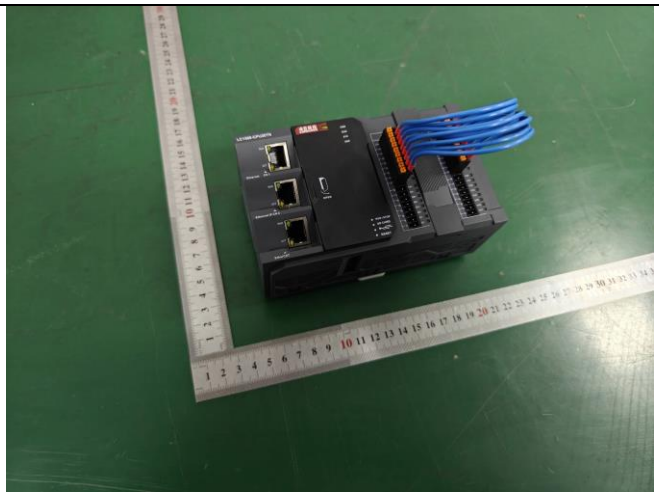
Prüfbericht-Nr.: *Test report no.*:	**CN25O28M 001**	**Auftrags-Nr.:** *Order no.*:	180326281	Seite 1 von 36 *Page 1 of 36*
Kunden-Referenz-Nr.: *Client reference no.*:	N/A	**Auftragsdatum:** *Order date:*	2025.03.10	
Auftraggeber: *Client*:	Suzhou Lingchen Acquistion Computer Co., Ltd No.55 Juhua Road, WangTing Town, Xiangcheng District, Suzhou City 215000 Jiangsu P.R. China			
Prüfgegenstand: *Test item*:	Programmable Logic Controller			
Bezeichnung / Typ-Nr.: *Identification / Type no.*:	LC1504—CPU20TN, LC1508—CPU20TN, LC1516—CPU20TN, LC1532—CPU20TN			
Auftrags-Inhalt: *Order content*:	TÜV Rheinland – EMC Service			
Prüfgrundlage: *Test specification*:	**EN 61131-2:2007** **IEC 61131-2:2017**			

Wareneingangsdatum: *Date of sample receipt*:	2025.03.10
Prüfmuster-Nr.: *Test sample no:*	A003965563-002
Prüfzeitraum: *Testing period*:	2025.03.11-2025.03.12
Ort der Prüfung: *Place of testing*:	Refer to section 1.1
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland / CCIC (Ningbo) Co., Ltd.
Prüfergebnis*: *Test result**:	Pass



geprüft von: *tested by*:	Chonghai Liang	**genehmigt von:** *authorized by*:	Keda Zhou
Datum: *Date:* 2025.04.23		**Ausstellungsdatum:** *Issue date:* 2025.04.23	
Stellung / *Position*:	Chonghai Liang/PE	**Stellung** / *Position*:	Keda Zhou/Authorizer

Sonstiges / *Other*: Refer to page 7 for further information.

Zustand des Prüfgegenstandes bei Anlieferung: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: *Test item complete and undamaged*

* Legende:	P(ass) = entspricht o.g. Prüfgrundlage(n)	F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
* *Legend:*	*P(ass) = passed a.m. test specification(s)*	*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

Prüfbericht - Nr.: CN25O28M 001

Test Report No.:

Anmerkungen
Remarks

1	Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben. Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden. *The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system.* *Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.*
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3	Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt. *Test clauses with remark of * are subcontracted to qualified subcontractors and descripted under the respective test clause in the report. Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.*
4	Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnisen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. Zu weiteren Informationen bezueglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019. *The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the “Zero Guard Band Rule” and “Simple Acceptance” in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report. For additional information to the resulting risk based of this decision rule please refer to ILAC G8:2019.*

Test Summary

5.1.1 CONDUCTED EMISSIONS ON DC POWER PORT
Result:
Pass
5.1.2 CONDUCTED EMISSIONS ON WIRED NETWORK PORT
Result:
Pass
5.2.1 RADIATED DISTURBANCE
Result:
Pass
6.1.1 ELECTROSTATIC DISCHARGE
Result:
Pass
6.1.2 RADIO FREQUENCY ELECTROMAGNETIC FIELD
Result:
Pass
6.1.3 POWER FREQUENCY MAGNETIC FIELDS
Result:
Pass
6.2.1 FAST TRANSIENTS
Result:
Pass
6.2.2 CONTINUOUS INDUCED RF DISTURBANCES
Result:
Pass
6.2.3 SURGES
Result:
Pass

Contents

1 Test Sites

1.1 Test Facilities

Laboratory: Suzhou SZQ Testing Co., Ltd.

Building 1, No.3-2, Dongwu South Road, Wuzhong Economic Developmen Suzhou Jiangsu P.R. China

The used test equipment is in accordance with CISPR 16-1 series standards for measurement of radio interference.

All the EMC tests have been conducted by “Suzhou SZQ Testing Co., Ltd.” under supervision of TÜV Rheinland’s engineer.

1.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

No.	Test Equipment	Model No.	Serial No.	Cal. due date
1.	EMI Test Receiver	ESCI	RU-001E	2025.07.06
2.	LISN	ESH 3-z5	EV-202E	2025.07.06
3.	PULSE LINITER	ESH 3-z2	RZ-032E	2026.02.28
4.	ISN	FCC-TLISN T2-02	RZ-001E	2025.07.06
5.	ISN	FCC-TLISN T4-02	RZ-002E	2025.07.06
6.	ISN	FCC-TLISN T8-02	RZ-003E	2025.07.06
7.	TRILOG Broadband Antenna	VULB9163	RG-001E	2025.07.08
8.	CDNE Coupled Network	KH3663E	RZ-019E	2025.07.06
9.	Power absorbing pliers	MDS 21	EM-001E	2025.07.09
10.	Spectrum Analyzer	N9000A	RV-002E	2025.12.29
11.	Pre-Amplifier	LNA0640	RZ-020E	2026.02.28
12.	Broad-Band Horn Antenna	3115	RG-003E	2025.12.29
13.	Electrostatic discharge generator	EDS20H	EV-203E	2026.03.02
14.	Signal Generator	SMB100A	EV-003E	2025.12.29
15.	Power Amplifier	HAP_80M01G-250W	RZ-011E	2025.07.06
16.	Power Amplifier	HAP_01G06G-75W	RZ-012E	2025.07.06
17.	Power Sensor	U2001A	RZ-030E	2025.07.06
18.	Power Sensor	U2001A	RZ-031E	2025.07.06
19.	RF Switch	PFSU_DC18G-4C	RZ-013E	2025.07.06
20.	Stacked logarithmic periodic antenna	STLP 9129 PLUS	RZ-014E	/
21.	Combined immunity tester	CCS 600	RZ-004E	2025.07.06
22.	Coupling and Decoupling Networks	CDN 405M40	RZ-008E	2025.07.06
23.	Capacitive coupling clamp	CCC 100	RZ-006E	2025.07.06
24.	Power fail simulator	PFS 2216SD	RZ-007E	2025.07.06

