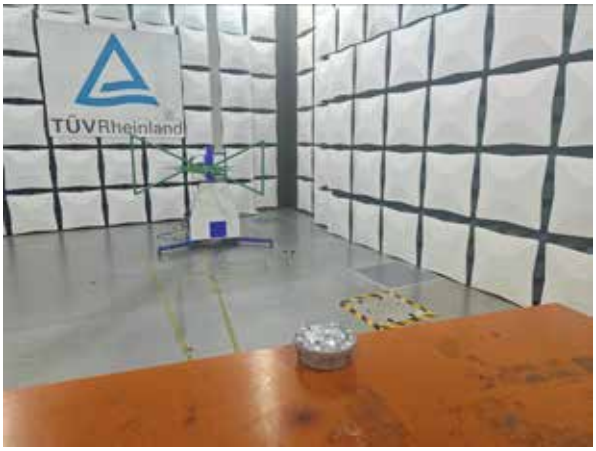
Prüfbericht-Nr.: *Test report no.*:	**CN24WCM4 001**	**Auftrags-Nr.:** *Order no.*:	180299102	Seite 1 von 23 *Page 1 of 23*
Kunden-Referenz-Nr.: *Client reference no.*:	N/A	**Auftragsdatum:** *Order date:*	2024.07.04	
Auftraggeber: *Client*:	[redacted]			
Prüfgegenstand: *Test item*:	Solar road stud			
Bezeichnung / Typ-Nr.: *Identification / Type no.*:	Refer to page 3			
Auftrags-Inhalt: *Order content*:	TÜV Rheinland – EMC Service			
Prüfgrundlage: *Test specification*:	**EN IEC 55015:2019+A11** **EN IEC 61547:2023**			

Wareneingangsdatum: *Date of sample receipt*:	2024.07.08
Prüfmuster-Nr.: *Test sample no:*	A003758498 003
Prüfzeitraum: *Testing period*:	2024.07.15-2024.07.18
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:	Chao Zhang	**genehmigt von:** *authorized by*:	Elva Zhang
Datum: *Date:* 2024.07.24		**Ausstelldatum:** *Issue date:* 2024.07.24	
Stellung / Position:	Chao Zhang/PE	**Stellung** / Position:	Elva Zhang/Authorizer

Sonstiges / *Other*: Refer to page 3 for further information.

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

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.*

Model：

Model name	Battery
SRBC-330, SRBC-330P, SRBA-340, SRBA-342R, SRBA-343R, SRBB-350, SRBB-352R, SRBB-353R, SRBC-360, SRBC-363R, SRAA1-234P, SRAA2-235P, SRAA1-236T, SRAA2-241P	Li-Po 3.7V, 1000mAh

Other aspects:

1. In electrical characteristics, all models are based on the similar circuit diagram and PCB layout. The difference among them is in the mechanical aspects.
2. Therefore, all EMC tests were performed on model SRBC-330.

TEST SUMMARY

5.1.1 TERMINAL CONTINUOUS DISTURBANCE VOLTAGE
Result:
N/A
5.1.2 RADIATED ELECTROMAGNETIC DISTURBANCE
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

Contents

1 Test Sites

1.1 Test Facilities

Laboratory: TÜV Rheinland /CCIC(Ningbo) Co., Ltd.

1st Floor, Building 11, Scholar Innovation Park, No.1188 Zhongguan Road, Zhenhai District, Ningbo 315200 P.R. China.

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

1.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment of Laboratory

No.	Equipment	Model	Serial no.	Cal. due date
1.	EMI test receiver	ESR3	102331	2024.10.29
2.	EMI test receiver	ESR7	101929	2024.10.29
3.	Bilog Antenna	CBL6112D	49033	2027.03.16
4.	Triple loop antenna	HM020	101000	2024.11.06
5.	ESD generator	NX30.1	11744	2024.10.29
6.	Amplifier	BBA150-BC250	102749	2024.10.29
7.	Signal generator	SMB100A	180488	2024.10.29
8.	Stacked Log-Per Antenna	STLP 9128 ES	219	N/A

1.3 Measurement Uncertainty

Test Item	Expanded Measurement Uncertainty (k=2)
Conducted Emission (9-150kHz)	3.70dB
Conducted Emission (150k-30MHz)	3.30dB
Disturbance Power	4.27dB
Radiated Emission (30-1000MHz)	4.39dB
Radiated Emission (1-18GHz)	4.67dB
Radiated Emission (CDNE method)	4.05dB

2 General Product Information

2.1 Product Function and Intended Use

The EUT (equipment under test) is a solar road stud for Lighting and similar use. For the further information, refer to the user's manual.

