DELTA Test Report

TEST REPORT issued by an Accredited Testing Laboratory

Accred. no. 1688
Testing
ISO/IEC 17025

EMC test of Connection box PSM

Performed for Cubist IT

621-20080-10-R0
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5 July 2021

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is a subsidiary company of
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Title	EMC test of Connection box PSM
Test object	Connection box PSM
Report no.	621-20080-10-R0
Test period	19 March 2021 to 10 June 2021
Client	Cubist IT Vasagatan 11 111 20 Stockholm Sweden
Contact person	Theresia Smedborn E-mail: theresia.smedborn@cubist.eu
Manufacturer	Cubist IT
Specifications	Selected parts of EN/(IEC) 61000-6-3:2007+A1, EN/(IEC) 61000-6-1:2007
Results	The test object was found to be in compliance with the specifications, as listed in Section 1.
Test personnel	Jari Jantunen
Date	5 July 2021

Project Manager

Jari Jantunen Specialist
DELTA

Responsible

Lars Johnsson. Head of quality
DELTA

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1. Summary of tests

Tests	Test methods	Results
Immunity to electrostatic discharges	EN/(IEC) 61000-4-2:2009	Passed
Immunity to radio frequency electromagnetic fields	EN/(IEC) 61000-4-3:2006+A1+A2	Passed
Immunity to surge transients	EN/(IEC) 61000-4-5:2014+A1	Passed
Immunity to AC mains voltage dips and interruptions	EN/(IEC) 61000-4-11:2004+A1	Passed
Measurement of radio frequency voltage on mains	CISPR 16-2-1:2014+A1	Passed
Measurement of radio frequency electromagnetic field	CISPR 16-2-3:2016	Passed

Conclusion

The test object(s) mentioned in this report meets the requirements of the selected parts of standard stated below.

- EN/(IEC) 61000-6-3:2007+A1
- EN/(IEC) 61000-6-1:2007

The test results relate only to the object(s) tested.

2. Test object and auxiliary equipment

2.1 Test object

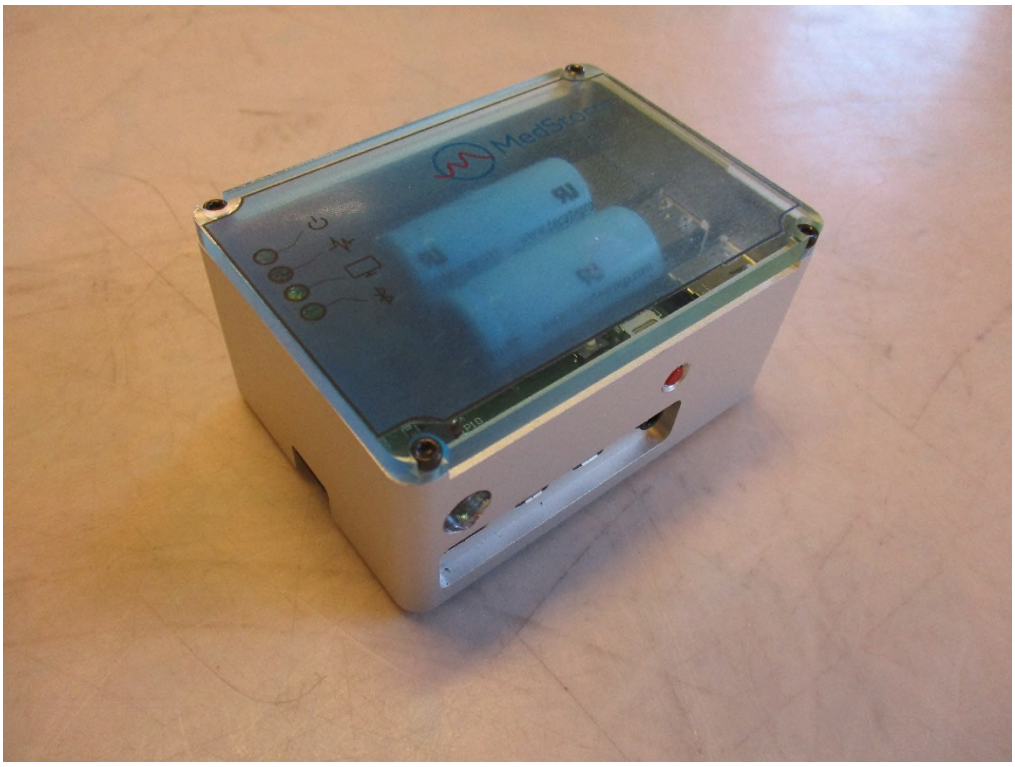


Photo 2.1.1 Test object.

Test object 2.1.1

Name of test object	Connection box
Model / type	PSM
Part no.	-
Serial no.	EMC sample
Manufacturer	Cubist AB
Supply voltage	5 VDC via AC/DC adaptor
Software version	-
Hardware version	-
Cycle time	-
Highest frequency generated or used	2483.5 MHz
Comment	-
Received	Date: 19 Mar. 2021 Status: Prototype

2.2 Auxiliary equipment

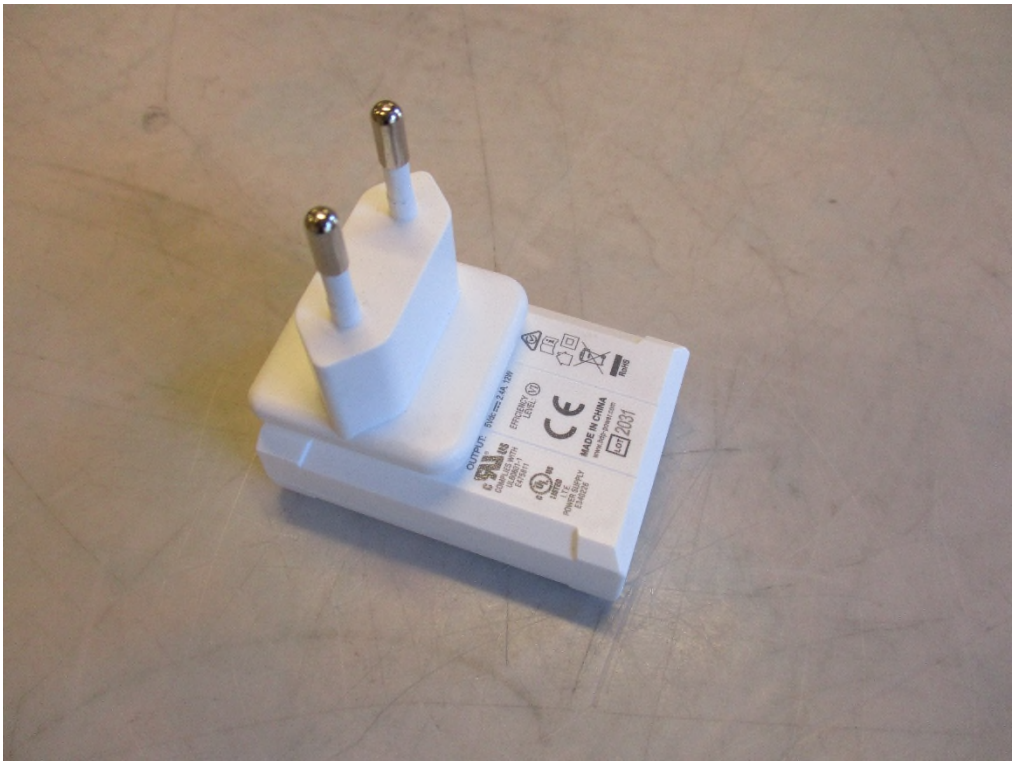


Photo 2.2.1 Auxiliary equipment.

