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EMC TEST REPORT

Report ID
REP087776

Project ID
PRJ0070567

Type of assessment:
Complete Assessment

Applicant:
Rockwell Automation

Product:
Husky A300

Model:
032808

Model variant(s):
- 032742
- 032743
- 032606
- 033029
- 031277
- 032607

Specification:
EN IEC 61326-1:2021

Date of issue: April 15, 2025

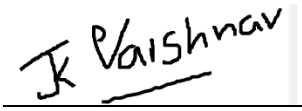
Ketav Jani, EMC/RF Specialist
Tested by


Signature

Tarek Elkholy, EMC/RF Specialist
Tested by


Signature

Jagrut Vaishnav, EMC/RF Specialist
Reviewed by


Signature

Lab and test locations

Company name	Nemko Canada Inc.		
Facilities	Ottawa site: 303 River Road Ottawa, Ontario Canada K1V 1H2 Tel: +1 613 737 9680 Fax: +1 613 737 9691	Montréal site: 292 Labrosse Avenue Pointe-Claire, Québec Canada H9R 5L8 Tel: +1 514 694 2684 Fax: +1 514 694 3528	Cambridge site: 1-130 Saltsman Drive Cambridge, Ontario Canada N3E 0B2 Tel: +1 519 650 4811
Test site registration number:	CA2040 (Ottawa) CA2041 (Montreal) CA0101 (Cambridge)		
Website	www.nemko.com		

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Copyright notification

Table of Contents

Section 1 Report summary

1.1 Test specifications

EN IEC 61326-1: 2021	Electrical equipment for measurement, control and laboratory use EMC requirements Part 1: General requirements

1.2 Exclusions

None

1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

Unless noted in section 1.2, all testing was performed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.4 Test report revision history

Table 1.4-1: *Test report revision history*

Report ID.	Date of issue	Details of changes made to test report
REP087776	April 15, 2025	Original report issued

Section 2 Engineering considerations

2.1 Modifications incorporated in the EUT for compliance

There were no modifications performed to the EUT during this assessment.

2.2 Technical judgment

None

2.3 Model variant declaration

As declared by the applicant, the EUT model 032808 (Which has highest power computer & power system load) has been chosen to be representative for all other models in the model family. The model family, the variants which come with different options and the description of the variations, are as follows:

- 032742 - Installation—Computer, Performance
- 032743 - Installation—Graphics Card
- 033029 - Installation—USB Hub, USB 3_2 gen 1, coolgear CG-G1M4PHT
- 031277 - Installation—Wireless E-stop, Autec
- 032606 - Subset of tested model 032808, has 2 batteries (40Ah configuration) as compared to 032608 (6 batteries 120Ah configuration)
- 032607 - Subset of tested model 032808, has 4 batteries (80Ah configuration) as compared to 032608 (6 batteries 120Ah configuration)

2.4 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 3 Test conditions

3.1 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 4 Information provided by the applicant

4.1 Disclaimer

This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results contained within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

4.2 Applicant/Manufacturer

Applicant name	Rockwell Automation
Applicant address	1425 Strasburg Rd., Suite 2A, Kitchener, ON, N2R 1H2, Canada
Manufacturer name	Same as applicant
Manufacturer address	Same as applicant

4.3 EUT information

Product	Husky A300	
Model	032808	
Serial number	Prototype	
Part number	032721	
Power requirements	Battery: 25.6 V_{DC} (Configuration 1) 28 V_{DC} via external 100–240 V_{AC} Power adapter/charger (Configuration 2)	
Description/theory of operation	This robot is a mobile indoor/outdoor platform that allows for the integration of a variety of sensors (lidars, cameras, etc.) for monitoring, recording, and analysing various aspects of the environment. This robot can be navigated manually or autonomously, using the appropriate sensor data and analysis for navigation	
Operational frequencies	Source description	Frequency (MHz)
	DC/DC converters (12V)	0.234
	DC/DC converter (24V)	0.221
	DC/DC converter (5V)	0.299
	STM micro-controller clock	25.00
	Ethernet PHY	25.00
	I2C bus	0.400
	SPI Clock	1.300
	CPU	1100/3600/4800
	RAM	3200
	Onboard GPU	300/1600
Hardware revision	Revision 4	
Software details	SW: 2.2; FW: 2.0-RC	

4.4 EUT setup details

4.4.1 EUT Exercise and monitoring

Methods used to exercise the EUT and all relevant ports:

- As per the EUT's typical application, EUT was not able to drive motors while powered externally with AC/DC power adapter/charger. Hence EUT was tested with two configurations.

– **Configuration 1:**

- EUT was powered by internal battery
- EUT was programmed to engage all motors running forward at 1.5 m/s continuously
- All LEDs were operational and updating
- HMI Display was active and updating
- CPUs were fully loaded using application software
- GPU was running at 100%
- All radio modules were powered up and were continuously transmitting
- IMU sensor was active

– **Configuration 2:**

- EUT was powered via AC/DC external power adapter/charger
- EUT was not able to drive motors while powered externally
- All LEDs were operational and updating
- HMI Display was active and updating
- CPUs was running application software
- All radio modules were powered up and were continuously transmitting
- IMU sensor was active

Configuration details:

- The EUT setup in a configuration that was expected to produce the highest amplitude emissions relative to the limit and that satisfy normal operation/installation practice by the end user.
- The type and construction of cables used in the measurement set-up were consistent with normal or typical use. Cables with mitigation features (for example, screening, tighter/more twists per length, ferrite beads) have been noted below:
- None
- The EUT was setup in a manner that was consistent with its typical arrangement and use. The measurement arrangement of the EUT, local AE and associated cabling was representative of normal practice. Any deviations from typical arrangements have been noted below:
- None

Monitoring details:

– **Configuration 1:**

- Wheels of the EUT were spinning and it was monitored thorough out the testing. LEDs and HMI display was continuously updating and was monitored while testing. Radio modules were powered up, transmitting and the status of the transmission was monitored on the laptop during the testing.

– **Configuration 2:**

- LEDs and HMI display was continuously updating and was monitored while testing. Data topics were also monitored during the testing. Radio modules were powered up, transmitting and the status of the transmission was monitored on the laptop during the testing.

4.4.2 EUT test configuration, Configuration 1

Table 4.4-1: *EUT interface ports*

Description	Qty.
DC power charging port	1
USB service port	1
Ethernet service port	1

Table 4.4-2: *Support equipment*

Description	Brand name	Serial number, Part number, Model, Revision level
Laptop	Lenovo	MN: ThinkPad, SN: PD-OEYQOR
Wireless access point	Tp-Link	SN: 22471A5000160, MN: Archer AXE75
Remote control pushbutton transmitting unit	Autec Srl	MN : LKN, SN : GD26636, Type : LA1JH

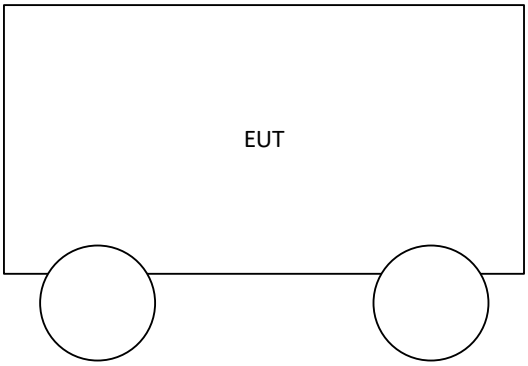


Figure 4.4-1: *Block diagram, Configuration 1*

EUT test configuration, continued, Configuration 2

Table 4.4-3: *EUT sub assemblies*

Description	Brand name	Model
AC/DC adapter	Meanwell	MN: NPB-240-24TB, SN: SC514C6368

Table 4.4-4: *EUT interface ports*

Description	Qty.
DC power charging port	1
USB service port	1
Ethernet service port	1

Table 4.4-5: *Support equipment*

Description	Brand name	Serial number, Part number, Model, Revision level
Laptop	Lenovo	MN: ThinkPad, SN: PD-OEYQOR
Wireless access point	Tp-Link	SN: 22471A5000160, MN: Archer AXE75
Remote control pushbutton transmitting unit	Autec Srl	MN : LKN, SN : GD26636, Type : LA1JH

Table 4.4-6: *Inter-connection cables*

Cable description	From	To	Length (m)
DC cable	EUT	AC/DC Adaptor	1.0
AC Mains Cable	AC/DC Adaptor	AC Mains	0.9

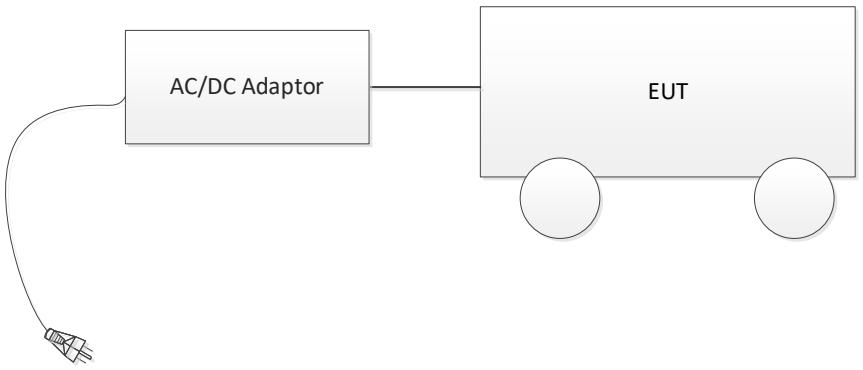


Figure 4.4-2: *Block diagram, Configuration 2*

Section 5 Summary of test results

5.1 Testing period

Test start date	March 17, 2025	Test end date	March 24, 2025

5.2 Sample information

Receipt date	March 17, 2025	Nemko sample ID number	PRJ00705670001, PRJ00705670002

5.3 Equipment classification

Table 5.3-1: *Equipment environment classification*

Equipment environment classification	
☐	Equipment intended to be used in a basic electromagnetic environment
☒	Equipment intended to be used in an industrial electromagnetic environment
☐	Equipment intended to be used in a controlled electromagnetic environment

Notes:

Basic electromagnetic environment: environment existing at locations characterized by being supplied directly at low voltage from the public mains network

Industrial electromagnetic environment: environment existing at locations characterized by a separate power network, in most cases supplied from a high- or medium-voltage transformer, dedicated for the supply of installations feeding manufacturing or similar plants with one or more of the following conditions:

- frequent switching of heavy inductive or capacitive loads;
- high currents and associated magnetic fields;
- presence of Industrial, Scientific and Medical (ISM) equipment (for example, welding machines)

Controlled electromagnetic environment: environment usually characterized by recognition and control of EMC threats by users of the equipment or by design of the installation

5.4 Test results

Table 5.4-1: *Emissions results*

Environmental phenomenon	Basic standard	Verdict
Radiated disturbance	EN 55011	Pass [1]
Mains terminal disturbance voltage	EN 55011	Pass [1,3]
Harmonics current emissions	EN 61000-3-2	Pass [2]
Voltage fluctuations and flicker	EN 61000-3-3	Pass

Notes: [1] Group 1 Class A
[2] Harmonic classification A
[3] The EUT is battery powered, the AC power line Conducted Emissions test was performed while the EUT was being charged (Configuration 2)

Table 5.4-2: *Immunity results – Equipment intended to be used in an industrial electromagnetic environment*

Environmental phenomenon	Basic standard	Verdict
Enclosure		
Electrostatic discharge (ESD)	EN 61000-4-2	Pass
Electromagnetic field	EN 61000-4-3	Pass
Power frequency magnetic field	EN 61000-4-8	Pass
AC power (including protective earth)[4]		
Burst	EN 61000-4-4	Pass
Surge	EN 61000-4-5	Pass
Conducted RF	EN 61000-4-6	Pass
Voltage dips	EN 61000-4-11	Pass
Short interruptions	EN 61000-4-11	Pass
DC power (including protective earth)[1]		
Burst	EN 61000-4-4	Not applicable
Surge	EN 61000-4-5	Not applicable
Conducted RF	EN 61000-4-6	Not applicable
I/O signal/control (including functional earth)[2]		
Burst	EN 61000-4-4	Not applicable
Surge	EN 61000-4-5	Not applicable
Conducted RF	EN 61000-4-6	Not applicable
I/O signal/control connected directly to mains[3]		
Burst	EN 61000-4-4	Not applicable
Surge	EN 61000-4-5	Not applicable
Conducted RF	EN 61000-4-6	Not applicable

Notes: [1] EUT is not DC powered
[2] EUT does not contain any I/O signal/control lines
[3] EUT does not contain any I/O signal/control lines which connect directly to mains
[4] The EUT is battery powered, the AC power line tests were performed while the EUT was being charged (Configuration 2)