2.2 Ratings and System Details

Input	:	Refer to page 3	For all models
Protection Class	:	Class III	For all models

Refer to the User Manual for further information.

2.3 Independent Operation Modes

The basic operation modes are: "On" or "Off".

Refer to the User Manual for further information.

2.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram for further information.

2.5 Submitted Documents

Photo, label 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. No software was used.

3.4 Special Accessories and Auxiliary Equipment

None.

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 Terminal Continuous Disturbance Voltage

Result:	**N/A**

Because the model is supplied by battery and it cannot be connected to the public low-voltage distribution systems. According to the standard EN IEC 55015:2019+A11, there are no limits of terminal disturbance voltage for this case. So the Conducted Emission item is not applicable.

5.1.2 Radiated Electromagnetic Disturbance

Result:	**Pass**

Date of testing	:	2024.07.18
Port	:	Enclosure
Basic standard	:	EN IEC 55015:2019+A11
Frequency range	:	9kHz – 30MHz
Limit	:	EN IEC 55015:2019+A11, clause 4.5

Test Setup

Operational Mode	:	ON
Earthing	:	No
Test Site	:	EMC shielding room
Temperature	:	20°C
Relative humidity	:	50%

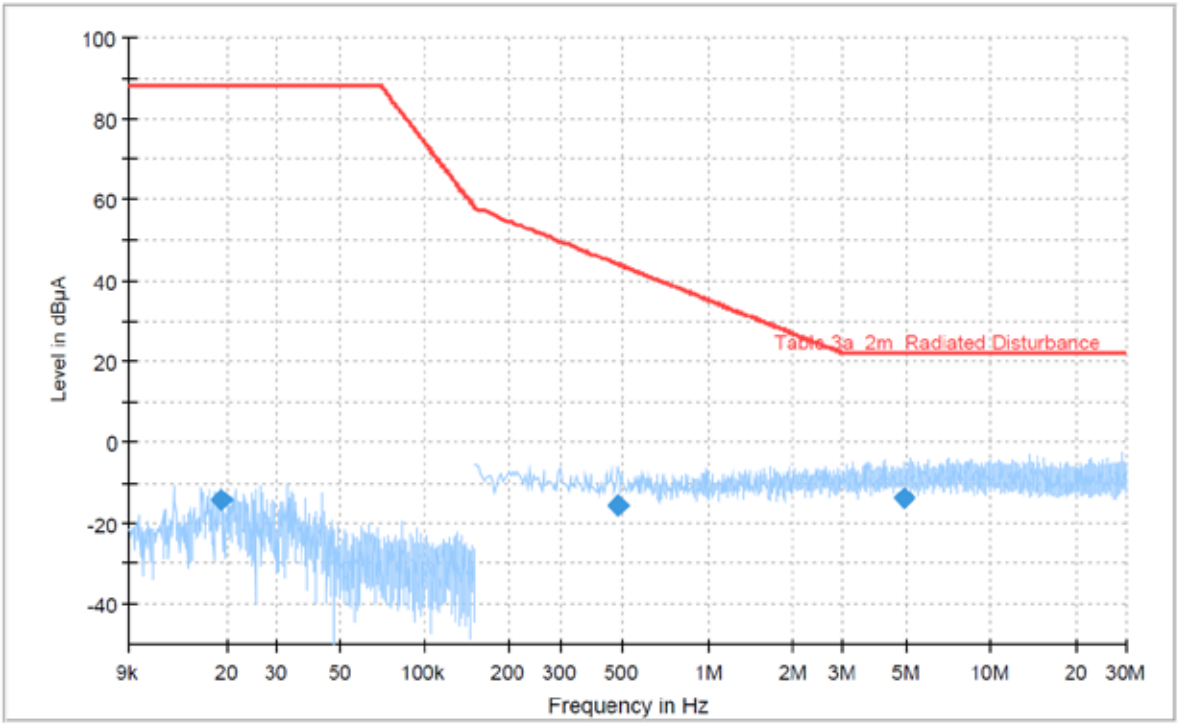
Measuring configuration and description

The measurement equipment like test receiver, loop antenna and coaxial switch are in compliance with the CISPR 16-1 series standards. The test setup was made according to Clause 9 of EN IEC 55015:2019+A11.