Auxiliary equipment 2.2.1

Name of test object	Power adaptor
Model / type	HDP12-MD05024U
Part no.	-
Serial no.	LOT 2031
Manufacturer	HDP Power
Supply voltage	100/240 VAC 50/60 Hz
Comment	Cable Tensility P/N 10-00248 Auxiliary equipment supplied by the client, who also has the responsibility for its correct function and set up.

3. General test conditions

3.1 Test setup during test

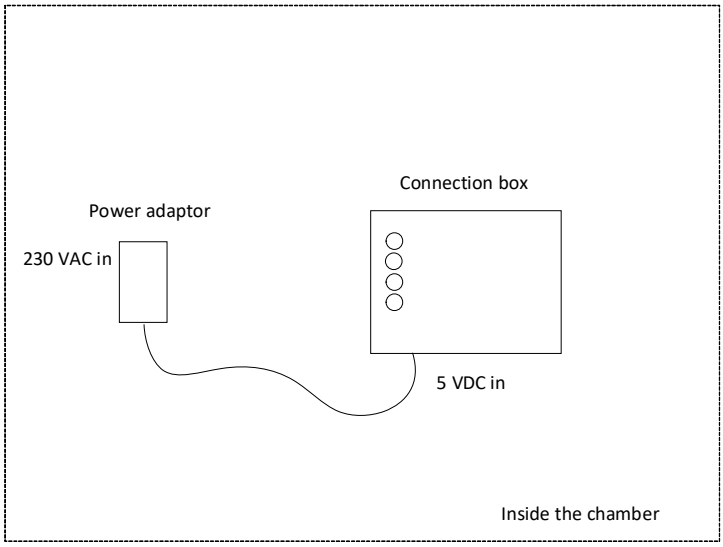


Figure 3.1.1 Block diagram of test object(s) with cables and auxiliary equipment.

3.1.1 Description of test setup

Test object is placed on a table and it is powered by AC power adaptor

3.1.2 Cables

The following cables were used during test.

Port name	Port type	Shielded/ unshielded	Length during test [m]	Maximum length [m]	Remarks
DC in	DC power	Shielded	1.8	-	100/240 VAC/ 5 VDC adaptor
Ethernet	Signal	Shielded	2	30	Note 1
USB	Signal	Shielded	2	5	Note 1
Note 1: Used in immunity to radio frequency electromagnetic field test					

3.1.3 Description and intended use of test object

The PSM connection box gets signals from a Bluetooth medical device by Bluetooth LE communication to the PSM connection box. Then send the data from PSM connection box to a medical monitor through usb port.

3.1.4 Test modes during immunity tests

Test object was set to power on mode.

3.1.5 Test modes during emission tests

The same test mode was executed as during immunity tests.

3.1.6 Nominal power consumption

< 12 W

3.2 Criteria for compliance during immunity test

Performance criteria according to corresponding standard were applied during immunity tests as follows:

General

The test object shall not become dangerous or unsafe as a result of the application of the tests.

Four LED lights are indicating the internal state of the the PSM connection box and the state of the LEDs is monitored during and after the tests.

Performance criterion A

The test object shall continue to operate as intended during the test.

The test object is not allowed to change operating mode.

Performance criterion B

The test object shall continue to operate as intended after the test.

No change of operating state or stored data are allowed.

Performance criterion C

The test object is allowed to have temporary degradation or loss of function or performance which requires operator intervention or systems reset.

3.3 Modifications of the test object

No	Modification
1	Improved grounding of Raspberry PCB to chassis. This modification was done in order to improve the performance of immunity to electrostatic discharges. See customer's reference document "CubistBox-Layout Diff 210610.pptx"

3.4 Test sequence

The tests described in this test report were performed in the following sequence:

1. Measurement of radio frequency electromagnetic field
2. Measurement of radio frequency voltage on mains
3. Immunity to radio frequency electromagnetic fields
4. Immunity to AC mains voltage dips and interruptions
5. Immunity to surge transients
6. Immunity to electrostatic discharges

4. Test results

4.1 Immunity to electrostatic discharges

Test object	Connection box	Project no.	621-20080
Type	PSM	Date	10 Jun. 2021
Serial no.	EMC sample	Initials	LAJ
Specification	EN/(IEC) 61000-6-1:2007	Required Perf. criter.	B

Test method	EN/(IEC) 61000-4-2:2009	Temperature	23°C
Characteristics	Discharge network: 150 pF, 330 Ω	Humidity	47% RH
Test equipm.	EMC transient lab Västerås Setup VIC1	Uncertainty	1.1 dB

Surface under test	Test standard's name of surface	Coupling of discharges	No of disch. each combin.	Amplitude [kV]	Passed	Remarks
Screws, connector frames	Metallic	Direct contact	10	+/- 4	Yes	Note 1, 2
Box	Painted metal	Direct contact	10	+/- 4	Yes	Note 1, 2
Cover, cables	Insulated	Direct air	10	+/- 2, 4, 8	Yes	Note 2
Enclosure	Enclosure	HCP contact	10	+/- 4	Yes	Note 1, 2
Enclosure	Enclosure	VCP contact	10	+/- 4	Yes	Note 1, 2

Note 1: LED indicating the power status flashes on every discharge

Note 2: Charge removed with semi conductive brush and high resistance bleeder cable between each test.

Criteria for compliance — See Section 3.2

Test result — The discharges caused no malfunctions

Compliant — Yes

Comments — With Modification 1.

