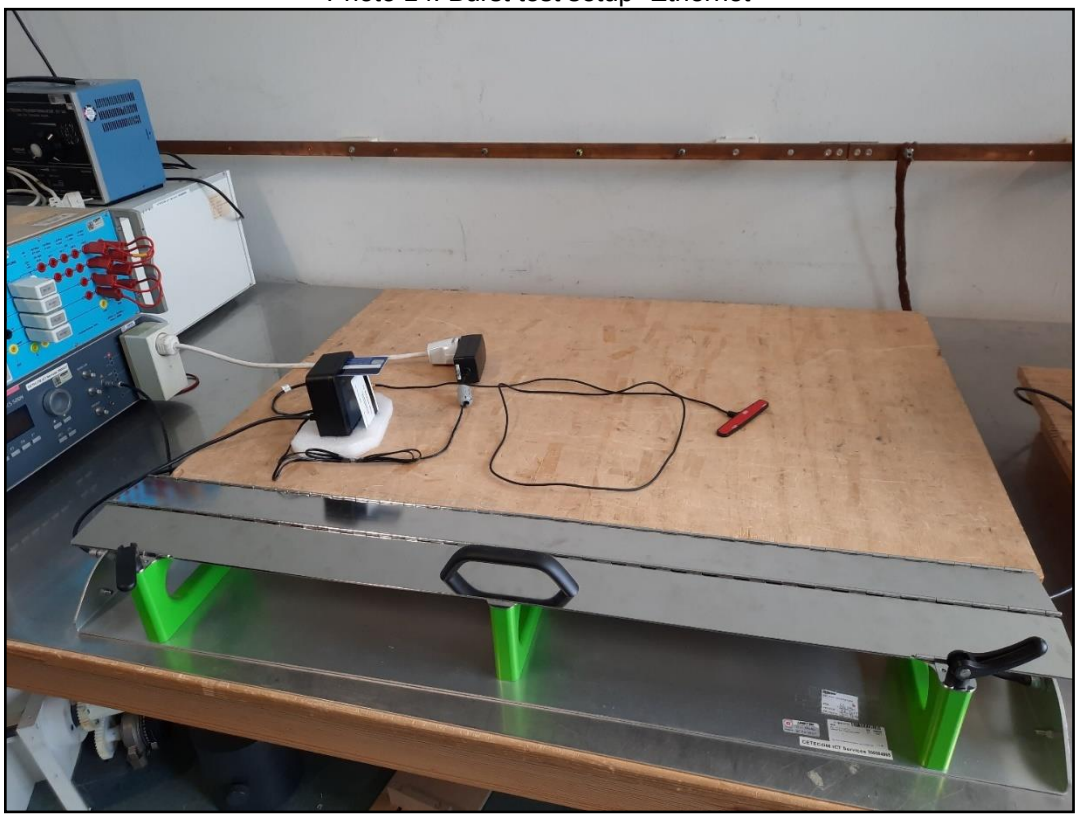


Photo 15: ESD test setup

Photo 16: ESD test setup