The EUT operated in ON mode and at its rated voltage. The EUT is put on a wooden table in the center of the loop antenna. Before a measurement the EUT was operated for about 20 min.

Induced current in the loop antenna was measured by means of a current probe (1V/A) according to clause 9 of EN IEC 55015:2019+A11. The three field components were measured in sequence by means of a coaxial switch (loop antenna controller).

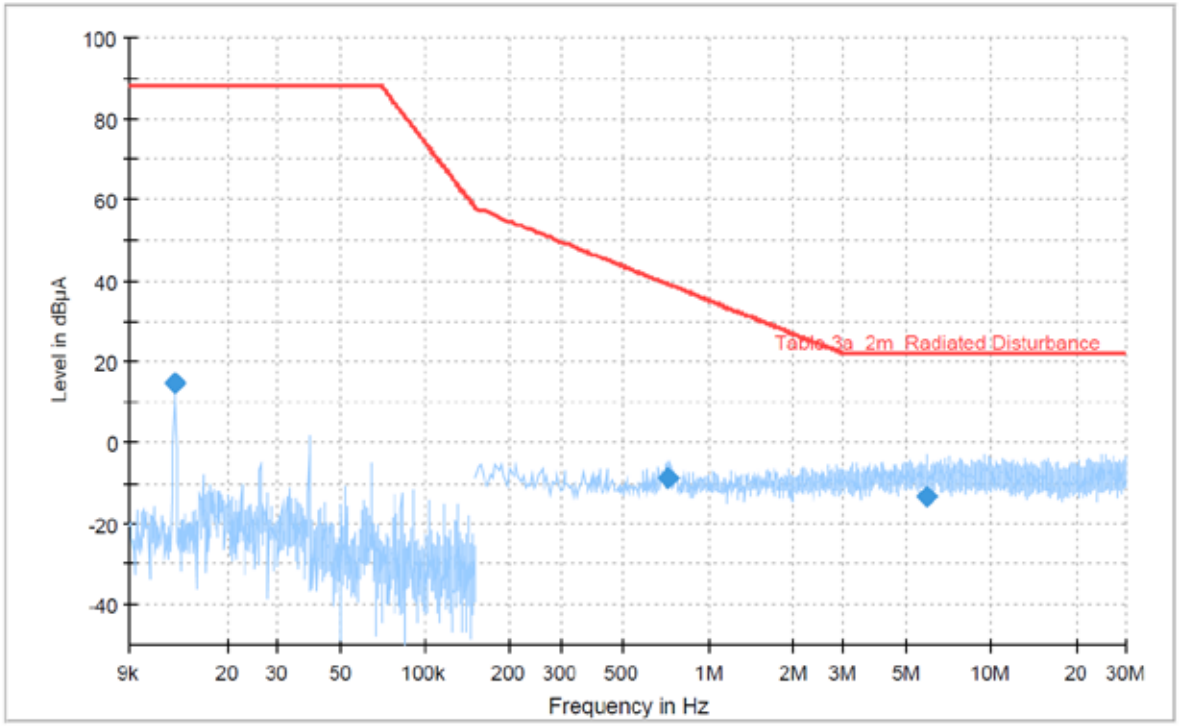
Figure 1: Graphic description of radiated electromagnetic disturbances for X direction



Final_Result

Frequency (MHz)	QuasiPeak (dBµA)	Limit (dBµA)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Axis	Corr. (dB)
0.019160	-14.35	88.00	102.35	1000.0	0.200	X	0.1
0.478000	-15.67	44.07	59.74	1000.0	9.000	X	0.0
4.934000	-13.56	22.00	35.56	1000.0	9.000	X	0.1