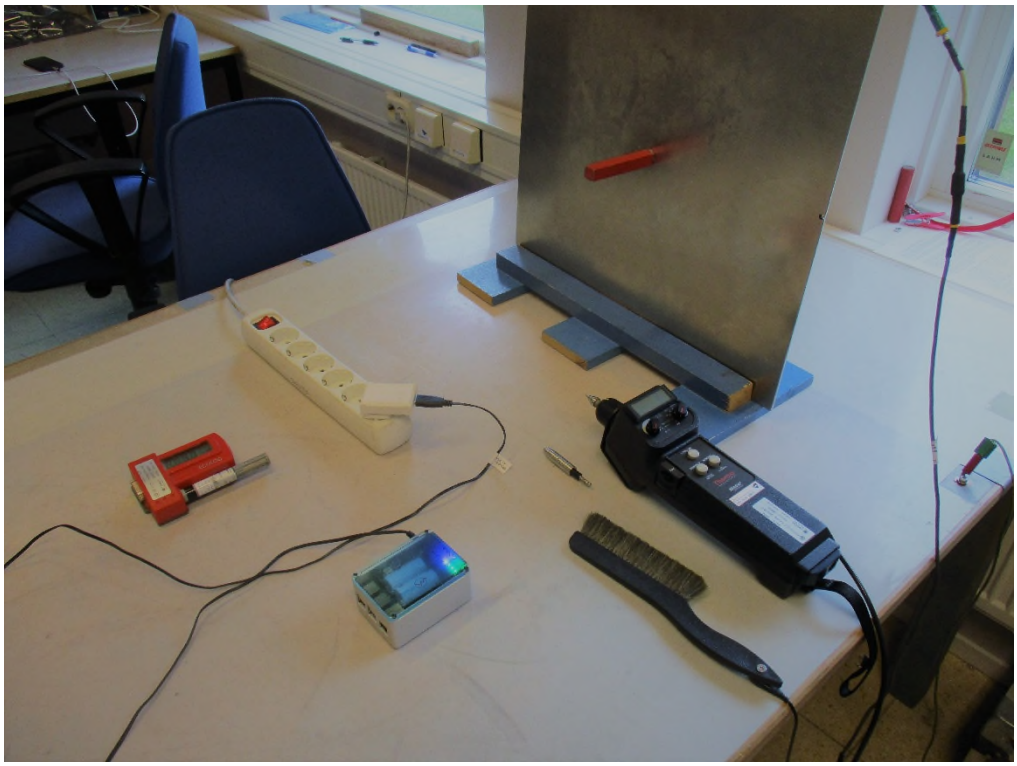


Photo 4.1.1 Test setup regarding immunity to electrostatic discharges.

Photo 4.1.2 Test points regarding immunity to electrostatic discharges.
Contact discharge test.

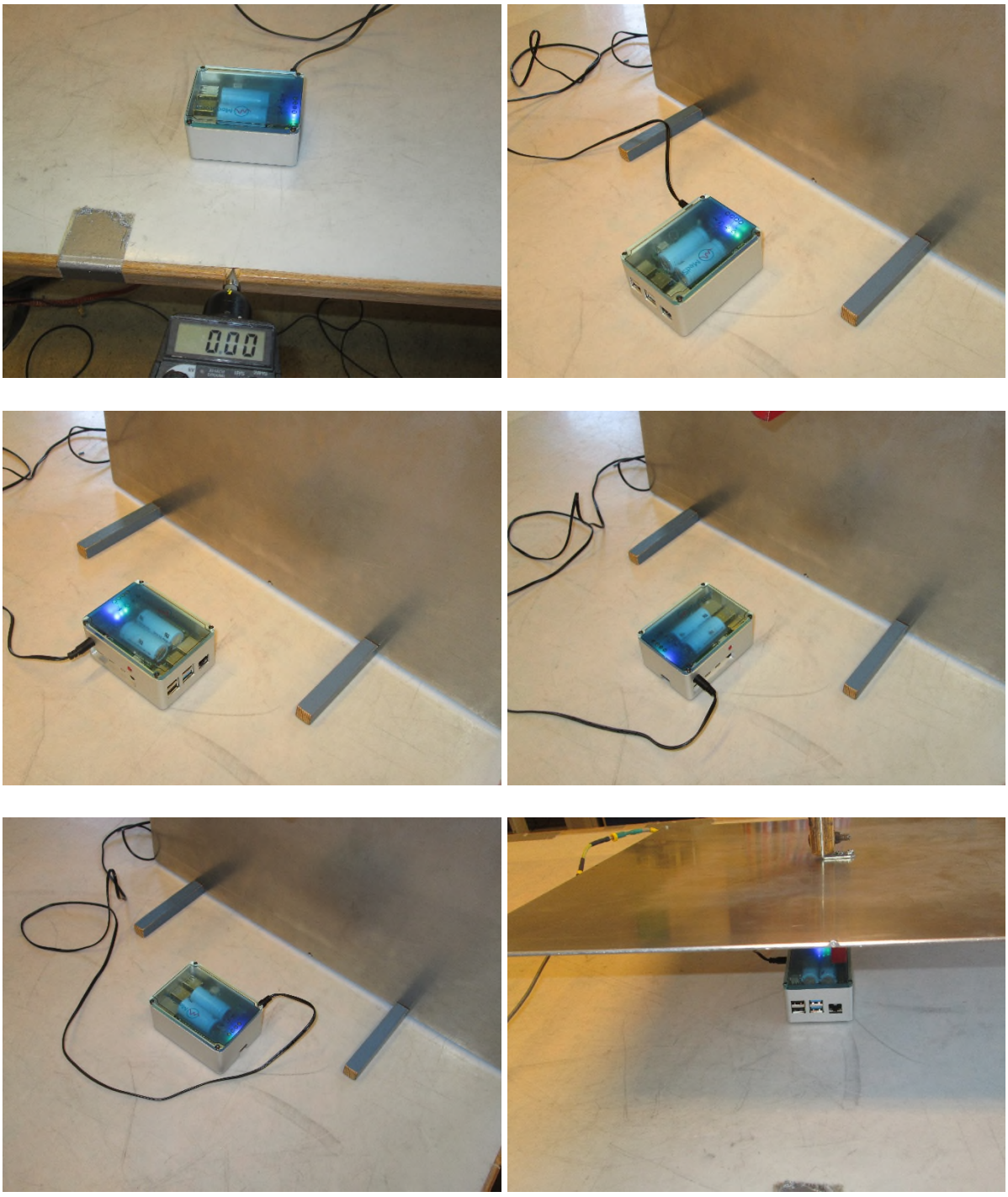


Photo 4.1.3 Test points regarding immunity to electrostatic discharges. Indirect discharge.

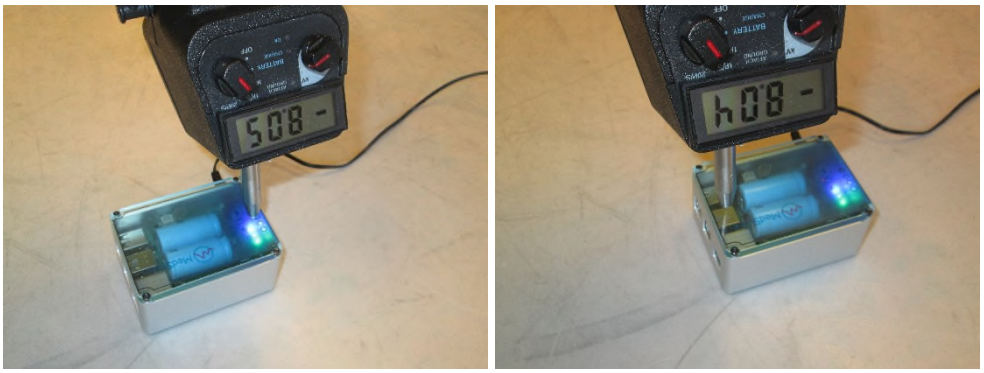


Photo 4.1.4 Test points regarding immunity to electrostatic discharges. Air discharge test.