Photo 17: ESD test setup

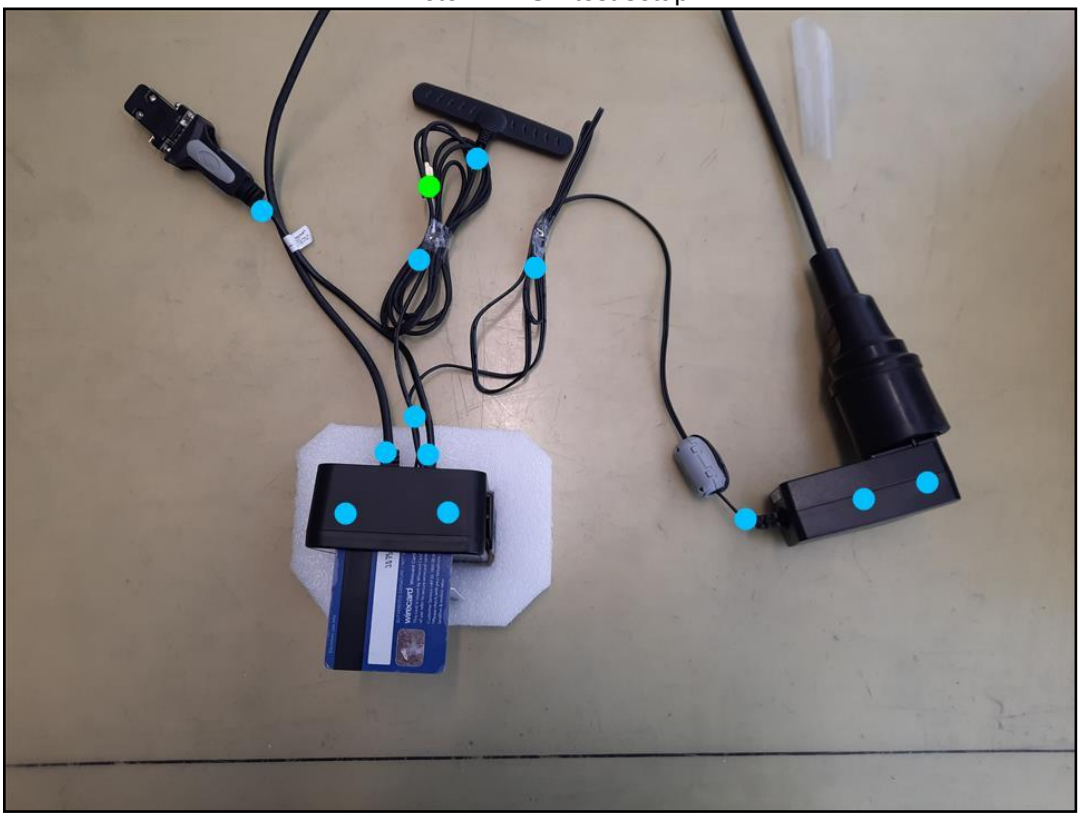
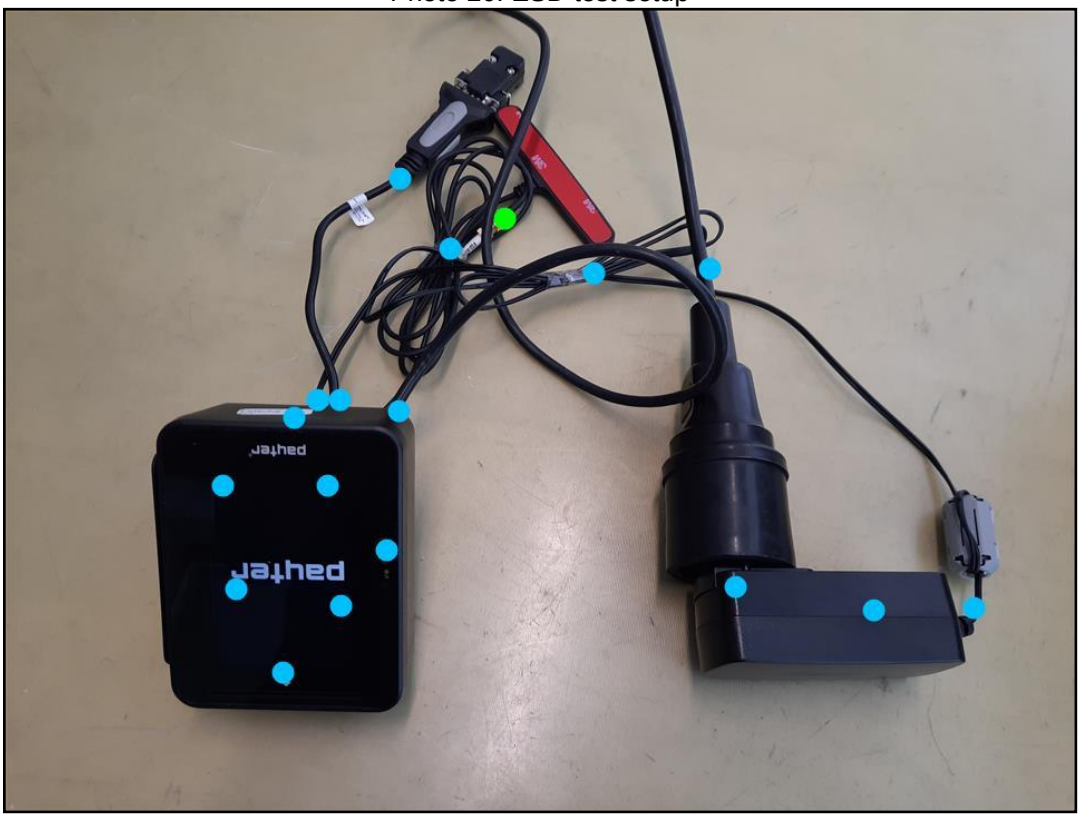