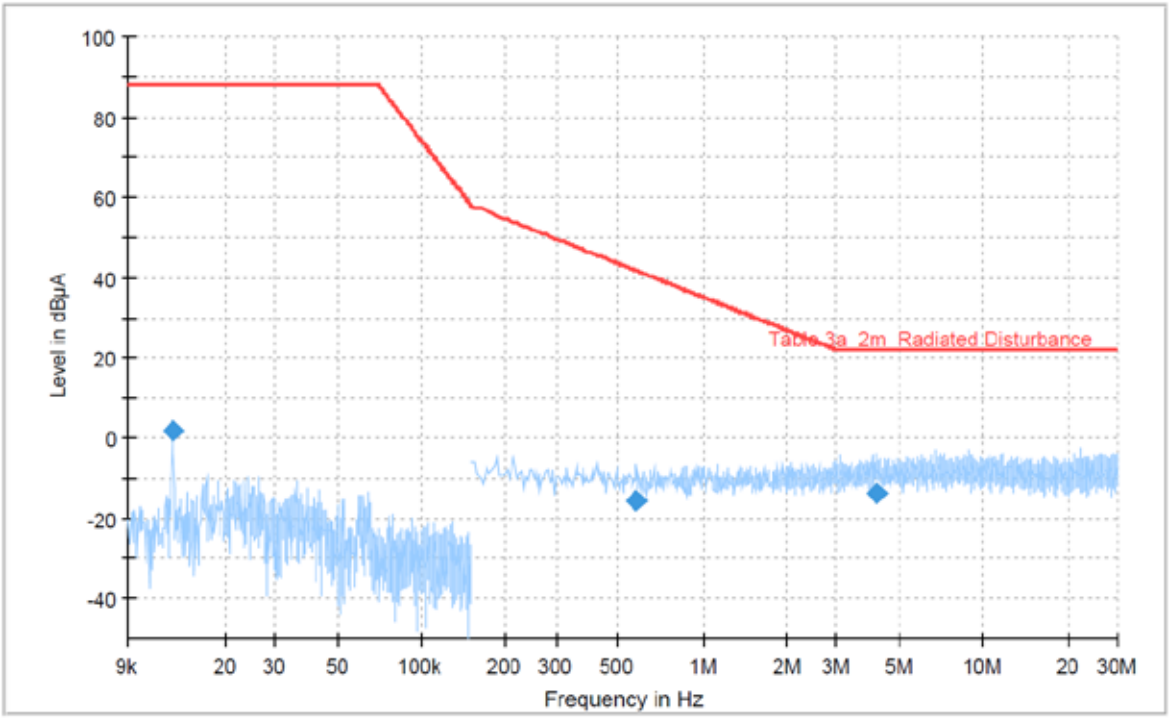
Figure 2: Graphic description of radiated electromagnetic disturbances for Y direction



Final_Result

Frequency (MHz)	QuasiPeak (dBµA)	Limit (dBµA)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Axis	Corr. (dB)
0.013000	14.59	88.00	73.41	1000.0	0.200	Y	0.1
0.718000	-8.83	39.18	48.01	1000.0	9.000	Y	0.0
5.882000	-13.39	22.00	35.39	1000.0	9.000	Y	0.1

Figure 3: Graphic description of radiated electromagnetic disturbances for Z direction



Final_Result

Frequency (MHz)	QuasiPeak (dBµA)	Limit (dBµA)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Axis	Corr. (dB)
0.013000	2.03	88.00	85.97	1000.0	0.200	Z	0.1
0.582000	-15.55	41.71	57.26	1000.0	9.000	Z	0.0
4.166000	-13.79	22.00	35.79	1000.0	9.000	Z	0.1

5.2 Emission in the Frequency Range above 30 MHz

5.2.1 Radiated disturbance

Result:	**Pass**

Date of testing	:	2024.07.15
Test procedure	:	EN IEC 55015:2019+A11 & CISPR 16-2-3
Frequency range	:	30-1000MHz
Kind of test site	:	Semi-anechoic Chamber
Measurement Distance	:	3m
Limit	:	EN IEC 55015:2019+A11 Clause 4.5.3 Table 10 Quasi-peak limits (3m test distance): 30-230MHz, 40dBµV/m; 230-1000MHz, 47dBµV/m

Test Setup

Input voltage	:	DC 3.7 V
Operational mode	:	NO
Temperature	:	21°C
Relative humidity	:	67%

