Test report

Number:	**T251-0237/22 M1**	Project file:	C20220323
		Date:	2022-07-15
		Pages:	50
Product:	**Access control and time attendance device**		
Type reference:	**C049**		
Ratings:	Input: 13 Vdc ± 10%; max. 0,374 A Output: 5 Vdc; 0,25 A Protection class: III		
Trademark:	Creasoft		
Applicant:	**CREASOFT IT SRL** **Strada Mircea cel Batran Nr. 76 Sector 5, 051112 Bucharest, Romania**		
Manufacturer:	EMS-ELECTRA S.R.L. Parc Industrial Miroslava Str. Principala nr.33 Corp B, Bratuleni-Miroslava 707307, Judet Iasi, Romania		
Place of manufacture:	EMS-ELECTRA S.R.L. Parc Industrial Miroslava Str. Principala nr.33 Corp B, Bratuleni-Miroslava 707307, Judet Iasi, Romania		

Summary of testing

Testing method:	EN 303 446-1 V1.2.1 in conjunction with EN 301 489-52 V1.2.1
Testing location:	SIQ Ljubljana, Mašera-Spasićeva ulica 10, SI-1000 Ljubljana, Slovenia
Remarks:	Date of receipt of test items: 2022-02-22 Number of items tested: 3 Date of performance of tests: 2022-03-18 - 2022-04-04 The test results presented in this report relate only to the items tested. The product complies with the requirements of the testing methods. The product is class A equipment.

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1 GENERAL

History sheet			
Date	Report No.	Change	Revision
2022-04-04	T251-0237/22	Initial Test Report issued.	--
2022-07-15	T251-0237/22 M1	Device consists of two boards one of them being C049 and the other C056. Manufacturer changed type designation of the combination to C049 only. Due this M1 modification of the report is prepared. Additionally with manufacturer changes corrections have been done to first page showing device is DC powered, removed accreditation logo, added labels and associated equipment and minor changes due to typing errors.	1.0

Environmental conditions:
Ambient temperature: 15 °C to 35 °C
Relative humidity: 30 % to 60 %
Atmospheric pressure: 860 mbar to 1060 mbar

Abbreviations

AC mains power port	Port used to connect to the mains supply network
DC network power port	Port, not powered by a dedicated AC/DC power converter and not supporting communication,that connects to a DC supply network
Signal/control port	Port intended for the interconnection of components of an EUT, or between an EUT and local AE and used in accordance with relevant functional specifications
Port	Physical interface through which electromagnetic energy enters or leaves the EUT
Wired network port	Point of connection for voice, data and signalling transfers intended to interconnect widelydispersed systems by di rect connection to a single-user or multi-user communication network (for example CATV, PSTN, ISDN, xDSL, LAN and similar networks).
AE associated equipment	Equipment needed to exercise and/or monitor th e operation of the EUT
Equipment Under Test (EUT)	Multimedia equipment (MME) being evaluated for compliance with the requirements of EN 55032 standard
Highest internal frequency (*Fx*)	Highest fundamental frequency generated or used within the EUT or highest frequency at which it operates
ESD	Electrostatic Discharge
CDN	Coupling and Decoupling Network
RF	Radio Frequency

1.1 Measurement uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the product, as specified in CISPR 16-4-2 and EN 55016-4-2. This represents an expanded uncertainty expressed at 95% confidence level using a coverage factor k=2.

Emission test		U_{LAB}	U_{CISPR}
Conducted emission measurement	(150 kHz to 30 MHz)	2,7 dB	3,4 dB
Radiated emission measurement (electric field strength at an OATS or in a SAC)	(30 MHz to 1000 MHz)	5,3 dB	6,3 dB
Radiated emission measurement	(1 GHz to 6 GHz)	4,4 dB	5,2 dB

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

Emission test	U_{LAB}
Harmonics current emission measurement	±0,0016 A
Voltage fluctuation measurement	2,4 %
Immunity test	
Electrostatic discharges (ESD)	All required parameters comply with requirements of standard.
Continuous RF electromagnetic field disturbances	2,2
Electrical fast transients/burst	All required parameters comply with requirements of standard.
Surges	All required parameters comply with requirements of standard.
Continuous induced RF disturbances	3,2
Power frequency magnetic field	All required parameters comply with requirements of standard.
Voltage dips and short interruptions	All required parameters comply with requirements of standard.

1.2 Equipment under test

Access control and time attendance device
Type: **C049**

1.3 General product information

The product is access control device.
Device C049 is a combination of C049 main unit and C056 add on board with the SARA G350 modem mounted. Together both of them form one device with type designation C049. Device is always powered with AC/DC power supply. Below power supply as AE is used with the EUT.

Input/Output Ports

Port No.	Name	Type*	Cable Length / m	Cable Shielded
0	Enclosure	N/E		
1	AC mains power port of AE equipment	AC		
2	DC mains power port	DC		
3	Entrance modul	I/O	< 3	NO
4	Exit modul	I/O	< 3	NO

*Note: AC = AC mains power port
DC = DC network power port / input d.c. power port
I/O = Signal/control port
WNP = wired network port
GND = grounding
N/E = Non-Electrical

Equipment Description

SIQ tested number :	S202201309, S202201308, S202201311
One/two/three phase EUT:	One phase
Floor standing / table-top equipment or a combination:	Table-top

Highest Internal Frequency (*Fx*)

Frequency (MHz)	Description
> 108	RF communication

Pictures of EUT

Associated equipment used during testing:

- Power supply (ratings: 100-240 V, 50/60 Hz)

Pictures of AE

1.4 Operating voltages/frequencies used for testing

Section	Test	Operating conditions
3.1	Conducted emission measurement	100 V; 60 Hz 240 V; 50 Hz
3.2	Radiated emission measurement	100 V; 60 Hz 240 V; 50 Hz
3.3	Harmonics current emission measurement	/
3.4	Voltage fluctuation measurement	230 V; 50 Hz
4.1	Electrostatic discharge	230 V; 50 Hz
4.2	Continuous RF electromagnetic field disturbances	230 V; 50 Hz
4.3	Electrical fast transients/burst	230 V; 50 Hz
4.4	Surge	230 V; 50 Hz
4.5	Continuous induced RF disturbances	230 V; 50 Hz
4.6	Power frequency	230 V; 50 Hz
4.7	Voltage dips and short interruptions	230 V; 50 Hz

1.5 Operating modes

No.	Operating mode
1	Locking and unlocking (registration reading)

2 TEST SUMMARY

STANDARDS (details on first page)	Tested yes	Tested no	Sample pass	Sample not pass
EN 303 446-1 V1.2.1 ElectroMagnetic Compatibility (EMC) standard for combined and/or integrated radio and non-radio equipment; Part 1: Requirements for equipment intended to be used in residential, commercial and light industry locations	☑	☐	☑	☐
SUBSTANDARD: RADIO PART				
EN 301 489-1 V2.2.3 ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard for ElectroMagnetic Compatibility	☑	☐	☑	☐
EN 301 489-52 V1.2.1 ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 52: Specific conditions for Cellular Communication User Equipment (UE) radio and ancillary equipment; Harmonised Standard for ElectroMagnetic Compatibility	☑	☐	☑	☐
SUBSTANDARD: NON-RADIO PART				
EN 55032:2015 + A11:2020 Electromagnetic compatibility of multimedia equipment – Emission requirements	☑	☐	☑	☐
EN 61000-3-2:2014 Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)	☑	☐	☑	☐
EN 61000-3-3:2013 Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems for equipment with rated current ≤ 16A per phase and not subjected to conditional connection	☑	☐	☑	☐
EN 55035:2017 + A11:2020 Electromagnetic compatibility of multimedia equipment – Immunity Requirements	☑	☐	☑	☐

Test	**Basic standard**	**Section within the report**	**Class**	**Conclusion**
Conducted emission	EN 55032:2015 + A11:2020	3.1	B	PASS
Radiated emission	EN 55032:2015 + A11:2020	3.2	A	PASS
Harmonic current emissions	EN 61000-3-2:2014	3.3	/	N/A
Voltage fluctuations and flicker	EN 61000-3-3:2013	3.4	/	PASS

Test	**Basic standard**	**Required criterion**	**Achieved criterion**	**Conclusion**
Electrostatic discharge	EN 61000-4-2:2009	B	A	PASS
Continuous RF electromagnetic field disturbances	EN 61000-4-3:2006 + A1:2008 + A2:2010	A	A	PASS
Electrical fast transients/burst	EN 61000-4-4:2012	B	A	PASS
Surge	EN 61000-4-5:2014	B	A	PASS
Continuous induced RF disturbances	EN 61000-4-6:2014	A	A	PASS
Power frequency	EN 61000-4-8:2010	/	/	N/A
Voltage dips and short interruptions	EN 61000-4-11:2004	B,C	A	PASS

* NOTE: for detailed criterion achievement refer to each test separately

2.1 Performance/observation criterion (Radio part)

If there are no special manufacturer performance criteria defined, those bellow are used for evaluation.

EN 301 489-3:

Criteria	During test	After test
A	Operate as intended. No loss of function. No unintentional responses.	Operate as intended. No degradation of performance. No loss of function. No loss of stored data or user programmable function.
B	May be loss of function. No unintentional responses.	Operate as intended. Lost function(s) shall be self-recoverable. No degradation of performance. No loss of stored data or user programmable function.

EN 301 489-52:

Performance criteria for Continuous phenomena:

GSM
Performance criteria for Continuous phenomena applied to Transmitters (CT)
During the test, the uplink speech output level shall be at least 35 dB (±3 dB) less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centered on 1 kHz (audio breakthrough check).

NOTE: When there is a high-level background noise present, the filter bandwidth can be reduced down to a minimum of 40 Hz.

At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or critical stored data, and the communication link shall have been maintained. In addition to confirming the above performance during a call, the test shall also be performed in idle mode, and the transmitter shall not unintentionally operate.

Performance criteria for Continuous phenomena applied to Receivers (CR)
During the test, the RXQUAL of the downlink shall not exceed the value of three, measured during each individual exposure in the test sequence. During the test, the downlink speech output level shall be at least 35 dB (±3 dB) less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centered on 1 kHz (audio breakthrough check).

NOTE: When there is a high-level background noise present, the filter bandwidth can be reduced down to a minimum of 40 Hz.

At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or critical stored data, and the communication link shall have been maintained.

UTRA
In the data transfer mode, the performance criteria can be one of the following:
- if the BER is used, it shall not exceed 0,001 during the test sequence;
- if the BLER is used, it shall not exceed 0,01 during the test sequence. The BLER calculation shall be based on evaluating the CRC on each transport block.

E-UTRA, E-UTRA with LAA, inband or guard band NB-IoT, Standalone NB-IoT
In data transfer mode, the data throughput of the EUT shall not fall below 95 % of the maximum data throughput.

NR
In data transfer mode, the data throughput of the EUT shall not fall below 95 % of the maximum data throughput.

Performance criteria for Transient phenomena applied to Receivers and Transmitters
At the conclusion of each exposure of the transient phenomena, the EUT shall operate without loss of the communication link. At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended without loss of user control functions or critical stored data. In addition, where the EUT supports idle mode it should be verified that the transmitter shall not unintentionally operate when transient phenomena are applied.

2.2 Performance/observation criterion (non-Radio part)

Criteria	
A	The equipment shall continue to operate as intended without operator intervention. No degradation of performance, loss of function or change of operating state is allowed below a performance level specified by the manufacturer when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.
B	During the application of the disturbance, degradation of performance is allowed. However, no unintended change of actual operating state or stored data is allowed to persist after the test. After the test, the equipment shall continue to operate as intended without operator intervention; no degradation of performance or loss of function is allowed, below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level (or the permissible performance loss), or recovery time, is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.
C	Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A reboot or re-start operation is allowed. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