Photo 18: ESD test setup

Photo 19: ESD test setup

Photo 20: ESD test setup



Annex B: Photographs of the EUT

Photo 21: EUT A - front side

Photo 22: EUT A - back side

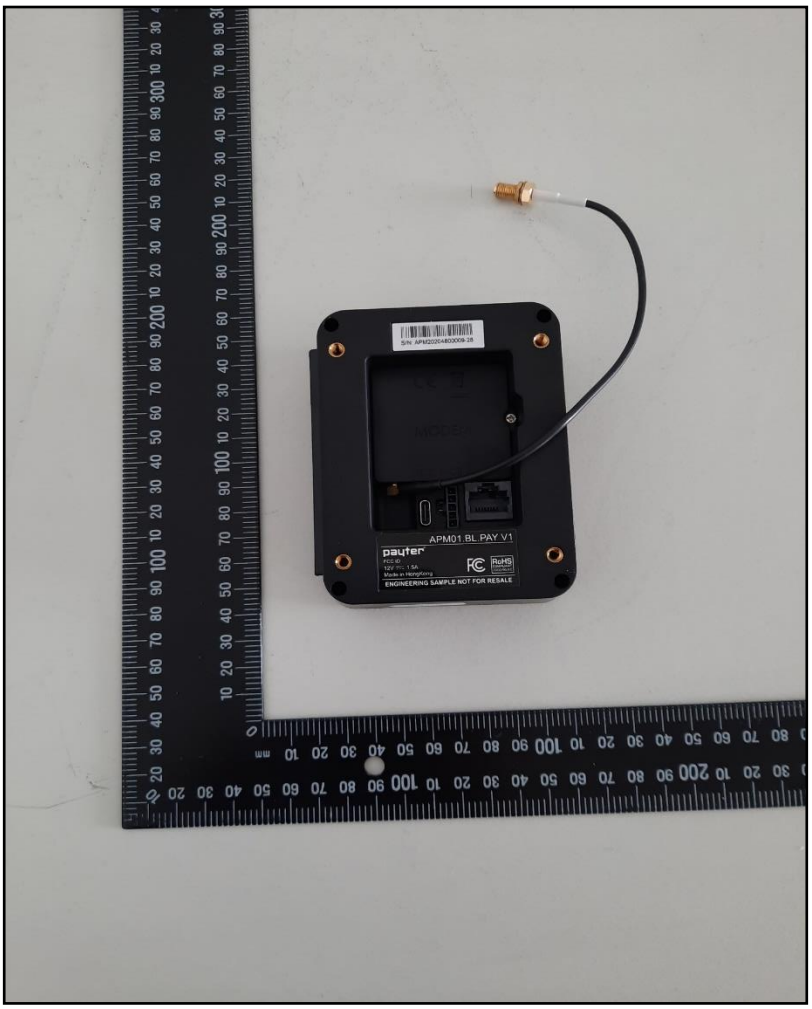