Section 6 Terms and definitions

6.1 Performance criterion

6.1.1 EN 61326-1

General performance criteria	The general principles (performance criteria) for the evaluation of the immunity test results are the following. Permissible LOSSES OF PERFORMANCE are allowed only if specified in the test plan before testing, and clearly provided to the user in the product specification. If the PERFORMANCE LEVEL or the permissible LOSS OF PERFORMANCE is not specified, either of these may be derived from the product specification or user documentation and what the user may reasonably expect from the equipment if used as intended.
Performance criterion A	The equipment shall continue to operate as intended during and after the test. No DEGRADATION OF PERFORMANCE or LOSS OF FUNCTION is allowed below a PERFORMANCE LEVEL specified in the user documentation, when the equipment is used as intended. In the case of applying immunity tests with continuous electromagnetic phenomena, the PERFORMANCE LEVEL may be replaced by a permissible LOSS OF PERFORMANCE which shall recover, without user intervention. A permissible LOSS OF PERFORMANCE is allowed within the PERFORMANCE LEVEL only when this information is clearly provided to the end user via documentation, such as the product user manual. No change in the operating state is allowed nor is loss of data.
Performance criterion B	The equipment shall continue to operate as intended after the test. No DEGRADATION OF PERFORMANCE or LOSS OF FUNCTION is allowed below a PERFORMANCE LEVEL specified in the user documentation, when the equipment is used as intended. During the test, the equipment PERFORMANCE LEVEL may be replaced by a permissible LOSS OF PERFORMANCE if such LOSS OF PERFORMANCE is detailed in the EMC test plan. A permissible LOSS OF PERFORMANCE is allowed within the PERFORMANCE LEVEL only when this information is clearly provided to the end user via documentation, such as the product user manual. An unintended change of the operating state is allowed if self-recoverable. No loss of stored data is allowed. The following are examples of performance criterion B: **EXAMPLE 1:** Data transfer is controlled or checked by parity check or by other means. In the case of malfunction, such as caused by a surge impulse, the data transfer will be repeated automatically. A reduced data transfer rate at this time is allowable degradation. **EXAMPLE 2:** During testing, an analogue function value may deviate in excess of the specified limits. After the test, the deviation vanishes. **EXAMPLE 3:** In the case of a monitor used only for man-machine monitoring, it is allowable that some degradation takes place, such as momentary display interference during the application of burst impulses.
Performance criterion C	LOSS OF FUNCTION is allowed, provided the function is self-recoverable or can be restored by the operation of the controls. Recovery procedure shall be included in the user documentation. No permanent damage to the equipment is allowed. The following are examples of performance criterion C: **EXAMPLE 1:** In the case of an interruption in the mains longer than the specified buffer time, the power supply unit of the equipment is switched off. The switch-on may be automatic or carried out by the operator. **EXAMPLE 2:** After a programme interruption caused by a disturbance, the processor functions of the equipment stops at a defined position and is not left in a "crashed state". An operator's action may be necessary. **EXAMPLE 3:** The test results in an opening of an over-current protection equipment that can be reset by the operator.

6.2 Product classification and definitions

6.2.1 EN 55011

Group 1 equipment	Group 1 contains all equipment in the scope of this standard which is not classified as group 2 equipment.
Group 2 equipment	Group 2 contains all ISM RF equipment in which radio-frequency energy in the frequency range 9 kHz to 400 GHz is intentionally generated and used or only used locally, in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material, for inspection/analysis purposes, or for transfer of electromagnetic energy.
Class A equipment	Equipment suitable for use in all locations other than those allocated in residential environments and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes. **Warning:** Class A equipment is intended for use in an industrial environment. In the documentation for the user, a statement shall be included drawing attention to the fact that there may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.
Class B equipment	Equipment suitable for use in locations in residential environments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

6.3 General definitions

6.3.1 EN 61000-3-2 (Harmonic emissions)

For the purpose of harmonic current limitation, equipment is classified as follows:

Class A	– Balanced three-phase equipment; – Household appliances, excluding those specified as belonging to Class B, C or D; – Vacuum cleaners; – High pressure cleaners; – Tools, excluding portable tools; – Independent phase control dimmers; – Audio equipment; – Professional luminaires for stage lighting and studios. Equipment not specified in one of the three other classes shall be considered as Class A equipment.
Class B	– Portable tools; – Arc welding equipment, which is not professional equipment.
Class C	– Lighting equipment.
Class D	Equipment having a specified power according to 6.3.2 less than or equal to 600 W, of the following types: – Personal computers and personal computer monitors; – Television receivers; – Refrigerators and freezers having one or more variable-speed drives to control compressor motor(s).

6.3.2 EN 61000-3-3 (Voltage fluctuations and flicker)

Voltage fluctuation	Series of changes of r.m.s voltage evaluated as a single value for each successive half-period between zero-crossings of the source voltage.
Flicker	Impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates with time.
Short-term flicker indicator, *P*st	The flicker severity evaluated over a short period (in minutes); *P*st = 1 is the conventional threshold of irritability.
Long-term flicker indicator, *P*lt	The flicker severity evaluated over a long period (a few hours) using successive *P*st values.

General definitions, continued

6.3.3 EN 61000-4-2 (Electrostatic discharge)

Electrostatic discharge; ESD	A transfer of electric charge between bodies of different electrostatic potential in proximity or through direct contact.
Contact discharge method	A method of testing, in which the electrode of the test generator is held in contact with the EUT, and the discharge actuated by the discharge switch within the generator.
Air discharge method	A method of testing, in which the charged electrode of the test generator is brought close to the EUT, and the discharge actuated by a spark to the EUT.
Direct application	Application of the discharge directly to the EUT.
Indirect application	Application of the discharge to a coupling plane in the vicinity of the EUT, and simulation of personnel discharge to objects, which are adjacent to the EUT.
Coupling plane	A metal sheet or plate, to which discharges are applied to simulate electrostatic discharge to objects adjacent to the EUT. HCP: Horizontal Coupling Plane; VCP: Vertical Coupling Plane.

6.3.4 EN 61000-4-3 (Radiated, radio-frequency, electromagnetic field)

Continuous waves (CW)	Electromagnetic waves, the successive oscillations of which are identical under steady-state conditions, which can be interrupted or modulated to convey information.
Electromagnetic (EM) wave	Radiant energy produced by the oscillation of an electric charge characterized by oscillation of the electric and magnetic fields.
Field strength	The term “field strength” is applied only to measurements made in the far field. The measurement may be of either the electric or the magnetic component of the field and may be expressed as V/m, A/m or W/m2; any one of these may be converted into the others.
Sweep	Continuous or incremental traverse over a range of frequencies.

6.3.5 EN 61000-4-4 (Electrical fast transient/burst)

Burst	Sequence of a limited number of distinct pulses or an oscillation of limited duration.
Common mode (coupling)	Simultaneous coupling to all lines versus the ground reference plane.
Ground reference plane	Flat conductive surface whose potential is used as a common reference.
Coupling clamp	Device of defined dimensions and characteristics for common mode coupling of the disturbance signal to the circuit under test without any galvanic connection to it.
Transient	Pertaining to or designating a phenomenon or a quantity which varies between two consecutive steady states during a time interval which is short compared with the time-scale of interest.

6.3.6 EN 61000-4-5 (Surge)

Surge	Transient wave of electrical current, voltage, or power propagating along a line or a circuit and characterized by a rapid increase followed by a slower decrease.
Ground (reference)	Part of the Earth considered as conductive, the electrical potential of which is conventionally taken as zero, being outside the zone of influence of any earthing (grounding) arrangement.

General definitions, continued

6.3.7 EN 61000-4-6 (Immunity to conducted disturbances, induced by radio-frequency fields)

Clamp injection	Clamp injection is obtained by means of a clamp-on “current” injecting device on the cable.
Coupling/decoupling network CDN	Electrical circuit incorporating the functions of both the coupling and decoupling networks.
Sweep	Continuous or incremental traverse over a range of frequencies.

6.3.8 EN 61000-4-8 (Power frequency magnetic field)

Induction coil	Conductor loop of defined shape and dimensions, in which flows a current, generating a magnetic field of defined constancy in its plane and in the enclosed volume.
Immersion method	Method of application of the magnetic field to the EUT, which is placed in the centre of an induction coil.
Proximity method	Method of application of the magnetic field to the EUT, where a small induction coil is moved along the side of the EUT in order to detect particularly sensitive areas.
Ground	A flat conductive surface whose potential is used as a common reference for the magnetic field generator and the auxiliary equipment (the ground plane can be used to close the loop of the induction coil.

6.3.9 EN 61000-4-11 (Voltage dips, short interruptions and voltage variations)

Voltage dip	A sudden reduction of the voltage at a particular point of an electricity supply system below a specified dip threshold followed by its recovery after a brief interval.
Short interruption	A sudden reduction of the voltage on all phases at a particular point of an electric supply system below a specified interruption threshold followed by its restoration after a brief interval.

Section 7 Testing data

7.1 Radiated disturbance

7.1.1 References and limits

EN 55011:2016 + A1:2017 + A11:2020 + A2:2021

Table 7.1-1: *Radiated disturbance – Group 1 limits*

Facility	Class	Rated input power	Frequency range [MHz]	Measurement		limits
				Distance [m]	Detector type	[dBµV/m]
OATS/SAC	Class A	≤ 20 kVA	30–230	3[1]	Quasi Peak	50
			230–1000			57

Notes: [1] The limits specified for the 3 m separation distance are based on a uniform reduction in the limit of 10 dB.

OATS – Open Area Test Site, SAC – Semi Anechoic Chamber
Where there is a step in the relevant limit, the lower value was applied at the transition frequency.

7.1.2 Test summary

Verdict	Pass		
Test date	March 17, 2025	Temperature	24 °C
Tested by	Tarek Elkholy	Air pressure	983 mbar
Test location	Cambridge	Relative humidity	41 %

7.1.3 Notes

- The spectral plots within this section are a summation of vertical and horizontal scans. The spectral plots within this section have been corrected with all relevant transducer factors.
- Where tabular data has not been provided, no emissions were observed within 10 dB of the specified limit when measured with the appropriate detector. Additionally, where less than 6 measurements per detector have been provided, fewer than 6 emissions were observed within 10 dB of the specified limit when measured with the appropriate detector.
- As per 3.17 of EN 55011 the EUT is considered to be small equipment. Small equipment is defined as equipment, either positioned on a table top or standing on the floor which, including its cables fits in an imaginary cylindrical test volume of 1.2 m in diameter and 1.5 m height to ground plane.
- Configuration 1 was considered as the worst-case scenario for the EUT and EUT was tested in configuration 1.

7.1.4 Setup details

Port under test	Enclosure Port
EUT power input during test	Battery: 25.6 V_{DC}
EUT setup configuration	Floor standing
Test facility	Semi anechoic chamber
Measuring distance	3 m
Antenna height variation	1–4 m
Turntable position	0–360°
Measurement details	A preview measurement was generated with the receiver in continuous scan or sweep mode while the EUT was rotated and the antenna adjusted to maximize radiated emission. Selected emissions detected were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver/spectrum analyzer settings:

Resolution bandwidth	120 kHz
Video bandwidth	300 kHz
Detector mode	Peak (Preview), Quasi-peak (Final)
Trace mode	Max Hold
Measurement time	100 ms

Setup details, continued

Table 7.1-2: *Radiated disturbance equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Receiver/spectrum analyzer	Rohde & Schwarz	ESR26	FA002969	1 year	May 17, 2025
3 m EMI test chamber	TDK	SAC-3	FA003012	1 year	March 09, 2026
Flush mount turntable	SUNAR	FM2022	FA003006	—	NCR
Controller	SUNAR	SC110V	FA002976	—	NCR
Antenna mast	SUNAR	TLT2	FA003007	—	NCR
Bilog antenna (30–2000 MHz)	SUNAR	JB1	FA003009	1 year	April 24, 2025
50 Ω coax cable	Huber + Suhner	None	FA003402	1 year	July 29, 2025
50 Ω coax cable	Huber + Suhner	None	FA003047	1 year	July 29, 2025

Notes: NCR - no calibration required

All equipment related to the contribution of measurement has been included in this list. Such items include, but are not limited to, cables, attenuators, directional couplers, and pre-amps.

Table 7.1-3: *Measurement uncertainty calculations based on equipment list*

Measurement	U_{cispr} dB	U_{lab} dB
Radiated disturbance (30 MHz to 1 GHz)	6.3	5.8

Notes: Nemko Canada Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 “Uncertainty in EMC measurements.” Measurement uncertainty was calculated using the methods described in CISPR 16-4-2 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Measurement instrumentation uncertainty. The expression of Uncertainty in EMC Testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

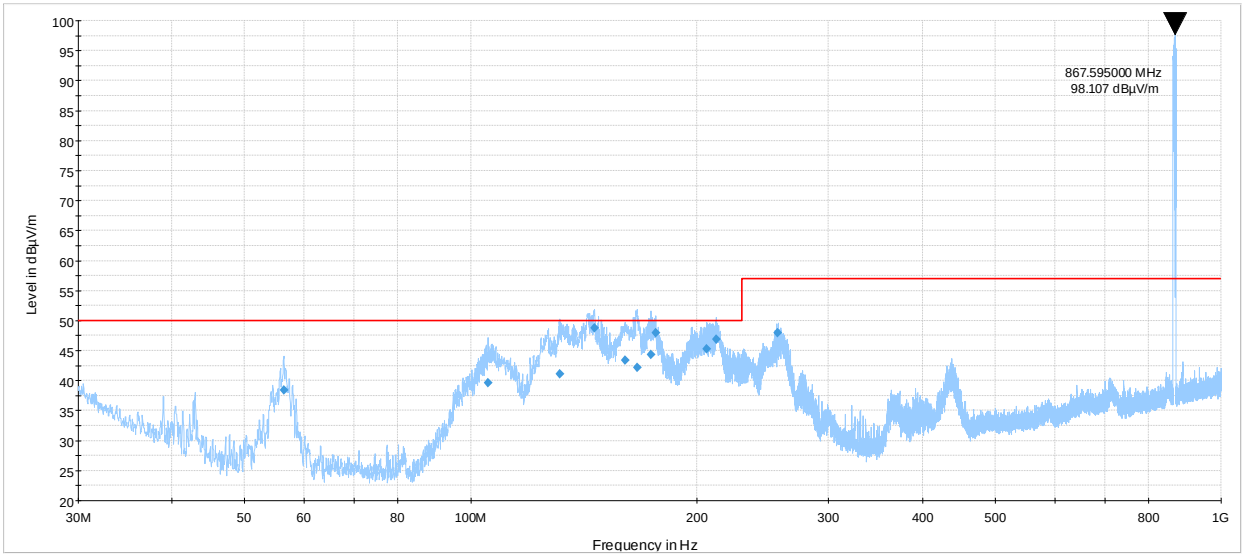
Compliance assessment:
If U_{lab} is less than or equal to U_{cispr} then:
- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit

If U_{lab} is greater than U_{cispr} then:
- compliance is deemed to occur if no measured disturbance level, increased by (U_{lab} - U_{cispr}), exceeds the disturbance limit
- non-compliance is deemed to occur if any measured disturbance level, increased by (U_{lab} - U_{cispr}), exceeds the disturbance limit

Table 7.1-4: *Radiated disturbance test software details*

Manufacturer of Software	Details
Rohde & Schwarz	EMC32, Software for EMC Measurements, Version 10.60.00

7.1.5 Test data



Note: Peak observed at 868 MHz is from the intentional transmitter of the auxiliary equipment and not related to the digital emissions.