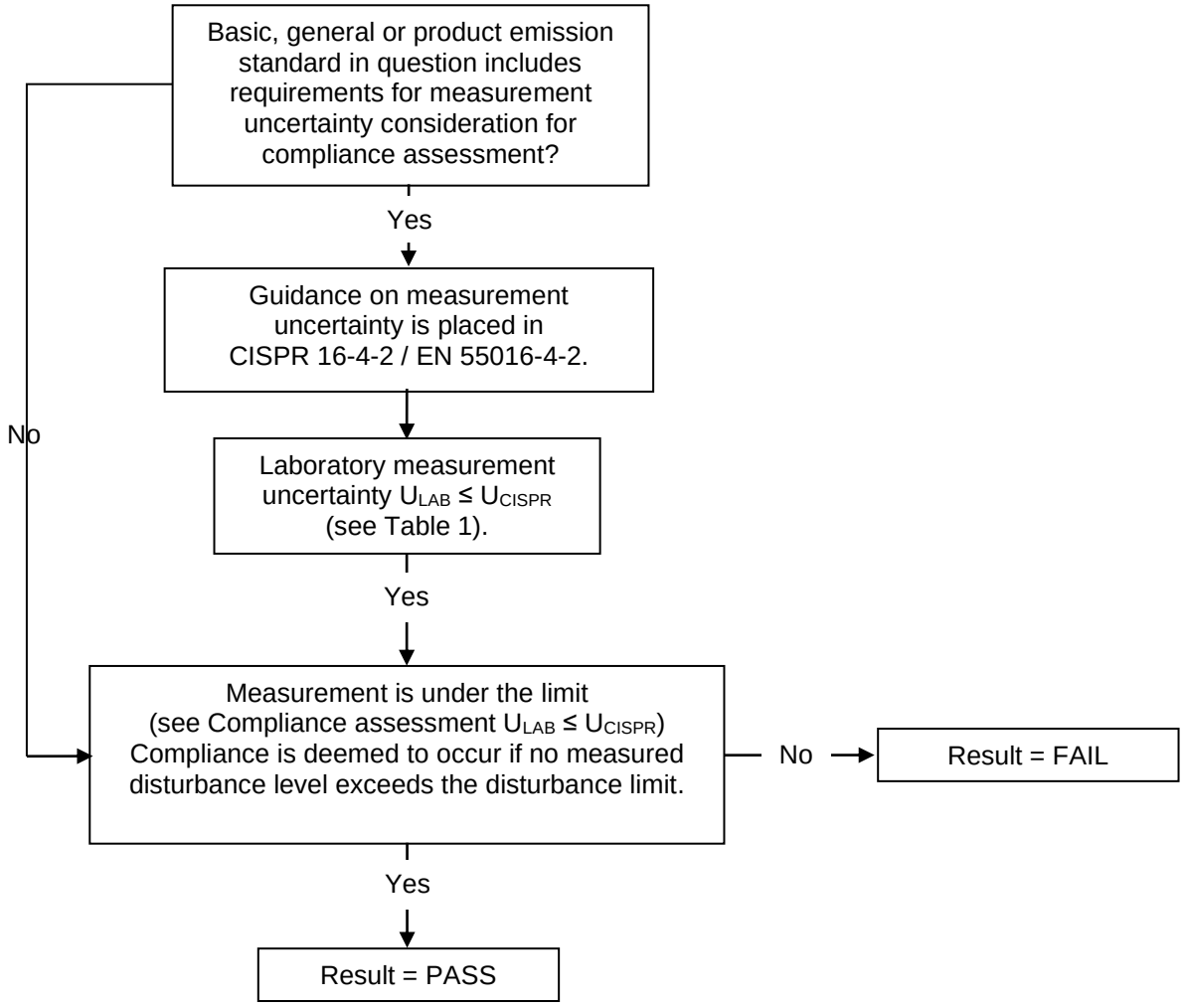
Test / Standard	Observed function
Electrostatic discharges (ESD) / EN 61000-4-2	Locking / unlocking (registering), GSM communication
Continuous RF electromagnetic field disturbances / EN 61000-4-3	Locking / unlocking (registering), GSM communication
Electrical fast transients/burst / EN 61000-4-4	Locking / unlocking (registering), GSM communication
Surges / EN 61000-4-5	Locking / unlocking (registering), GSM communication
Continuous induced RF disturbances/ EN 61000-4-6	Locking / unlocking (registering), GSM communication
Power frequency magnetic field/ EN 61000-4-8	/
Voltage dips and short interruptions / EN 61000-4-11	Locking / unlocking (registering), GSM communication

2.3 Application of decision rule

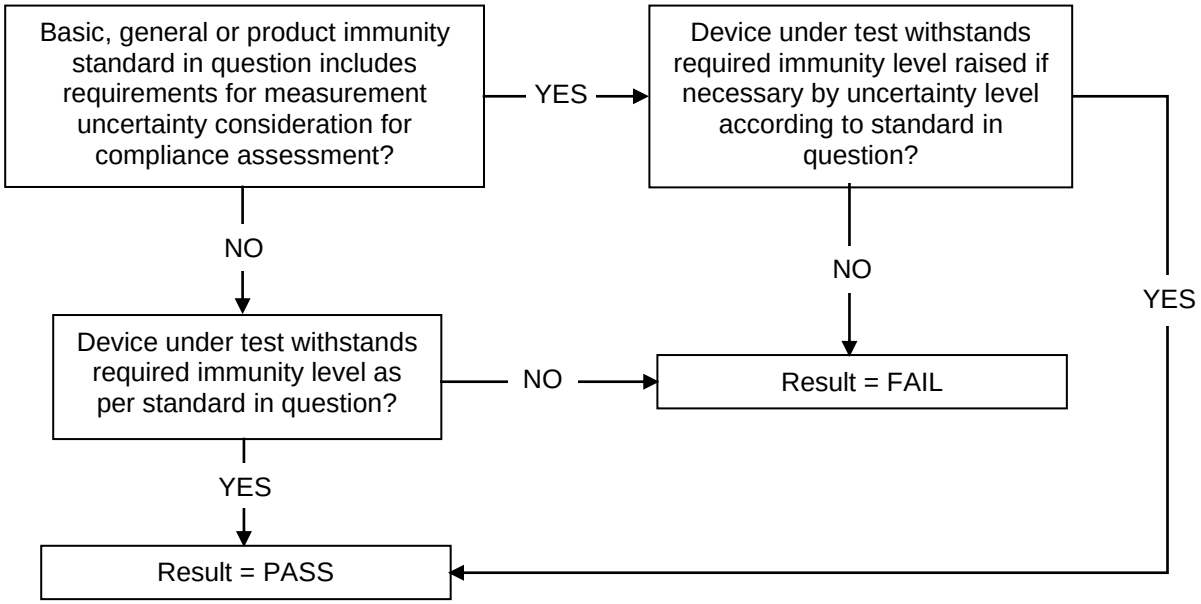
Application of decision rule and statement of conformity is defined in document TN023 Decision rule and measurement uncertainty.

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

Decision rule applicable for emission



Decision rule applicable for imunity



3 EMISSION TESTS

3.1 Conducted emission measurement

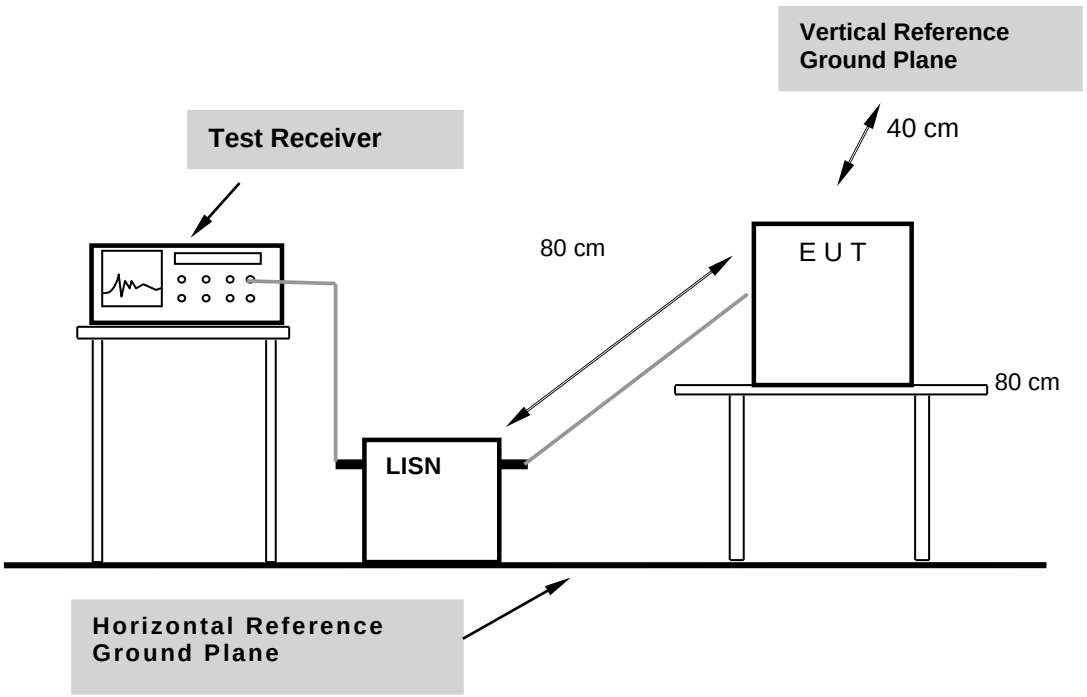
3.1.1 Limits of conducted emission measurement – AC mains port limits

Frequency (MHz)	Limit Class B (dBμV)	
	Quasi-peak	Average
0.15 – 0.5	66 - 56	56 - 46
5.0 – 30.0	60	50

3.1.2 Test procedure

- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). LISN provide 50 Ohm/ 50 μH+5 Ohm of coupling impedance for the measuring instrument.
- AC power line of EUT was checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched.

3.1.3 Test setup



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

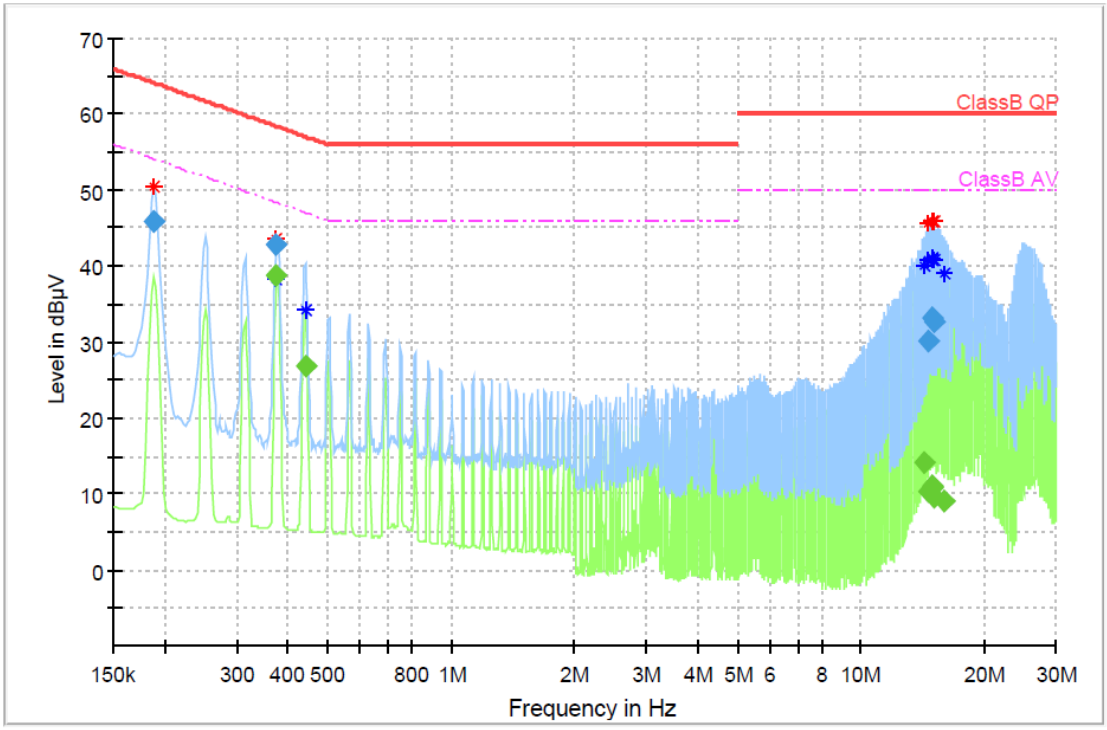
3.1.4 Test results

Operating modes:	1

CONDUCTED EMISSION

EUT Information

EUT:	C20220323
Operating mode:	Uin: 100 V / 60 Hz
Lines:	MAINS



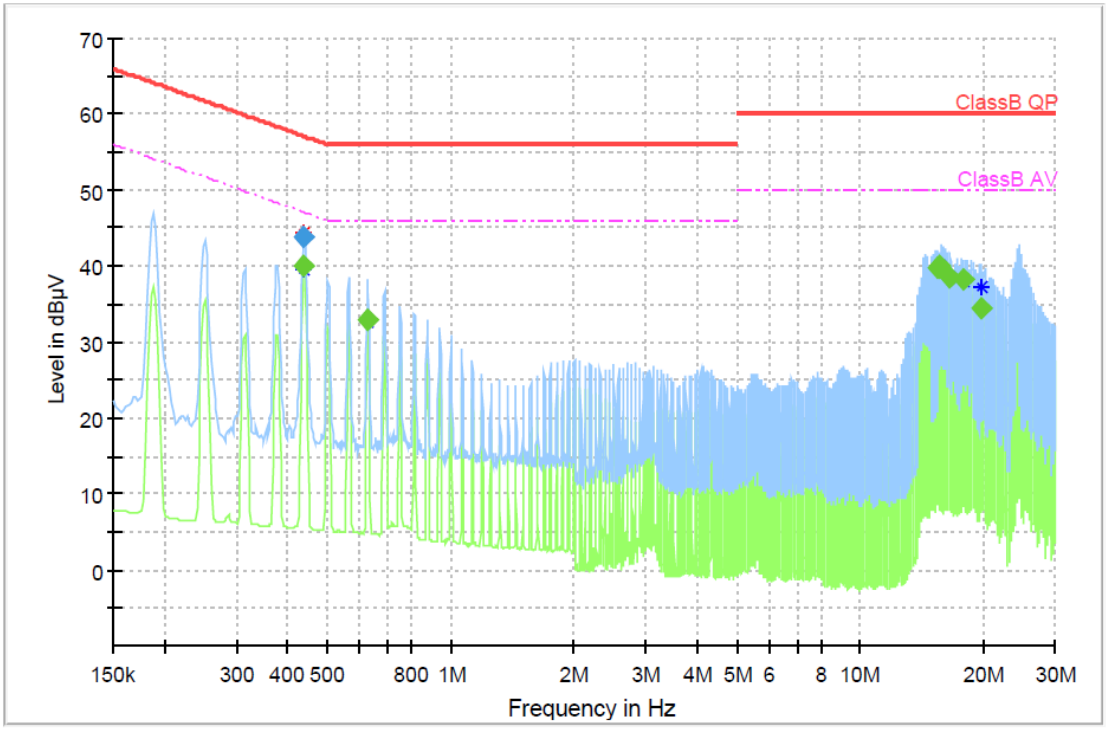
Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.375000	---	38.80	48.39	9.59	1000.0	9.000	L1	ON	10.0
0.375000	42.89	---	58.39	15.50	1000.0	9.000	L1	ON	10.0
0.188250	45.99	---	64.11	18.12	1000.0	9.000	N	ON	10.0
0.440250	---	26.85	47.06	20.21	1000.0	9.000	N	ON	10.1
14.874000	33.08	---	60.00	26.92	1000.0	9.000	N	ON	9.9
15.123750	32.62	---	60.00	27.38	1000.0	9.000	N	ON	9.9
14.622000	30.05	---	60.00	29.95	1000.0	9.000	N	ON	9.9
14.232750	---	14.19	50.00	35.81	1000.0	9.000	L1	ON	9.9
14.950500	---	11.00	50.00	39.00	1000.0	9.000	N	ON	9.9
15.013500	---	10.74	50.00	39.26	1000.0	9.000	N	ON	9.9
14.637750	---	10.35	50.00	39.65	1000.0	9.000	N	ON	9.9
15.076500	---	9.62	50.00	40.38	1000.0	9.000	N	ON	9.9
15.893250	---	9.17	50.00	40.83	1000.0	9.000	N	ON	9.9

