Wismar, 2024-10-18

Test Report #422.208.3 Rev.0
EMC tests on the devices/equipment:

VN202 mkII

Equipment under Test:

Description:	oxygen analyzer
Model:	VN202 mkII

Applicant/ Manufacturer: VANDAGRAPH Ltd.
15 Station Road
Cross Hills
BD20 7DT Keighley ,United Kingdom

Test laboratory: CEcert GmbH
Alter Holzhafen 19a
23966 Wismar, Germany

DAkkS Deutsche Akkreditierungsstelle D-PL-12049-01-00

Summary of Test:

Tests	Standards	Result
Emission:		
Radiated emission	IEC 61326-1:2020	**PASS**
Interference immunity:		
Electrostatic discharge	IEC 61326-1:2020	**PASS**
Electromagnetic field	IEC 61326-1:2020	**PASS**
Magnetic field (power-frequency)	IEC 61326-1:2020	**PASS**

Explanation:
PASS – The EUT meets the test requirements.
FAIL – The EUT does not meet the requirements.
N/A – Test is not applicable.

Evaluation:
The Equipment under Test (EuT) meets the EMC requirements of the IEC 61326-1 (group 1, class B equipment for use in industrial environment) in the above listed specification.

Period of test: 2024-09-30 - 2024-10-02

This test report with Appendix consists of **19** pages.

1. General information on the test item(s)

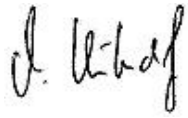
Description: oxygen analyzer
Model: VN202 mkII
Serial no.: --
Manufacturer/Customer: VANDAGRAPH Ltd.
Contact person: Mr. Ryan Swaine
Date of receipt of test items: 2024-09-24

Brief description:
EMC conformity test of an oxygen analyser for use in industrial and commercial application.
The test scope was defined by the manufacturer.

Steps to EMC, suppressions:
- none

Participant in the tests: none

Responsible for the technical content of the test report:

	Name	Signature
Tested by	Marco Klüßendorf (Test engineer)	
Approved by	Andreas Schenk (Project leader)	

Note:
The CEcert GmbH assures the applicant that the tests are carried out within the scope of the tests outlined under point 2 and in accordance with the test specifications outlined under point 3. Any exceptions or deviations will be clearly indicated.

The results contained in this test report are relevant exclusively to the item(s) submitted for testing. The CEcert GmbH is not liable for any conclusions and generalizations which may be drawn from the test results and applied to further samples and examples of the type of device represented by the item submitted for testing.

This report may only be reproduced or published in its entirety. Written permission must be obtained from the CEcert GmbH prior to the reproduction or publishing of extracts.

Report history Log:

Ref.	Date of issue	Comment	Approved by
422.208.3 Rev.0	2024-10-18	first certification	Andreas Schenk

2. Test Specification

2.1. Emission

Applied standards:
IEC 61326-1:2020
Classification: group 1, class B

Tests performed:

Test method:	Basic Standard:	Chapter:
Radiated disturbance (ER)	CISPR 11:2015 + A1:2016 + A2:2019	**4.1.**

Exceptions and explanations:none

2.2. Susceptibility

Applied standards:
IEC 61326-1:2020
Classification: Industrial electromagnetic environmental

Tests performed:

Test method:	Basic Standard:	Chapter:
Electrostatic discharge – ESD	IEC 61000-4-2:2008	**5.1.**
Electromagnetic field	IEC 61000-4-3:2006 + A1:2007 + A2:2010	**5.2.**
Magnetic fields (power-frequency)	IEC 61000-4-8:2009	**5.3.**

Exceptions and explanations:none

2.3. Applied non-standard methods

none

3. Specification of the device/equipment

3.1. Configuration

Description:	Model:	S/N.:	Manufacturer:	Notes:
Product:				
oxygen analyzer	VN202 mkII	--	VANDAGRAPH Ltd.	
Components:				
oxygen analyzer	VN202 mkII	--	VANDAGRAPH Ltd.	
oxygen sensor	R-17VAN	111167	VANDAGRAPH Ltd.	
Accessories/peripherals:				
--				
Simulators: none **Software:** not defined				