Figure 7.1-2: *Radiated disturbance spectral plot (30 to 1000 MHz)*

Table 7.1-5: *Radiated emissions results*

Frequency (MHz)	Quasi-Peak field strength[1 and 3] (dBµV/m)	Quasi-Peak limit (dBµV/m)	Quasi-Peak margin (dB)	Correction factor[2] (dB)
131.49	41.1	50.0	8.9	18.6
146.33	48.8	50.0	1.2	17.5
160.46	43.5	50.0	6.5	17.1
166.58	42.1	50.0	7.9	16.9
173.97	44.3	50.0	5.7	16.5
176.42	48.0	50.0	**2.0**	16.4
206.39	45.3	50.0	4.7	15.7
212.36	46.9	50.0	3.1	15.4
256.70	47.9	57.0	9.1	16.7

Notes:
[1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB) − amplifier gain (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

Sample calculation: 37.5 dBµV/m (field strength) = 21.3 dBµV (receiver reading) + 16.2 dB (Correction factor)

7.1.6 Setup photo

Figure 7.1-1: *Radiated disturbance setup photo*

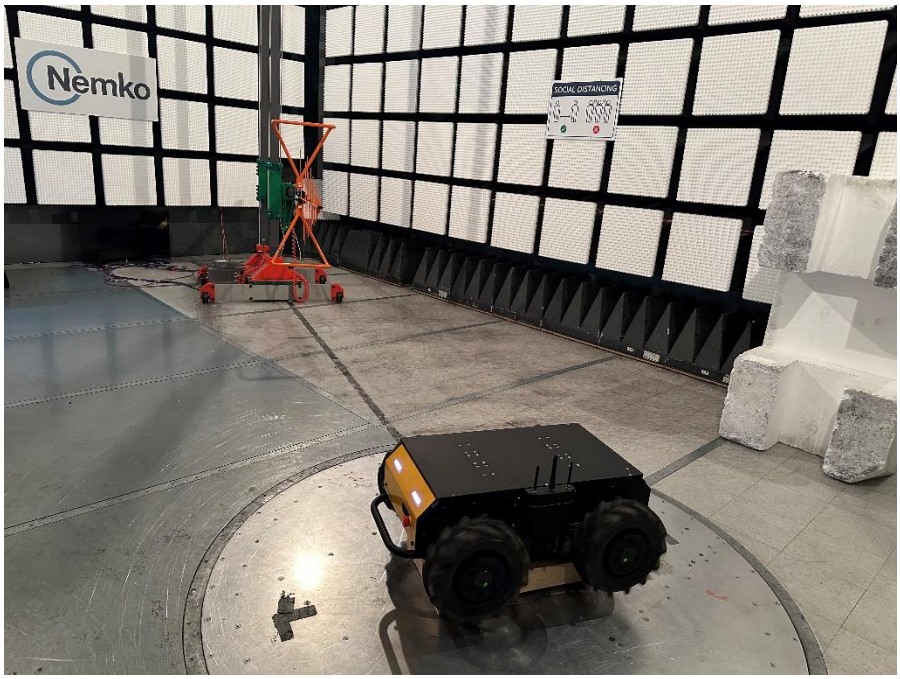


Figure 7.1-2: *Radiated disturbance setup photo*

7.2 Mains terminal disturbance voltage

7.2.1 References and limits

EN 55011:2016 + A1:2017 + A11:2020 + A2:2021

Table 7.2-1: *Mains terminal disturbance voltage limits*

Frequency range [MHz]	Measurement		Limits
	Coupling device	Detector type/ bandwidth	[dBµV]
Class A group 1 (Rated input power of ≤ 20 kVA)			
0.15–0.5			79
0.5–5	AMN	Quasi Peak/9 kHz	73
5–30			73
0.15–0.5			66
0.5–5	AMN	CAverage/9 kHz	60
5–30			60

Notes: [1]These limits apply to equipment with a rated input power > 20 kVA and intended to be powered by a dedicated power transformer or generator, and which is not connected to Low Voltage (LV) overhead power lines. For equipment not intended to be powered by a user specific power transformer, the limits for ≤ 20 kVA apply. The manufacturer and/or supplier shall provide information on installation measures that can be used to reduce emissions from the installed equipment. In particular, it shall be indicated that this equipment is intended to be powered by a dedicated power transformer or generator and not by LV overhead power lines.

[2]Decreasing linearly with logarithm of frequency

[3]The manufacturer and/or supplier shall provide information on installation measures that can be used to reduce emissions from the installed equipment.

7.2.2 Test summary

Verdict	Pass		
Test date	March 24, 2025	Temperature	24 °C
Tested by	Ketav Jani	Air pressure	975 mbar
Test location	Cambridge	Relative humidity	41 %

7.2.3 Notes

- The spectral plots within this section have been corrected with all relevant transducer factors.
- Where tabular data has not been provided, no emissions were observed within 10 dB of the specified limit when measured with the appropriate detector. Additionally, where less than 6 measurements per detector have been provided, fewer than 6 emissions were observed within 10 dB of the specified limit when measured with the appropriate detector.
- Equipment with a DC power port powered by a dedicated AC/DC power converter is considered to be AC mains powered equipment and tested with a power converter. Where the manufacturer provided the power converter, the supplied converter was used.
- EUT was tested in configuration 2.

7.2.4 Setup details

Port under test – Coupling device	AC input of AC/DC adapter – Artificial Mains Network (AMN)
EUT power input during test	230 V_{AC}, 50 Hz
EUT setup configuration	Floor standing
Measurement details	A preview measurement was generated with the receiver in continuous scan mode. Selected emissions detected were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver settings:

Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	Peak and Average (Preview), Quasi-peak and CAverage (Final)
Trace mode	Max Hold
Measurement time	100 ms (Preview), 160 ms (Final)

Table 7.2-2: *Mains terminal disturbance voltage equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Receiver/spectrum analyzer	Rohde & Schwarz	ESR26	FA002969	1 year	May 17, 2025
Two-line v-network	Rohde & Schwarz	ENV216	FA002965	1 year	November 30, 2025
50 Ω coax cable	Rohde & Schwarz	None	FA003074	1 year	July 29, 2025

Notes: NCR - no calibration required

All equipment related to the contribution of measurement has been included in this list. Such items include, but are not limited to, cables, attenuators, directional couplers, and pre-amps.

Table 7.2-3: *Measurement uncertainty calculations based on equipment list*

Measurement	U_{cispr} dB	U_{lab} dB
Conducted disturbance at AC mains and other port power using a V-AMN (150 kHz to 30 MHz)	3.4	3.0

Notes: Nemko Canada Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 “Uncertainty in EMC measurements.” Measurement uncertainty was calculated using the methods described in CISPR 16-4-2 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Measurement instrumentation uncertainty. The expression of Uncertainty in EMC Testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Compliance assessment:
If U_{lab} is less than or equal to U_{cispr} then:
- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit

If U_{lab} is greater than U_{cispr} then:
- compliance is deemed to occur if no measured disturbance level, increased by (U_{lab} - U_{cispr}), exceeds the disturbance limit
- non-compliance is deemed to occur if any measured disturbance level, increased by (U_{lab} - U_{cispr}), exceeds the disturbance limit

Table 7.2-4: *Mains terminal disturbance voltage software details*

Manufacturer of Software	Details
Rohde & Schwarz	EMC32, Software for EMC Measurements, Version 10.60.00