25.	RF conducted immunity testing system	CST 1075	RZ-005E	2025.07.06
26.	Coupled decoupling network	CDN M2M3	RZ-024E	2025.07.06
27.	EM Clamp	EM CL100	RZ-021E	2025.07.06
28.	AC/DC variable frequency magnetic field with coil	MFS 300AP TYX130	RZ-010E	2025.07.06
29.	pulsed magnetic field simulator	PMC 1200 TCXS111	RZ-009E	2025.07.06
30.	CYCLE SAG SIMULATOR	DRP6101lTx	RZ-033E	2025.07.26
31.	50ohm Termination	TF2-1G-A	RZ-022E	2025.07.06
32.	50ohm Termination	TF2-1G-A	RZ-023E	2025.07.06
33.	DC power supply	ADC200-30G	EV-220	2025.07.06
34.	DC power supply	ADC200-30G	EV-221	2025.07.06
35.	DC power supply	ADC200-30G	EV-222	2025.12.29
36.	Surge Generator	NSX-560CT	EV-204E	2026.02.28
37.	Unshielded Symmetric Coupling/Decoupling Network	CDN-5802C	EV-205E	2026.02.28

1.3 Measurement Uncertainty

Table 2: Measurement Uncertainty

Measurement	Value
Conducted emissions (150 kHz-30 MHz)-AMN	2.6 dB
Conducted emissions (150 kHz-30 MHz)-AAN	2.8 dB
Radiated emissions (30 MHz-1 GHz)	4.7 dB
Radiated emissions (1 GHz-6 GHz)	5.1 dB

2 General Product Information

2.1 Product Function and Intended Use

The EUT (equipment under test) is an ordinary Programmable Logic Controller. The product is intended to use in the general industrial environment or similar environment. For the further information, refer to the user's manual.

2.2 Ratings and System Details

Rated Voltage	:	DC 24V	For all models
Rated Current	:	1A	For all models
Protection Class	:	Class III	For all models

Other aspects:

1. In electrical characteristic, all models are based on the same circuit diagram and PCB Layout. The only difference among them is the number of system bus axes, Including 4 axes, 8 axes, 16 axes and 32 axes.
2. According to the customer's declaration, the cables connected to the 485 signal port and Ethernet ports of the Programmable Logic Controller are less than 30 m and do not extend to the outdoor directly.
3. Therefore, all EMC tests were performed on the model LC1508—CPU20TN.

Refer to the user's manual for further information.

2.3 Independent Operation Modes

The basic operation modes are:

A. On (Running with Full System)

B. Off

Refer to the user's Manual for further information.

2.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram for further information.

2.5 Submitted Documents

Circuit diagram, PCB layout, label, user's manual etc.

3 Test Set-up and Operation Modes

3.1 Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test conditions were adapted accordingly in reference to the instructions for use.

Refer to the related paragraph of this report.

Immunity: The equipment under test (EUT) was configured to have its highest possible susceptibility against the tested phenomena. The test conditions were adapted accordingly in reference to the instructions for use.

Refer to the related paragraph of this report.

3.2 Physical Configuration for Testing

Refer to the related paragraph of this report.

3.3 Test Operation and Test Software

Refer to the related paragraph of this report.

3.4 Special Accessories and Auxiliary Equipment

The sample was tested together with the following accessories:

Description	Manufacturer	Model	Description
Laptop	DELL	Vostro 15 3510	N/A
Display screen	FLEXEM	FE9070WE	N/A

3.5 Countermeasures to achieve EMC Compliance

The tested sample contained noise suppression components as specified in the circuit diagram. No special measure is employed to achieve the requirement.

4 Conformity Decision Rule

For all EMI tests (when included in this report), as measurement uncertainties are less than the values U_{CISPR} given in CISPR 16-4-2, compliance with the limits is determined by comparing measurement results directly with corresponding limits without taking into consideration of measurement uncertainties. For all EMS tests (when included in this report), measurement uncertainties are not considered as well according to corresponding test standards.

5 Test Results EMISSION

5.1 Emission in the Frequency Range up to 30 MHz

5.1.1 Conducted Emissions on DC power port

Result:	**Pass**

Date of testing	:	2025.03.11
Kind of test site	:	EMC Shielding Room
Port	:	DC power port
Test procedure	:	EN 61131-2:2007, IEC 61131-2:2017 and CISPR 16-1 series standards
Frequency range	:	150kHz – 30MHz
Limit	:	Table 4 of IEC 61000-6-4:2018
Ambient condition	:	Temperature: 23°C; Relative Humidity: 37%

Test Setup

Input voltage	:	DC 24V
Operational mode	:	Normal Operation
Earthing	:	No

The measurement setup was made according to EN 61131-2:2007 and IEC 61131-2:2017 in an EMC shielding room.

The measurement equipment like test receiver, quasi-peak detector and Artificial Mains Network (AMN) are in compliance with CISPR 16-1 series standards, EN 61131-2:2007 and IEC 61131-2:2017. The tested object was operated under its rated voltage and its rated frequency. Prior to the measurements the EUT operated enough time (warm-up) in order to stabilize its operating conditions and to ensure reliable measurement values.

Furthermore an internal calibration with the test receiver was conducted prior to and after each measurement.

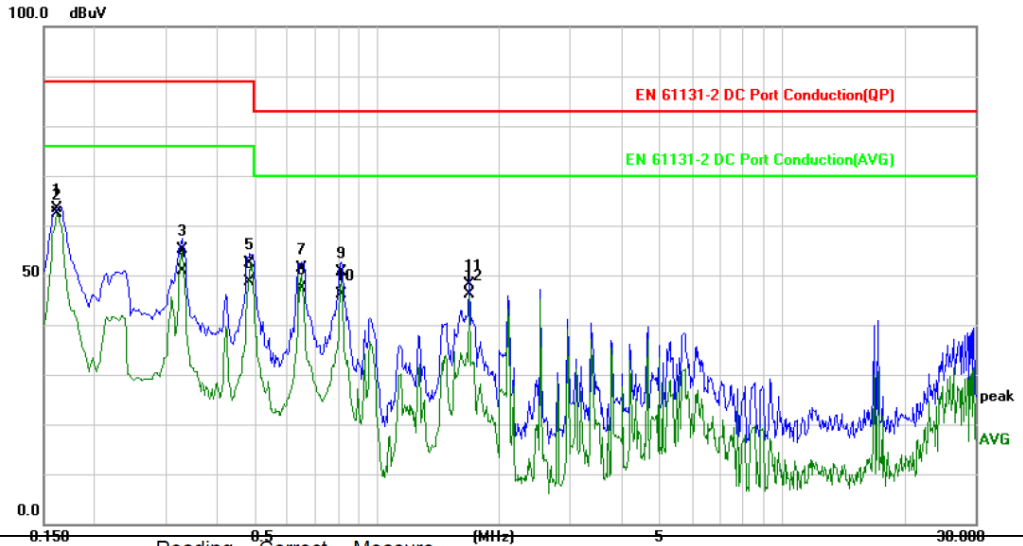
A pre-scan test has been performed for different operation modes, and the final test was performed on the worst case.

The tested object was set-up on a 0.8 m wooden table. The EUT was set 0.8 m away from the AMN. The part of the cord that is longer than necessary to be connected to the AMN was folded forth and backs parallel so as to form a bundle with a length between 0.3 m and 0.4 m.

The following figures and tables were those measured by an automatic measuring system. Both Quasi Peak and Average Value were measured. Quasi-Peak and Average Value were measured and listed respectively where they had a maximum in previous scanning survey. In the Figures, "×" means Quasi-Peak Value and Average Value which were measured in final measurement.