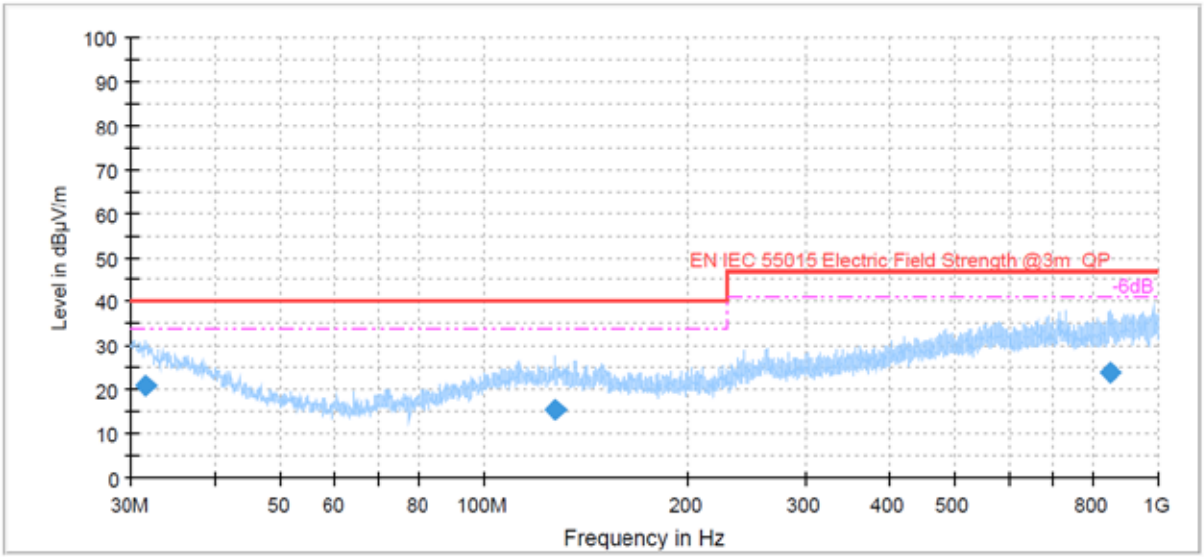
Measuring configuration and description

The radiated disturbance was measured in the frequency range from 30MHz to 1000MHz according to EN IEC 55015:2019+A11. 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 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.

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.

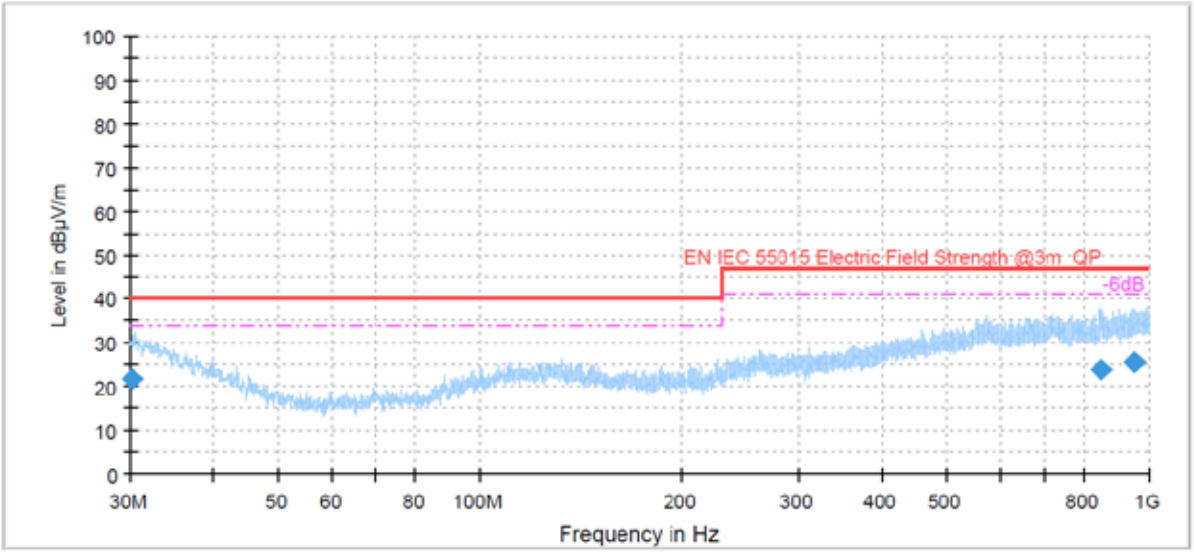
Figure 4: Spectral Diagrams, Radiated disturbance, horizontal