7.2.5 Test data

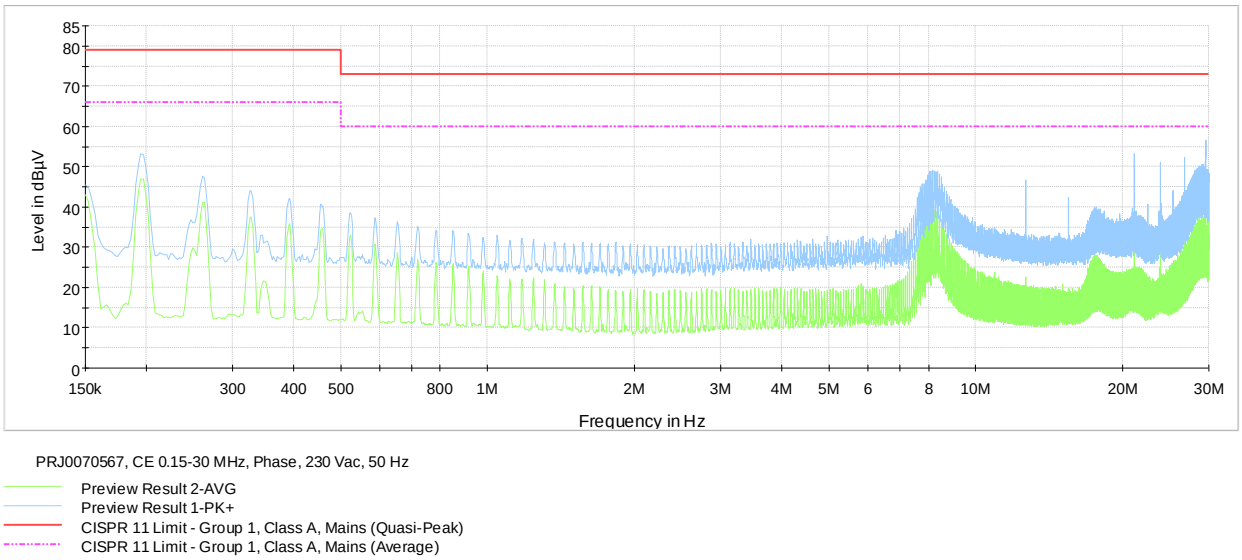


Figure 7.2-1: *Mains terminal disturbance voltage spectral plot on phase line*

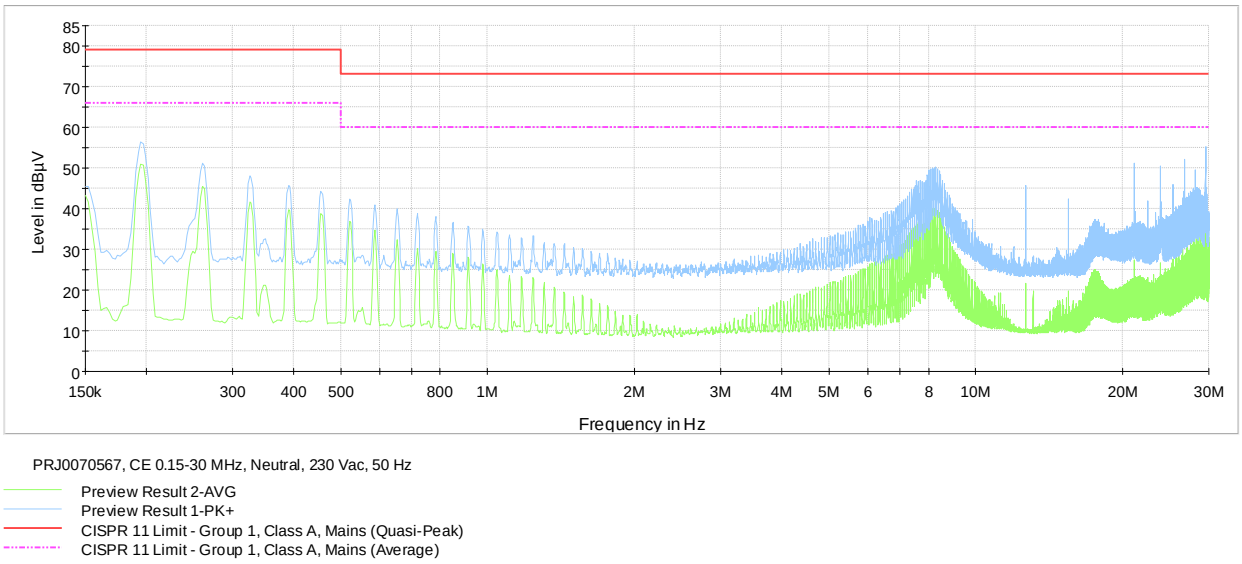


Figure 7.2-2: *Mains terminal disturbance voltage spectral plot on neutral line*

7.2.6 Setup photos

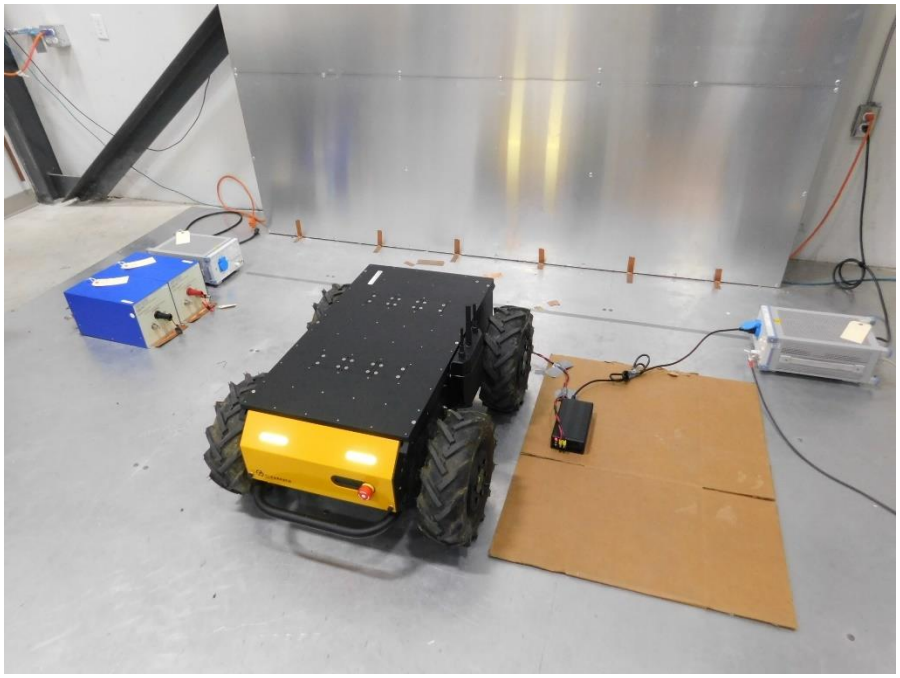


Figure 7.2-3: *Mains terminal disturbance voltage setup photo*

Figure 7.2-4: *Mains terminal disturbance voltage setup photo*

7.3 Harmonic current emissions

7.3.1 References and limits

EN 61000-3-2: 2018

Table 7.3-1: *Limits for Class A equipment*

Harmonic order (*n*)	Maximum permissible harmonic current (A)
Odd harmonics	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
$15 \le n \le 39$	$0.15 \times 15/n$
Even harmonics	
2	1.08
4	0.43
6	0.30
$8 \le n \le 40$	$0.23 \times 8/n$

7.3.2 Test summary

Verdict	Pass		
Test date	March 24, 2025	Temperature	24 °C
Tested by	Ketav Jani	Air pressure	975 mbar
Test location	Cambridge	Relative humidity	41 %

7.3.3 Notes

EUT was tested in configuration 2.

7.3.4 Setup details

Port under test	AC input of AC/DC adapter
Measurement time	10 minutes
EUT power input during test	230 V_{AC}, 50 Hz

Table 7.3-2: *Harmonic current emissions equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Harmonics and Flicker Analyzer	EMC Partner	Har 1000-1P	FA002987	1 year	November 30, 2025
AC power source	Chroma	61509	FA003020	—	NCR

Notes: NCR - no calibration required

Table 7.3-3: *Measurement uncertainty*

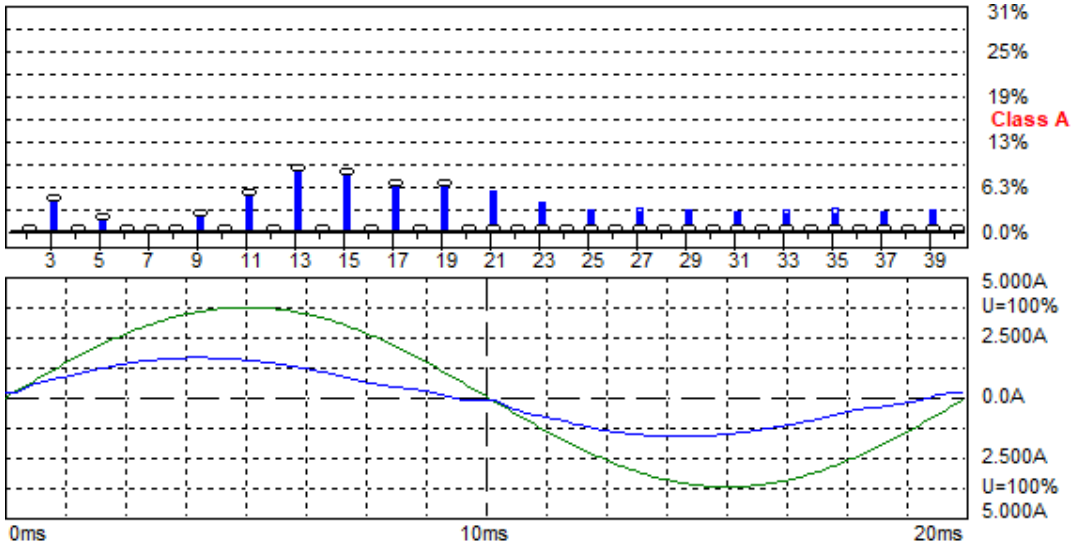
Measurement uncertainty (MU) considerations
Measurement uncertainty requirements for EN 61000-3-2 are currently under consideration, and no applicable requirements have been established at this time. The test equipment is calibrated to meet the tolerance requirements of EN 61000-3-2, with calibration uncertainty taken into account. (Tolerances are not reduced by MU)

Table 7.3-4: *Harmonic current emissions test software details*

Manufacturer of Software	Details
EMC Partner	HARCS, version 6.2

7.3.5 Test data

Measurement data



Harmonic Emission - IEC 61000-3-2 , EN 61000-3-2 , (EN60555-2) 2025-03-24 3:55:04 PM

Urms = 230.5 V P = 242.2 W THC = 0.103 A
Irms = 1.091 A pf = 0.963

Range: 5 A
V-nom: 230 V
TestTime: 10 min (100%)

Husky
Clearpath Robotics

Test completed, Result: PASSED

HAR-1000 EMC-Partner

Order	Freq. (Hz)	Iavg (A)	Irms (A)	Imax (A)	Limit (A)	Order	Freq. (Hz)	Iavg (A)	Irms (A)	Imax (A)	Limit (A)
1	50	1.0809	1.0852	1.0852		21	1050	0.0000	0.0058	0.0058	0.1071
2	100	0.0000	0.0009	0.0012	1.0800	22	1100	0.0000	0.0000	0.0003	0.0836
3	150	0.0956	0.0955	0.0958	2.3000	23	1150	0.0000	0.0037	0.0037	0.0978
4	200	0.0000	0.0003	0.0003	0.4300	24	1200	0.0000	0.0000	0.0003	0.0767
5	250	0.0201	0.0201	0.0201	1.1400	25	1250	0.0000	0.0024	0.0024	0.0900
6	300	0.0000	0.0000	0.0003	0.3000	26	1300	0.0000	0.0000	0.0003	0.0708
7	350	0.0000	0.0006	0.0009	0.7700	27	1350	0.0000	0.0021	0.0024	0.0833
8	400	0.0000	0.0000	0.0003	0.2300	28	1400	0.0000	0.0000	0.0003	0.0657
9	450	0.0085	0.0085	0.0085	0.4000	29	1450	0.0000	0.0021	0.0021	0.0776
10	500	0.0000	0.0000	0.0003	0.1840	30	1500	0.0000	0.0003	0.0003	0.0613
11	550	0.0166	0.0168	0.0168	0.3300	31	1550	0.0000	0.0018	0.0018	0.0726
12	600	0.0000	0.0003	0.0003	0.1533	32	1600	0.0000	0.0003	0.0003	0.0575
13	650	0.0174	0.0174	0.0177	0.2100	33	1650	0.0000	0.0015	0.0018	0.0682
14	700	0.0000	0.0003	0.0003	0.1314	34	1700	0.0000	0.0003	0.0003	0.0541
15	750	0.0119	0.0119	0.0122	0.1500	35	1750	0.0000	0.0015	0.0018	0.0643
16	800	0.0000	0.0003	0.0003	0.1150	36	1800	0.0000	0.0003	0.0003	0.0511
17	850	0.0085	0.0085	0.0085	0.1324	37	1850	0.0000	0.0015	0.0015	0.0608
18	900	0.0000	0.0000	0.0003	0.1022	38	1900	0.0000	0.0003	0.0003	0.0484
19	950	0.0076	0.0076	0.0076	0.1184	39	1950	0.0000	0.0015	0.0015	0.0577
20	1000	0.0000	0.0000	0.0003	0.0920	40	2000	0.0000	0.0003	0.0003	0.0460

7.3.6 Setup photos

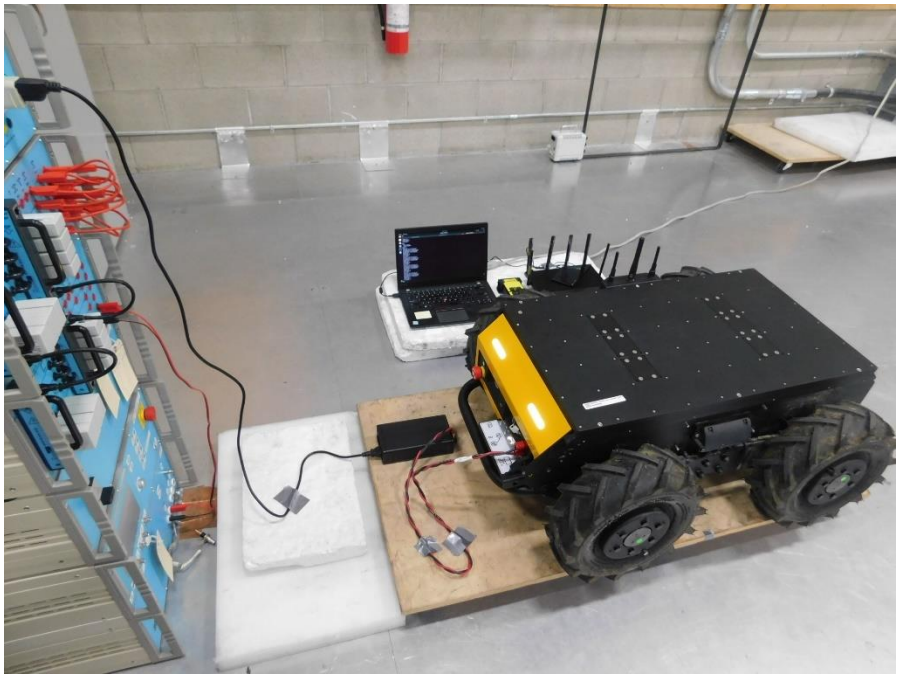


Figure 7.3-1: *Harmonic current emissions setup photo*

7.4 Voltage fluctuations and flicker

7.4.1 References

EN 61000-3-3: 2013 + A1:2019

7.4.2 Test summary

Verdict	Pass		
Test date	March 24, 2025	Temperature	24 °C
Tested by	Ketav Jani	Air pressure	975 mbar
Test location	Cambridge	Relative humidity	41 %

7.4.3 Notes

EUT was tested in configuration 2.

7.4.4 Setup details

Port under test	AC input of AC/DC adapter
Measurement time	10 minutes
EUT power input during test	230 V_{AC}, 50 Hz

Table 7.4-1: *Voltage fluctuations and flicker equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Harmonics and Flicker Analyzer	EMC Partner	Har 1000-1P	FA002987	1 year	November 30, 2025
AC power source	Chroma	61509	FA003020	—	NCR

Notes: NCR - no calibration required

Table 7.4-2: *Measurement uncertainty*

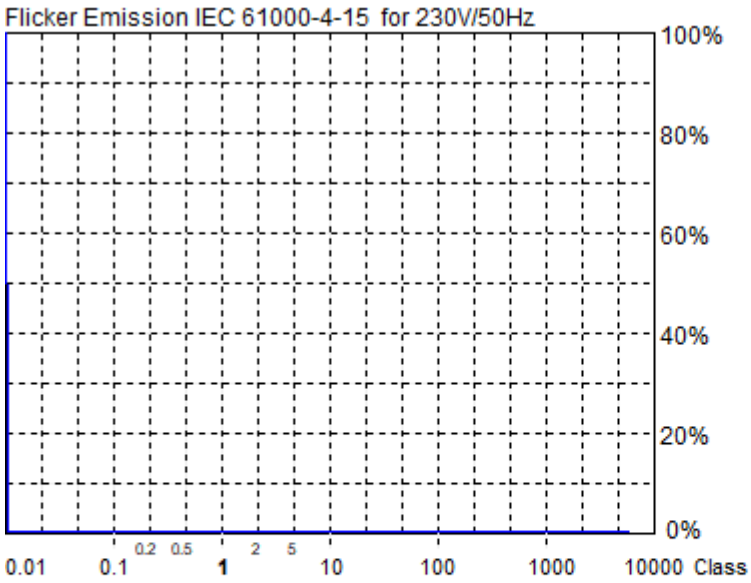
Measurement uncertainty (MU) considerations
Measurement uncertainty requirements for EN 61000-3-3 are currently under consideration, and no applicable requirements have been established at this time. The test equipment is calibrated to meet the tolerance requirements of EN 61000-3-3, with calibration uncertainty taken into account. (Tolerances are not reduced by MU)

Table 7.4-3: *Voltage fluctuations and flicker test software details*

Manufacturer of Software	Details
EMC Partner	HARCS, version 6.2

7.4.5 Test data

Measurement data



Actual Flicker (Fli):	**0.00**
Short-term Flicker (Pst):	**0.07**
Limit (Pst):	1.00
Long-term Flicker (Plt):	**0.07**
Limit (Plt):	0.65
Maximum Relative Volt. Change (dmax):	**0.00%**
Limit (dmax):	4.00%
Relative Steady-state Voltage Change (dc):	**0.00%**
Limit (dc):	3.30%
Tmax 3.30% (dt):	**0.00ms**
Limit (dt>Lim):	500ms