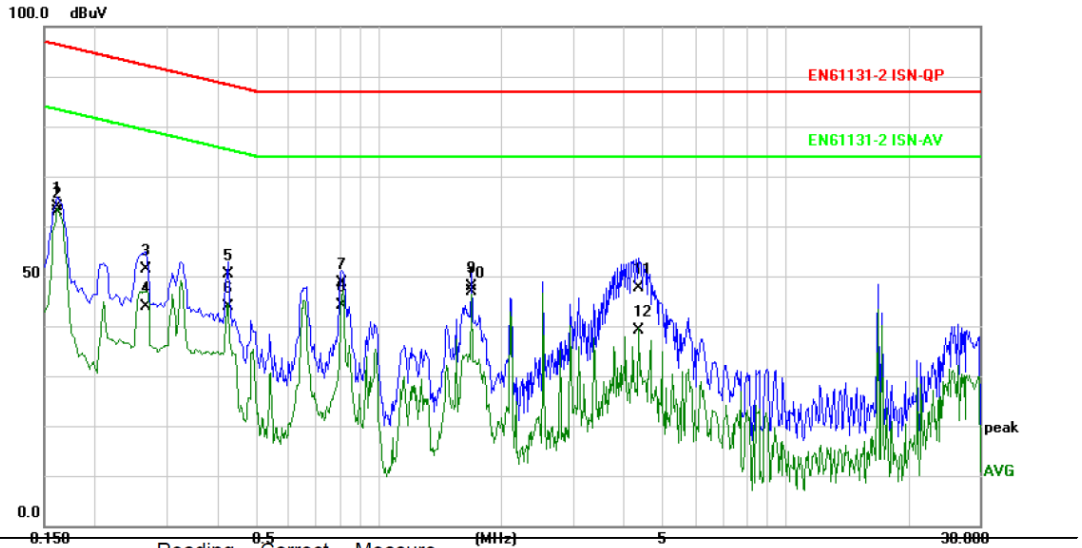
The margin value in the final test table can be calculated by the limit value minus the Quasi-Peak Value or Average Value which was measured in final measurement.

Figure 1: Spectral Diagrams, Conducted emission, DC power port, 0.15-30MHz, Positive



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1620	53.38	9.97	63.35	89.00	-25.65	QP	
2	*	0.1620	52.30	9.97	62.27	76.00	-13.73	AVG	
3		0.3300	45.25	9.92	55.17	89.00	-33.83	QP	
4		0.3300	40.93	9.92	50.85	76.00	-25.15	AVG	
5		0.4860	42.32	10.00	52.32	89.00	-36.68	QP	
6		0.4860	38.67	10.00	48.67	76.00	-27.33	AVG	
7		0.6540	41.21	10.15	51.36	83.00	-31.64	QP	
8		0.6540	37.35	10.15	47.50	70.00	-22.50	AVG	
9		0.8140	40.52	10.13	50.65	83.00	-32.35	QP	
10		0.8140	36.10	10.13	46.23	70.00	-23.77	AVG	
11		1.6900	38.07	10.14	48.21	83.00	-34.79	QP	
12		1.6900	36.04	10.14	46.18	70.00	-23.82	AVG	

Figure 2: Spectral Diagrams, Conducted emission, DC power port, 0.15-30MHz, Negative



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1620	54.03	9.94	63.97	96.36	-32.39	QP	
2	*	0.1620	53.02	9.94	62.96	83.36	-20.40	AVG	
3		0.2660	41.40	10.00	51.40	92.24	-40.84	QP	
4		0.2660	33.85	10.00	43.85	79.24	-35.39	AVG	
5		0.4260	40.40	9.92	50.32	88.33	-38.01	QP	
6		0.4260	34.01	9.92	43.93	75.33	-31.40	AVG	
7		0.8100	38.57	10.09	48.66	87.00	-38.34	QP	
8		0.8100	34.04	10.09	44.13	74.00	-29.87	AVG	
9		1.6900	37.69	10.09	47.78	87.00	-39.22	QP	
10		1.6900	36.86	10.09	46.95	74.00	-27.05	AVG	
11		4.3420	36.85	10.81	47.66	87.00	-39.34	QP	
12		4.3420	28.32	10.81	39.13	74.00	-34.87	AVG	

5.1.2 Conducted Emissions on wired network port

Result:	**Pass**

Date of testing	:	2025.03.11
Kind of test site	:	EMC Shielding Room
Port	:	Wired network port
Test procedure	:	EN 61131-2:2007, IEC 61131-2:2017 and CISPR 32
Frequency range	:	150kHz – 30MHz
Limit	:	Table 5 of IEC 61000-6-4:2018
Ambient condition	:	Temperature: 23°C; Relative Humidity: 37%

Test Setup

Input voltage	:	DC 24V
Operational mode	:	Normal Operation
Earthing	:	No

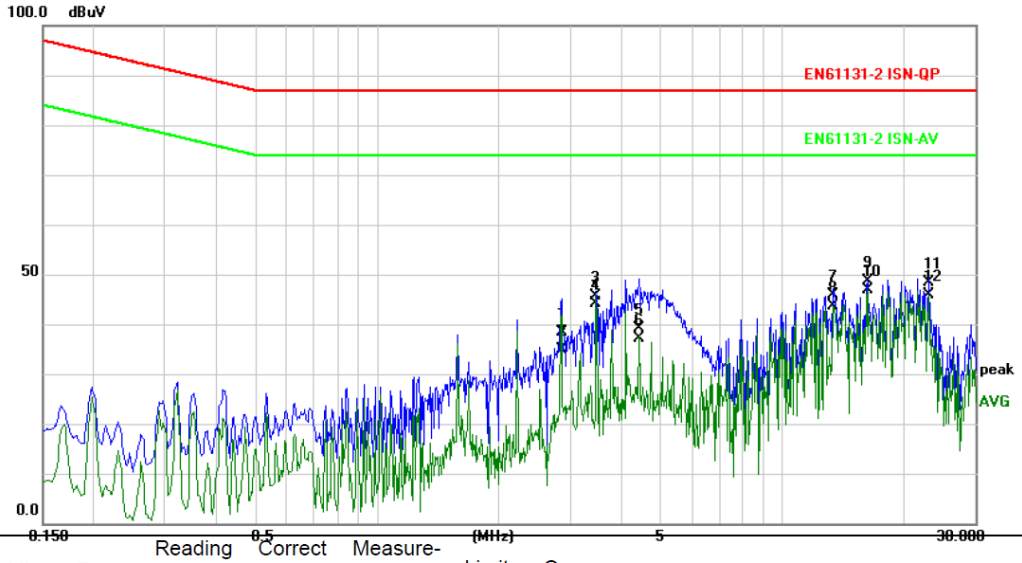
The measurement setup was made according to EN 61131-2:2007 and IEC 61131-2:2017 in an EMC shielding room.

During the test, the EUT was placed on a 0.8 m wooden table above the ground reference plane (GRP). The communication port was connected to an ISN (impedance stabilization network). The distance between the EUT and the ISN is about 80 cm.

The following figures and tables were those measured by an automatic measuring system. Both Quasi Peak and Average Value were measured. Quasi-Peak and Average Value were measured and listed respectively where they had a maximum in previous scanning survey. In the Figures, "×" means Quasi-Peak Value and Average Value which were measured in final measurement.