3.2. Cables and Lines

Interface:	Type/model/plug:	Length:	Shielding:	Comments:
Sensor line	Helix cable	< 3 m	yes	

3.3. Particulars related to EMC

System frequencies: --
Earth / Grounding: none
Shielding: none

3.4. Notes and/or sketches

Fig. 1: Equipment under Test

Fig. 2: Label

Dimension of EuT: 14 cm x 6 cm x 3 cm

3.5. Operating condition of the product

The status of the test object during the tests represented its normal area of deployment.

measurement mode: The EUT is switched on and measures the oxygen concentration of the ambient air.

Power supply: 3 Vdc (internal battery supplied – 2x PC1500 LR6 1,5Vdc)

Climatic conditions during the tests:

Ambient temperature:	15 °C - 35 °C (if not otherwise specified in this report)
Relatively air humidity:	25 % - 75 % (if not otherwise specified in this report)
Air pressure:	86 kPa - 106 kPa (860 mbar - 1060 mbar)

3.6. Evaluation and observation of test results

The EUT is visual observed.

3.7. Simulation of operating conditions

None

3.8. Sampling particulars

The product was tested as a single device.

3.9. Information about compliance assessment (consideration of measurement uncertainty)

In cases where the legislation mandates the application of certain decision rules, the conformity assessment is always carried out according to these rules. If the legislation does not state the decision rules, the conformity assessment is based on the decision rules of the applied standard. If the applied standard does also not specify a decision rule and no decision rule is stated in the corresponding section of this report, the conformity assessment is based on the “simple acceptance” decision rule (without the use of a guard band). This means: As closer the measured value is to the limit value, the higher the risk of an incorrect conformity statement must be assumed. If the measured value is at the limit value, the risk is a maximum of 50 %. This conformity assessment is based on the rules of the IEC GUIDE 115 (procedure 1) and ILAC G8 (latest versions).

Measurements and Test Results

4. Emission

4.0.1 Particulars of measuring uncertainties and tolerance range

The calculated uncertainties and tolerance ranges of the Tests are in accordance with the requirements of IEC/CISPR 16-4-2 (latest version) with $U_{lab} \leq U_{CISPR}$.

4.0.2 Preliminary remarks and classification

Classification:

Group 1: ISM equipment with intentionally internal used conducted RF-energy

Group 2: ISM equipment in which the intentionally generated RF energy is used as radiation for treatment of materials.

Class A: Equipment to use in non-domestic properties and facilities with direct connection to the low-voltage supply system

Class B: Equipment for use in residential properties, light-industrial locations, business or commercial premises, outdoor locations

The device is classified as follows:

Group 1, Class B.

4.0.3 Pre information

The test object was tested with the configuration and operating conditions described in section 3.

Notes on measuring the radiated measurements:

The spectrographs have a logarithmic frequency division. Measurements with the Peak-detector were used to assess the product. If these measuring values are in the range of the Quasi-Peak or Average limits, the frequencies are measured using the Quasi-Peak or Average detector. The observation time at the relevant frequencies will take at least 3 seconds.