Flicker Emission - IEC 61000-3-3 , EN 61000-3-3

2025-03-24 4:09:24 PM

Urms =	230.1	V	P =	242.4	W
Irms =	1.094	A	pf =	0.963	

Range: 5 A
V-nom: 230 V
TestTime: 10 min (100%)

Husky
Clearpath Robotics

Test completed, Result: PASSED

HAR-1000 EMC-Partner

7.4.6 Setup photos

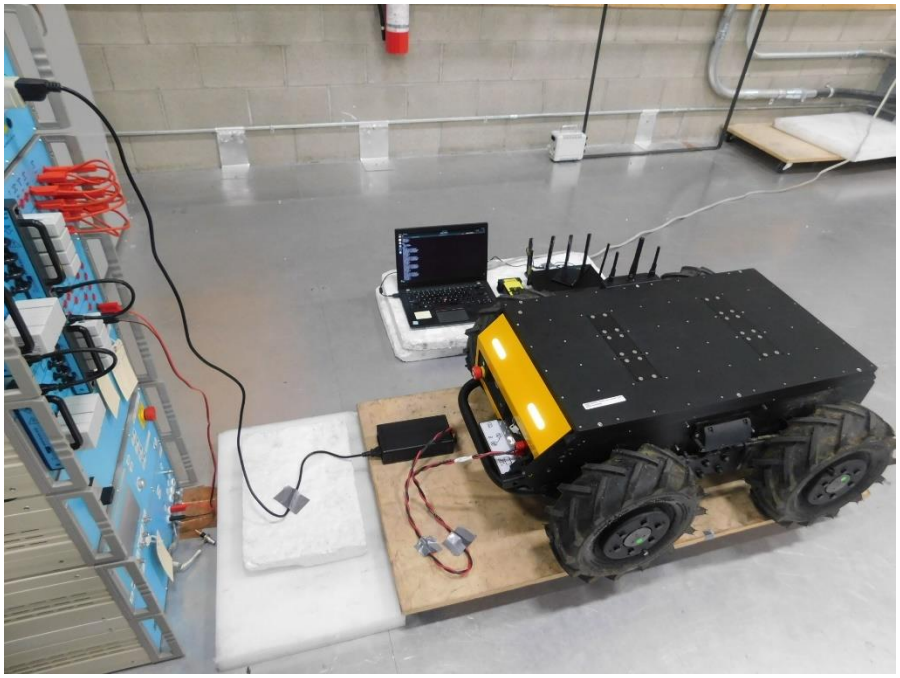


Figure 7.4-1: *Voltage fluctuations and flicker setup photo*

7.5 Electromagnetic Field

7.5.1 References and limits

EN 61000-4-3: 2006 + A1: 2008 + A2: 2010

Table 7.5-1: *Electromagnetic Field specification*

Test specification	Performance criterion
Industrial electromagnetic environment	
10 V/m (80 – 1000 MHz), 3 V/m (1.4 – 6 GHz), 80 % AM (1 kHz)	A

Notes: None

7.5.2 Test summary

Verdict	Pass		
Test date	March 18, 2025	Temperature	24 °C
Tested by	Tarek Elkholy	Air pressure	979 mbar
Test location	Cambridge	Relative humidity	40 %

7.5.3 Notes

Configuration 1 was considered as the worst-case scenario for the EUT and EUT was tested in configuration 1.

7.5.4 Setup details

Table 7.5-2: *Electromagnetic Field equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA003012	1 year	March 09, 2026
Flush mount turntable	SUNAR	FM2022	FA003006	—	NCR
Controller	SUNAR	SC110V	FA002976	—	NCR
Antenna mast	SUNAR	TLT2	FA003007	—	NCR
AC Power source	Chroma	61605	FA003034	—	NCR
Horn antenna (1–18 GHz)	ETS Lindgren	3115	FA000649	1 year	April 04, 2025
Directional coupler (80–1000 MHz)	AR	DC6180A	FA002973	1 year	Jan 16, 2026
Directional coupler (0.7–6 GHz)	AR	DC725A	FA002994	1 year	Jan 16, 2026
Power sensor	Rohde & Schwarz	NRP-6A	FA002962	1 year	Jan 30, 2026
Signal generator	Rohde & Schwarz	SMB100A	FA002968	1 year	April 27, 2025
Amplifier (0.08–1 GHz, 250 W)	AR	250W1000C	FA003008	—	NCR
Amplifier (1–6 GHz, 125 W)	AR	120S1G4	FA003004	—	NCR
50 Ω coax cable	Huber + Suhner	None	FA002607	—	NCR
Biconilog Antenna (20 MHz – 2 GHz)	EMCO	3141	FA003128	—	NCR
Starprobe (0.1–6000 MHz)	AR	FI7006	FA002961	1 year	August 16, 2025

Notes: NCR - no calibration required

All equipment related to the contribution of measurement has been included in this list. Such items include, but are not limited to, cables, attenuators, directional couplers, and pre-amps.

Table 7.5-3: *Measurement uncertainty*

Measurement uncertainty (MU) considerations
Measurement uncertainty requirements for EN 61000-4-3 are currently under consideration, and no applicable requirements have been established at this time. The test equipment is calibrated to meet the tolerance requirements of EN 61000-4-3, with calibration uncertainty taken into account. (Tolerances are not reduced by MU)

Table 7.5-4: *Electromagnetic Field test software details*

Manufacturer of Software	Details
Rohde & Schwarz	EMC32, Software for EMC Measurements, Version 10.60.00

7.5.5 Test data

Table 7.5-5: *Electromagnetic Field results*

Step size increment	1 %
Dwell time[1]	1 s
Antenna polarization	Vertical and Horizontal
Modulation	CW signal amplitude modulated (AM) with 80 % depth with a 1 kHz sine wave
EUT setup configuration	Floor standing[2]
Transmit antenna	3 meters from EUT, 1.5 meters above GRP
EUT power input during test	Battery: 25.6 V_{DC}
EUT position facing antenna	Front side, back side, left side and right side

Frequency range, MHz		Test level, V/m	Comments
80	1000	10	No degradation
1400	6000	3	No degradation

Notes: [1]The dwell time at each frequency was not less than the time necessary for the EUT to be exercised and to be able to respond. The time to exercise the EUT is not interpreted as a total time of a program or a cycle but related to the reaction time in case of failure of the EUT.
[2]To maintain the field uniformity for the EUT while testing, EUT was kept on the table during the testing.

7.5.6 Setup photos

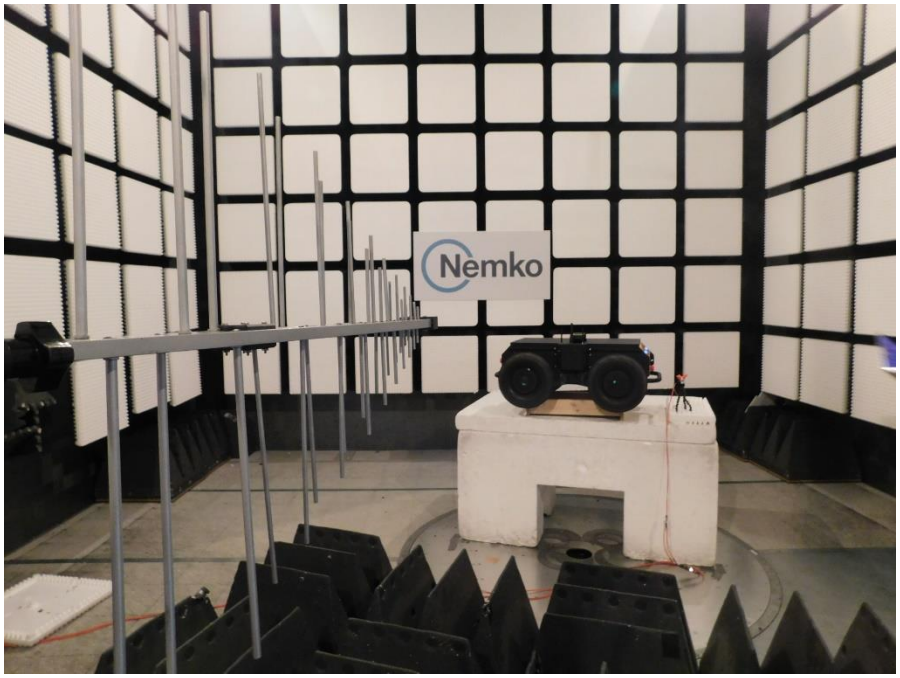


Figure 7.5-1: *Electromagnetic field setup photo – Below 1 GHz*

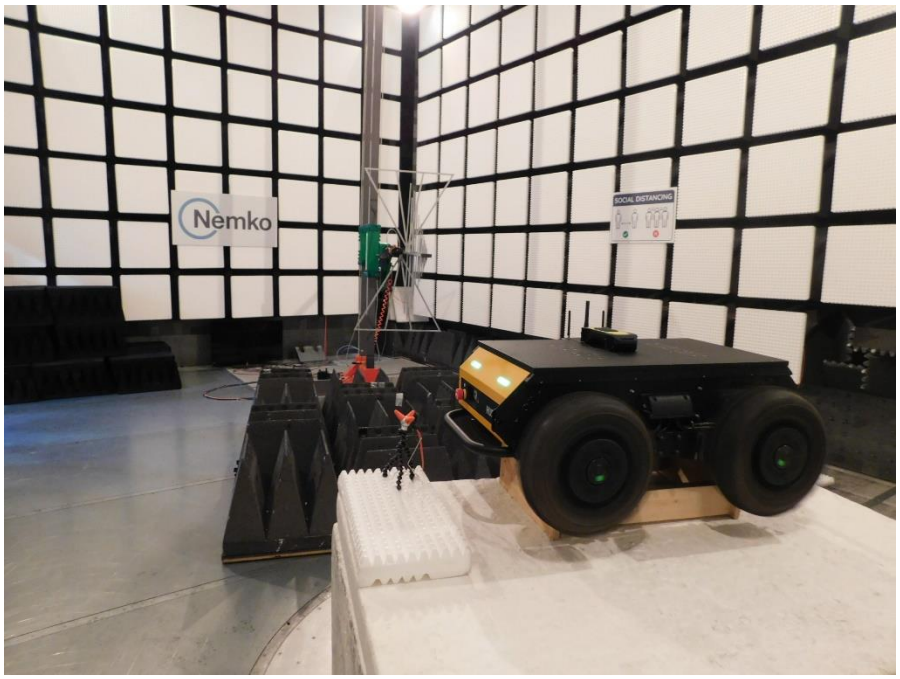


Figure 7.5-2: *Electromagnetic field setup photo – Below 1 GHz*

Setup photos, continued

Figure 7.5-3: *Electromagnetic field setup photo – Above 1 GHz*

Figure 7.5-4: *Electromagnetic field setup photo – Above 1 GHz*

7.6 Electrostatic discharge (ESD)

7.6.1 References and limits

EN 61000-4-2: 2009

Table 7.6-1: *Electrostatic discharge (ESD) specification*

Test specification	Performance criterion
Industrial electromagnetic environment	
±4 (Contact discharge), ±8 (Air discharge)	B

Notes: None

7.6.2 Test summary

Verdict	Pass		
Test date	March 19, 2025	Temperature	24 °C
Tested by	Ketav Jani	Air pressure	965 mbar
Test location	Cambridge	Relative humidity	44 %

7.6.3 Notes

Configuration 1 was considered as the worst-case scenario for the EUT and EUT was tested in configuration 1.