CONDUCTED EMISSION

EUT Information

EUT:	C20220323
Operating mode:	Uin: 240 V / 50 Hz
Lines:	MAINS



Preview Result 2-AVG
Critical_Freqs PK+
Final_Result QPK
Preview Result 1-PK+
ClassB QP
Final_Result CAV
Critical_Freqs AVG
ClassB AV

Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.438000	---	39.92	47.10	7.18	1000.0	9.000	L1	ON	10.1
15.607500	---	39.99	50.00	10.01	1000.0	9.000	N	ON	9.9
15.420750	---	39.84	50.00	10.16	1000.0	9.000	N	ON	9.9
15.544500	---	39.69	50.00	10.31	1000.0	9.000	N	ON	9.9
16.611000	---	38.63	50.00	11.37	1000.0	9.000	N	ON	9.9
17.864250	---	38.23	50.00	11.77	1000.0	9.000	N	ON	9.9
0.627000	---	33.00	46.00	13.00	1000.0	9.000	N	ON	10.0
0.438000	43.76	---	57.10	13.34	1000.0	9.000	L1	ON	10.1
19.873500	---	34.33	50.00	15.67	1000.0	9.000	L1	ON	9.9

Figure 1: Conducted emission test

3.2 Radiated emission measurement

3.2.1 Limits of radiated emission measurement

Frequency (MHz)	Class A (at 3 m) (dBμV/m)	
30 – 230	50	Quasi Peak
230 – 1000	57	
1000 – 3000	56	AV
3000 – 6000	60	
1000 – 3000	76	Peak
3000 – 6000	80	

NOTE: • The lower limit shall apply at the transition frequencies.
• Emission level (dBμV/m) = 20 log Emission level (μV/m).

3.2.2 Test procedure

1. The EUT was set 3 m away from the interference-receiving antenna, which was mounted on the top of variable-height antenna tower.

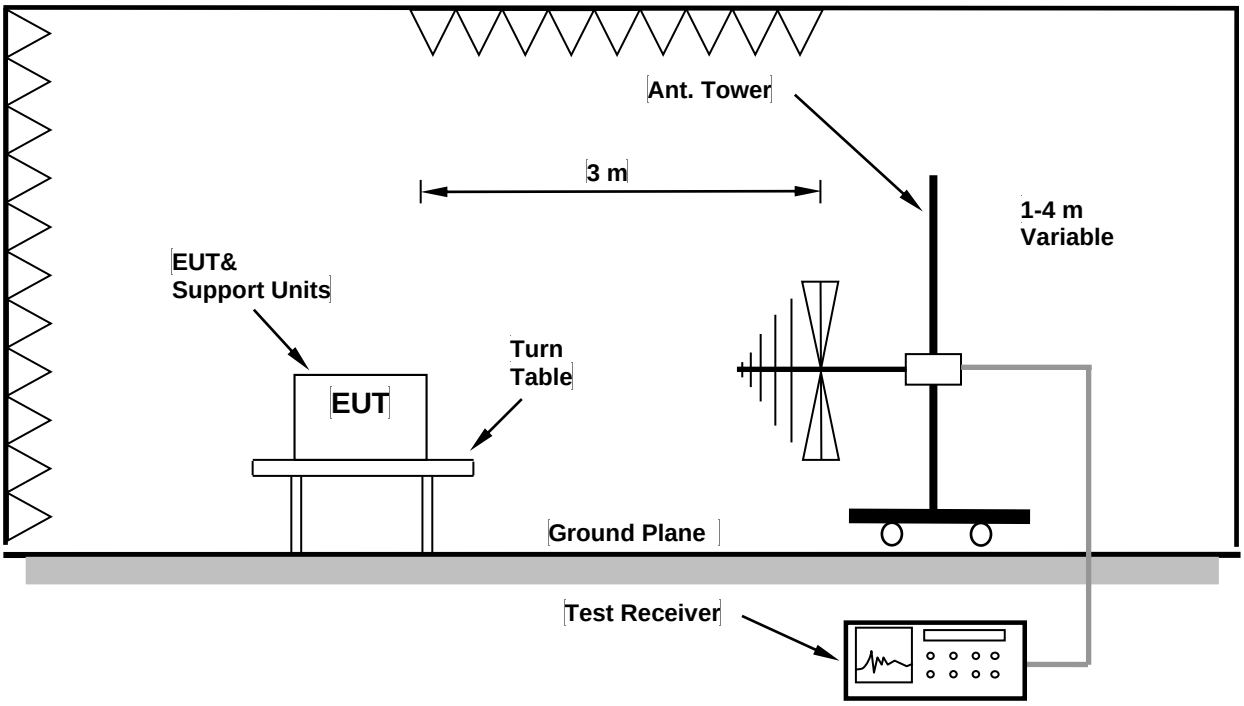
2. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

3. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.

4. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

5. The highest points would be re-tested one by one using the quasi-peak method.

3.2.3 Test setup



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

3.2.4 Test result

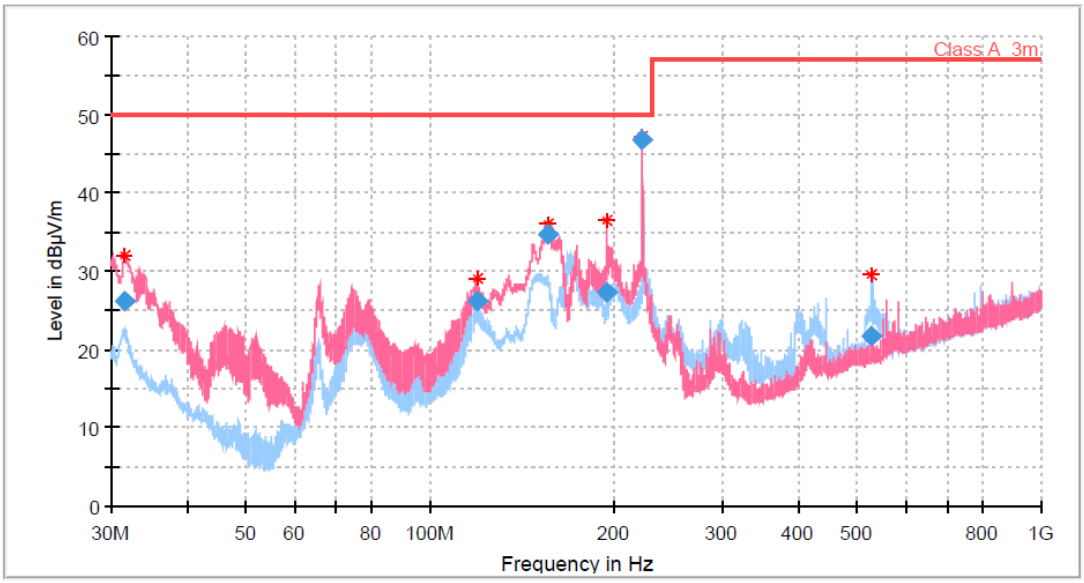
Operating modes:	**1**

Radiated emission

EUT Information

EUT:	C20220323
Test condition:	Uin: 100 V / 60 Hz;

Full Spectrum



Final Result

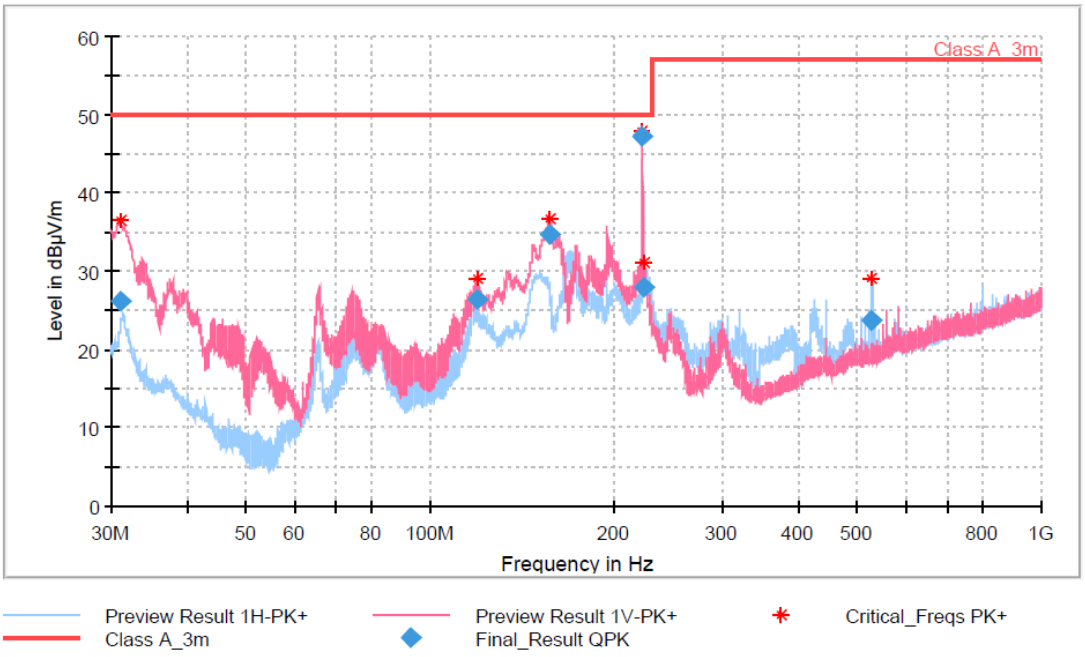
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
222.510000	46.71	50.00	3.29	5000.0	120.000	100.0	V	352.0
156.120000	34.65	50.00	15.35	5000.0	120.000	100.0	V	73.0
194.670000	27.27	50.00	22.73	5000.0	120.000	100.0	V	190.0
31.620000	26.25	50.00	23.75	5000.0	120.000	100.0	V	262.0
119.130000	26.19	50.00	23.81	5000.0	120.000	100.0	V	273.0
528.000000	21.71	57.00	35.29	5000.0	120.000	100.0	H	0.0

Radiated emission

EUT Information

EUT:	C20220323
Test condition:	Uin: 240 V / 50 Hz;

Full Spectrum



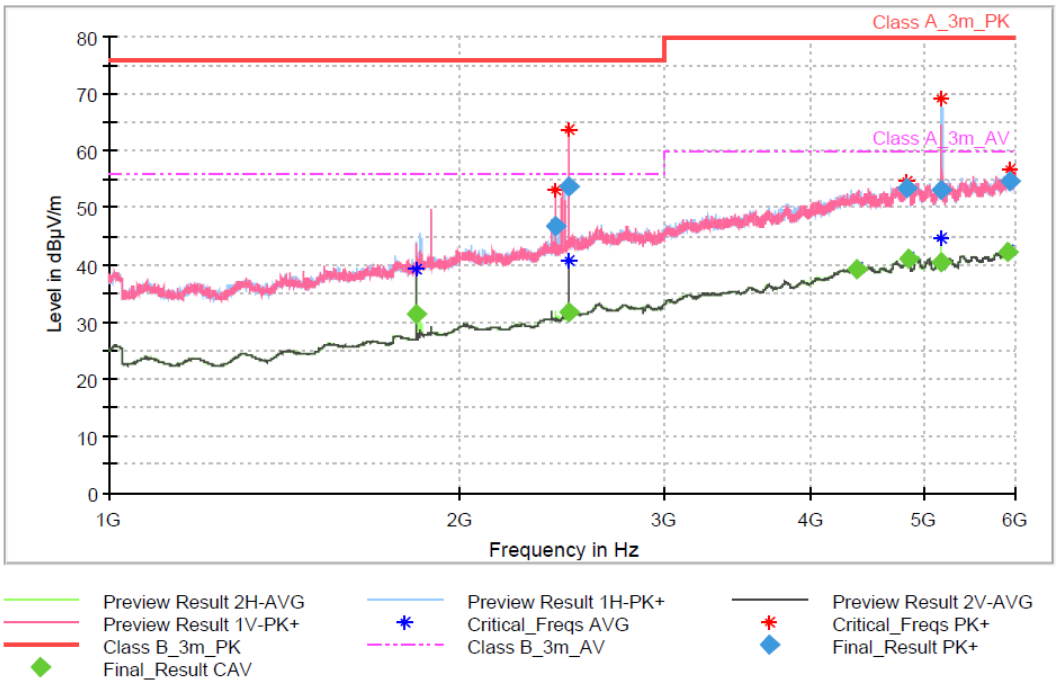
Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
222.510000	47.15	50.00	2.85	5000.0	120.000	100.0	V	344.0
156.870000	34.76	50.00	15.24	5000.0	120.000	100.0	V	62.0
224.160000	28.02	50.00	21.98	5000.0	120.000	100.0	V	344.0
119.130000	26.49	50.00	23.51	5000.0	120.000	100.0	V	284.0
31.110000	26.16	50.00	23.84	5000.0	120.000	100.0	V	296.0
528.000000	23.80	57.00	33.20	5000.0	120.000	100.0	H	325.0