Photo 23: EUT A - port side

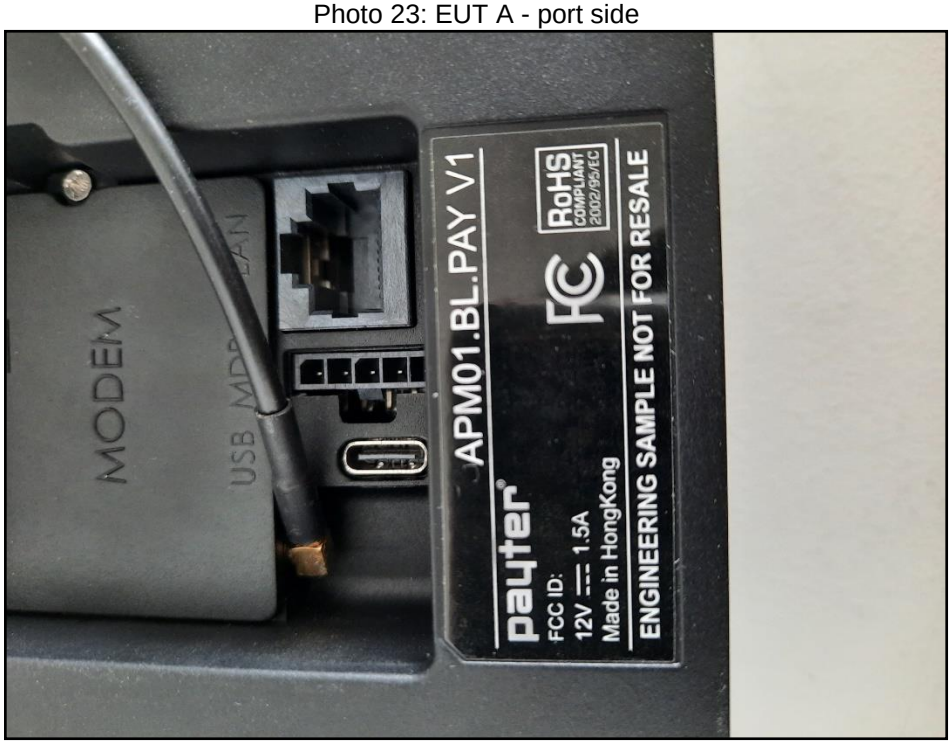


Photo 24: EUT A - top side

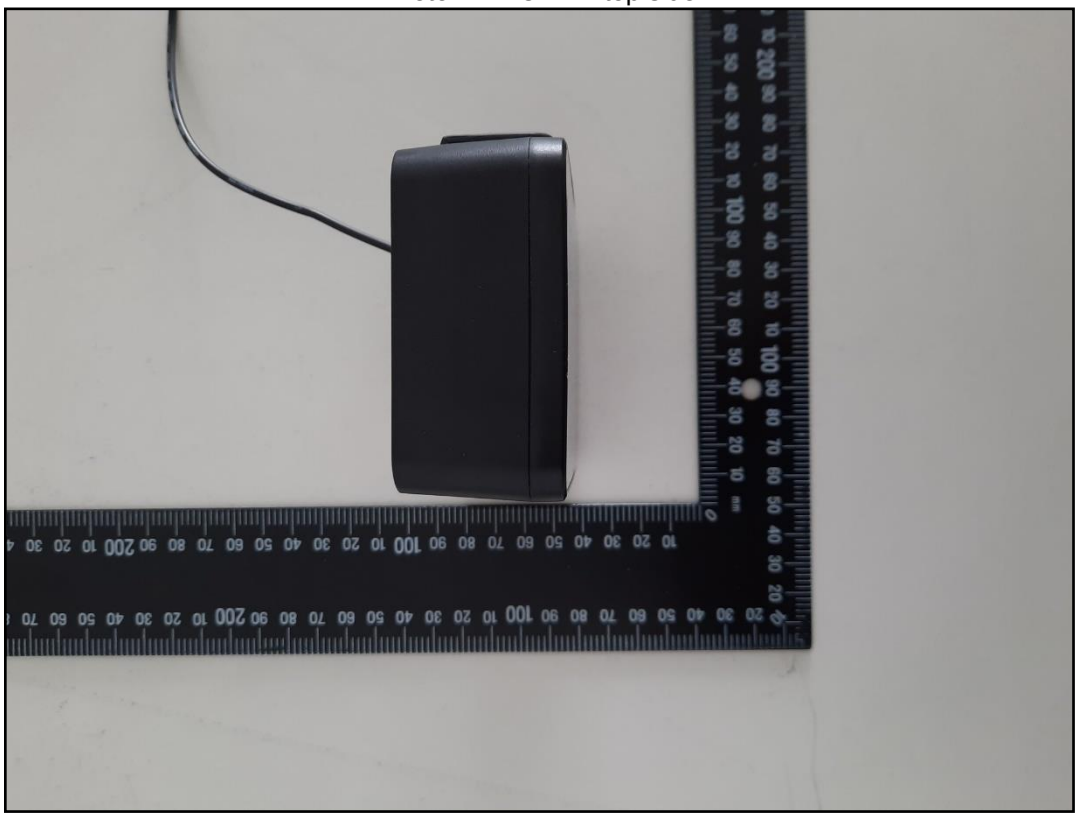


Photo 25: EUT A - bottom side

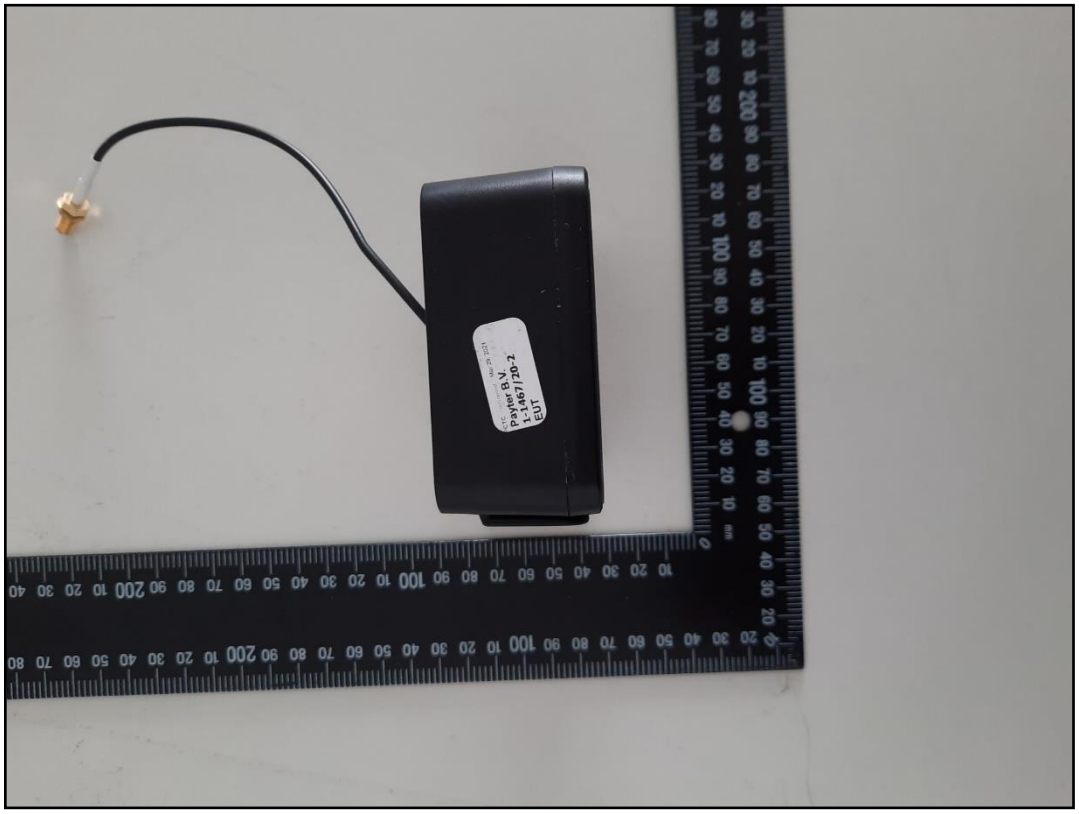