4.2 Immunity to radio frequency electromagnetic field

Test object	Connection box	Project no.	621-20080
Type	PSM	Date	31 Mar. 2021
Serial no.	EMC sample	Initials	JJAN
Specification	EN/(IEC) 61000-6-1:2007	Required Perf. criter.	A

Test method	EN/(IEC) 61000-4-3:2006+A1+A2	Temperature	23°C
Characteristics	16 point pre-Calibration	Humidity	31% RH
Test equipm.	EMC Hall B Västerås Setup VIE3 and VIE4	Uncertainty	1.9 dB

Frequency range	Modulation	Field direction	Amplitude [V/m]	Passed	Remarks
Test object: Side 1 facing the transmitting antenna					
80-1000 MHz	80 % AM 1 kHz	Horizontal	3	Yes	
80-1000 MHz	80 % AM 1 kHz	Vertical	3	Yes	
1-6 GHz	80 % AM 1 kHz	Horizontal	3	Yes	
1-6 GHz	80 % AM 1 kHz	Vertical	3	Yes	
Test object: Side 2 facing the transmitting antenna					
80-1000 MHz	80 % AM 1 kHz	Horizontal	3	Yes	
80-1000 MHz	80 % AM 1 kHz	Vertical	3	Yes	
1-6 GHz	80 % AM 1 kHz	Horizontal	3	Yes	
1-6 GHz	80 % AM 1 kHz	Vertical	3	Yes	
Test object: Side 3 facing the transmitting antenna					
80-1000 MHz	80 % AM 1 kHz	Horizontal	3	Yes	
80-1000 MHz	80 % AM 1 kHz	Vertical	3	Yes	
1-6 GHz	80 % AM 1 kHz	Horizontal	3	Yes	
1-6 GHz	80 % AM 1 kHz	Vertical	3	Yes	
Test object: Side 4 facing the transmitting antenna					
80-1000 MHz	80 % AM 1 kHz	Horizontal	3	Yes	
80-1000 MHz	80 % AM 1 kHz	Vertical	3	Yes	
1-6 GHz	80 % AM 1 kHz	Horizontal	3	Yes	
1-6 GHz	80 % AM 1 kHz	Vertical	3	Yes	
Test object: Side 5 facing the transmitting antenna					
1-6 GHz	80 % AM 1 kHz	Horizontal	3	Yes	
1-6 GHz	80 % AM 1 kHz	Vertical	3	Yes	

Criteria for compliance	See Section 3.2
Test result	The radio frequency electromagnetic field caused no malfunctions
Compliant	Yes
Setup comments	Frequency step: 1 %, dwell time: 1 second
Comments	In agreement with the client, the sides assumed to be most susceptive were tested here.

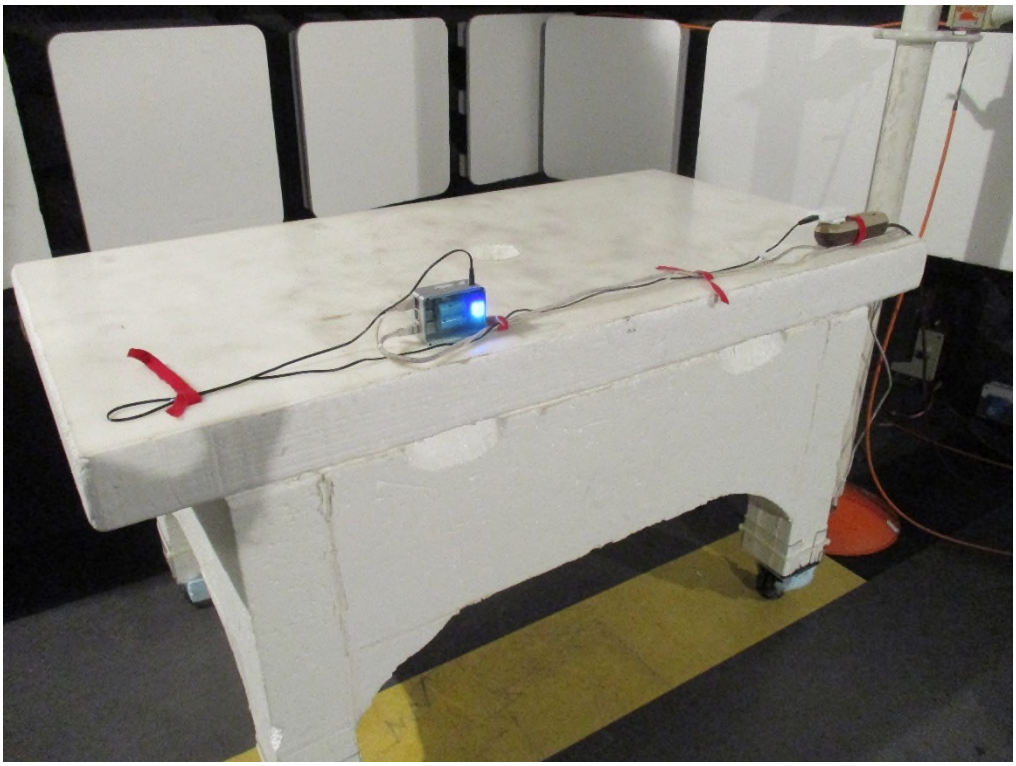


Photo 4.2.1 Test setup regarding immunity to radio frequency electromagnetic field. Side 1.

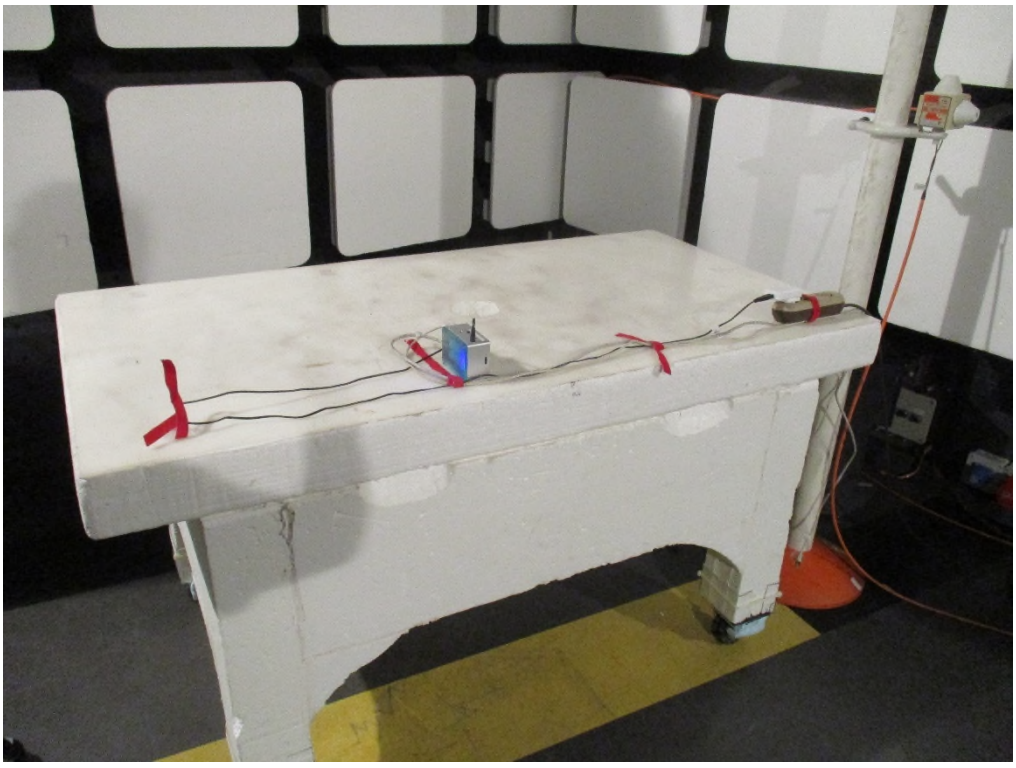


Photo 4.2.2 Test setup regarding immunity to radio frequency electromagnetic field. Side 2

Photo 4.2.3 Test setup regarding immunity to radio frequency electromagnetic field. Side 3.