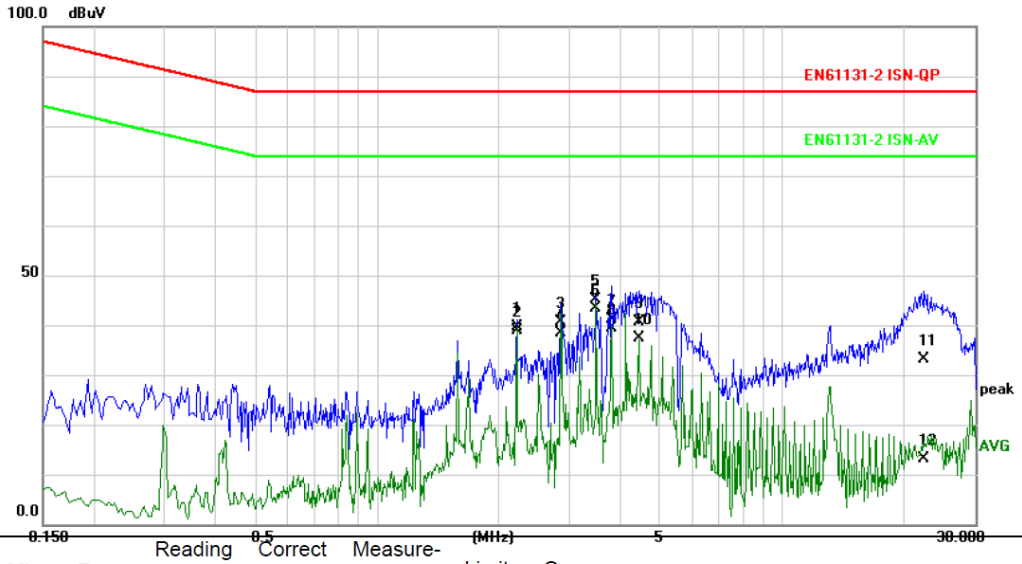
The margin value in the final test table can be calculated by the limit value minus the Quasi-Peak Value or Average Value which was measured in final measurement.

Figure 3: Spectral Diagrams, Conducted emission, 0.15-30MHz, LAN, RJ45-1



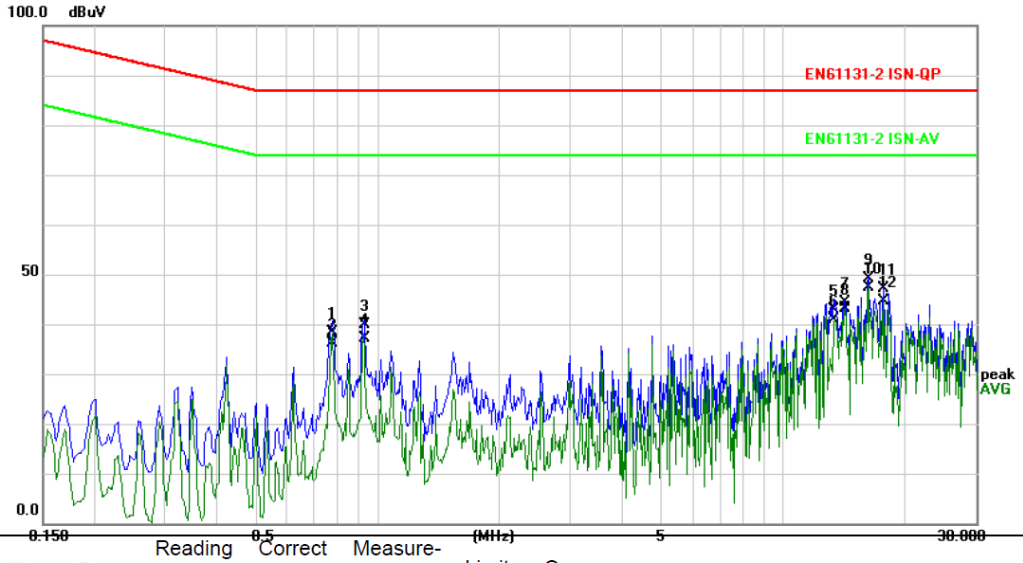
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		2.8580	38.40	0.05	38.45	87.00	-48.55	QP	
2		2.8580	34.85	0.05	34.90	74.00	-39.10	AVG	
3		3.4900	45.46	0.12	45.58	87.00	-41.42	QP	
4		3.4900	44.08	0.12	44.20	74.00	-29.80	AVG	
5		4.4420	38.89	0.22	39.11	87.00	-47.89	QP	
6		4.4420	36.97	0.22	37.19	74.00	-36.81	AVG	
7		13.3580	45.07	0.70	45.77	87.00	-41.23	QP	
8		13.3580	42.83	0.70	43.53	74.00	-30.47	AVG	
9		16.2300	47.69	0.84	48.53	87.00	-38.47	QP	
10	*	16.2300	45.97	0.84	46.81	74.00	-27.19	AVG	
11		23.1300	47.38	1.09	48.47	87.00	-38.53	QP	
12		23.1300	44.77	1.09	45.86	74.00	-28.14	AVG	

Figure 4: Spectral Diagrams, Conducted emission, 0.15-30MHz, LAN, RJ45-2



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		2.2180	39.61	-0.05	39.56	87.00	-47.44	QP	
2		2.2180	39.01	-0.05	38.96	74.00	-35.04	AVG	
3		2.8540	40.63	0.05	40.68	87.00	-46.32	QP	
4		2.8540	38.30	0.05	38.35	74.00	-35.65	AVG	
5		3.4860	44.89	0.12	45.01	87.00	-41.99	QP	
6	*	3.4860	43.30	0.12	43.42	74.00	-30.58	AVG	
7		3.8020	40.97	0.15	41.12	87.00	-45.88	QP	
8		3.8020	39.15	0.15	39.30	74.00	-34.70	AVG	
9		4.4340	40.48	0.22	40.70	87.00	-46.30	QP	
10		4.4340	37.22	0.22	37.44	74.00	-36.56	AVG	
11		22.4220	32.08	1.07	33.15	87.00	-53.85	QP	
12		22.4220	11.98	1.07	13.05	74.00	-60.95	AVG	

Figure 5: Spectral Diagrams, Conducted emission, 0.15-30MHz, LAN, RJ45-3



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.7780	38.53	-0.08	38.45	87.00	-48.55	QP	
2		0.7780	36.27	-0.08	36.19	74.00	-37.81	AVG	
3		0.9300	40.04	-0.12	39.92	87.00	-47.08	QP	
4		0.9300	37.37	-0.12	37.25	74.00	-36.75	AVG	
5		13.3580	42.22	0.70	42.92	87.00	-44.08	QP	
6		13.3580	40.21	0.70	40.91	74.00	-33.09	AVG	
7		14.2140	43.61	0.74	44.35	87.00	-42.65	QP	
8		14.2140	42.29	0.74	43.03	74.00	-30.97	AVG	
9		16.2300	48.30	0.84	49.14	87.00	-37.86	QP	
10	*	16.2300	46.59	0.84	47.43	74.00	-26.57	AVG	
11		17.6940	46.15	0.91	47.06	87.00	-39.94	QP	
12		17.6940	43.75	0.91	44.66	74.00	-29.34	AVG	

5.2 Emission in the Frequency Range above 30 MHz

5.2.1 Radiated disturbance

Result:	**Pass**

Date of testing	:	2025.03.11
Test procedure	:	EN 61131-2:2007, IEC 61131-2:2017 & CISPR 16-2-3
Frequency range	:	30 – 6000MHz
Kind of test site	:	Semi-anechoic Chamber
Measurement distance	:	3m
Polarization of antenna	:	Both horizontal and vertical
Limit	:	Table 3 of IEC 61000-6-4:2018

Test Setup

Input voltage	:	DC 24V
Operational mode	:	Normal Operation
Temperature	:	22°C
Relative humidity	:	38%

Measuring configuration and description

The radiated disturbance was measured in the frequency range from 30MHz to 6000MHz according to EN 61131-2:2007 and IEC 61131-2:2017. The measurement was performed in accordance with the method specified in CISPR 16-2-3.