4.1. Radiated Emissions

Basic standard: IEC 61326-1:2020

Measuring set-up: CISPR 16-2-3

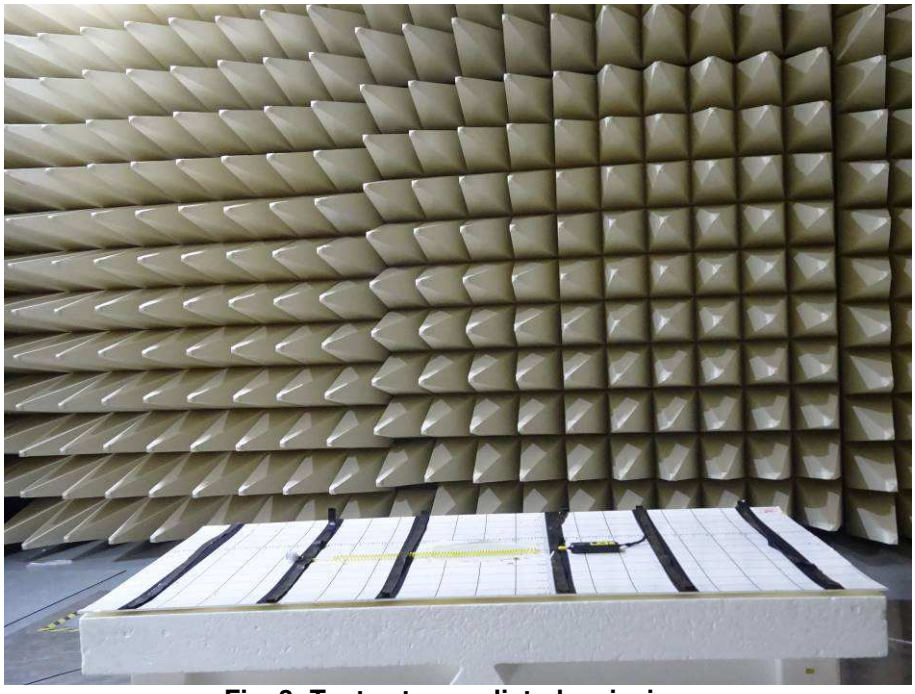


Fig. 3: Test set-up radiated emissions

Measuring Equipment:

Description	Model	Identifier	Manufacturer	Cal/Ver. Date	Cal//Ver. Due
EMI Receiver (9 kHz - 7 GHz)	ESCI 7	002/03	R&S	2024,03	2025,03
Two-line-V-artificial mains network 16 A	ESH3-Z5	003/01	R&S	2023,04	2026,03
Chase antenna (30 MHz - 1GHz)	CBL 6111B	008/06	EMC	2023,03	2026,03
Data logger temp./humid. *	Testo 150 TUC4, Probe 0572 2164	065/25	Testo	2024,01	2025,03
semi anechoic chamber	3- Meter	070/06	Frankonia	2022,02	2025,03
Measurement cable 14 m 3 m chamber	LMR-400	PHM 013/05	arnotec	2024,09	2025,09
EMC test software	V2022.3.06	PHM 015/08	DARE	N/A	N/A

*) used for ambient monitoring
ICO initial calibration only

Measuring process:
A prescan with in horizontal and vertical polarization was done at the beginning. The accessories/peripherals were placed inside the test set-up.
The radiated emissions were measured in the whole frequency range with the maximum level. The position of the equipment and the antenna height were changed during the measurements.

Measurement results:

Operating condition	Frequency range [MHz]	Polarization	Position of the EUT / Antenna height	Test results diagram / table	Compliance Pass/ Fail/ N/A
measurement mode	30 – 1000	horizontal, vertical	0 to 360° / 1 to 4 m	see Appendix	**PASS**

Measuring Distance: 3 m

During this EMC test several relevant interference emissions from the test object could be determined. Final test results (frequencies, max hold level) see Appendix.

The measurement environment was the shielded, absorber-lined hall.

Measurement results:

According to the above test set-up the equipment under test specified in chapter 3 meets the radiated emission requirements in accordance with IEC 61326-1:2020.

5. Susceptibility

5.0 General information for immunity tests

Measurement uncertainty:

The accuracy of the test equipment used and test set-up complies with the requirements of the basic standards.

Performance and acceptance criteria:

Performance criteria of IEC 61326-1:2020
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.

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.

Particular performance criteria determined by the manufacturer:

Accuracy: +/- 1% of full scale

5.1. Electrostatic Discharge – ESD

Required performance criterion: **B**

Test set-up:
The test set-up was conforming to the standard IEC 61000-4-2 for desk-type equipment.