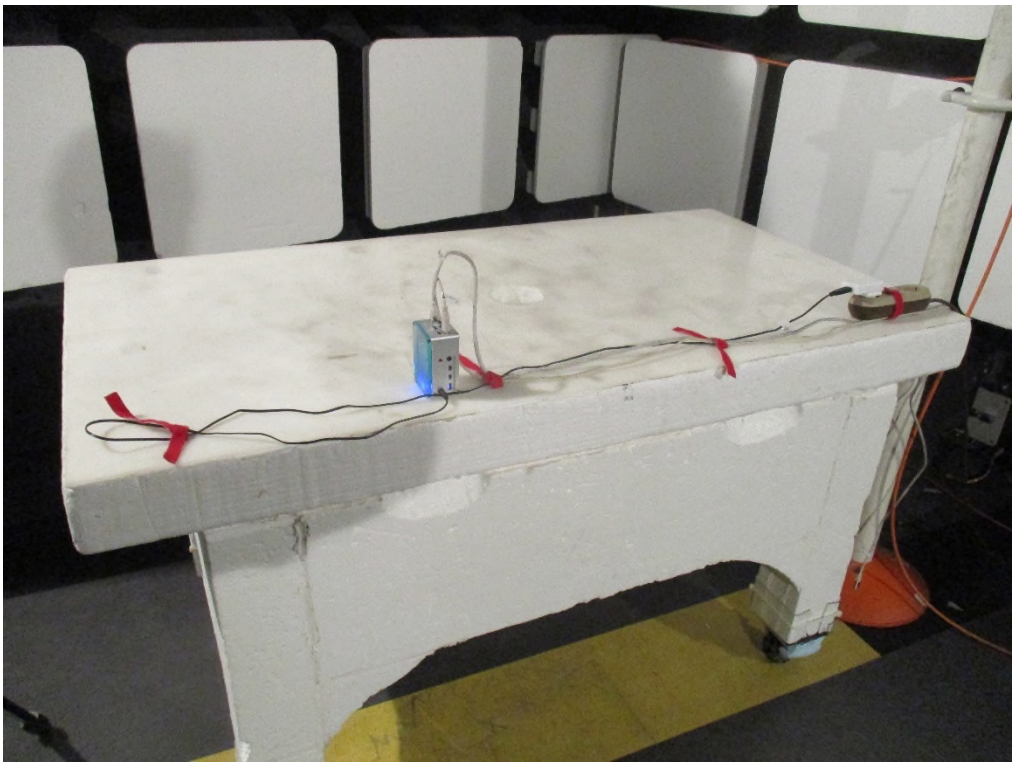


Photo 4.2.4 Test setup regarding immunity to radio frequency electromagnetic field. Side 4.

Photo 4.2.5 Test setup regarding immunity to radio frequency electromagnetic field. Side 5.

4.3 Immunity to surge transients

Test object	Connection box	Project no.	621-20080
Type	PSM	Date	31 Mar. 2021
Serial no.	EMC sample	Initials	JJAN
Specification	EN/(IEC) 61000-6-1:2007	Required Perf. criter.	B

Test method	EN/(IEC) 61000-4-5:2014+A1	Temperature	23°C
Characteristics	Open circuit volt.: 1.2/50 µs. Short circuit curr.: 8/20 µs	Humidity	30% RH
Test equipm.	EMC transient lab Västerås Setup VID5	Uncertainty	1.1 dB

Manufacturer's name of port	Test standard's name of port	Coupling and generator impedance	No of surges each combin.	Amplitude [kV]	Passed	Remarks
Power in	AC power	L-N 2 Ω	5	+/-0.5, 1	Yes	

Time between tests 30 s

Criteria for compliance See section 3.2

Test result The surge transients caused no malfunctions

Compliant Yes

Comments During test on AC power supply the surge pulse was synchronized with the phase angle.
Tested angles were 0, 90, 180 and 270 degrees.

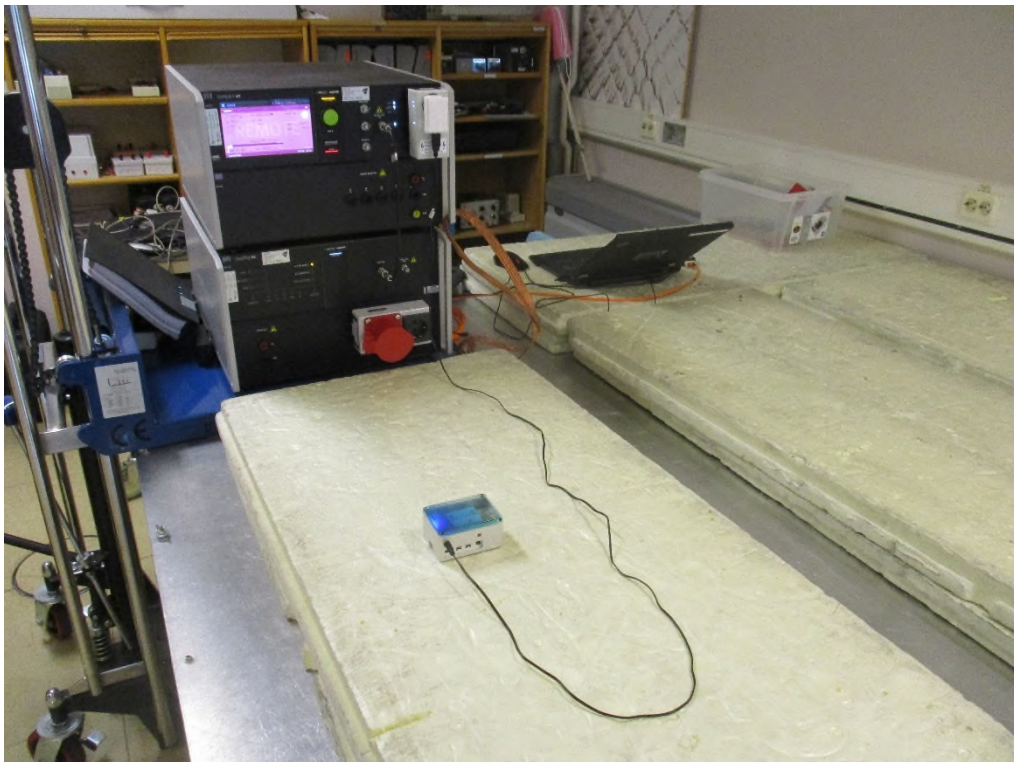


Photo 4.3.1 Test setup regarding immunity to surge transients.