7.6.4 Setup details

Table 7.6-2: *Electrostatic discharge (ESD) equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
ESD gun	TESEQ	NSG 435	FA002947	1 year	December 10, 2025

Notes: None

Table 7.6-3: *Measurement uncertainty*

Measurement uncertainty (MU) considerations
Measurement uncertainty requirements for EN 61000-4-2 are currently under consideration, and no applicable requirements have been established at this time. The test equipment is calibrated to meet the tolerance requirements of EN 61000-4-2, with calibration uncertainty taken into account. (Tolerances are not reduced by MU)

7.6.5 Test data

Table 7.6-4: *Electrostatic discharge (ESD) discharge results*

EUT setup configuration	Floor standing
ESD repetition rate	1 pulse per second
Discharges	10 contact discharges and 10 air discharges at each polarity
EUT power input during test	Battery: 25.6 V_{DC}

Contact discharge	**Test voltage (±kV)**	**Comments**
Please refer to "Electrostatic discharge test location points" photos of this section	4	No degradation
Indirect discharge	**Test voltage (±kV)**	**Comments**
VCP (all sides)	4	No degradation
Air discharge	**Test voltage (±kV)**	**Comments**
Please refer to "Electrostatic discharge test location points" photos of this section	2, 4, 8	No degradation

Notes: None

Test data, continued

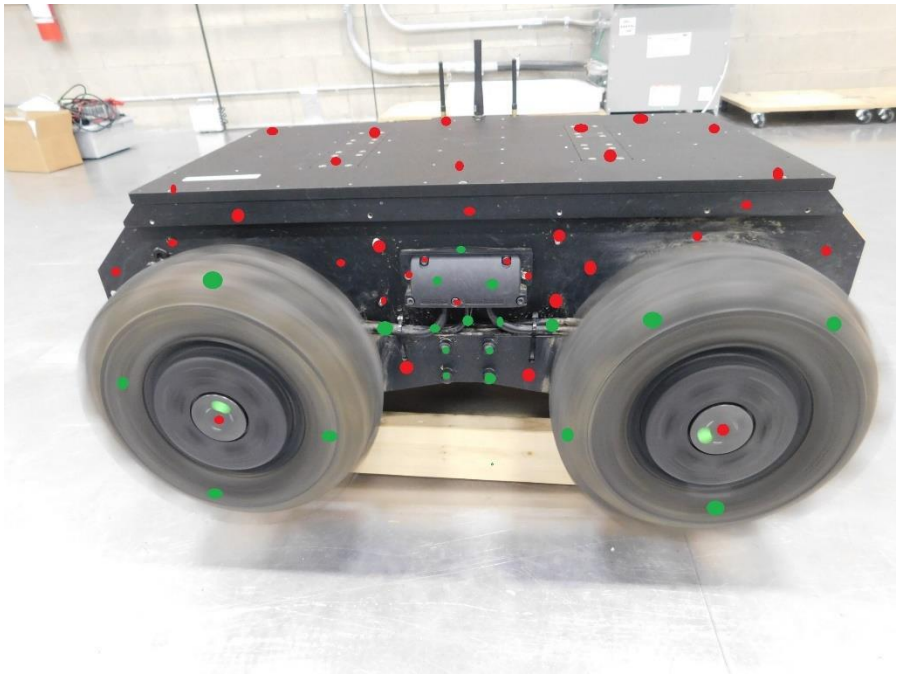


Figure 7.6-1: *Electrostatic discharge location point's photo*

Figure 7.6-2: *Electrostatic discharge location point's photo*

Red points = contact discharge
Green points = air discharge

Test data, continued

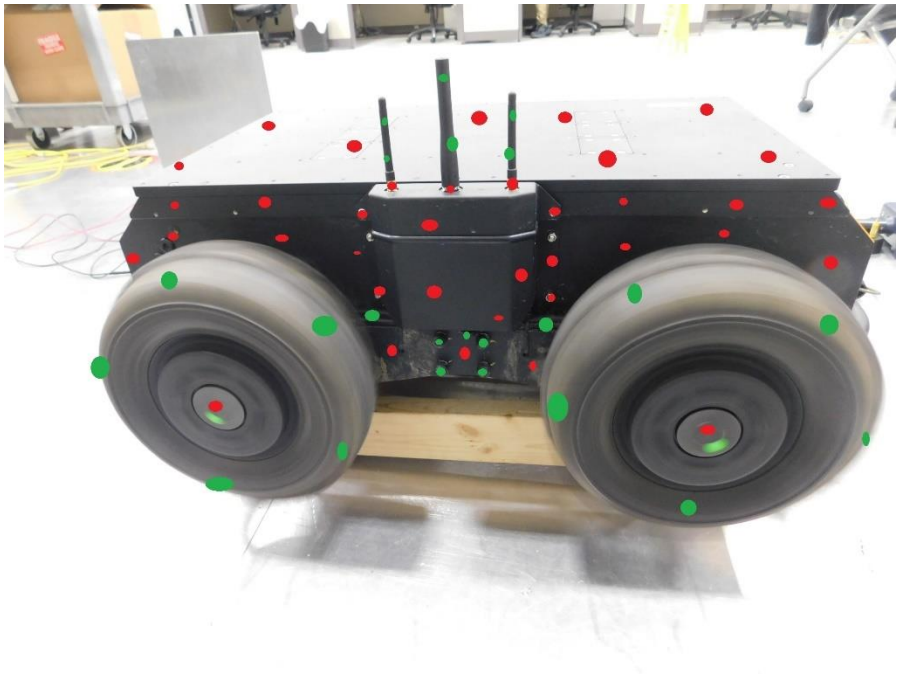


Figure 7.6-3: *Electrostatic discharge location point's photo*

Figure 7.6-4: *Electrostatic discharge location point's photo*

Red points = contact discharge
Green points = air discharge

7.6.6 Setup photo

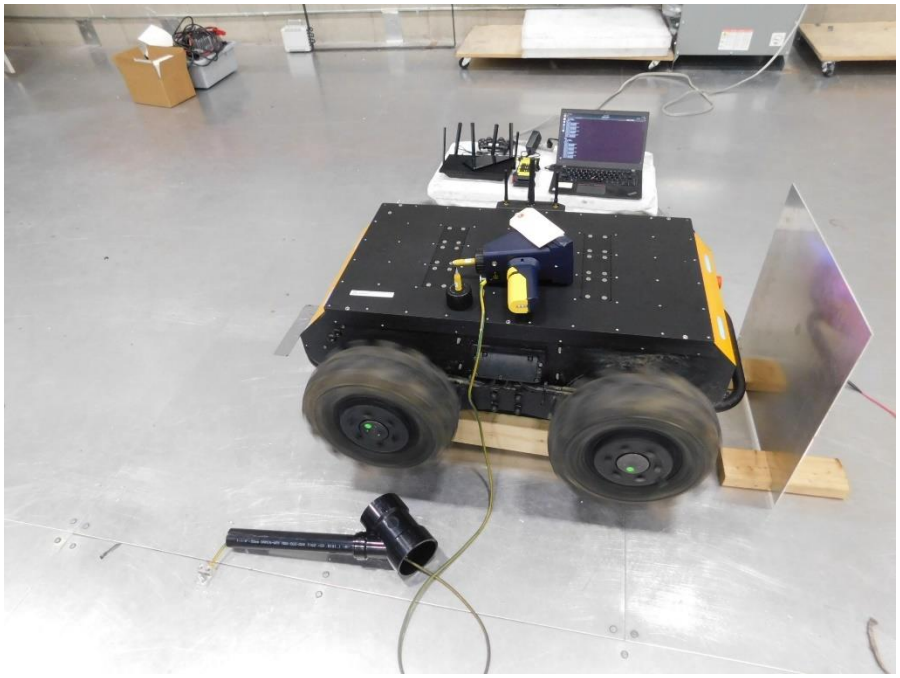


Figure 7.6-5: *Electrostatic discharge (ESD) setup photo*

7.7 Burst

7.7.1 References and limits

EN 61000-4-4: 2012

Table 7.7-1: *Burst specification*

Test specification	Performance criterion
Industrial electromagnetic environment	
AC power (including protective earth)	
±2 kV (peak), 5/50 Tr/Th ns, 5 kHz (repetition rate)	B

Notes: None

7.7.2 Test summary

Verdict	Pass		
Test date	March 24, 2025	Temperature	24 °C
Tested by	Ketav Jani	Air pressure	975 mbar
Test location	Cambridge	Relative humidity	41 %

7.7.3 Notes

EUT was tested in configuration 2.

7.7.4 Setup details

Table 7.7-2: *Burst equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Surge/EFT/Dips generator	EMC Partner	IMU3000 F5-S6-T6-D	FA002982	1 year	November 30, 2025
AC power source	Chroma	61509	FA003020	—	NCR

Notes: NCR - no calibration required

Table 7.7-3: *Measurement uncertainty*

Measurement uncertainty (MU) considerations
Measurement uncertainty requirements for EN 61000-4-4 are currently under consideration, and no applicable requirements have been established at this time. The test equipment is calibrated to meet the tolerance requirements of EN 61000-4-4, with calibration uncertainty taken into account. (Tolerances are not reduced by MU)

Table 7.7-4: *Burst test software details*

Manufacturer of Software	Details
EMC Partner	TEMA 3000 V 4.10.2

7.7.5 Test data

Table 7.7-5: *Burst results*

Wave shape (Tr / Td)	5/50 ns (Tr = rise time, Td= duration time)
Burst duration	15 ms @ 5 kHz repetition frequency / 0.75 ms @ 100 kHz repetition frequency
Burst period	300 ms
Test duration	60 s
EUT power input during test	28 V_{DC} (via external 100–240 V_{AC}, 50/60 Hz power adapter)

Test port	Repetition frequency (kHz)	Test voltage (±kV)	Comments
AC input of power adapter[1 and 2]	5	1, 2	See Notes[3]

Notes:
[1]Transient applied asynchronous (relation to power supply)
[2]The test voltage was applied simultaneously between a ground reference plane and all of the power supply terminals and the protective or functional earth port on the EUT cabinet
[3]At ± 1kV, ±2kV test level LED lights of the EUT stared flashing blue intermittently during the stress period and came back to its normal state once the stress period got over. EUT satisfies the performance criteria B requirement of the standard.

7.7.6 Setup photos

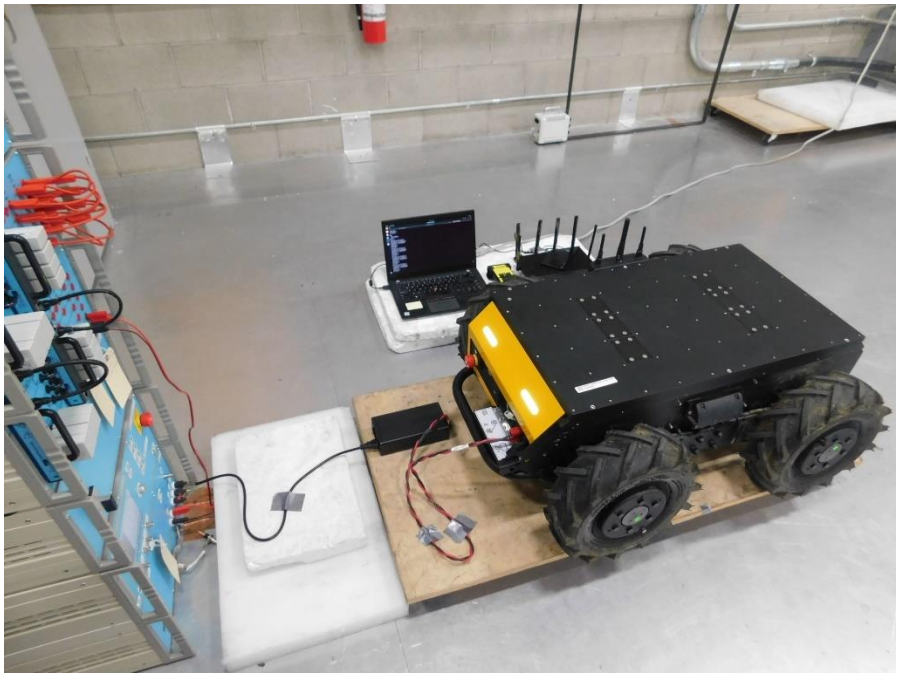


Figure 7.7-1: *Burst setup photo – Power*

7.8 Conducted RF

7.8.1 References and limits

EN 61000-4-6: 2014

Table 7.8-1: *Conducted RF specification*

Test specification	Performance criterion
Industrial electromagnetic environment	
AC power (including protective earth)	
0.15–80 MHz, 3 V (unmodulated), 80 % AM (1 kHz)	A

Notes: None

7.8.2 Test summary

Verdict	Pass		
Test date	March 24, 2025	Temperature	24 °C
Tested by	Ketav Jani	Air pressure	975 mbar
Test location	Cambridge	Relative humidity	41 %

7.8.3 Notes

EUT was tested in configuration 2.

7.8.4 Setup details

Table 7.8-2: *Conducted RF equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Amplifier (0.01–400 MHz, 100 W)	AR	100A400A	FA002972	—	NCR
Signal generator	Rohde & Schwarz	SMB100A	FA002968	1 year	April 27, 2025
6 dB attenuator	AR	64671	FA002975	1 year	Jan 16, 2026
Directional coupler (0.01–400 MHz)	AR	DC3400A	FA002974	1 year	Jan 16, 2026
Power sensor	Rohde & Schwarz	NRP-6A	FA002963	1 year	Feb 24, 2026
50 Ω coax cable	Huber + Suhner	None	FA002014	—	NCR
CDN-M2/M3	TESEQ	CDN M016	FA002949	1 year	November 30, 2024
CDN-M2/M3	TESEQ	CDN M016	FA002950	1 year	November 30, 2024

Notes: NCR - no calibration required

All equipment related to the contribution of measurement has been included in this list. Such items include, but are not limited to, cables, attenuators, directional couplers, and pre-amps.

Table 7.8-3: *Measurement uncertainty*

Measurement uncertainty (MU) considerations
Measurement uncertainty requirements for EN 61000-4-6 are currently under consideration, and no applicable requirements have been established at this time. The test equipment is calibrated to meet the tolerance requirements of EN 61000-4-6, with calibration uncertainty taken into account. (Tolerances are not reduced by MU)

Table 7.8-4: *Conducted RF test software details*

Manufacturer of Software	Details
Rohde & Schwarz	EMC32, Software for EMC Measurements, Version 10.60.00

7.8.5 Test data

Table 7.8-5: *Conducted RF results*

Frequency range	0.15–80 MHz
Step size increment	1 %
Dwell time[1]	1 s
Signal level	3 V_{RMS}
Modulation	CW signal amplitude modulated (AM) with 80 % depth with a 1 kHz sine wave
EUT power input during test	28 V_{DC} (via external 100–240 V_{AC}, 50/60 Hz power adapter)

Ports investigated	Coupling method	50 Ω termination point	Comments
AC input of power adapter	CDN-M3 (EUT)	CDN-M3 (AE)	No degradation

Notes: [1]The dwell time at each frequency was not less than the time necessary for the EUT to be exercised and to be able to respond. The time to exercise the EUT is not interpreted as a total time of a program or a cycle but related to the reaction time in case of failure of the EUT.