EUT Information

EUT: C20220323
Test condition: Uin: 240 V / 50 Hz;

Full Spectrum



Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
5914.250000	---	42.22	60.00	17.78	100.0	V	359.0
4855.000000	---	41.01	60.00	18.99	100.0	H	0.0
5185.250000	---	40.35	60.00	19.65	100.0	H	0.0
4380.250000	---	39.15	60.00	20.85	100.0	H	0.0
2479.750000	53.70	---	76.00	22.30	100.0	V	0.0
2480.000000	---	31.56	56.00	24.44	100.0	V	0.0
1836.000000	---	31.27	56.00	24.73	100.0	H	0.0
5942.500000	54.79	---	80.00	25.21	100.0	H	55.0
4842.500000	53.34	---	80.00	26.66	100.0	H	78.0
5186.000000	53.02	---	80.00	26.98	100.0	H	0.0
2418.000000	46.67	---	76.00	29.33	100.0	V	359.0

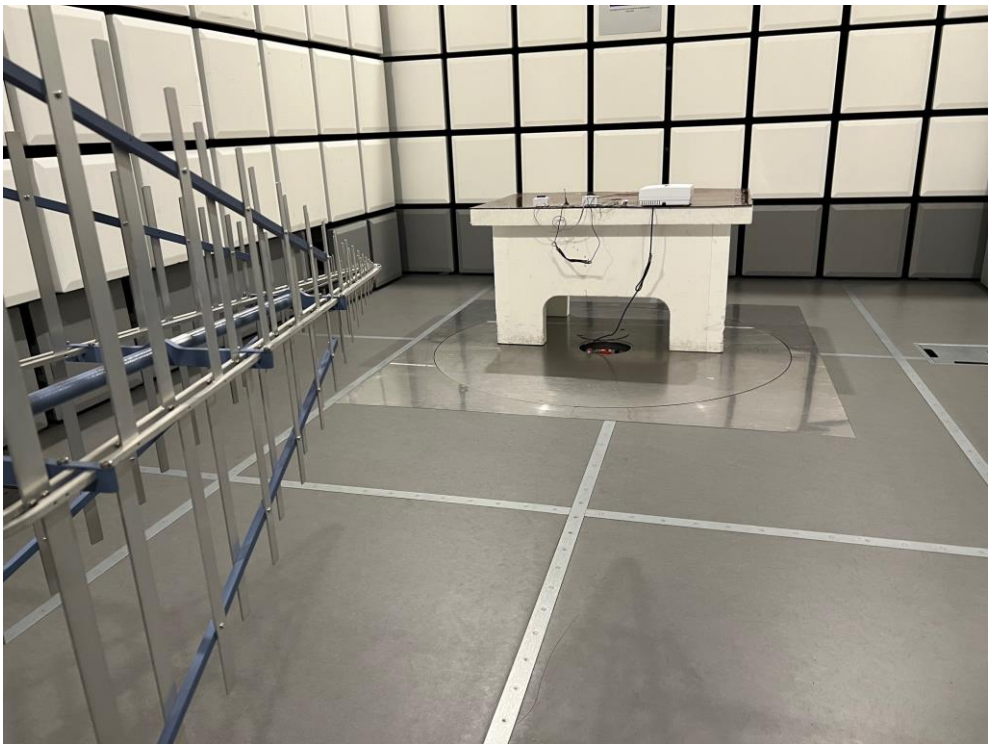


Figure 2: Radiated emission test

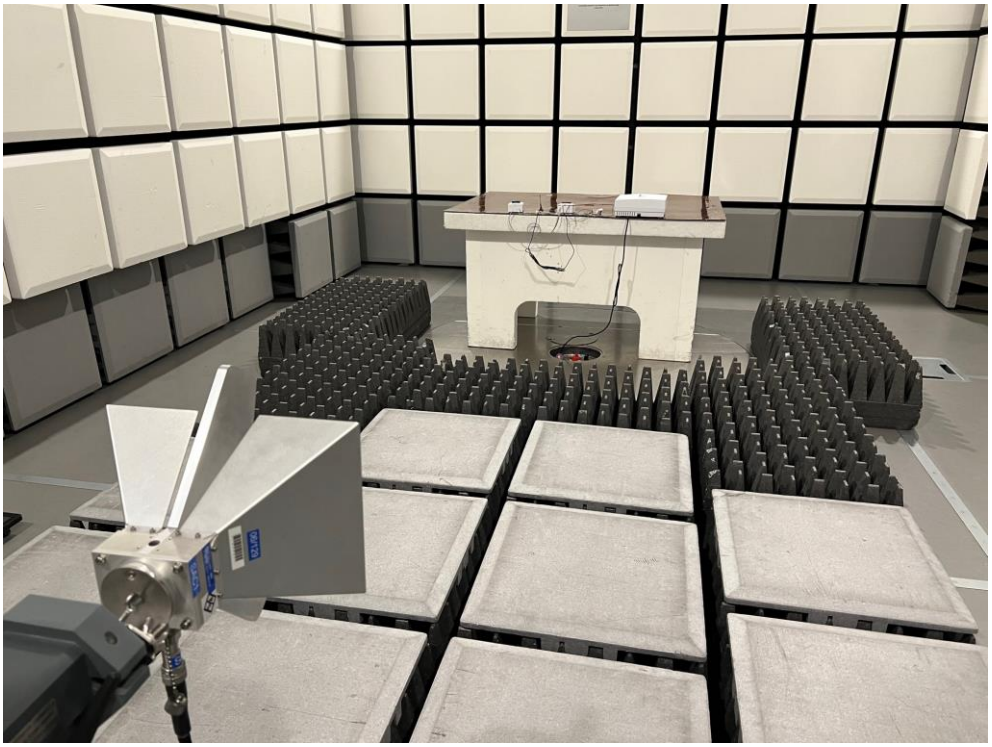


Figure 3: Radiated emission test

3.3 Harmonics current emission measurement

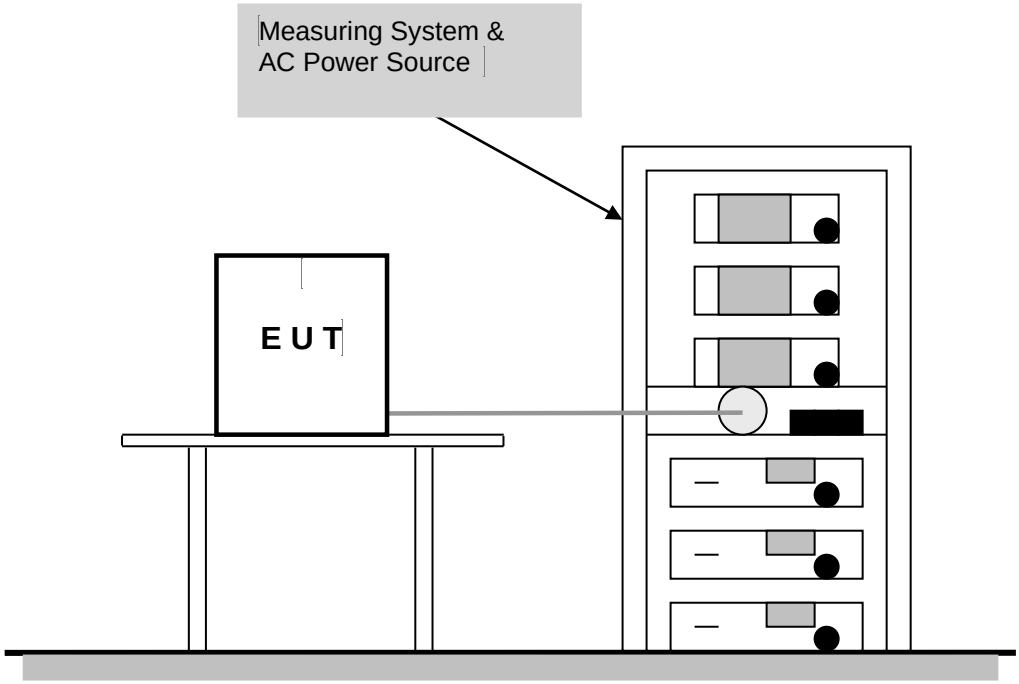
3.3.1 Configuration

1. The EUT was placed on the top of a wooden table/support 0.8 (or 0.1m for floor-standing equipment) meters above the ground and operated to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn.

2. The correspondent test program of test instrument to measure the current harmonics emanated from EUT is chosen. The measure time shall be not less than the time necessary for the EUT to be exercised.

3. Harmonic currents less than 0,6% of the input current measured under the test conditions, or less than 5 mA, whichever is greater, are disregarded

3.3.2 Test setup



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

3.3.3 Test results

Test is not applicable due to less than 75 W power consumption.

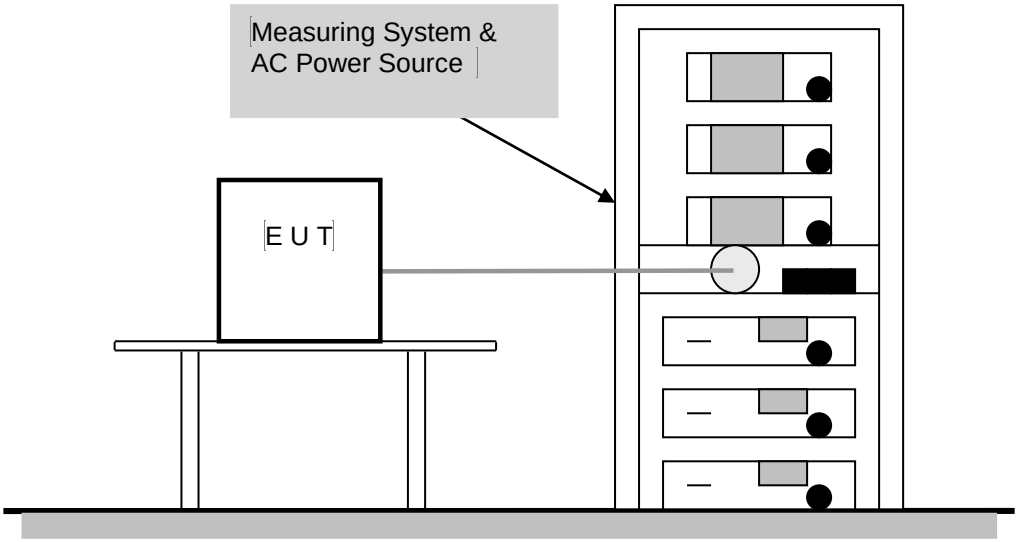
3.4 Voltage fluctuation measurement

3.4.1 Configuration

1. The EUT was placed on the top of a wooden table/support 0.8 (or 0.1m for floor-standing equipment) meters above the ground and operated to produce the **most unfavourable sequence of voltage changes under normal operating** conditions.

2. During the flick measurement, the measure time shall include that part of whole operating cycle in which the EUT produce the most unfavourable sequence of voltage changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours.

3.4.2 Test setup



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

3.4.3 Test results

Test parameter	Limit	Note
P_{st}	1.0	PASS
P_{lt}	0.65	PASS
Dt (ms)	500	PASS
D_{max} (%)	4	PASS
dc (%)	3.3	PASS

NOTE:
- P_{st} means short-term flicker indicator.
- P_{lt} means long-term flicker indicator.
- D_t means maximum time that dt exceeds 3.3 %.
- d_{max} means maximum relative voltage change.