4.4 Immunity to AC mains voltage dips and interruptions

Test object	Connection box	Project no.	621-20080
Type	PSM	Date	31 Mar. 2021
Serial no.	EMC sample	Initials	JJAN
Specification	EN/(IEC) 61000-6-1:2007	Required Perf. criter.	B+C

Test method	EN/(IEC) 61000-4-11:2004+A1	Temperature	23°C
Characteristics	Transition at voltage zero cross	Humidity	30% RH
Test equipm.	EMC transient lab Västerås Setup VII4	Uncertainty	0.92 dB

Manufacturer's name of power supply	Nominal voltage [VAC]	Changed voltage [VAC]	Voltage change [%]	Nominal frequency [Hz]	Changed frequency [Hz]	Dip duration	Passed	Remarks
AC adaptor	230	0	-100	50	-	10 ms	Yes	
AC adaptor	230	0	-100	50	-	20 ms	Yes	
AC adaptor	230	161	-30	50	-	500 ms	Yes	
AC adaptor	230	92	-60	50	-	200 ms	Yes	
AC adaptor	230	0	-100	50	-	5 s	Yes	Note 1
AC adaptor	100	0	-100	60	-	8.8 ms.	Yes	
AC adaptor	100	0	-100	60	-	16.7 ms.	Yes	
AC adaptor	100	70	-30	60	-	500 ms	Yes	
AC adaptor	100	40	-60	60	-	200 ms	Yes	
AC adaptor	100	0	-100	60	-	5 s	Yes	Note 1

Note 1: Test object's LED indicated that there was an interruption in power supply

Performed at 0°phaze angle

Criteria for compliance	See Section 3.2
Test result	The voltage dips and interruptions caused no malfunctions
Compliant	Yes
Comments	Each selected voltage dips, short interruptions or voltage variations were performed 3 times at 10 seconds between each test event

Photo 4.4.1 Test setup regarding immunity to AC mains voltage dips and interruptions.

4.5 Measurement of radio frequency electromagnetic field

Test object	Connection box	Project no.	621-20080
Type	PSM	Date	19 Mar. 2021
Serial no.	EMC sample	Initials	JJAN
Specification	EN/(IEC) 61000-6-3:2007+A1	Frequency	30-1000 MHz

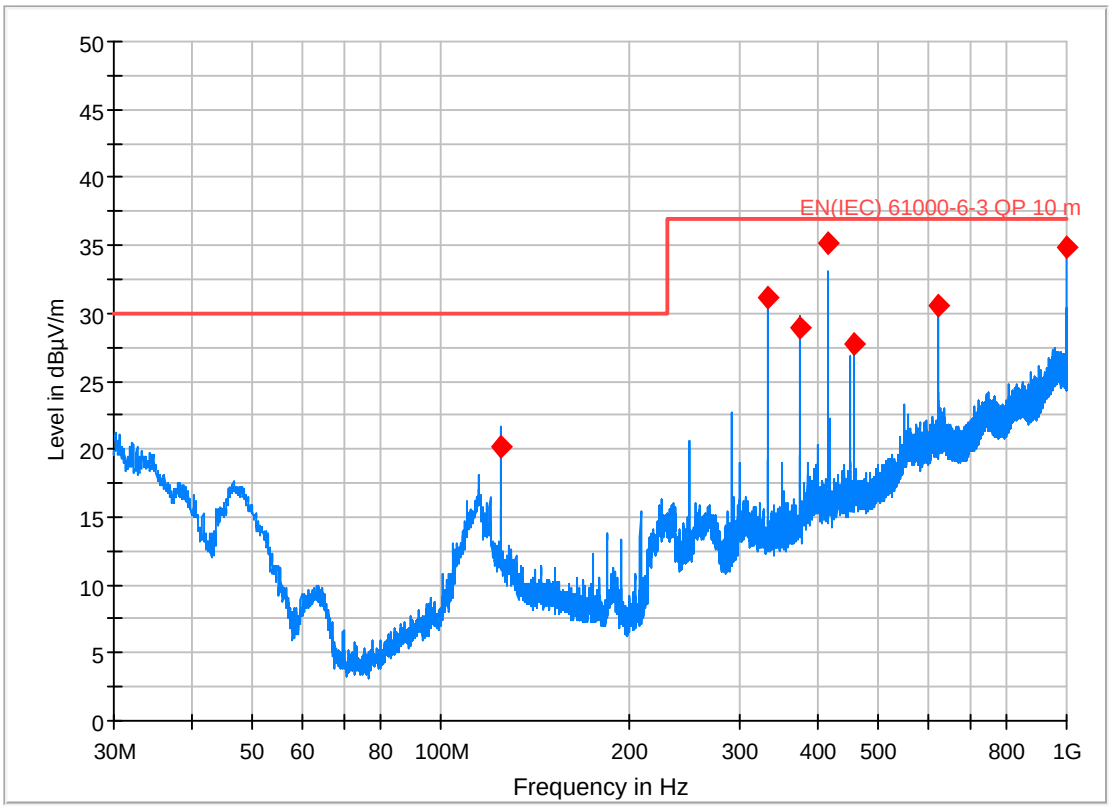
Test method Characteristics	CISPR 16-2-3:2016 Complete search, antenna distance 10 m	Temperature Humidity	21°C 37% RH
Detector	Peak and quasi peak	Bandwidth	120 kHz
Test equipm.	EMC Hall A Västerås Setup VEC1	Uncertainty	5.0 dB

Test result	The measured field strengths were below the limit
Compliant	Yes
Comments	Final maximal measurements by variation of turntable azimuth, antenna height, and antenna polarisation. CMAD absorption clamp was used on power supply cable.

Radiated Emission Test

Common Information

Test Description:	Radiated emission. Complete measurement 30 - 1000 MHz
Date:	2021-03-19
EUT Name:	Cubist Box Hat
Manufacturer:	Cubist IT
Serial Number:	-
Operating Conditions:	Power on, charging
Test Site:	DELTA Development Technology AB
Operator Name:	JJAN
Test Specification:	EN 61000-6-3
Comment:	-



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)
124.985000	20.22	30.00	9.78	1000.0	120.000	120.0	V	204.0	-6.9
333.343500	31.22	37.00	5.78	1000.0	120.000	350.0	V	93.0	-3.6
374.985000	28.96	37.00	8.04	1000.0	120.000	318.0	H	61.0	-2.3
416.686500	35.09	37.00	1.91	1000.0	120.000	250.0	H	62.0	-0.7
458.328500	27.68	37.00	9.32	1000.0	120.000	119.0	H	70.0	0.3
625.015000	30.63	37.00	6.37	1000.0	120.000	150.0	H	179.0	4.9
1000.000000	34.86	37.00	2.14	1000.0	120.000	103.0	H	84.0	10.0

Photo 4.5.1 Test setup regarding measurement of radio frequency electromagnetic field.

Photo 4.5.2 Test setup regarding measurement of radio frequency electromagnetic field.