7.8.6 Setup photos

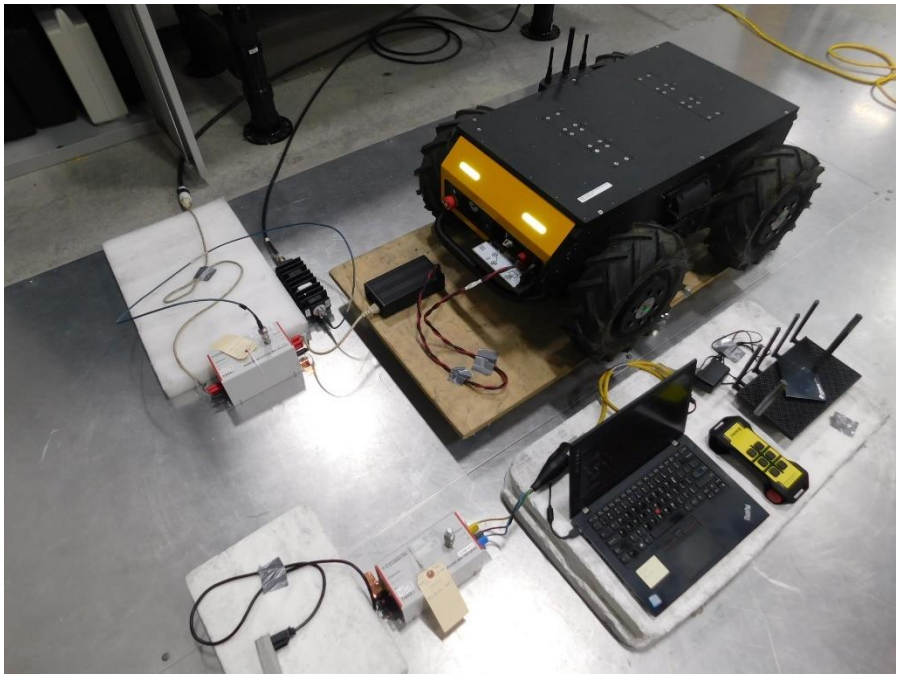


Figure 7.8-1: *Conducted RF setup photo – Power*

7.9 Voltage dips and short interruptions

7.9.1 References and limits

EN IEC 61000-4-11: 2020

Table 7.9-1: *Voltage dips and short interruptions specification*

Test specification	Performance criterion
Industrial electromagnetic environment	
Voltage dip: 0 % during 1 cycle	B
Voltage dip: 40 % during 10/12 cycles	C
Voltage dip: 70 % during 25/30 cycles	C
Short Interruption: 0 % during 250/300 cycles	C

Notes:
– Changes to occur at 0 degree crossover point of the voltage waveform.
– For example, "25/30 cycles" means "25 cycles for 50 Hz test" or "30 cycles for 60 Hz test".

7.9.2 Test summary

Verdict	Pass		
Test date	March 24, 2025	Temperature	24 °C
Tested by	Ketav Jani	Air pressure	975 mbar
Test location	Cambridge	Relative humidity	41 %

7.9.3 Notes

EUT was tested in configuration 2

7.9.4 Setup details

Table 7.9-2: *Voltage dips and short interruptions equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Surge/EFT/Dips generator	EMC Partner	IMU3000 F5-S6-T6-D	FA002982	1 year	November 30, 2025
Dips voltage variac	EMC Partner	VAR-EXt1000	FA002984	1 year	November 30, 2025
AC power source	Chroma	61509	FA003020	-	NCR

Notes: NCR - no calibration required

Table 7.9-3: *Measurement uncertainty*

Measurement uncertainty (MU) considerations
Measurement uncertainty requirements for EN/IEC 61000-4-11 are currently under consideration, and no applicable requirements have been established at this time. The test equipment is calibrated to meet the tolerance requirements of EN/IEC 61000-4-11, with calibration uncertainty taken into account. (Tolerances are not reduced by MU)

Table 7.9-4: *Voltage dips and short interruptions test software details*

Manufacturer of Software	Details
EMC Partner	TEMA 3000 V 4.8.3

7.9.5 Test data

Table 7.9-5: *Voltage dips results*

Variation/dip repetition	Sequence of three dips/interruptions with an interval of 10 seconds between each test
EUT power input during test	230 V_{AC}, 50 Hz

Test port	Residual voltage (%)	Cycles	Comments
AC input of power adapter @ 50 Hz	0	1	No degradation
	40	10	No degradation
	70	25	No degradation

Notes: Changes occurred at the 0 crossings of the voltage waveform
The EUT peak inrush current was less than 70% of the peak drive capability of the generator

Table 7.9-6: *Short interruptions results*

Variation/dip repetition	Sequence of three dips/interruptions with an interval of 10 seconds between each test
EUT power input during test	230 V_{AC}, 50 Hz

Test port	Residual voltage (%)	Cycles	Comments
AC input of power adapter @ 50 Hz	0	250	No degradation

Notes: Changes occurred at the 0 crossings of the voltage waveform
The EUT peak inrush current was less than 70% of the peak drive capability of the generator

7.9.6 Setup photo

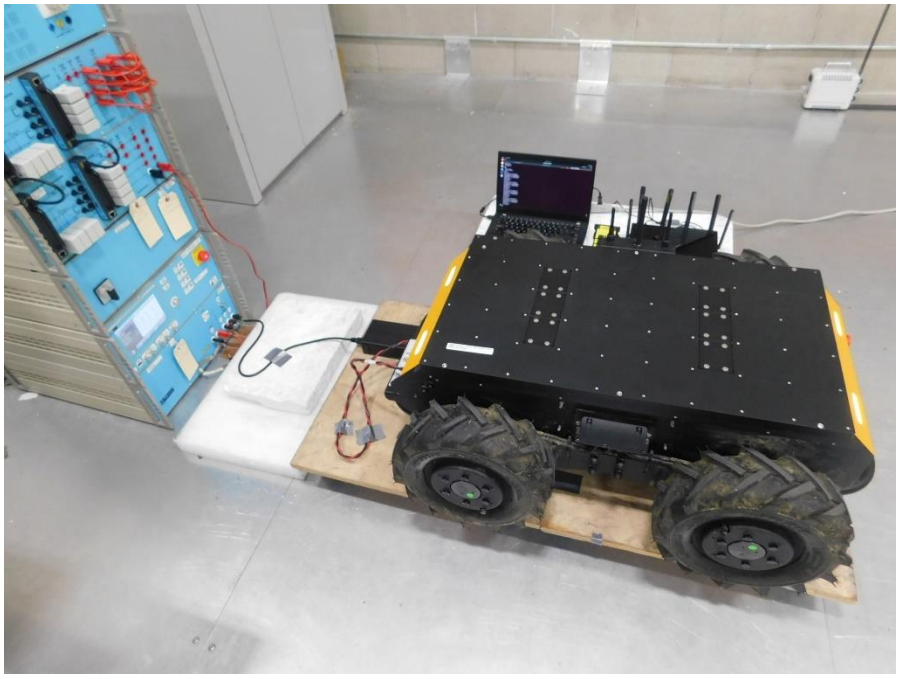


Figure 7.9-1: *Voltage dips and short interruptions setup photo*

7.10 Surge

7.10.1 References and limits

EN 61000-4-5: 2014 + A1:2017

Table 7.10-1: *Surge specification*

Test specification	Performance criterion
Industrial electromagnetic environment	
AC power (including protective earth)	
±1 kV Line to Line, ±2 kV Line to Ground, 1.2/50 Tr/Th µs	B

Notes: None

7.10.2 Test summary

Verdict	Pass		
Test date	March 24, 2025	Temperature	24 °C
Tested by	Ketav Jani	Air pressure	975 mbar
Test location	Cambridge	Relative humidity	41 %

7.10.3 Notes

EUT was tested in configuration 2

7.10.4 Setup details

Table 7.10-2: *Surge equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Surge/EFT/Dips generator	EMC Partner	IMU3000 F5-S6-T6-D	FA002982	1 year	November 30, 2025
AC power source	Chroma	61509	FA003020	—	NCR

Notes: NCR - no calibration required

Table 7.10-3: *Measurement uncertainty*

Measurement uncertainty (MU) considerations
Measurement uncertainty requirements for EN 61000-4-5 are currently under consideration, and no applicable requirements have been established at this time. The test equipment is calibrated to meet the tolerance requirements of EN 61000-4-5, with calibration uncertainty taken into account. (Tolerances are not reduced by MU)

Table 7.10-4: *Surge test software details*

Manufacturer of Software	Details
EMC Partner	TEMA3000 v4.10.2

7.10.5 Test data

Table 7.10-5: *Surge at AC power (including protective earth) port results*

Open circuit voltage (T_1 / T_2)	1.2/50 µs (T_1 = front time, T_2= time to half value)
Short circuit curent (T_1 / T_2)	8/20 µs (T_1 = front time, T_2= time to half value)
Surge pulse interval	60 s
Number of pulses	5 positive and 5 negative
EUT power input during test	28 V_{DC} (via external 100–240 V_{AC}, 50/60 Hz power adapter)

Test port	Coupling	Test voltage (±kV)	Comments
AC input of power adapter	Phase to Neutral	1	No degradation
	Phase to ground	1, 2	No degradation
	Neutral to ground	1, 2	No degradation

Notes:
- **Phase to neutral coupling:** Surge applied with generator output impedance set to 2 Ω
- **Phase/neutral to ground coupling:** Surge applied with generator output impedance set to 12 Ω
- Surge applied synchronous (relation to power supply): 0, 90, 180, and 270°

7.10.6 Setup photos

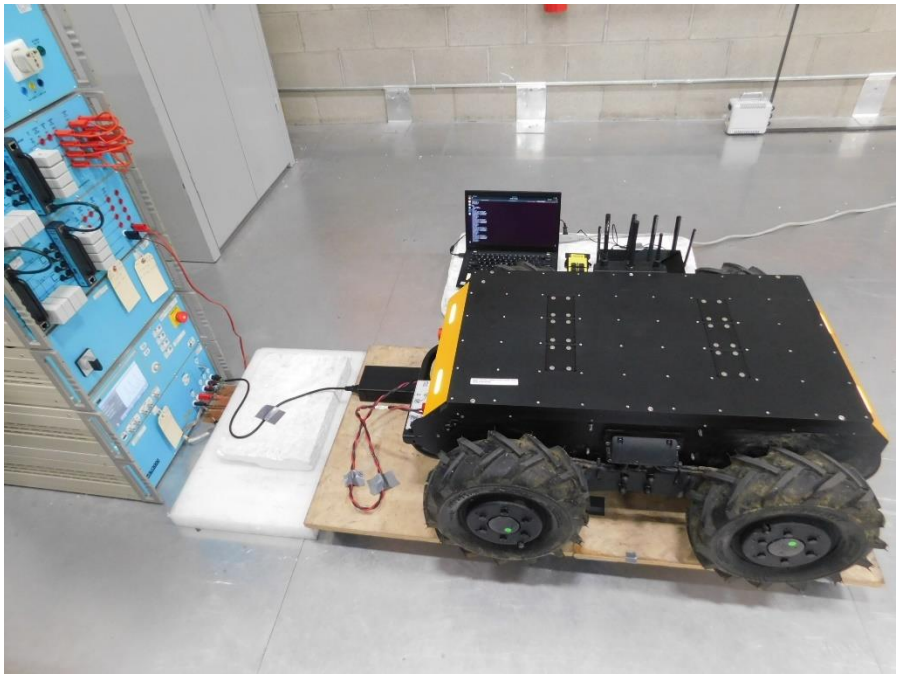


Figure 7.10-1: *Surge setup photo – Power*

7.11 Power-frequency magnetic field

7.11.1 References and limits

EN 61000-4-8: 2010

Table 7.11-1: *Power-frequency magnetic field specification*

Test specification	Performance criterion
Industrial electromagnetic environment	
30 A/m (50 Hz)	A

Notes: Only to magnetically sensitive equipment.

7.11.2 Test summary

Verdict	Pass		
Test date	March 18, 2025	Temperature	24 °C
Tested by	Ketav Jani	Air pressure	975 mbar
Test location	Cambridge	Relative humidity	41 %

7.11.3 Notes

Configuration 1 was considered as the worst-case scenario for the EUT and EUT was tested in configuration 1.

7.11.4 Setup details

Table 7.11-2: *Power-frequency magnetic field equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Magnetic current loop	EMC Partner	MF1000-1	FA003038	3 year	June 21 2025
Magnetic Field generator	EMC Partner	IMU3000 F5-S6-T6-D	FA002982	1 year	November 30, 2025
Dips voltage variac	EMC Partner	VAR-EXt1000	FA002984	1 year	November 30, 2025
AC source	Chroma	61509	FA003020	-	NCR
Triple axis pro EMF meter	Latnex	MG-2000T	FA003409	-	NCR

Notes: NCR - no calibration required

Table 7.11-3: *Measurement uncertainty*

Measurement uncertainty (MU) considerations
Measurement uncertainty requirements for EN 61000-4-8 are currently under consideration, and no applicable requirements have been established at this time. The test equipment is calibrated to meet the tolerance requirements of EN 61000-4-8, with calibration uncertainty taken into account. (Tolerances are not reduced by MU)

Table 7.11-4: *Power-frequency magnetic field test software details*

Manufacturer of Software	Details
EMC Partner	TEMA3000 v4.10.2

7.11.5 Test data

Table 7.11-5: *Power-frequency magnetic field results*

Assessment time	5 minutes at each loop polarization
EUT power input during test	Battery:25.6 V_{DC}

Loop polarization	Signal frequency, Hz	Magnetic field test level, A/m	Comments
Vertical (aligned with AC power line)	50	30	No degradation
Vertical (perpendicular to AC power line)	50	30	No degradation
Horizontal	50	30	No degradation

Notes: The ambient magnetic field of the test laboratory at the time of testing was measured to be 0.008 A/m , > 20 dB below the selected test level.
EUT is tested using the proximity method of susceptibility to magnetic field.