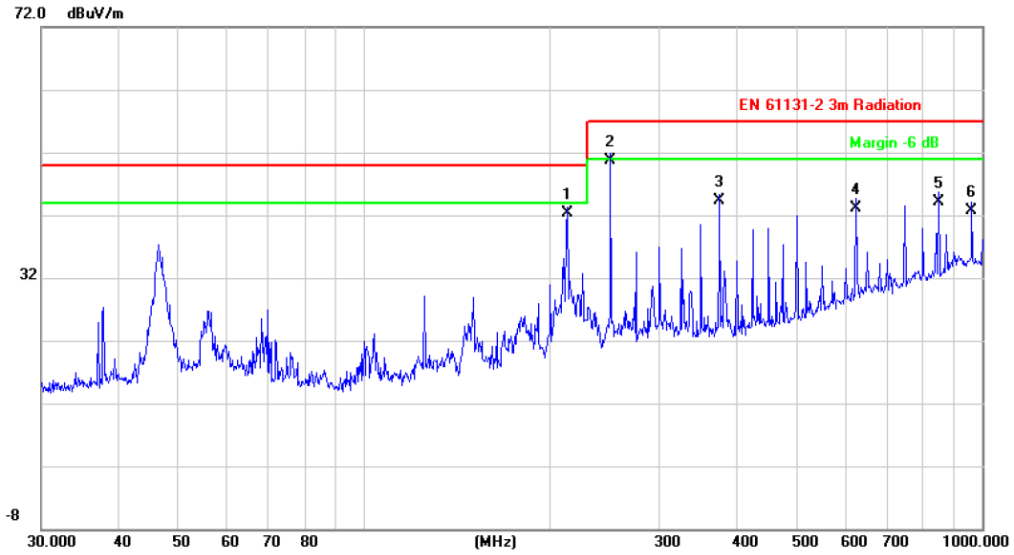
The radiated disturbance test was performed in a 3m semi-anechoic chamber. The test distance is 3m. The 10m radiated emission limits are converted to 3m radiated emission limits by an inverse proportionality of 20 dB per decade. The normalized site attenuation of the semi-anechoic chamber is regularly calibrated to ensure the radiated disturbance test results are valid. During the test, the EUT was placed on a 0.8m high wooden support above the reference ground plane. The turntable was rotated 360° around and the antenna was varied from 1m to 4m to find the maximum disturbance. The test was performed with the antenna both in its horizontal and vertical polarizations.

Before measurement, a survey was made to determine in which state the maximum disturbance was obtained. And the measurement was made in the state the maximum disturbance was obtained.

The following figures were those measured and recorded by a test receiver. The curves in the figure were those measured with a Peak detector. The symbol "×" in the figures are those of QP value which were measured in final measurement. Quasi-peak measurements were only performed at those critical frequencies obtained during the test with Peak Detector.

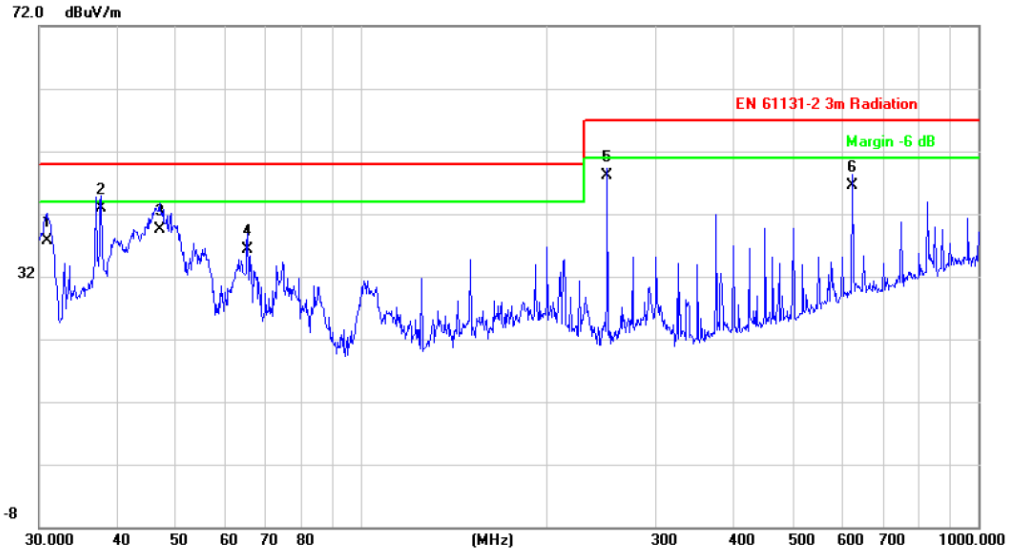
The margin value in the final test table can be calculated by the limit value minus the Quasi-Peak Value, Peak value or Average Value which was measured in final measurement.

Figure 6: Spectral Diagrams, Radiated Emission, 30MHz-1GHz, Horizontal



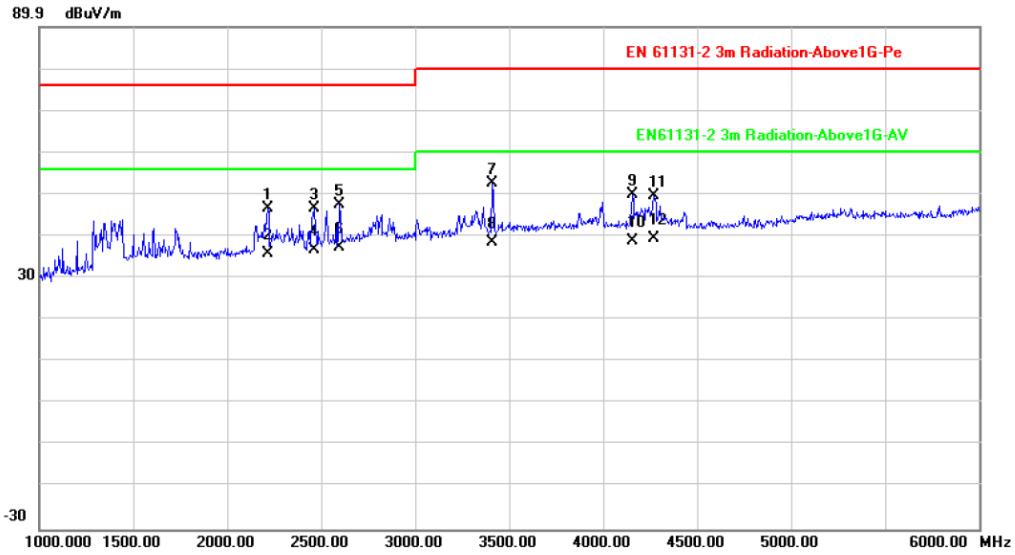
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		213.0151	28.54	13.83	42.37	50.00	-7.63	QP	200	2	
2	*	250.3012	35.24	15.55	50.79	57.00	-6.21	QP	200	191	
3		375.9385	25.62	18.64	44.26	57.00	-12.74	QP	200	73	
4		625.0780	18.37	24.80	43.17	57.00	-13.83	QP	200	154	
5		851.0353	16.37	27.82	44.19	57.00	-12.81	QP	200	28	