4.6 Measurement of radio frequency voltage on mains

Test object	Connection box	Project no.	621-20080
Type	PSM	Date	19 Mar. 2021
Serial no.	EMC sample	Initials	JJAN
Specification	EN/(IEC) 61000-6-3:2007+A1	Frequency	0.15-30 MHz

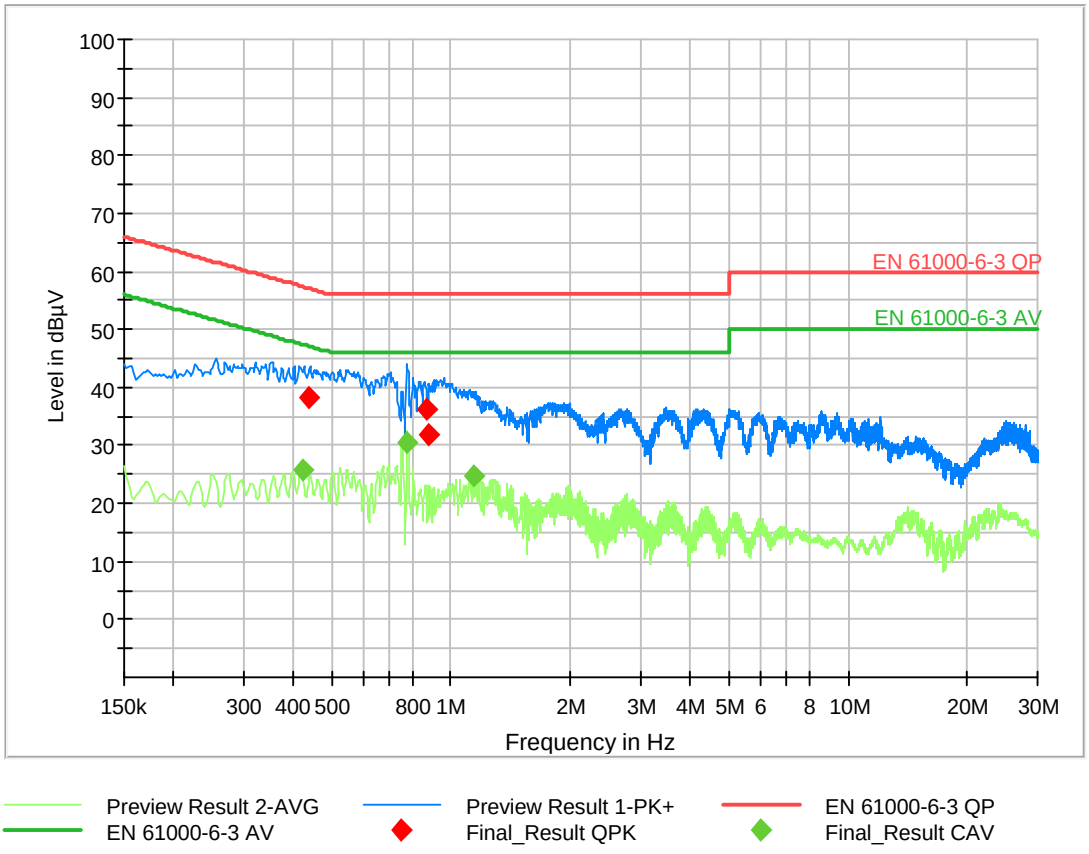
Test method Characteristics	CISPR 16-2-1:2014+A1 Artificial mains network: 50 Ω, 50 µH	Temperature Humidity	21°C 37% RH
Detector	Peak, quasi peak, and average	Bandwidth	9 kHz
Test equipm.	EMC Hall A Västerås Setup VEA1	Uncertainty	2.7 dB

Line under test	Maximum of Line and Neutral
Test result	The measured voltages were below the limit
Compliant	Yes
Comments	Mains voltage: 230 VAC 50 Hz

Conducted Emission Test

Common Information

Test Description:	Conducted emission. Complete measurement 150 kHz - 30 MHz
Date:	2021-03-19
EUT Name:	PSM connection box
Manufacturer:	Cubist IT
Serial Number:	-
Operating Conditions:	Power on, charging
Test Site:	DELTA Development Technology AB
Operator Name:	JJAN
Test Specification:	EN 61000-6-3
Comment:	



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.422250	---	25.86	47.40	21.54	2000.0	9.000	N	FLO	16.1
0.435750	38.11	---	57.14	19.04	2000.0	9.000	L1	FLO	16.1
0.777750	---	30.33	46.00	15.67	2000.0	9.000	N	FLO	16.1
0.865500	36.32	---	56.00	19.68	2000.0	9.000	L1	FLO	16.1
0.876439	31.92	---	56.00	24.08	2000.0	9.000	L1	FLO	16.1
1.134322	---	24.72	46.00	21.28	2000.0	9.000	N	FLO	16.2

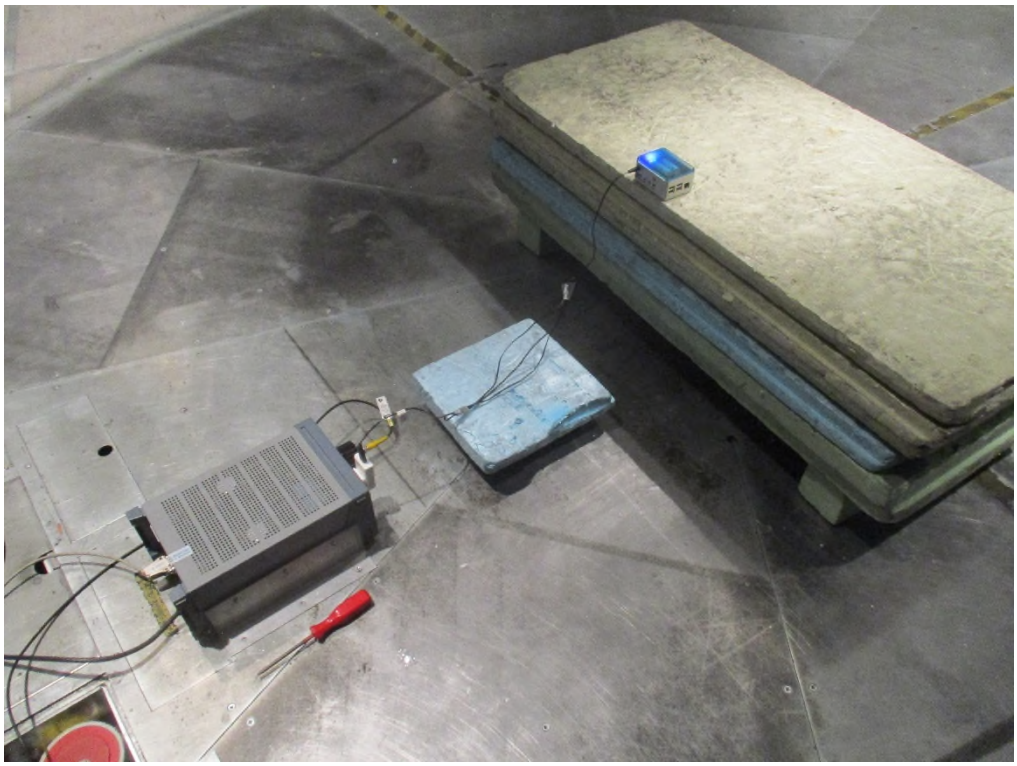


Photo 4.6.1 Test setup regarding measurement of radio frequency voltage on mains.