Operating modes:	**1**

Test Report

Report Number :	C20221311
Test Standard :	IEC 61000-3-3 (Edition 3) Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection
Test Date :	3/18/2022 9:51:28 AM

Result

E.U.T. : Test passed

Flicker Results

Standard Specific Results for IEC 61000-3-3 (Edition 3)

Standard Group: Industry

Standard Name: IEC 61000-3-3 (Edition 3)
Limitation of voltage changes, voltage fluctuations and flicker
in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase
and not subject to conditional connection

Test Condition: General Test Conditions

Analysis Status: PASS

Flicker Measurements Settings	
Main Line:	230V, 50Hz
Flicker Meter:	230V / 50Hz
Flicker Impedance:	Zref
Observation Time:	1 × 10 min
Measurements:	1

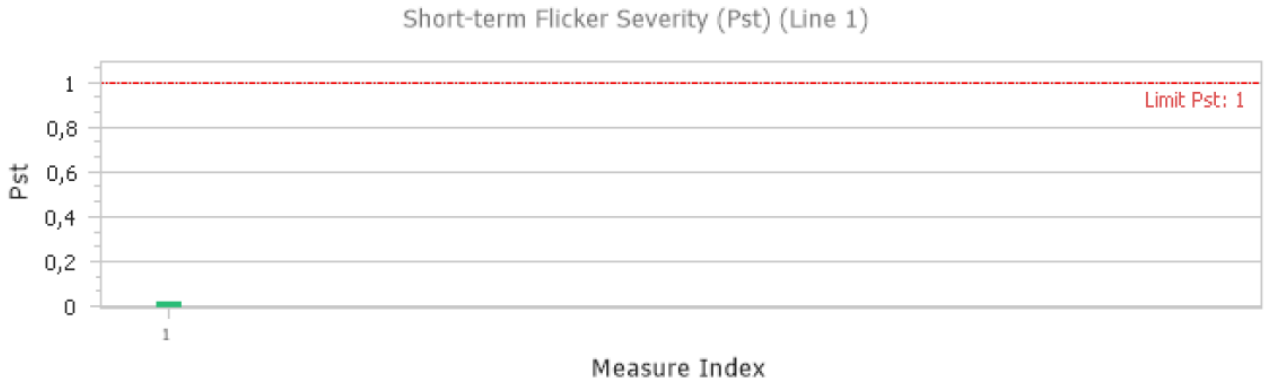
Flicker Measurements	P_{lt}	Max P_{st}	Max d_c	Max d_{max}	Max T_{max}
Line 1:	0,012	0,028	0	0,215	0
Limits:	0,65	1	3,3	4	0,5
Results:	PASS	PASS	PASS	PASS	PASS

Flicker Individual Measurements												
Measurement	P_{st} [ ]			d_c [%]			d_{max} [%]			T_{max} [s]		
	Value	Limit	Result	Value	Limit	Result	Value	Limit	Result	Value	Limit	Result
#1	0,03	1,00	PASS	0,00	3,30	PASS	0,21	4,00	PASS	0,00	0,50	PASS

Pst Data

Flicker (Line 1)

Meas. No.	P0,1	P1s	P3s	P10s	P50s	Pst	dc [%]	dmax [%]	Tmax [s]
1	0	0	0	0,001	0,005	0,028	0	0,215	0



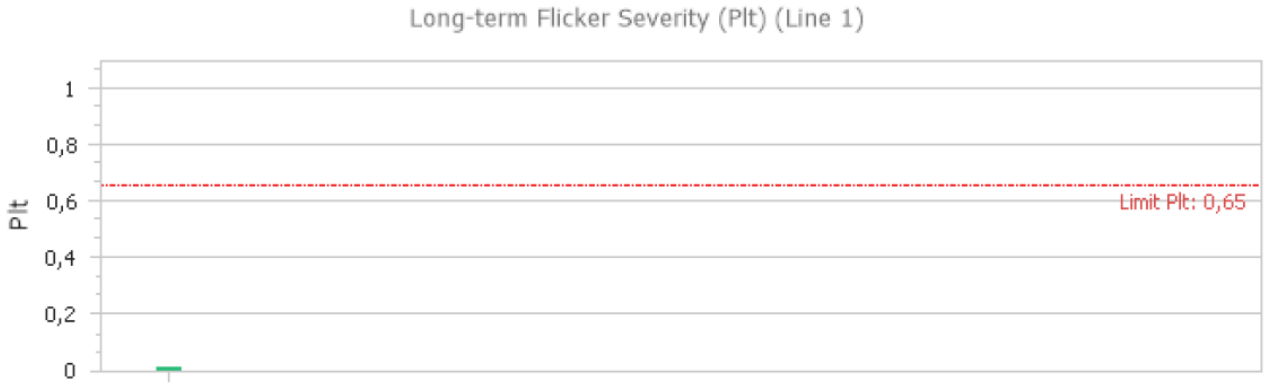


Figure 4: Harmonics current emission measurement and Voltage fluctuation measurement

4 IMMUNITY

4.1 Electrostatic discharges (ESD)

4.1.1 Test specification

Basic Standard:	IEC/EN 61000-4-2
Discharge Impedance:	330 Ω / 150 pF
Discharge Voltage:	Air Discharges – 8 kV (Direct) Contact Discharge- 4 kV (Indirect, Direct)
Polarity:	Positive / Negative
Number of Discharges:	Minimum 20 discharges (10 positive and 10 negative polarity)
Discharge Mode:	Single Discharge
Discharge Period:	1-second minimum

4.1.2 Test procedure

The discharges shall be applied in two ways:

1. Contact discharges to the conductive surfaces and coupling planes:

   The EUT shall be exposed to at least 20 discharges, 10 each at negative and positive polarity on each accessible metal part. If no direct contact points are available, then at least 20 indirect discharges shall be applied in the indirect mode. Test shall be performed at a maximum repetition rate of one discharge per second.

2. Air discharges at slots and apertures and insulating surfaces:

   On those parts of the EUT where it is not possible to perform contact discharge testing, the equipment should be investigated to identify user accessible points where breakdown may occur. Such points are tested using the air discharge method. This investigation should be restricted to those area normally handled by the user.

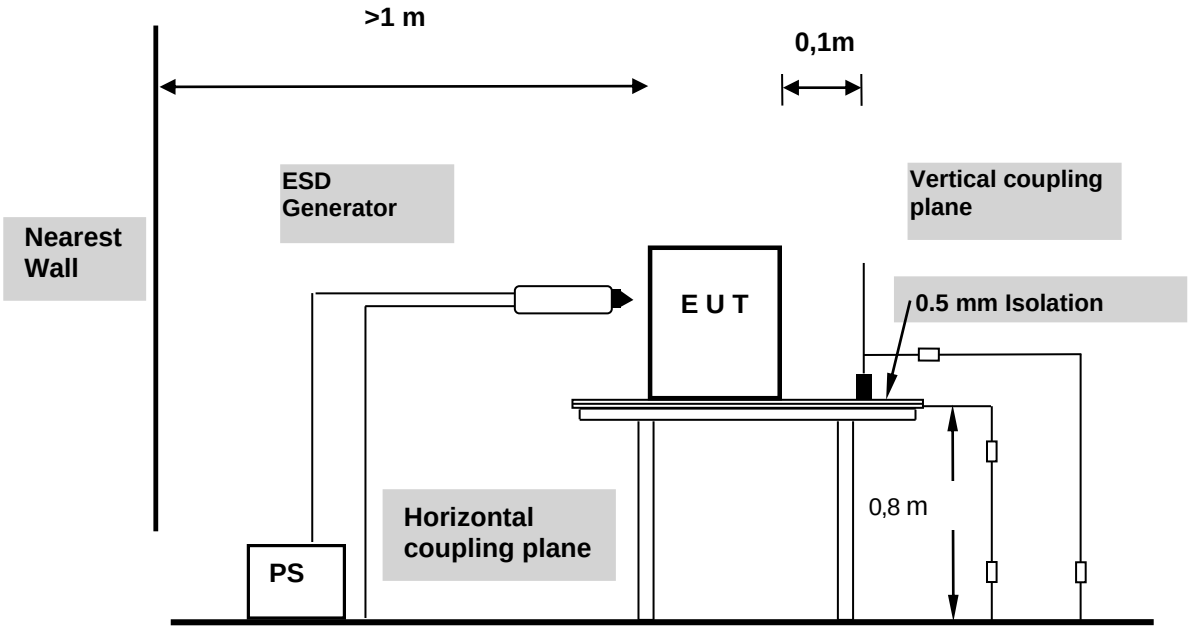
   For air discharge testing, the test starts with 2 kV and continues with value multiplied by 2 up to and including the specified test level.

The basic test procedure was in according with IEC/EN 61000-4-2:

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

8. At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the Vertical Coupling Plane in sufficiently different positions that the four faces of the EUT were completely illuminated. The Vertical Coupling Plane (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the EUT.

4.1.3 Test setup



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

The EUT shall be isolated from the ground reference plane by an insulating support of 0,05 m to 0,15 m thick. The EUT cables shall be isolated from the ground reference plane by an insulating support of (0 ,5 ± 0,05) mm. This cable isolation shall extend beyond the edge of the EUT isolation.

4.1.4 Test results

Operating mode:		**1**				
Discharge Level (kV)	**Polarity**	**Test Point**	**Contact Discharge**	**Air Discharge**	**Required criterion**	**Achieved criterion**
2	+ / -			X	B	A
4	+ / -			X	B	A
8	+ / -			X	B	A
4	+ / -		X		B	A
Changes in operation observed during testing: No changes observed. No changes observed.						