Figure 7: Spectral Diagrams, Radiated Emission, 30MHz-1GHz, Vertical



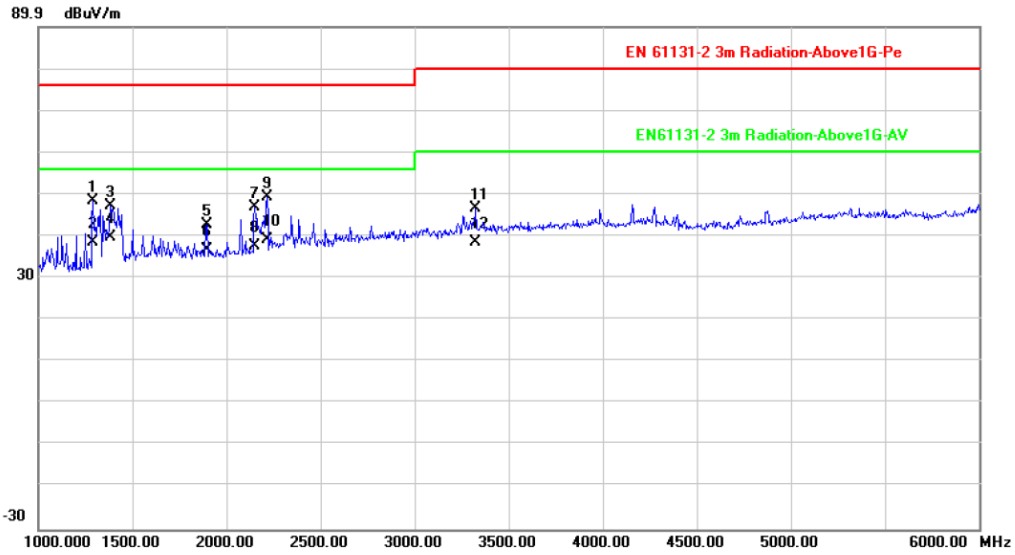
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		30.8535	26.49	11.14	37.63	50.00	-12.37	QP	100	357	
2	*	37.8121	31.06	11.88	42.94	50.00	-7.06	QP	100	360	
3		46.9948	27.12	12.44	39.56	50.00	-10.44	QP	100	347	
4		65.3432	23.53	12.84	36.37	50.00	-13.63	QP	100	101	
5		250.3012	32.58	15.55	48.13	57.00	-8.87	QP	100	108	
6		625.0780	21.73	24.80	46.53	57.00	-10.47	QP	100	282	

Figure 8: Spectral Diagrams, Radiated Emission, 1GHz-6GHz, Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2217.500	53.76	-7.24	46.52	76.00	-29.48	peak	200	360	
2		2217.500	42.87	-7.24	35.63	56.00	-20.37	AVG	200	360	
3		2462.500	52.46	-5.77	46.69	76.00	-29.31	peak	200	4	
4		2462.500	42.30	-5.77	36.53	56.00	-19.47	AVG	200	4	
5		2595.000	53.02	-5.42	47.60	76.00	-28.40	peak	200	210	
6	*	2595.000	42.56	-5.42	37.14	56.00	-18.86	AVG	200	210	
7		3412.500	56.21	-3.72	52.49	80.00	-27.51	peak	200	135	
8		3412.500	42.24	-3.72	38.52	60.00	-21.48	AVG	200	135	
9		4155.000	52.55	-2.75	49.80	80.00	-30.20	peak	200	26	
10		4155.000	41.42	-2.75	38.67	60.00	-21.33	AVG	200	26	
11		4270.000	52.32	-2.76	49.56	80.00	-30.44	peak	200	217	
12		4270.000	42.19	-2.76	39.43	60.00	-20.57	AVG	200	217	

Figure 9: Spectral Diagrams, Radiated Emission, 1GHz-6GHz, Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		1290.000	61.46	-13.18	48.28	76.00	-27.72	peak	100	83	
2		1290.000	51.67	-13.18	38.49	56.00	-17.51	AVG	100	83	
3		1385.000	58.87	-11.84	47.03	76.00	-28.97	peak	100	351	
4	*	1385.000	51.59	-11.84	39.75	56.00	-16.25	AVG	100	351	
5		1895.000	51.61	-8.91	42.70	76.00	-33.30	peak	100	23	
6		1895.000	45.43	-8.91	36.52	56.00	-19.48	AVG	100	23	
7		2150.000	54.40	-7.65	46.75	76.00	-29.25	peak	100	360	
8		2150.000	45.24	-7.65	37.59	56.00	-18.41	AVG	100	360	
9		2217.500	56.53	-7.24	49.29	76.00	-26.71	peak	100	1	
10		2217.500	46.18	-7.24	38.94	56.00	-17.06	AVG	100	1	
11		3325.000	50.59	-3.97	46.62	80.00	-33.38	peak	100	26	
12		3325.000	42.40	-3.97	38.43	60.00	-21.57	AVG	100	26	

6 Test Results I M M U N I T Y

During the immunity tests, the EUT was operated under conditions specified by clause 3 of this report.

Performance criterion of EN 61131-2:2007 and IEC 61131-2:2017

Performance criterion		
Criterion	**Operation**	
	During test	**After test**
A	The EUT shall continue to operate as intended. No loss of function or performance, according to PFVPs (4.2.8)	The EUT shall continue to operate as intended
B	Degradation of performance accepted Examples: analog values vary within manufacturer-specified limits[a], communication delay times vary within manufacturer-specified limits, flickering on HMI display, etc. No change of operating mode Examples: loss of data or uncorrected errors in communication, unintentional state changes of digital I/O which are seen by the EUT or test set-up, etc. No irreversible loss of stored data, according to PFVPs (4.2.8)	The EUT shall continue to operate as intended. Temporary degradation of performance shall be self-recoverable
C	Loss of functions accepted, but no destruction of hardware or software (programme or data)	The EUT shall continue to operate as intended automatically, after manual restart or power off/power on

Testing date: 2025.03.11 - 2025.03.12

Room temperature: 22°C
Relative Humidity: 37-38%
Atmospheric pressure: 102.0kPa

Remark:

1. *The following tests were performed while the EUT was continuously operating at DC 24 V.*

6.1 Enclosure

6.1.1 Electrostatic Discharge

Result:	**Pass**

The immunity against electrostatic discharge was tested in accordance EN 61131-2:2007 and IEC 61131-2:2017.

Test setup and ESD-Generator are according to IEC 61000–4–2 which is specified under EN 61131-2:2007 and IEC 61131-2:2017. The EUT was placed on an insulation lining of 0.5mm thick. Between the insulation lining and the wooden table, there was a horizontal coupling plane (HCP) of 1.6×0.8m. The EUT and its power supply cord were isolated from the HCP by the insulating lining.

Charge Voltage	**:**	±4.0kV (Contact Discharge) ±8.0kV (Air Discharge)
Polarity	**:**	positive / negative
Number of Discharges	**:**	>10
Performance Criteria	**:**	B

Table 3: ESD test results, positive / negative polarity

Position	Kind of Discharge	Remarks	Result
Non-metal enclosure	Air discharge ±8kV	Operating as intended, no degradation detected during and after testing.	Pass
Metal enclosure	Contact discharge ±4kV	Operating as intended, no degradation detected during and after testing.	Pass
Coupling plane (Both HCP and VCP)	Contact discharge ±4kV		Pass

6.1.2 Radio Frequency Electromagnetic Field

Result:	**Pass**

The immunity against radio-frequency electromagnetic fields was tested in accordance to EN 61000-4-3 which is specified by EN 61131-2:2007 and IEC 61131-2:2017.

The test was performed inside a 3m modified semi-anechoic chamber. During the test the part of the ground plane between the field generating antenna and the equipment under test was covered by absorbing material. The distance between the tip of the antenna and the side of the system tested is 3m. The field uniformity of the 1.5mx1.5m plane where the surface of the EUT tested coincides with is regularly calibrated to ensure the 0-6 dB field uniformity criterion as specified by IEC 61000-4-3 is met.

The four sides of the system were tested sequentially. The test was performed with the electric field in horizontal and vertical polarizations respectively.