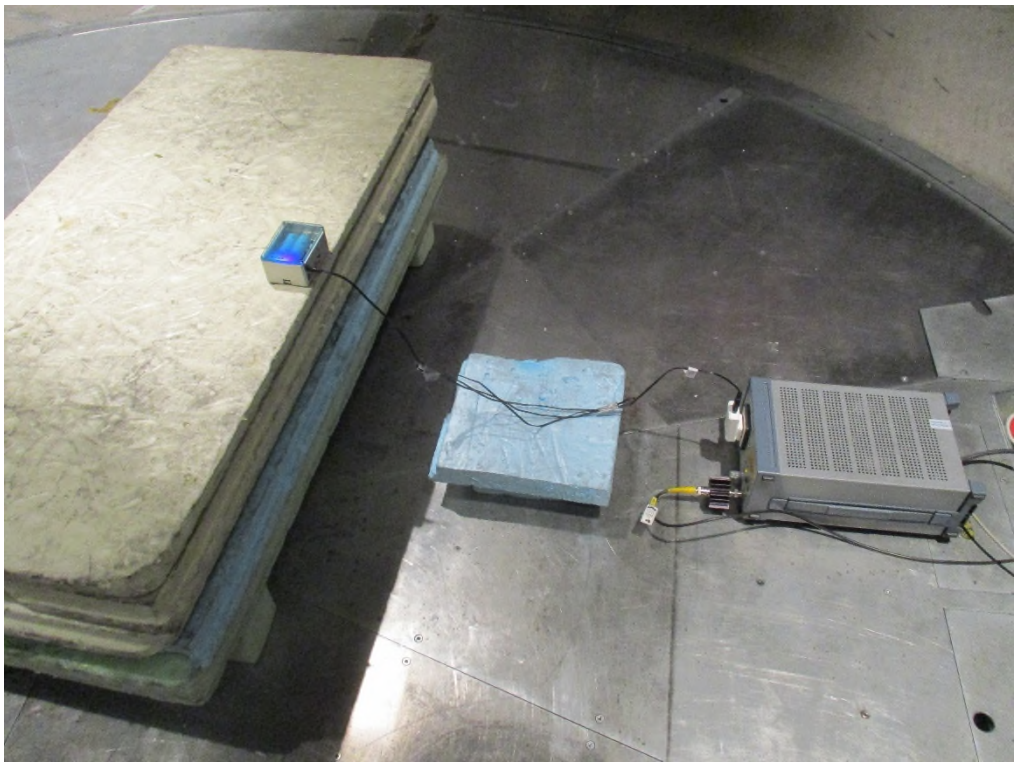


Photo 4.6.2 Test setup regarding measurement of radio frequency voltage on mains.

5. National registrations and accreditations

5.1 SWEDAC Accreditation

Organization: Swedish Board for Accreditation and Conformity Assessment - SWEDAC, see www.swedac.se and www.ilac.org

Registration Number: 1688

SWEDAC is part of ILAC (International Laboratory Accreditation Cooperation) including its MRA (Mutual Recognition Arrangement).

5.2 FCC Registrations

Organization: Federal Communications Commission, USA

Designation number: SE0004

Company Number: 187770

Facilities: EMC chamber A 3 m and 10 m

5.3 ISED Registrations

Organization: Innovation, Science and Economic Development Canada

Designation number: SE0006

Company Number: 9347A

Facilities: EMC chamber A 3 m and 10 m

6. List of instruments

Setup VIC1					
Immunity to electrostatic discharges					
Used	***ID no.***	***Description***	***Manufacturer***	***Type no.***	***Setup uncertainty***
☒	35064	ESD simulator	KeyTek	MiniZap MZ-15/EC	1.1 dB

Setup VIE4					
Immunity to radio frequency electromagnetic fields					
Used	***ID no.***	***Description***	***Manufacturer***	***Type no.***	***Setup uncertainty***
☒	36070	Software	Rohde & Schwarz	EMC32 ver. 10.60.20	1.8 dB
☒	36185	Signal Generator	Rohde & Schwarz	SMB100B	
☒	304	Field Strength Meter	Amplifier Research	FM 2000	
☒	IE-B886	E-field Sensor	Amplifier Research	FP 2000	
☒	36186	Average Power Sensor	Rohde & Schwarz	NRP6AN	
☒	36187	Average Power Sensor	Rohde & Schwarz	NRP6AN	
☒	36184	Broadband Amplifier	Rohde & Schwarz	BBA150-BC1250	
☒	35105	Antenna Log Periodic	Rohde & Schwarz	HL 023 A1	
☒	29451	Antenna Tower	EMCO	1050	
☒	29452	Tower Controller	EMCO	1050	

Setup VIE3					
Immunity to radio frequency electromagnetic fields					
Used	***ID no.***	***Description***	***Manufacturer***	***Type no.***	***Setup uncertainty***
☒	36070	Software	Rohde & Schwarz	EMC32 ver. 10.60.20	1.8 dB
☒	36102	Signal Generator	Rohde & Schwarz	SMB100A	
☒	IE-B884	Field Strength Meter	Amplifier Research	FM 2000	
☒	304	Field Strength Meter	Amplifier Research	FM 2000	
☒	IE-B886	E-field Sensor	Amplifier Research	FP 2000	
☒	36103	Average Power Sensor	Rohde & Schwarz	NRP-Z91	
☒	36104	Average Power Sensor	Rohde & Schwarz	NRP-Z91	
☒	36100	Broadband Amplifier	Rohde & Schwarz	BBA150-D200	
☒	36101	Broadband Amplifier	Rohde & Schwarz	BBA150-E100	
☒	36105	Horn Antenna	Rohde & Schwarz	HF907	

Setup VID5					
Immunity to surge transients					
Used	***ID no.***	***Description***	***Manufacturer***	***Type no.***	***Setup uncertainty***
☒	36165	Software	EM TEST	iec.control ver. 9.2.2	1.1 dB
☒	36158	Transient generator	EM TEST	Compact NX5 bspt-1-300-16	

Setup VII4					
Immunity to AC voltage dips and interruptions					
Used	***ID no.***	***Description***	***Manufacturer***	***Type no.***	***Setup uncertainty***
☒	36165	Software	EM TEST	iec.control ver. 9.0.1	0.52 dB
☒	36158	Transient generator	EM TEST	Compact NX5 bspt-1-300-16	
☒	36160	Tapped auto transformer	EM TEST	V 4780S2	
☒	E-P401	AC power source	Chroma	61604	

Setup VEC1					
Measurement of radio frequency electromagnetic field					
Used	***ID no.***	***Description***	***Manufacturer***	***Type no.***	***Setup uncertainty***
☒	36070	Software	Rohde & Schwarz	EMC32 ver. 10.60.15	5.0 dB 30-1000 MHz (10 m)
☒	36020	Measuring receiver	Rohde & Schwarz	ESU26	
☒	IE-B928	Antenna Bilog	Chase	CBL6111A	
☒	36151	Preamplifier	FORCE	Preamp 0.5MHz-4GHz	
☒	36022	Power supply	DELTA	UVB	
☒	36129	CMAD Absorption clamp	DELTA	CMAD D25/16-1-4	
☒	36071	Controller	Maturo	NCD	
☒	36072	Tilt antenna mast	Maturo	TAM 4.0-E	
☒		Turntable	Heinrich Deisel	DT 440	

Setup VEA1					
Measurement of radio frequency voltage on mains					
Used	***ID no.***	***Description***	***Manufacturer***	***Type no.***	***Setup uncertainty***
☒	36070	Software	Rohde & Schwarz	EMC32 ver. 10.60.15	2.7 dB
☒	36020	Measuring receiver	Rohde & Schwarz	ESU26	
☒	IE-B919	LISN 2 x 10 A 250 V	Rohde & Schwarz	ESH3-Z5	
☒	36134	Attenuator 6 dB 10 W	BIRD	10-A-MFB-06	
☒	36062	Impulse Voltage Limiter	Rohde & Schwarz	ESH3-Z2	