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

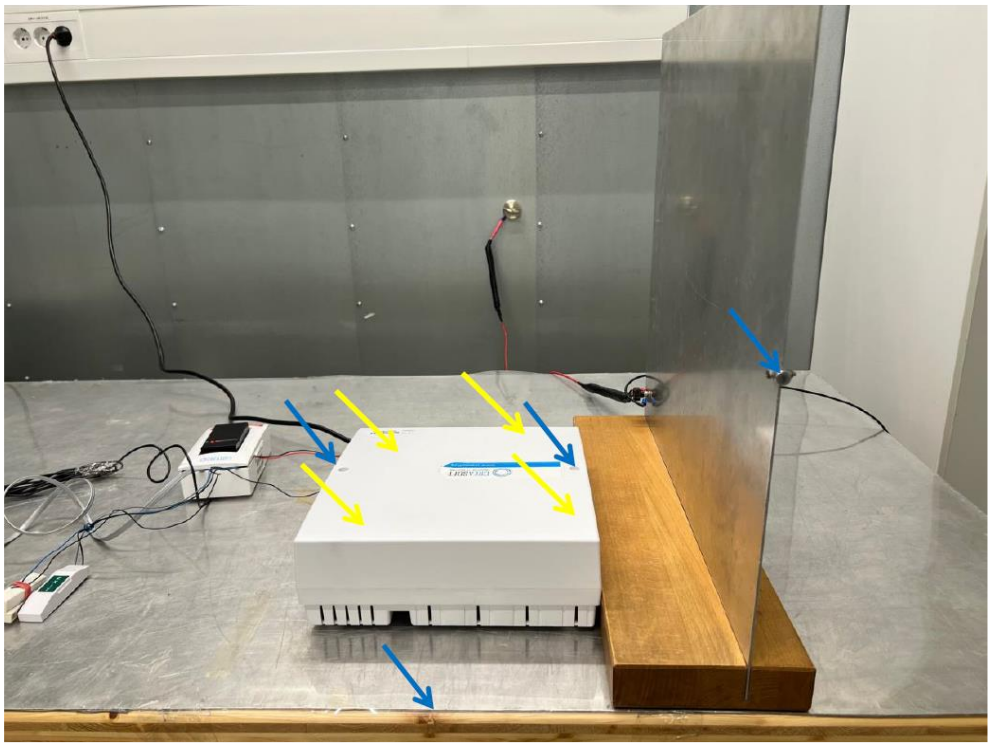


Figure 5: ESD

Figure 6: ESD

Figure 7: ESD

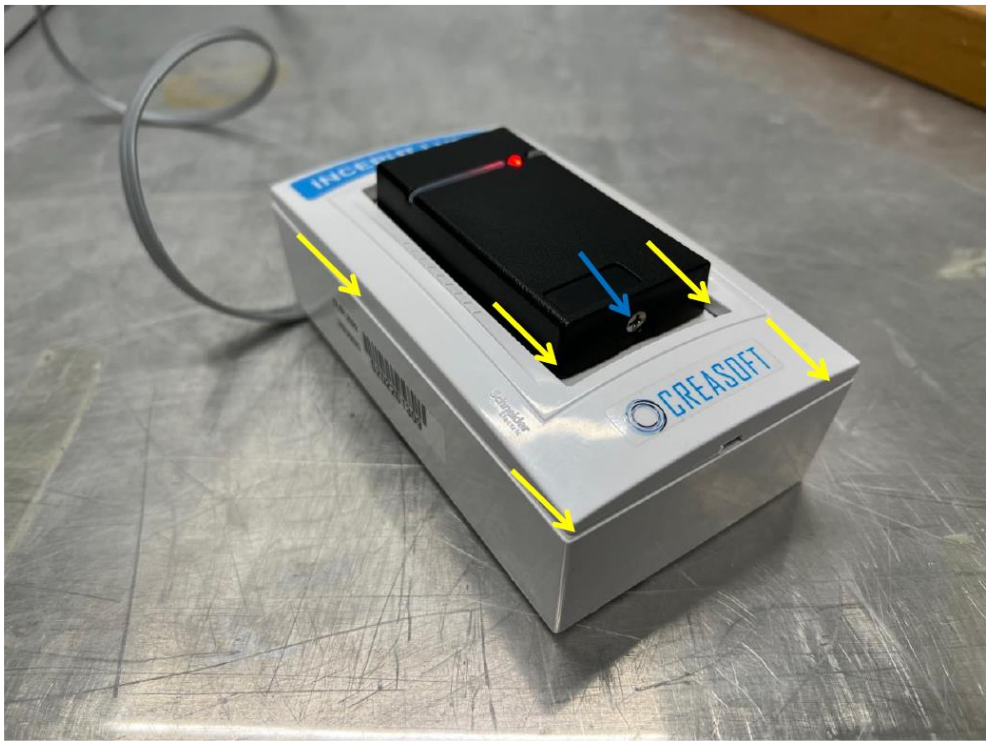


Figure 8: ESD

Figure 9: ESD

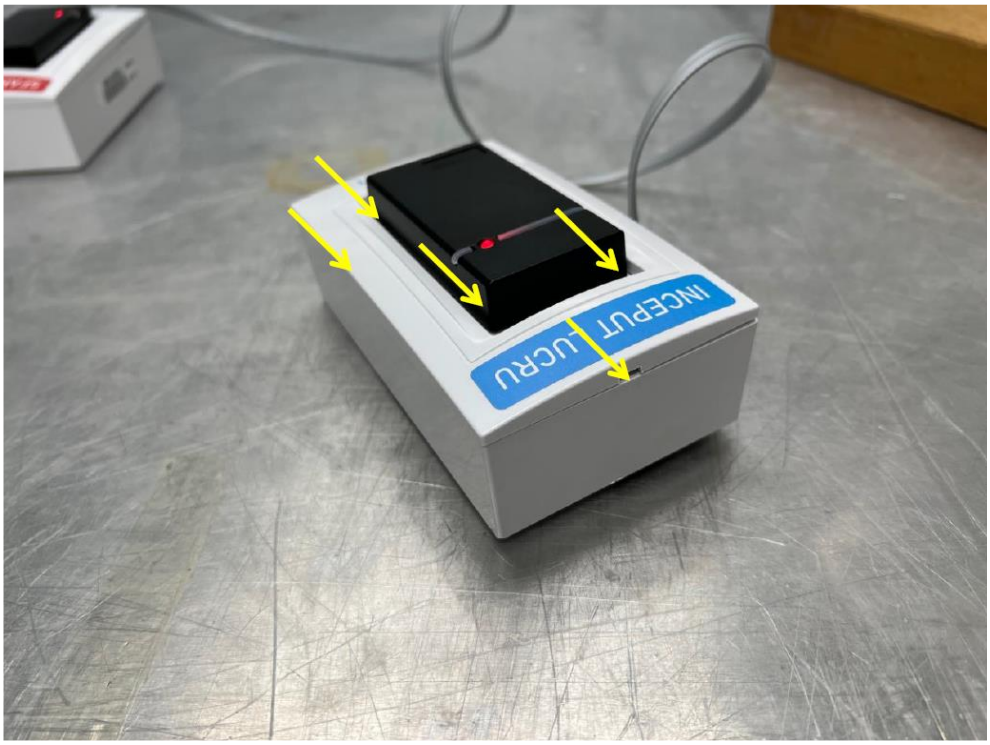


Figure 10: ESD

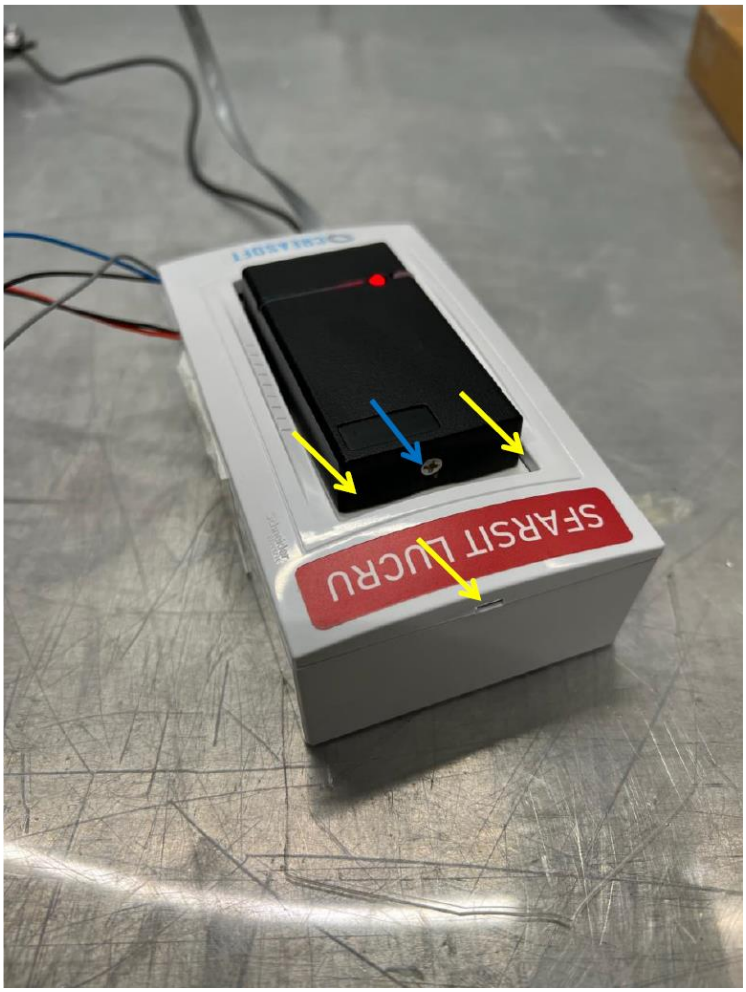


Figure 11: ESD

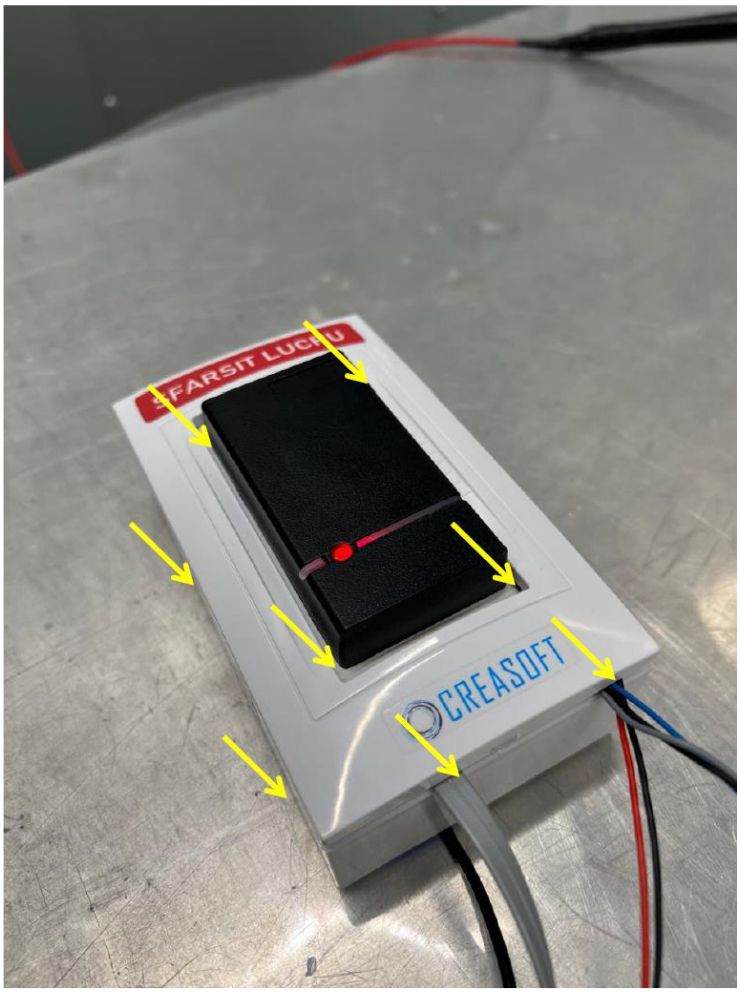


Figure 12: ESD

4.2 Continuous RF electromagnetic field disturbances

4.2.1 Test specification

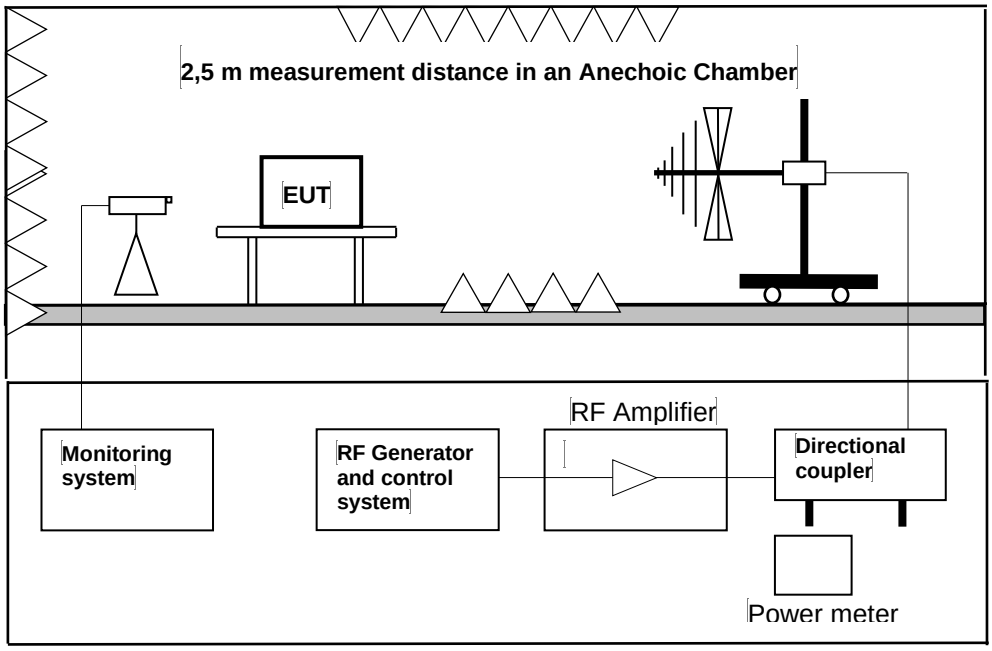
Basic Standard:	IEC/EN 61000-4-3
Frequency Range:	80 – 6000 MHz
Field Strength:	3 V/m
Modulation:	1 kHz Sine Wave, 80 %, AM Modulation
Polarity of Antenna:	Horizontal and Vertical
Illumination sides:	Front, Rear, Left and Right side
Test Distance:	2,5 m
Antenna Height:	1.55 m

4.2.2 Test procedure

The test procedure was in accordance with IEC/EN 61000-4-3

1. The testing was performed in an anechoic chamber. The transmit antenna was located at a distance of 2,5 meters from the EUT.
2. The frequency range is swept from 80 MHz to 6000 MHz, with the signal 80 % amplitude modulated with 1 kHz sine-wave. The rate of sweep did not exceed 1.5×10^{-3} decade/s. Where the frequency range is swept incrementally, the step size was 1% of fundamental.
3. The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
4. The field strength level was 3 V/m.
5. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

4.2.3 Test setup



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

The EUT installed in a representative system as described in IEC/EN 61000-4-3. The system under test was connected to the power and signal wire according to relevant installation instructions.

4.2.4 Test results

Operating mode:	**1**				
Frequency / MHz	**Level**	**Dwell time**	**Illuminated side**	**Required criterion**	**Achieved criterion**
80 - 6000	3 V/m	1 s	Front	A	A
			Rear		
			Left		
			Right		
Changes in operation observed during testing: no changes observed					

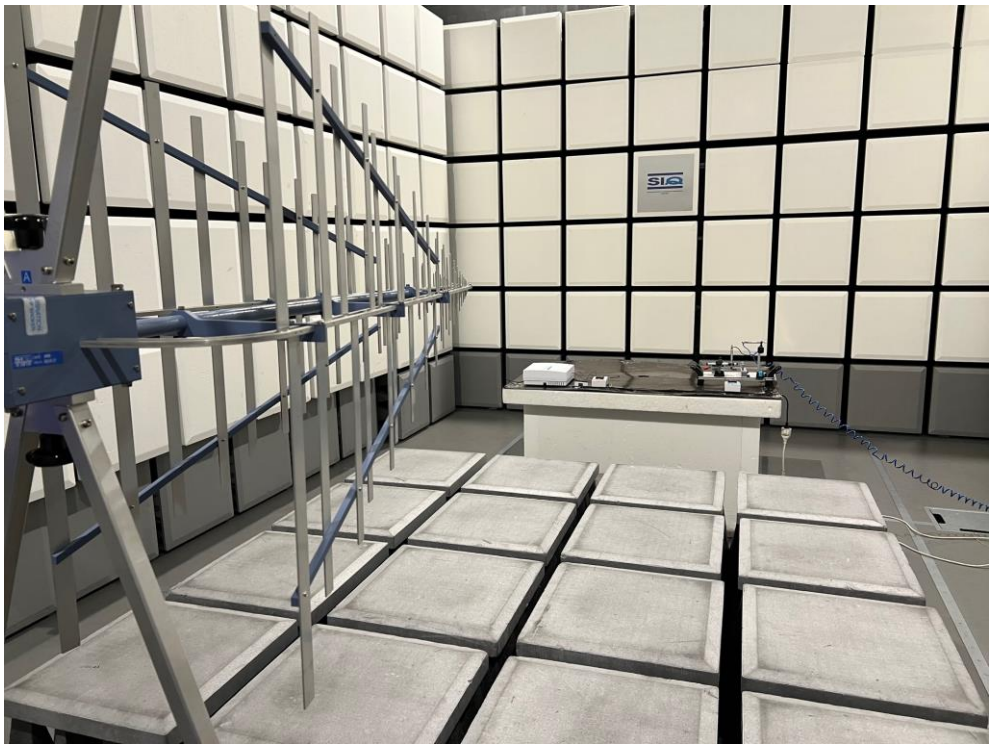


Figure 13: Continuous RF electromagnetic field disturbances

4.3 Electrical fast transients/burst

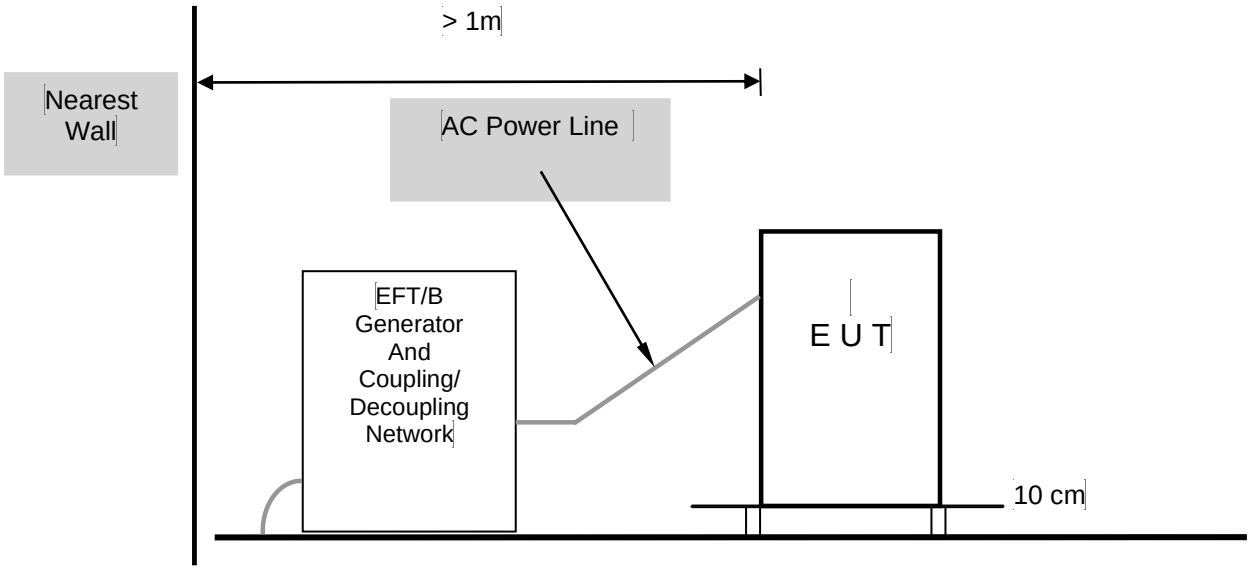
4.3.1 Test specification

Basic Standard:	IEC/EN 61000-4-4
Test Voltage:	AC power Line – 1 kV
Polarity:	Positive/Negative
Impulse Frequency:	5 kHz
Impulse Waveshape:	5/50 ns
Burst Duration:	15 ms
Burst Period:	300 ms
Test Duration:	not less than 1 min.