Test Level & Frequency Range	**:**	10V/m (80–1000MHz)	
		3V/m (1.4–2.0GHz)	(only for EN 61131-2:2007)
		1V/m (2.0–2.7GHz)	(only for EN 61131-2:2007)
		3V/m (1.4–6GHz)	(only for IEC 61131-2:2017)
Modulation	**:**	80%AM, 1kHz	
Frequency Sweep Speed	**:**	1% step size	
Dwell Time	**:**	3s	
Performance Criteria	**:**	A	

Table 4: Radiated Susceptibility, Field Strength

Position	Result	Remarks
Antenna in vertical orientation	Pass	Operating as intended, no degradation detected during and after testing.
Antenna in horizontal orientation	Pass	Operating as intended, no degradation detected during and after testing.

6.1.3 Power Frequency Magnetic Fields

Result:	**Pass**

Test level : 30 A/m
Field polarization : X, Y, Z
Frequency : 50 Hz, 60 Hz
Performance Criteria : A

Table 5: Power Frequency Magnetic Field test results

Field polarization	Remarks	Result
X	Operating as intended, no degradation detected during and after testing.	Pass
Y	Ditto	Pass
Z	Ditto	Pass

6.2 Power Ports and Signal Ports

6.2.1 Fast Transients

Result:	**Pass**

Test setup and the fast transient noise generator are according to EN 61000-4-4 which is specified by EN 61131-2:2007 and IEC 61131-2:2017.

The EUT is placed on 0.1 m wooden support above the ground plane. And the minimum distance between the EUT and all other conductive structures except the ground plane is more than 0.5 m.

A capacitive coupling clamp was used to couple the disturbing signal. The coupling clamp was placed 0.1m above the reference ground plane. During the test, the signal line was extended long enough to allow the placement of the capacitive coupling clamp.

The reference ground plane is an aluminum sheet of 0.25 mm minimum thickness. The reference ground plane is connected to the protective earth. The size of the ground plane is 2 m × 2 m.

Test Voltage	**:**	2kV for DC power port 1kV for Signal Ports
Polarity	**:**	negative/positive
Repetition Frequency	**:**	5kHz
Test Duration	**:**	≥120sec
Tr/Tn	**:**	5ns/50ns
Performance Criteria	**:**	B

Table 6: Fast transients test results, positive / negative polarity

Coupling Port	Coupling method	Remark	Result
DC power port	CDN	Operating as intended, no degradation detected during and after testing.	Pass
Signal Ports	Capacitive coupling clamp	Operating as intended, no degradation detected during and after testing.	Pass

6.2.2 Continuous Induced RF Disturbances

Result:	**Pass**

The immunity against injected current into DC power port and Signal Ports was tested according to EN 61131-2:2007 and IEC 61131-2:2017 in a shielded room.

The test setup and the test generator was according to IEC 61000–4–6 which is specified by EN 61131-2:2007 and IEC 61131-2:2017. The EUT was placed on a small wooden support 0.1m above a reference ground plane that is of aluminum. The coupling and decoupling networks was inserted on the power supply connection. The coupling and decoupling networks was placed on the ground reference plane, making direct contact with it at about 0.1 – 0.3 meters from EUT. The height of cable between the EUT and the coupling and decoupling networks above the ground reference plane was 50mm.

A coupling clamp was used to couple the disturbing signal to the signal line. The coupling clamp was placed on the reference ground plane. During the test, the signal line was extended long enough to allow the placement of the coupling clamp.

Voltage Level	:	10V(rms)(unmodulated)
Environmental Phenomena	:	r.f. current, common mode, 1kHz, 80%AM
Frequency Range	:	0.15 – 80MHz
Frequency Step	:	1% step size
Dwell Time	:	3 s
Performance Criteria	:	A

Table 7: Continuous induced RF disturbances test results

Line	Result	Remark
DC power port	Pass	Operating as intended, no degradation detected during and after testing.
Signal Ports	Pass	Operating as intended, no degradation detected during and after testing.

6.2.3 Surges

Result:	**Pass**

Test setup and the Combination Wave Generator (CWG) are according to IEC 61000-4-5 which is specified by EN 61131-2:2007 and IEC 61131-2:2017.

The EUT is placed on 0.1 m wood support above the ground plane.

Test Level	:	For DC power port: ±0.5kV (line-to-earth) ±0.5kV (line-to-line)
Tr/Tn	:	1.2/50μs (open-circuit voltage) 8/20μs (short-circuit current)
Test Numbers	:	5 positive and 5 negative pulses at phases of ±π/2
Repetition Rate	:	1 surge/min
Performance Criteria	:	B

Table 8: Surges test results, positive / negative polarity

Tested ports or lines	Test voltage	Remark	Result
line-to-earth	±0.5 kV	Operating as intended, no degradation detected during and after testing.	Pass
line-to-line	±0.5 kV	Operating as intended, no degradation detected during and after testing.	Pass