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.448889	21.08	40.00	18.92	1000.0	120.000	100.0	H	10.0	24.7
127.638889	15.59	40.00	24.41	1000.0	120.000	100.0	H	351.0	18.9
845.038889	23.89	47.00	23.11	1000.0	120.000	100.0	H	295.0	28.4

Figure 5: Spectral Diagrams, Radiated disturbance, vertical



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.291111	21.85	40.00	18.15	1000.0	120.000	100.0	V	356.0	25.3
845.600556	23.88	47.00	23.12	1000.0	120.000	100.0	V	158.0	28.4
948.651667	25.66	47.00	21.34	1000.0	120.000	100.0	V	11.0	29.7

6 Test Results I M M U N I T Y

During the immunity tests, the EUT was operated under conditions specified by clause 3.1 of this report.

Performance criterion A: During the test no change of the luminous intensity shall be observed and the regulating control, if any, shall operate during the test as intended.

Performance criterion B: During the test the luminous intensity may change to any value. After the test the luminous intensity shall be restored to its initial value within 1 min.

Regulating controls need not function during the test, but after the test the mode of the control shall be the same as before the test provided that during the test no mode changing commands.

Performance criterion C: During and after the test any change of the luminous intensity is allowed and the lamp(s) may be extinguished. After the test, within 30 min, all functions shall return to normal if necessary by temporary interruption of the mains supply and/or operating the regulating control.

The EMC immunity performances of the EUT were tested according to EN IEC 61547:2023.

Testing date: 2024.07.17-2024.07.18
Room temperature: 17-23°C
Relative Humidity: 50-57%
Atmospheric pressure: 102.1 kPa

6.1 Enclosure

6.1.1 Electrostatic Discharge

Result:	**Pass**

The immunity against electrostatic discharge was tested in accordance EN IEC 61547:2023. Test setup and ESD-Generator are according to IEC 61000–4–2 which is specified under EN IEC 61547:2023. 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 2: ESD, Positive / Negative Polarity

Position	Kind of Discharge	Remarks	Result
Nonmetal enclosure	Air discharge ±8kV	No change of luminous intensity	Pass
Metal enclosure	Contact discharge ±4kV	No change of luminous intensity	Pass
Coupling plane (Both HCP and VCP)	Contact discharge ±4kV	No change of luminous intensity	Pass

6.1.2 Radio Frequency Electromagnetic Field

Result:	**Pass**

The immunity against radio-frequency electromagnetic fields in the frequency range between 80MHz and 1000MHz was tested in accordance to IEC 61000-4-3 which is specified by clause 5.3 in EN IEC 61547:2023.

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.

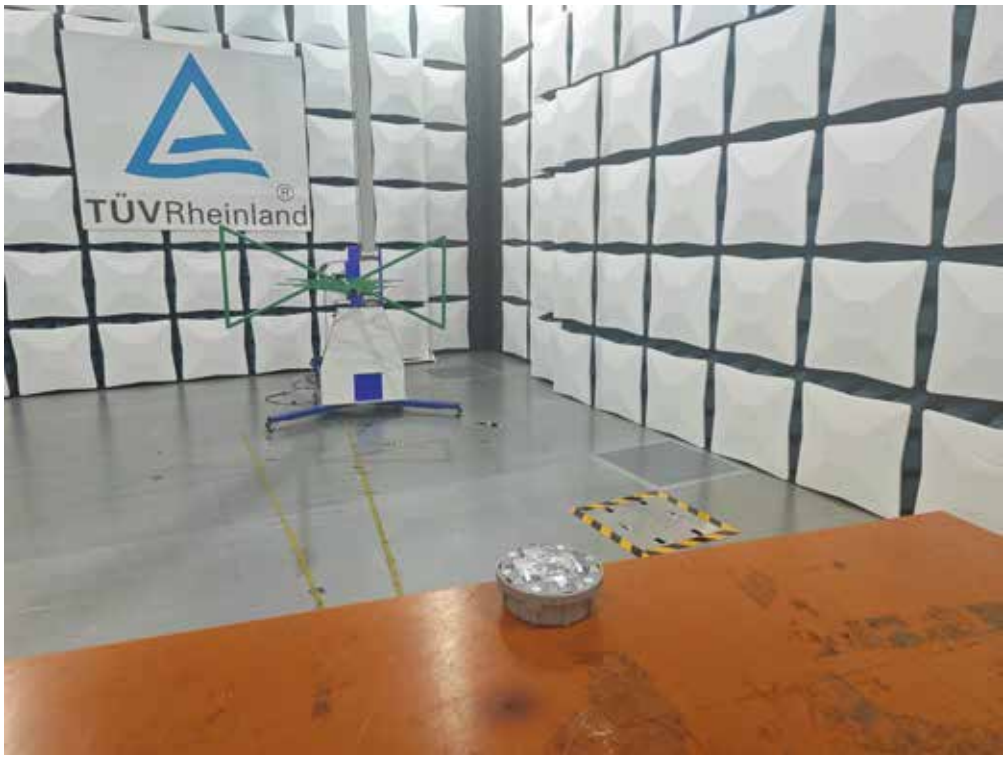
Test Level	:	3V/m
Frequency Range	:	80-1000MHz
Modulation	:	80%AM, 1kHz
Frequency Sweep Speed	:	≤0.005 octave/s (1.5×1E–3 decades/s)
Performance Criteria	:	A