4.3.2 Test procedure

1. The EUT was tested with 1000 volt discharges to the AC power input leads.
2. Both positive and negative polarity discharges were applied.
3. The cable length between the EUT and the coupling device shall be as intended for installation.
4. The duration time of each test sequential was 1 minute.
5. The transient/burst waveform was in accordance with IEC/EN 61000-4-4, 5/50 ns.

4.3.3 Test setup



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

The EUT installed in a representative system as described in of IEC/EN 61000-4-4 and its cables were isolated from the Ground Reference Plane. The GRP consisted of a sheet of aluminum (at least 0.25mm thick and 2.5 m square) connected to the protective grounding system.

4.3.4 Test results

Operating mode:		1			
Test Point		Polarity	Test Level (kV)	Required criterion	Achieved criterion
1)	AC port L+N+PE	+/-	1	B	A
Changes in operation observed during testing: 1) no changes observed					

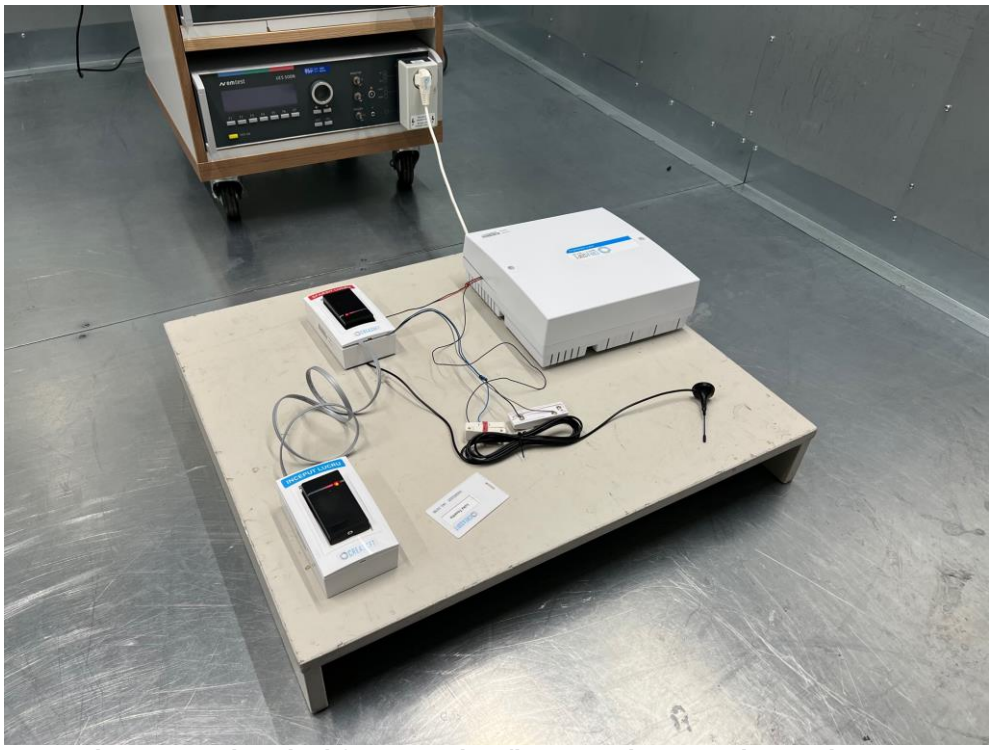


Figure 14: Electrical fast transient/burst and Surges immunity test

4.4 Surges

4.4.1 Test specification

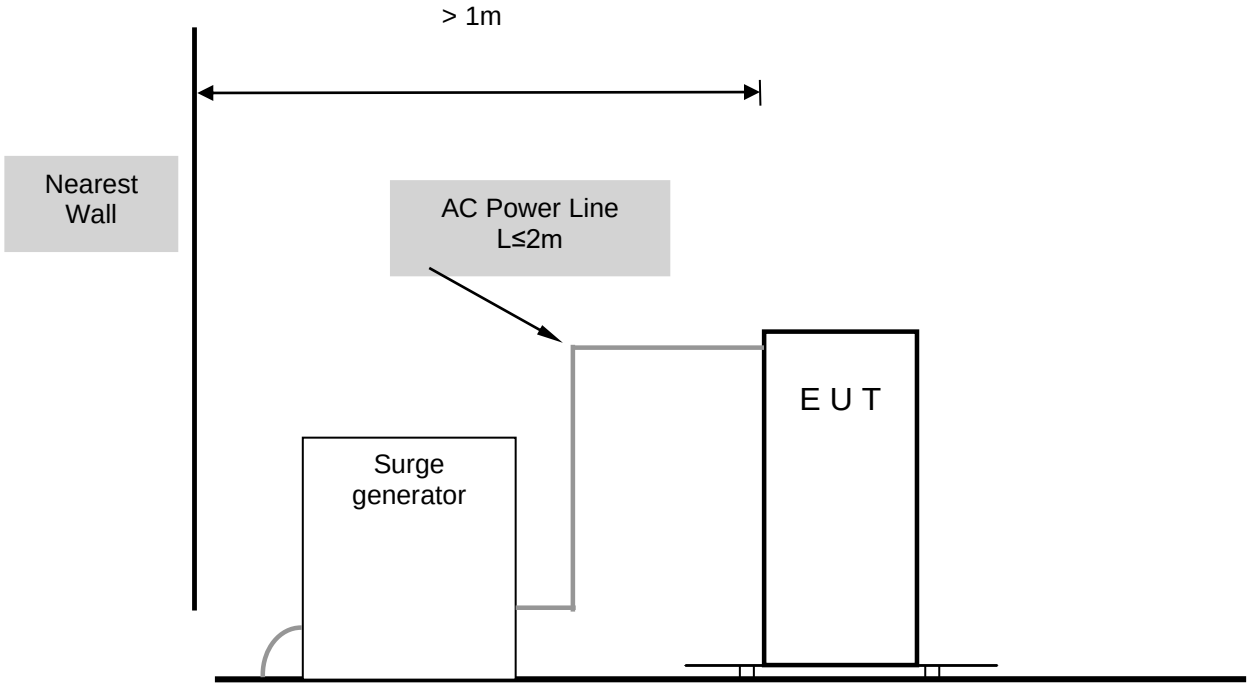
Basic Standard:	IEC/EN 61000-4-5
Wave-Shape:	Combination Wave
Test Voltage:	±2 kV unsymmetrical – Common mode, ±1 kV symmetrical – Differential mode, 1.2/50 us Open Circuit Voltage
Generator Source:	2 ohm between networks 12 ohm between network and ground
Polarity:	Positive/Negative
Phase Angle:	90 ° / 270 °
Pulse Repetition rate:	10 s – 60 s
Number of Tests:	5 positive and 5 negative at selected points

4.4.2 Test procedure

1. For EUT power supply:

   The surge is to be applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave. The power cord between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter).
   The test shall be started with low voltage 0,5 kV and continued with level, which is higher for 0,5 kV.

4.4.3 Test setup



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

4.4.4 Test results

Operating mode:		1				
Test Point		Polarity	Angle (^{0})	Test Level (kV)	Required criterion	Achieved criterion
1)	L -N	+	90	1	B	A
2)	L -N	-	270	1	B	A
3)	L -PE	+	90	2	B	A
4)	L -PE	-	270	2	B	A
5)	N -PE	-	90	2	B	A
6)	N -PE	+	270	2	B	A

Changes in operation observed during testing:
1) no changes observed
2) no changes observed
3) no changes observed
4) no changes observed
5) no changes observed
6) no changes observed

4.5 Continuous induced RF disturbances

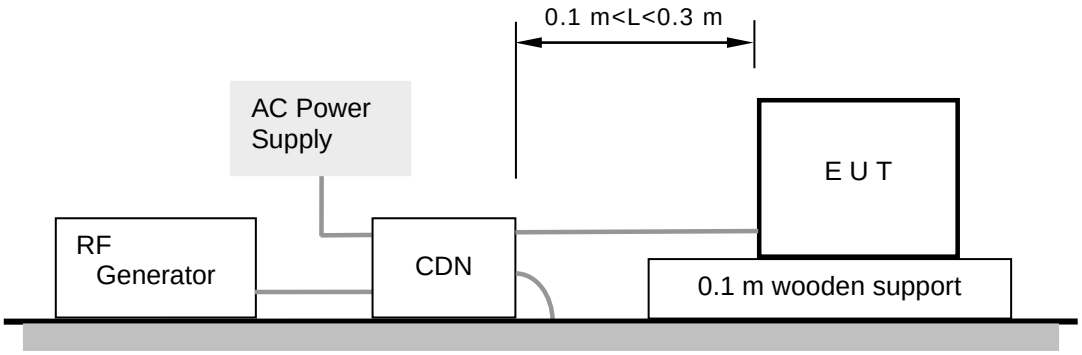
4.5.1 Test specification

Basic Standard:	IEC/EN 61000-4-6
Frequency Range:	0.15 MHz –10 MHz
Field Strength:	3 V rms
Frequency Range:	10 MHz –30 MHz
Field Strength:	3 V rms – 1 V rms
Frequency Range:	30 MHz –80 MHz
Field Strength:	1 V rms
Modulation:	1 kHz Sine Wave, 80 %, AM Modulation
Frequency Step:	1 % of fundamental
Coupled Cable:	Power Mains

4.5.2 Test procedure

1. The EUT shall be tested within its intended operating and climatic conditions.
2. The test shall be performed with the test generator connected to each of the coupling and decoupling devices in turn, while the other non-excited RF input ports of the coupling devices are terminated by a 50 Ω load resistor.
3. The frequency range is swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80 % amplitude. The signal is modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. The sweep rate shall not exceed 1.5×10^{-3} decades/s. The step size shall not exceed 1 % of the start and thereafter 1 % of the preceding frequency value where the frequency is swept incrementally.
4. The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised, and able to respond. Sensitive frequencies such as clock frequency(ies) and harmonics or frequencies of dominant interest, shall be analyzed separately.
5. Attempts should be made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility.

4.5.3 Test setup



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

The equipment to be tested is placed on an insulating support on a ground reference plane. All relevant cables shall be provided with the appropriate coupling and decoupling devices at a distance between 0.1 meters and 0.3 meters from the projected geometry of the EUT on the ground reference plane.