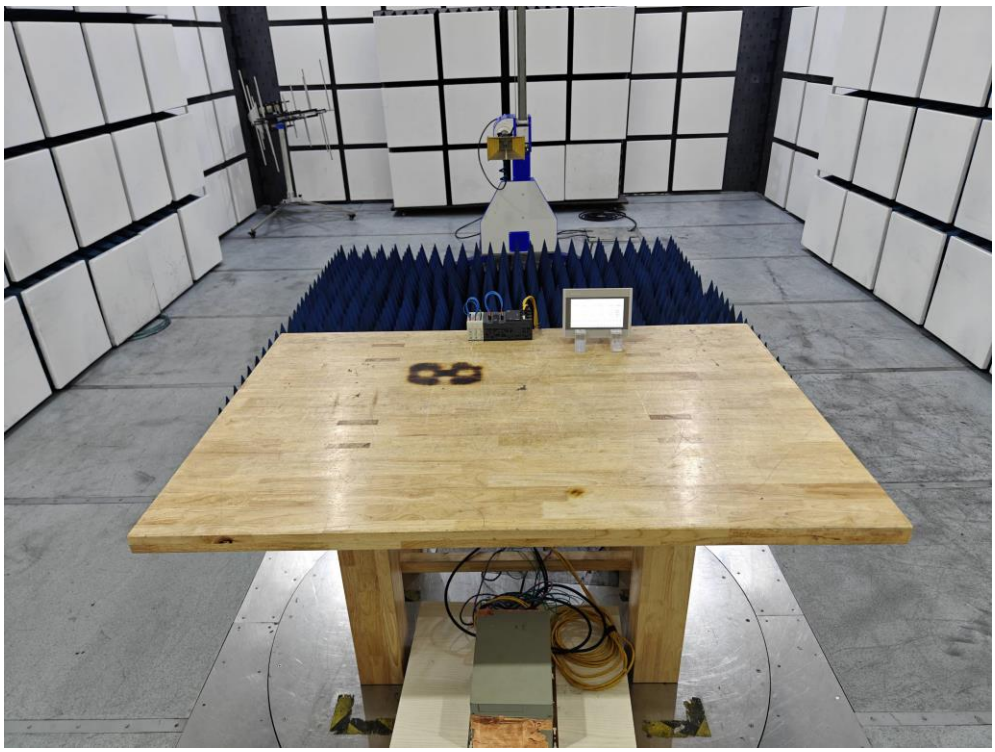
7 Photographs of the Test Setup

Photograph 1: Set-up for conducted emission, DC power port

Photograph 2: Set-up for conducted emission, Ethernet ports

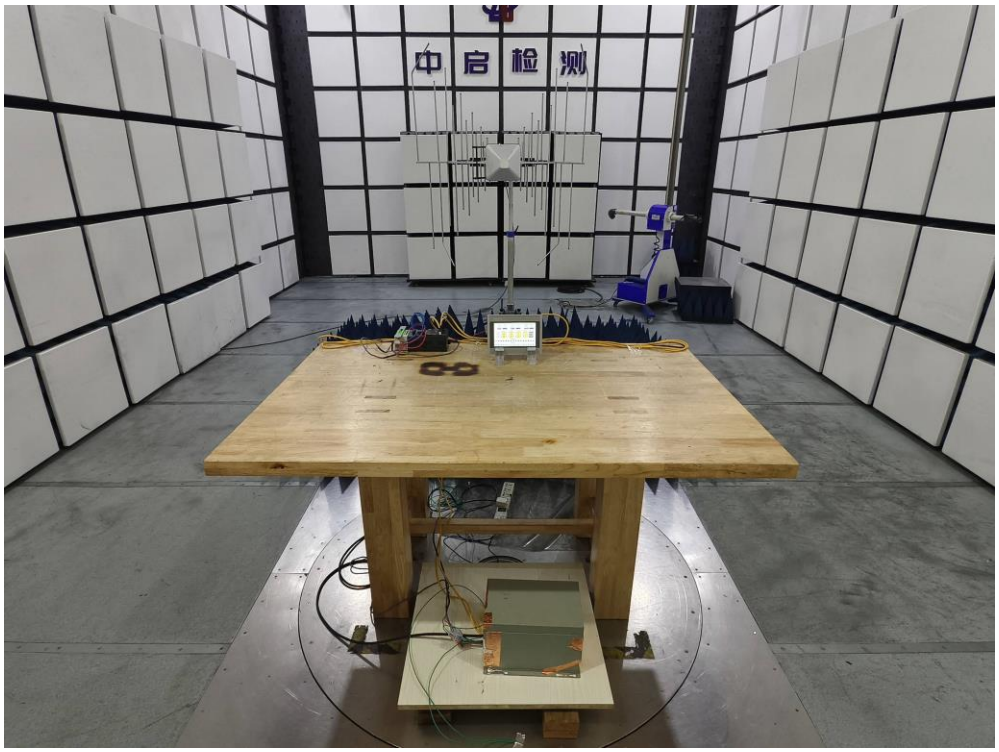
Photograph 3: Set-up for radiated emission, Below 1GHz

Photograph 4: Set-up for radiated emission, Above 1GHz



Photograph 5: Set-up for electrostatic discharge

Photograph 6: Set-up for RF radiated immunity test

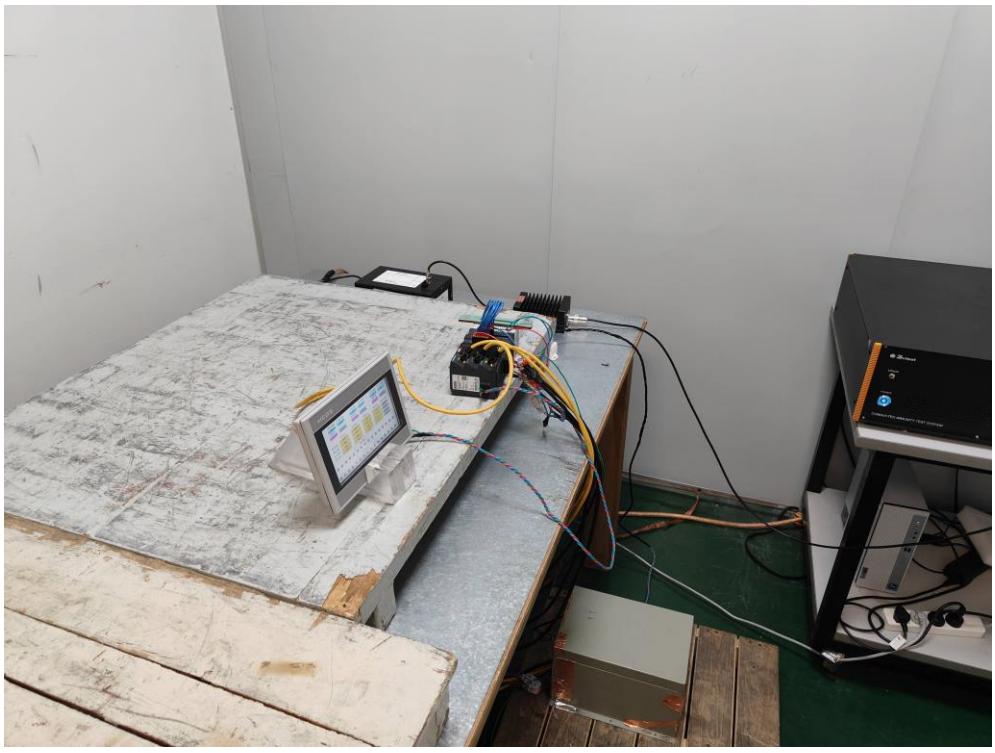


Photograph 7: Set-up for power-frequency magnetic fields

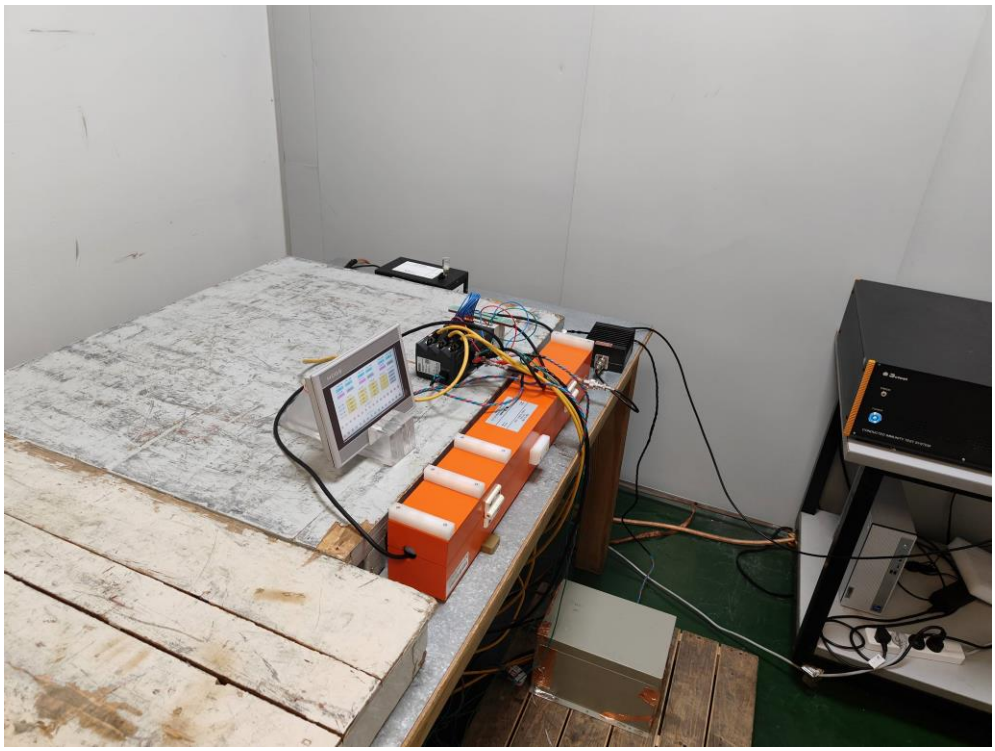
Photograph 8: Set-up for fast transients and surges, DC power port

Photograph 9: Set-up for fast transients, Signal Ports

Photograph 10: Set-up for continuous induced RF disturbances, DC power port



Photograph 11: Set-up for continuous induced RF disturbances, Signal Ports



8 List of Tables

9 List of Figures

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