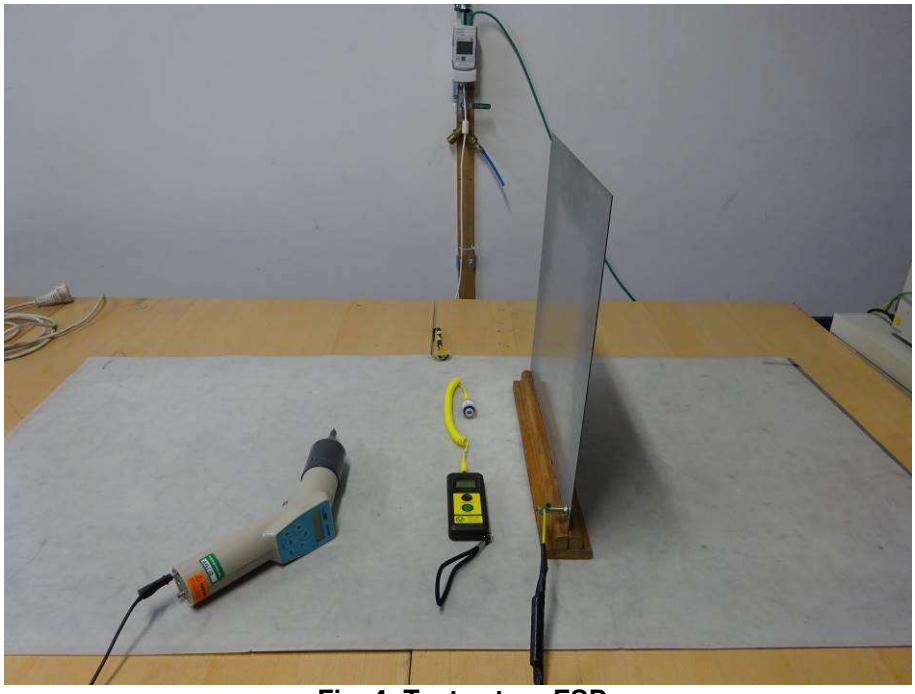


Fig. 4: Test set-up ESD

Test Equipment:

Description	Model	Identifier	Manufacturer	Cal/Ver. Date	Cal//Ver. Due
Generator for transients	TRA 2000 (v.3.260)	014/10	EMC	2024,04	2025,03
ESD-discharge kit	ESD2000	014/16	EMC	2024,04	2025,03
Data logger temp./humid. *	Testo 150 TUC4, Probe 0572 2164	065/25	Testo	2024,01	2025,03
Data logger pressure	BA1000; 0572 9999; 0572 2166	065/30	Testo	2024,02	2025,03
horizontal coupling plate	1,60 m x 0,80 m, min. 2 mm thick, aluminium	PHM 005/03	CEcert	2013,04	ICO
Vertical coupling plate	0,5 m x 0,5 m, min. 1 mm thick, zinc	PHM 005/04	Cecert	2013,04	ICO
isolation foil ESD	0,5 mm thick	PHM 005/06	Cecert	before Use	--
resistor ESD	2 x 470 kΩ	PHM 005/09	Cecert	2024,04	2025,03
resistor ESD	2 x 470 kΩ	PHM 005/10	Cecert	2024,04	2025,03
Reference ground plane	4,0 x 2,0m (±0,01) min. 1 mm thick, aluminium	PHM 006/02	Cecert	2013,04	ICO

*) used for ambient monitoring
ICO initial calibration only

Test process:
At each test point there were for each polarity, at least 10 discharges. The product was monitored during this test. The test object and the measuring values were observed as to whether any deviation from normal performance occurred. The periphery was arranged beside the horizontal coupling plate for the indirect discharge.