Photo 26: EUT A - right side

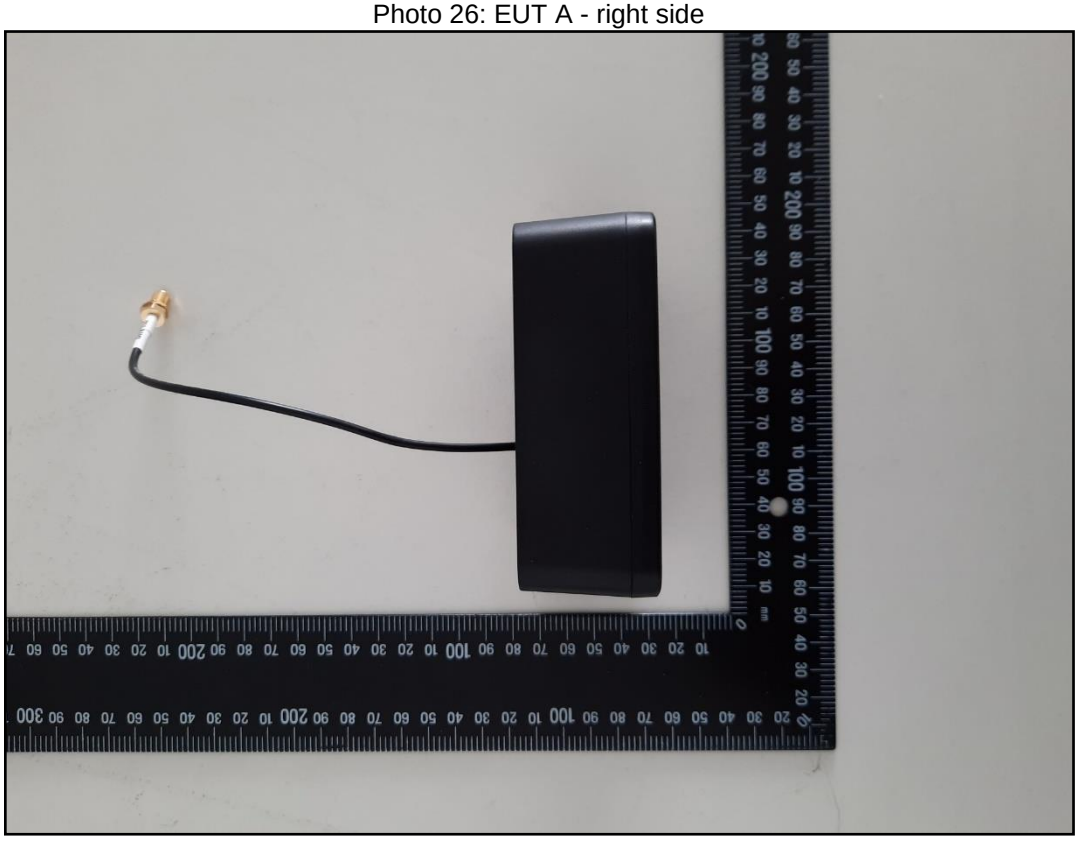


Photo 27: EUT A - left side

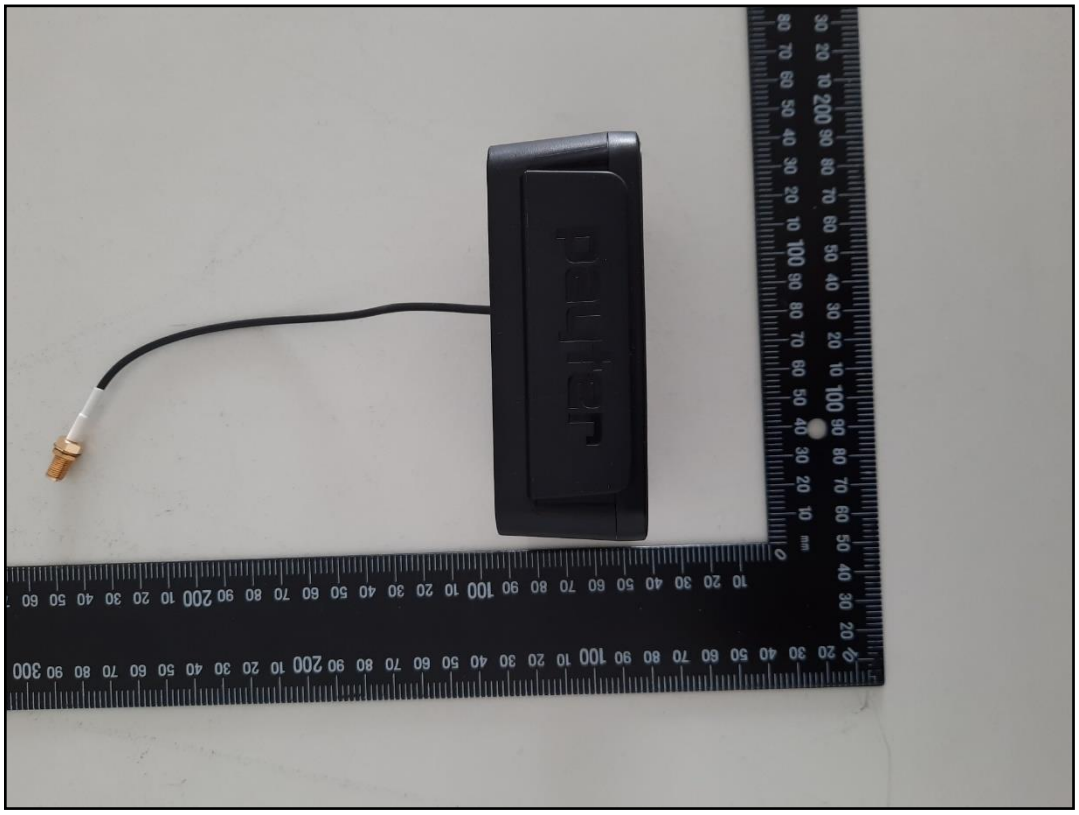


Photo 28: EUT A - label

Photo 29: EUT B - front side