4.5.4 Test results

Operating mode:		**1**						
Frequency	**Level**	**Modulation**	**Test point**	**CDN type**	**Terminated CDN**	**Dwell time**	**Required criterion**	**Achieved criterion**
150 kHz – 10 MHz	3 V	80%	AC	M3	/	0,5 s	A	A
10 MHz – 30 MHz	3 V – 1 V	80%	AC	M3	/	0,5 s	A	A
30 MHz – 80 MHz	1 V	80%	AC	M3	/	0,5 s	A	A
Changes in operation observed during testing: No change observed								

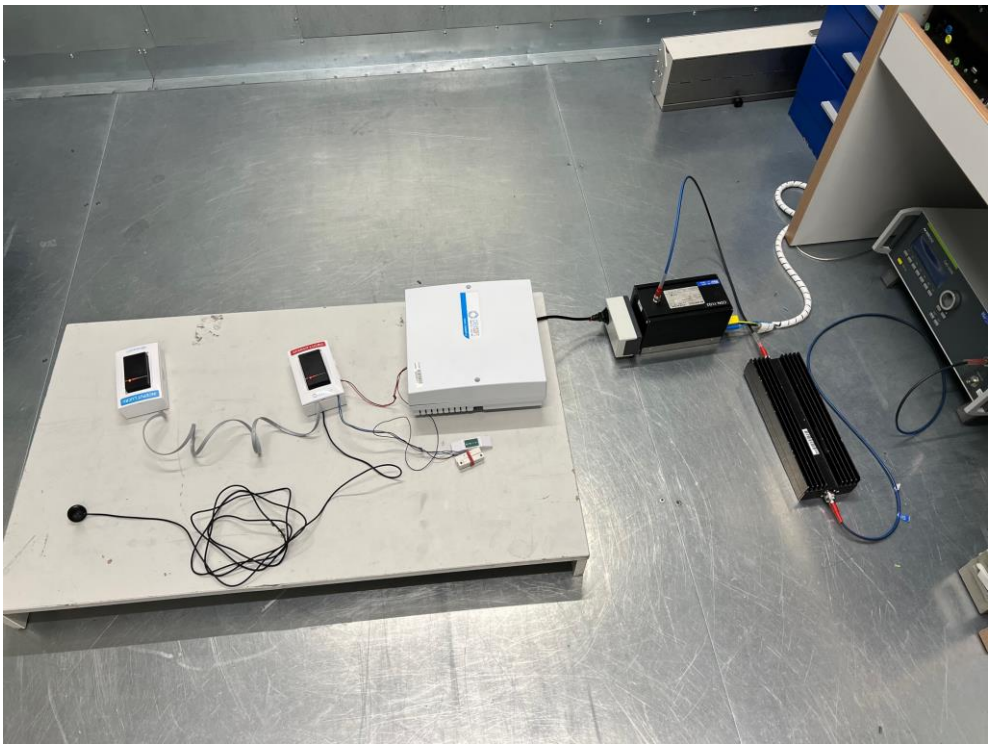


Figure 15: Continuous induced RF disturbances

4.6 Power frequency magnetic field

4.6.1 Test specification

Basic Standard:	IEC/EN 61000-4-8
Frequency Range:	50, 60 Hz
Field Strength:	1 A/m

4.6.2 Test procedure

The test procedure was in accordance with IEC/EN 61000-4-8

The EUT was tested with magnetic field antenna

The frequency was set to 50, 60 Hz

The field strength level was 1 A/m

The test was performed with the EUT exposed to all three directions (X, Y, Z).

4.6.3 Test setup

The EUT installed in a representative system as described in section 7 IEC/EN 61000-4-8 was placed on non-conductive table 0.1 (floor equipment) or 0.8 (table-top equipment) meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

4.6.4 Test results

The test is not applicable due to EUT not containing any parts susceptible to magnetic fields.

4.7 Voltage dips and short interruptions

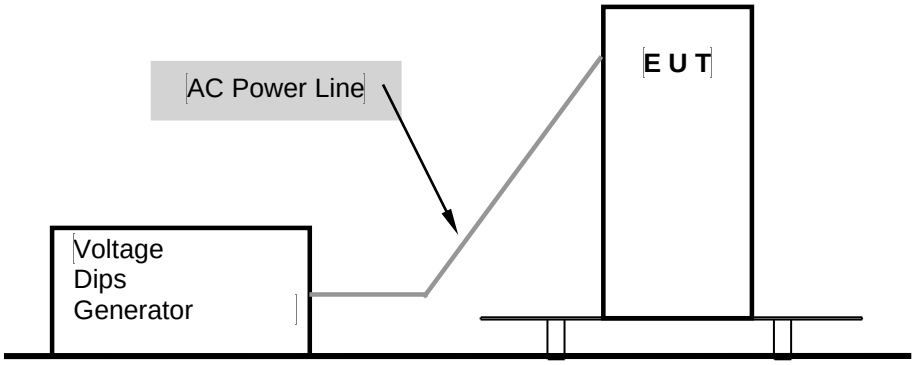
4.7.1 Test specification

Basic Standard:	IEC/EN 61000-4-11
Test Duration Time:	Minimum three test events in sequence
Interval between Event:	Minimum ten seconds
Phase Angle:	0 °
Test Cycle:	3 times

4.7.2 Test procedure

The EUT shall be tested for each selected combination of test levels and duration with a sequence of tree dips/interruptions with intervals of 10s minimum (between each test event). Each representative mode of operation shall be tested. Abrupt changes in supply voltage shall occur at zero crossings of the voltage waveform.

4.7.3 Test setup



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

4.7.4 Test result

Operating mode:		**1**			
Phenomena		**Test level (dip)**	**Duration (in periods)**	**Required criterion**	**Achieved criterion**
1)	Voltage dips	>95%	0,5	B	A
2)	Voltage dips	30%	25	C	A
3)	Voltage dips	>95%	250	C	A
Changes in operation observed during testing: 1) No changes observed. 2) No changes observed. 3) No changes observed.					

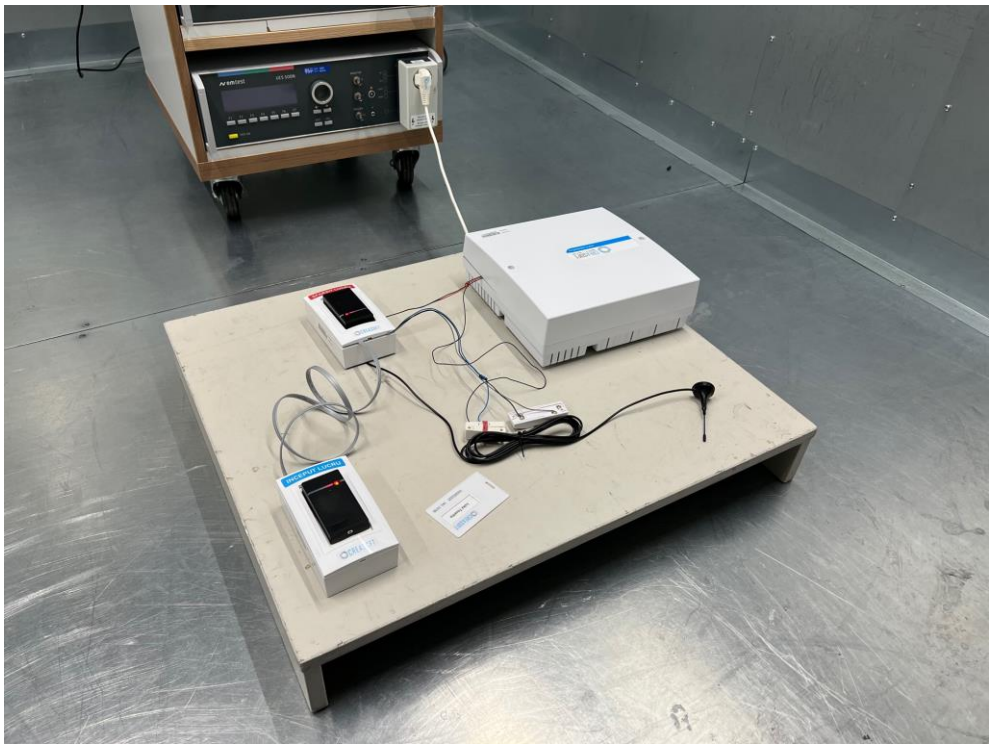


Figure 16: Voltage dips and short interruptions

5 USED TEST EQUIPMENT

3.1 Conducted emission measurement

Manufacturer & Description	Model No.	SIQ No.	Used	Calibrated until
Rohde & Schwarz, RFI receiver	ESU8	105187	X	2022-07
Rohde & Schwarz, RFI receiver	ESU26	106897	/	2023-07
Rohde & Schwarz, Artificial main network	ESH 2-Z5	106899	/	2023-02
Rohde & Schwarz, Artificial main network	ENV216	106765	/	2022-09
Rohde & Schwarz, Artificial main network	ENV216	109818	X	2023-02

3.2 Radiated emission measurement

Manufacturer & Description	Model No.	SIQ No.	Used	Calibrated until
Rohde & Schwarz, EMI test receiver	ESW	/	X	2023-11
Rohde & Schwarz, RFI test receiver	ESU8	105187	/	2022-07
Rohde & Schwarz, RFI receiver	ESU26	106897	/	2022-06
Comtest Engineering, SAC 1	SAC 3m	NPS001	X	2025-04
Rohde & Schwarz, Ultra Broadband Antenna	HL562E	/	X	2022-07
Rohde & Schwarz, Horn Antenna	HF907	/	X	2022-08
Maturo, Turn table (2 m diameter)	TT 2.0 SI	/	X	N/A
Maturo, Bore-sight antenna mast	BAM-4.0-P	/	X	N/A
Maturo, Multi-channel positioning equipment	Maturo NCD	/	X	N/A
Comtest Engineering, SAC 2	SAC 3m	NPS002	/	2025-04
Rohde & Schwarz, Ultra Broadband Antenna	HL562E	/	/	2022-07
Rohde & Schwarz, Horn Antenna	HF907	/	/	2022-08
Maturo, Turn table (2 m diameter)	TT 2.0 SI	/	/	N/A
Maturo, Bore-sight antenna mast	BAM-4.0-P	/	/	N/A
Maturo, Multi-channel positioning equipment	Maturo NCD	/	/	N/A

3.3 Harmonics current emission measurement

Manufacturer & Description	Model No.	SIQ No.	Used	Calibrated until
EM Test, 3-phase harmonics and flicker system	DPA 503N with AIF503	106895	/	2023-05
	NETWAVE20	106896		

3.4 Voltage fluctuation measurement

Manufacturer & Description	Model No.	SIQ No.	Used	Calibrated until
EM Test, 3-phase harmonics and flicker system	DPA 503N with AIF503	106895	X	2023-05
	NETWAVE20	106896		

4.1 Electrostatic discharge

Manufacturer & Description	Model No.	SIQ No.	Used	Calibrated until
EM TEST, Simulator ESD	ESD 30N	106894	X	2022-09
	P30N			

4.2 Continuous RF electromagnetic field disturbances

Manufacturer & Description	Model No.	SIQ No.	Used	Calibrated until
Comtest Engineering, SAC 1	SAC 3m	NPS001	X	2025-04
Rohde & Schwarz, Ultra Broadband Antenna	HL562E	/	X	N/A
Rohde & Schwarz, Horn Antenna	HF907	/	/	N/A
Rohde & Schwarz, RF and Microwave signal generator	SMB100A	/	X	2022-11
Rohde & Schwarz, Broadband amplifier	BBA150-BC1000	/	X	N/A
Rohde & Schwarz, Broadband amplifier	BBA150-D400E200	/	X	N/A
Maturo, Turn table (2 m diameter)	TT 2.0 SI	/	X	N/A
Maturo, Bore-sight antenna mast	BAM-4.0-P	/	X	N/A
Maturo, Multi-channel positioning equipment	Maturo NCD	/	X	N/A
Comtest Engineering, SAC 2	SAC 3m	NPS002	/	2023-12
Rohde & Schwarz, Ultra Broadband Antenna	HL562E	/	/	N/A
Rohde & Schwarz, Horn Antenna	HF907	/	/	N/A
Rohde & Schwarz, RF and Microwave signal generator	SMBV100A	/	/	2022-07
Rohde & Schwarz, Broadband amplifier	BBA150-BC250	/	/	N/A
Rohde & Schwarz, Broadband amplifier	BBA150-D110E100	/	/	N/A
Maturo, Turn table (2 m diameter)	TT 2.0 SI	/	/	N/A
Maturo, Bore-sight antenna mast	BAM-4.0-P	/	/	N/A
Maturo, Multi-channel positioning equipment	Maturo NCD	/	/	N/A

4.3 Electrical fast transients/burst

Manufacturer & Description	Model No.	SIQ No.	Used	Calibrated until
EM TEST, Ultra compact Simulator	UCS 500 N5	106887	X	2022-07
EM TEST, Ultra compact Simulator	UCS 500 N5	108360	/	2023-03
EM TEST, Capacitance coupling clamp	HFK	106889	/	2022-11

4.4 Surge

Manufacturer & Description	Model No.	SIQ No.	Used	Calibrated until
EM TEST, Ultra compact Simulator	UCS 500 N5	106887	X	2022-07
EM TEST, Ultra compact Simulator	UCS 500 N5	108360	/	2023-03
EM TEST, 3-phase coupling network	CNI 503 A2	106888	/	2023-01

4.5 Continuous induced RF disturbances

Manufacturer & Description	Model No.	SIQ No.	Used	Calibrated until
Robert Luthi, EM clamp	EM 101	/	/	With instrument
EM TEST, Conductive immunity system	CWS500N1.4	108175	X	2023-02
EM TEST, Coupling/decoupling device	CDN-M3N/32A	/	X	2022-12
EM TEST, Coupling/decoupling device	CDN-M2/32A	/	/	2022-12
EM TEST, Coupling/decoupling device	CDN-M5/16A	/	/	2022-12
EM TEST, Coupling/decoupling device	CDN-T8-RJ45	/	/	2022-12
EM TEST, Coupling/decoupling device	CDN-S8-RJ45	/	/	2022-12
EM TEST, Coupling/decoupling device	CDN-S4-USB	/	/	2022-12
EM TEST, Attenuator	ATT6/80	/	X	With instrument

4.6 Power frequency

Manufacturer & Description	Model No.	SIQ No.	Used	Calibrated until
EM TEST, Current transformer	MC 2630	106893	/	2023-08
EM TEST, Magnetic field coil	MS100N	106892	/	With instrument

4.7 Voltage dips and short interruptions

Manufacturer & Description	Model No.	SIQ No.	Used	Calibrated until
EM TEST, Ultra compact Simulator	UCS 500 N5	106887	X	2022-07
EM TEST, Ultra compact Simulator	UCS 500 N5	108360	/	2023-03
EM TEST, Motorized variac	MV2616	106891	X	N/A
EM TEST, Single phase tapped transformer	V 4780	108361	/	N/A