7.11.6 Setup photo

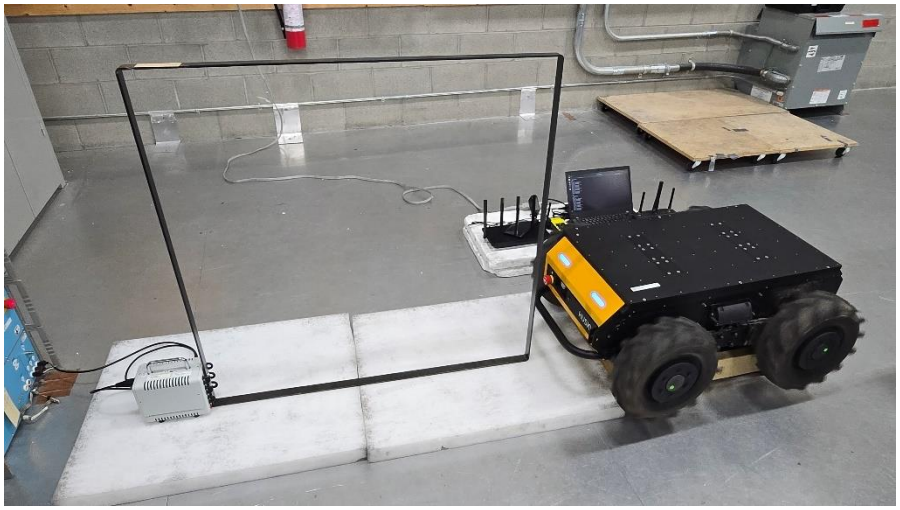


Figure 7.11-1: *Power-frequency magnetic field setup photo*

Figure 7.11-2: *Power-frequency magnetic field setup photo*

Section 8 EUT photos

8.1 External photos

Figure 8.1-1: *Front view photo*

Figure 8.1-2: *Rear view photo*

External photos continued

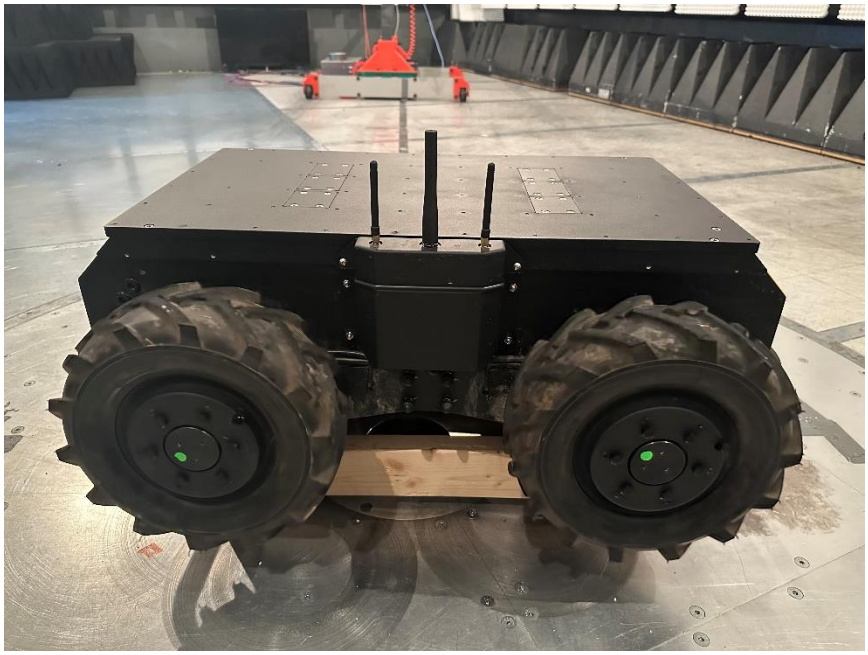


Figure 8.1-3: *Side view photo*

Figure 8.1-4: *Side view photo*

External photos continued

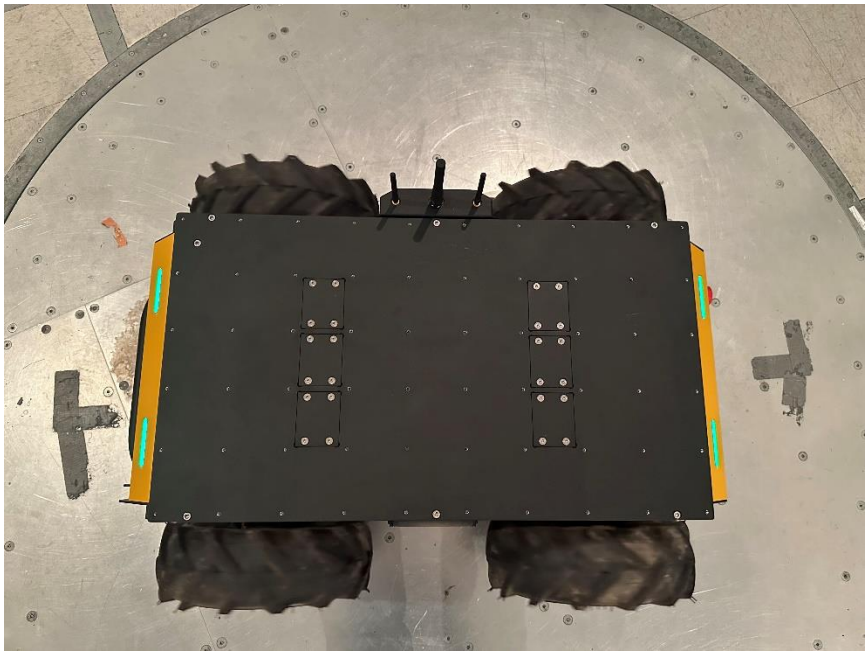


Figure 8.1-5: *Top view photo*

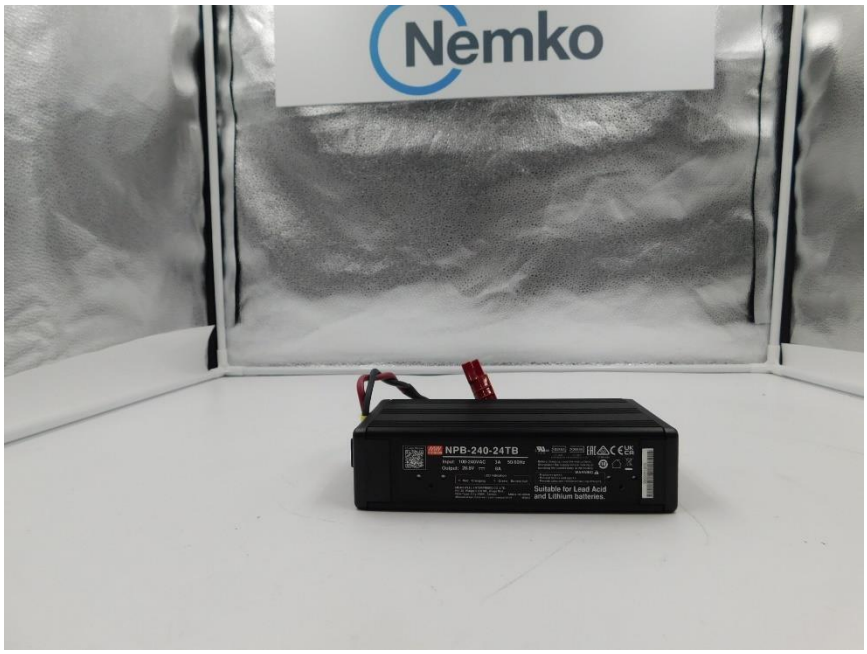


Figure 8.1-6: *Front view photo*

External photos continued

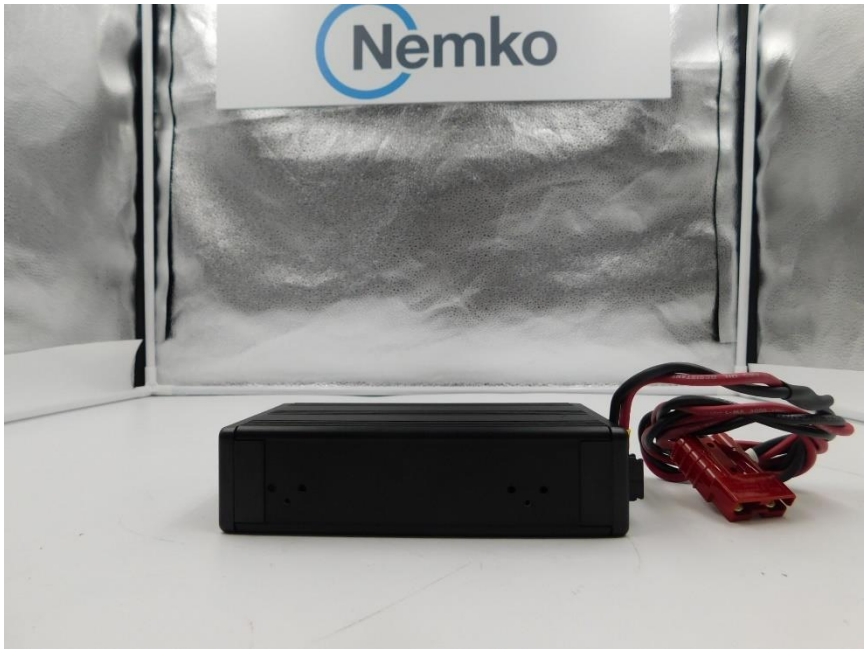


Figure 8.1-7: *Rear view photo*

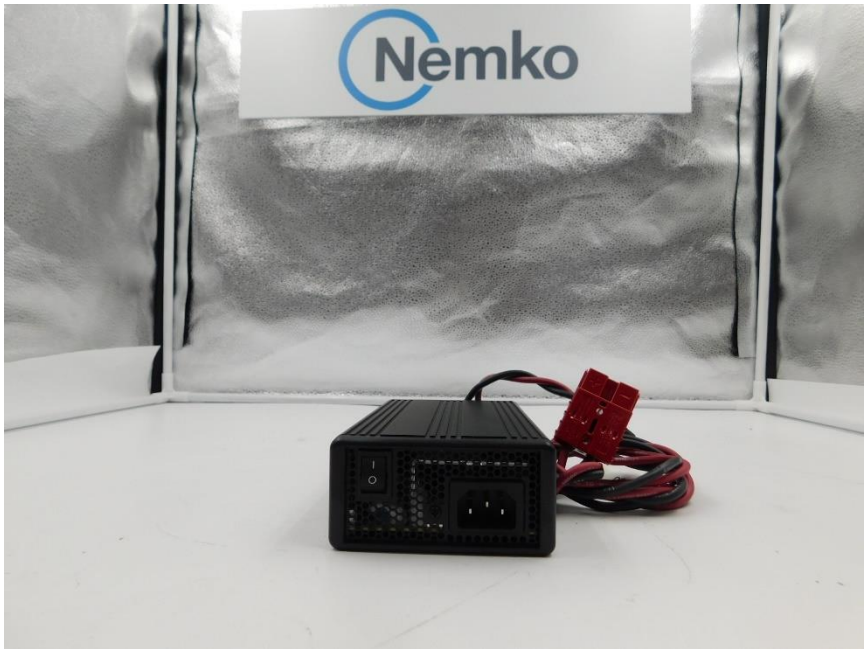


Figure 8.1-8: *Side view photo*

External photos continued

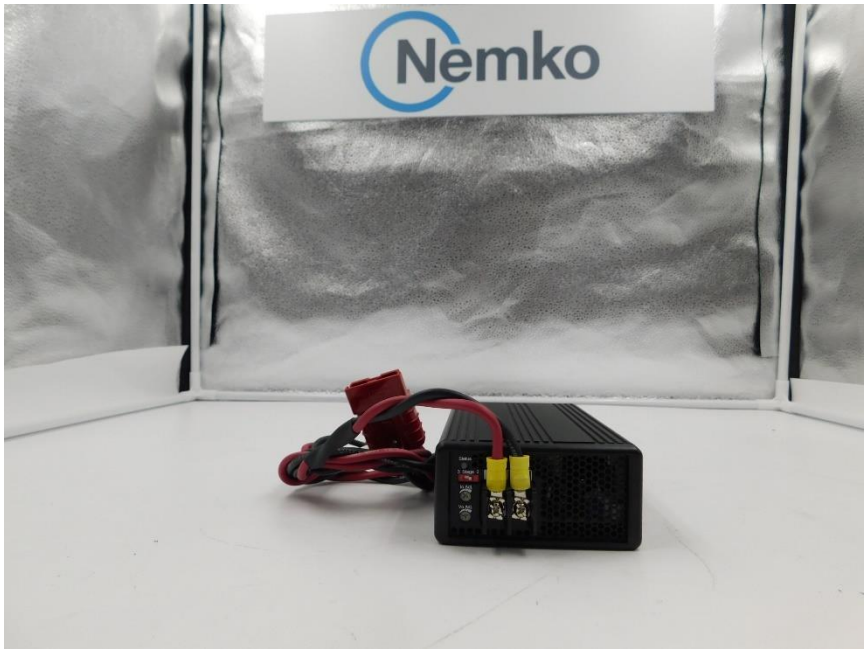


Figure 8.1-9: *Side view photo*

Figure 8.1-10: *AC/DC adapter view photo*

End of the test report