Photo 30: EUT B - back side

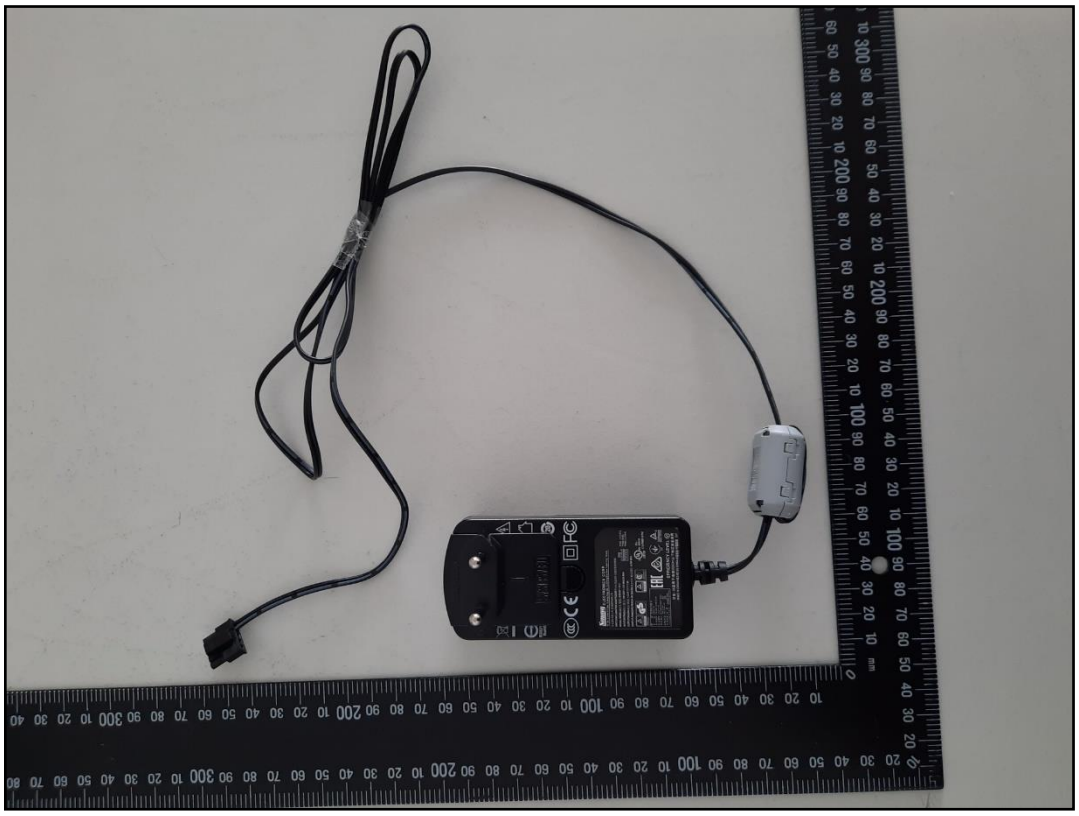


Photo 31: EUT B - right side

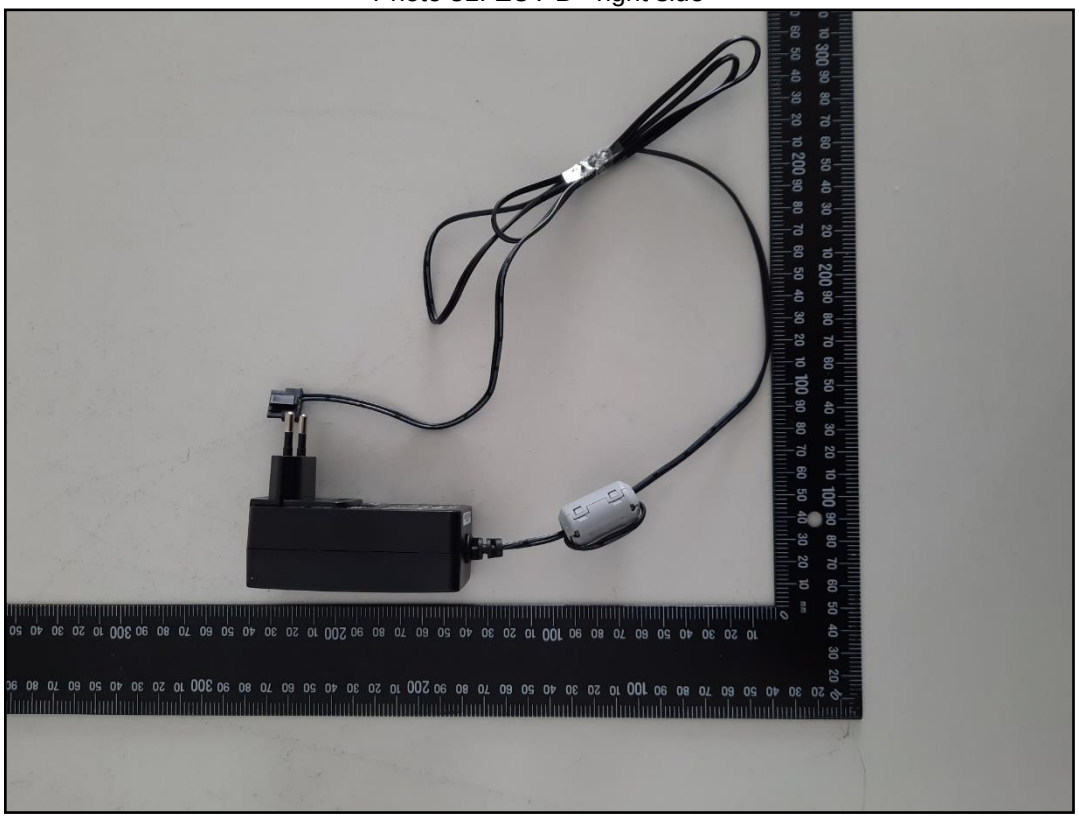


Photo 32: EUT B - label

Photo 33: AE 1 - front side