Tests:

Working condition	Point of discharge	Test	Test level	Polarity	Compliance Pass/ Fail/ N/A
measurement mode	Points on surface as indicated in the picture below	D, L	**2 kV**	pos./neg.	**PASS**
measurement mode		D, L	**4 kV**	pos./neg.	**PASS**
measurement mode		D, L	**8 kV**	pos./neg.	**PASS**
measurement mode	Coupling plates	I, H, V	**2 kV**	pos./neg.	**PASS**
measurement mode		I, H, V	**4 kV**	pos./neg.	**PASS**
measurement mode	Points on surface as indicated in the picture below	D, K	**2 kV**	pos./neg.	**PASS**
measurement mode		D, K	**4 kV**	pos./neg.	**PASS**
Supplementary information: Air discharge is indicated with red arrows in the picture below. Contact discharge is indicated with yellow arrows in the picture below.					

Note:

D	direct discharge onto the test object	L	air discharge
I	indirect discharge onto the test object	H	horizontal coupling plate under the EUT
K	contact discharge	V	vertical coupling plate

Allocation of discharge points:

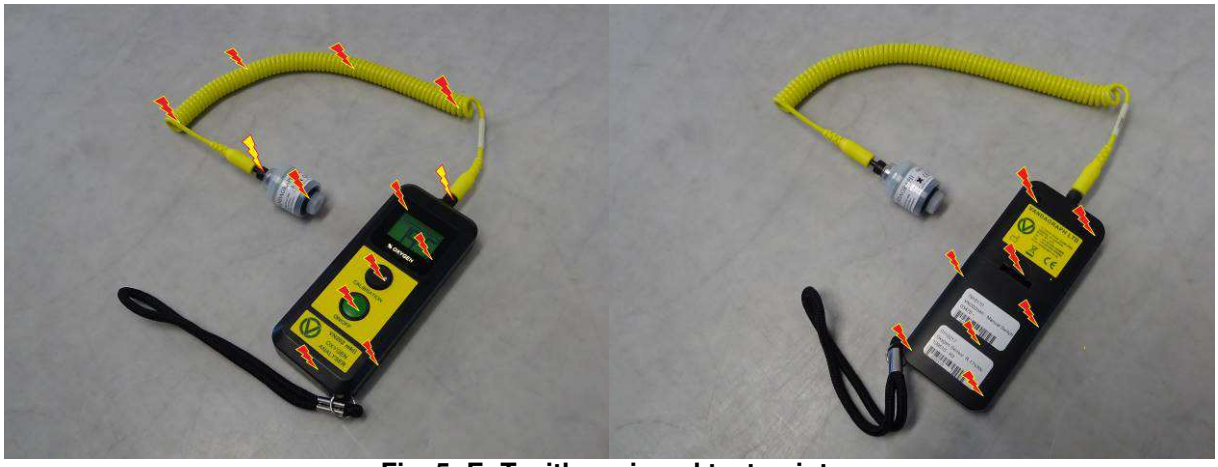


Fig. 5: EuT with assigned test points

Environmental Conditions while test:

Humidity:	**40,0 % rH**	Temperature:	**20,6 °C**
Barometric pressure:	**101,3 kPa**		

Functional test after test procedure: PASS

Test results:
No relevant influencing functions of the equipment were detected during this EMC-Test. The performance criterion for the immunity was met. There was no function failure nor loss of data, neither was there any change in the working conditions.

According to the above test set-up the equipment under test specified in chapter 3 complies with the electrostatic discharge requirements in accordance with IEC 61326-1:2020.

5.2. High Frequency Electromagnetic Fields

Required performance criterion: A

Test set-up:
The test set-up was conforming to the standard IEC 61000-4-3 for desk-type equipment.
The equipment was mounted 0.8m above the ground plane. The field strength was calibrated at a distance of 3 m. There the Equipment under Test was placed.

- Antenna distance: 3 m
- Time per step, depends on the reaction time of the product: 1 sec.