Table 3: Radiated Susceptibility, Field Strength 3V/m

Position	Observation	Result
Antenna in vertical orientation	No change of luminous intensity	Pass
Antenna in horizontal orientation	No change of luminous intensity	Pass

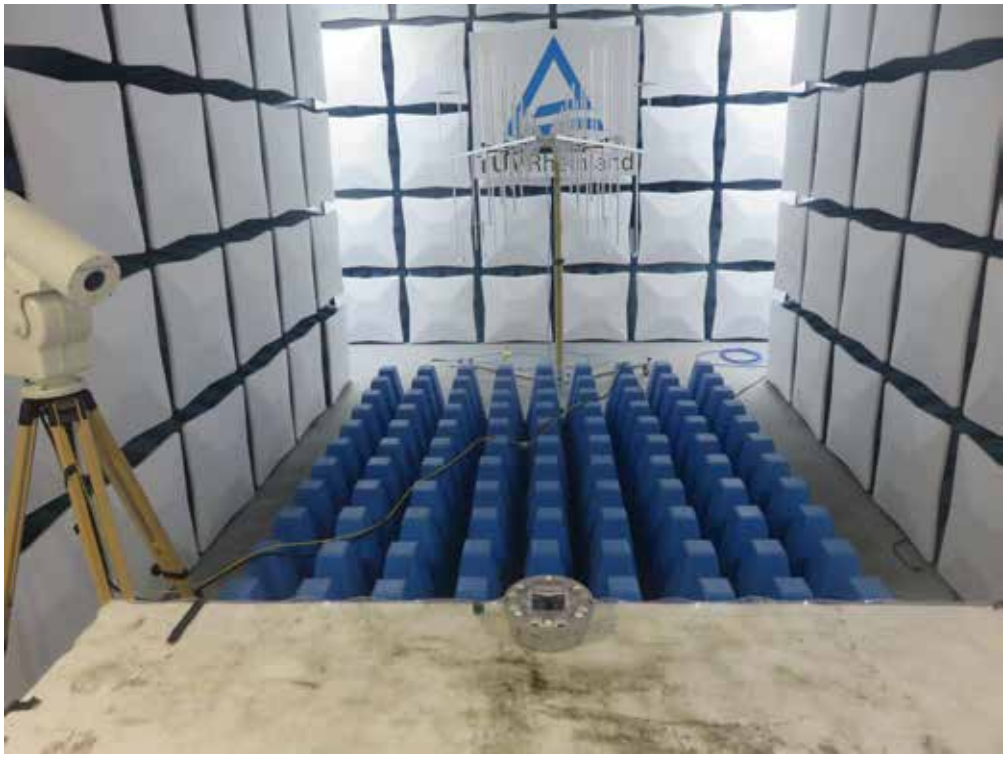
7 Photographs of the Test Set-Up

Photograph 1: Set-up for Radiated Emission



Photograph 2: Set-up for Electrostatic Discharge

Photograph 3: Set-up for Radiated Susceptibility



Photograph 4: Set-up for Radiated electromagnetic disturbances

8 List of Tables

9 List of Figures

10 List of Photographs

-- The END --