Photo 34: AE 1 - back side

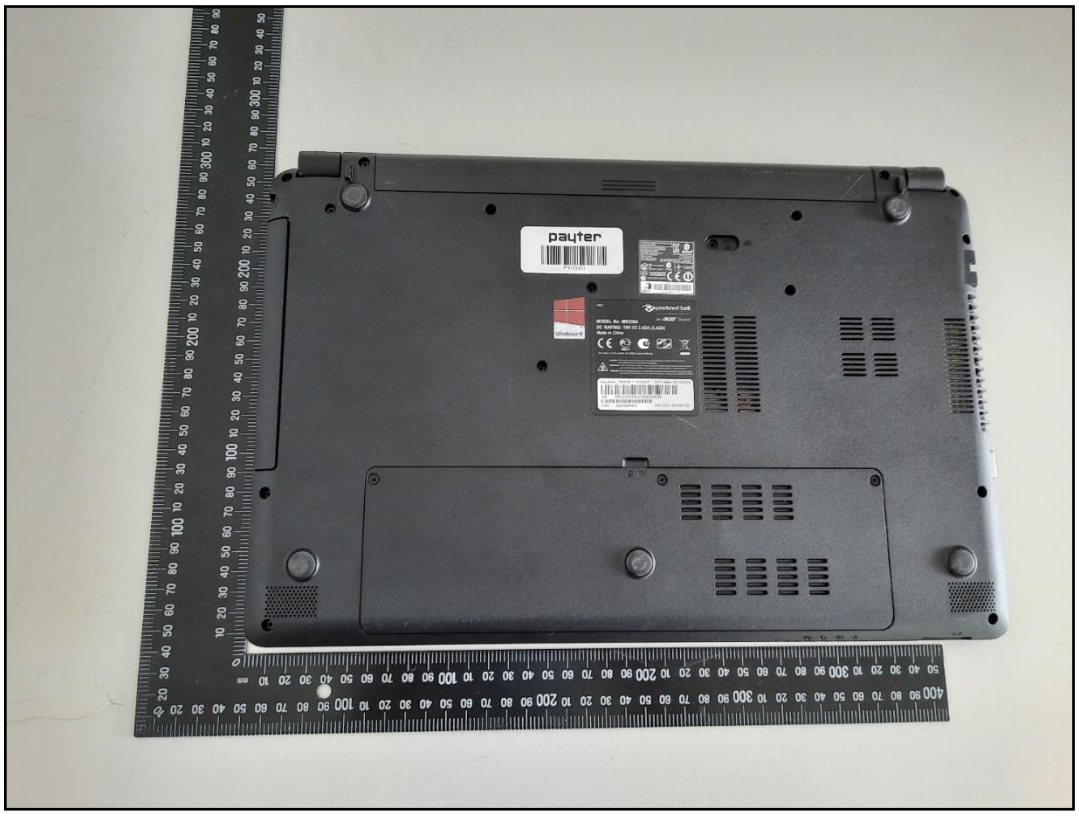


Photo 35: AE 1 - label

Photo 36: Antenna and USB cable used

Annex C: Document history

Version	Applied changes	Date of release
---	Initial release	2021-05-17

Annex D: Further information

Glossary

BT	-	Bluetooth
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
ME	-	Medical electrical
N/A	-	not applicable
S/N	-	Serial Number
SW	-	Software