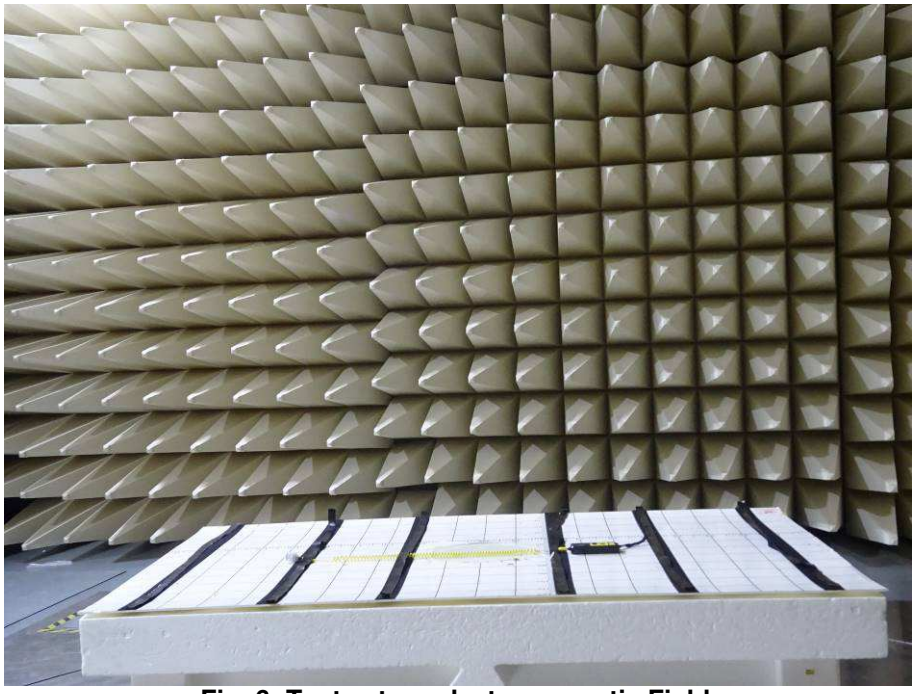


Fig. 6: Test set-up electromagnetic Fields

Test Equipment:

Description	Model	Identifier	Manufacturer	Cal/Ver. Date	Cal//Ver. Due
Horn antenna (1 - 18GHz)	HAX-18	008/20	Frankonia	2023,05	2026,03
Signal generator	SMB100A (5.00.116.90)	019/07	R&S	2023,10	2026,09
Power meter, single channel	NRVS	022/01	R&S	2023,09	2026,09
Thermal power sensor 50W	NRV- Z51	023/04	R&S	2024,08	2026,09
100-V-voltage probe (Insertion unit)	URV5-Z4	023/05	R&S	2024,09	2026,09
Average power sensor	NRP18AN	023/06	R&S	2023,07	2025,09
E- field probe	HI-6053	025/04	ETS	2022,08	2024,10
Data logger temp./humid. *	Testo 150 TUC4, Probe 0572 2164	065/25	Testo	2024,01	2025,03
Reference ground plane	4,0 x 4,0 m (±0,01) min. 1 mm thick, stainless steel	PHM 006/07	Cecert	2013,04	ICO
radiated field cable 3m chamber <1GHz	LMR-400	PHM 013/08	arnotec	2024,04	2025,03
radiated field cable 3m chamber >1GHz	LMR-400	PHM 013/09	arnotec	2024,04	2025,03

Description	Model	Identifier	Manufacturer	Cal/Ver. Date	Cal//Ver. Due
Broadband amplifier	250W1000A	PHM 014/09	ar	2024,03	2025,03
Broadband amplifier	BLMA1060-50	PHM 014/10	Bonn Elektronik GmbH	2024,03	2025,03
EMC test software	V2022.3.06	PHM 015/08	DARE	N/A	N/A
Dual directional coupler	DC6180A	PHM 017/04	AR	2024,03	2025,03
Dual directional coupler	BDC1060-40/500	PHM 017/05	Bonn Elektronik GmbH	2024,02	2025,03
Log.- per. Antenna	AT1080	PHM 018/02	AR	2024,04	2025,03
Chamber	3m	PHM 019/03	Frankonia	2024,03	2025,03

*) used for ambient monitoring
ICO initial calibration only

Test procedure:
The output of the level in the frequency range was gradually changed in steps of 1 % of the first frequency and then 1 % of the frequency before.

Tests:

Operating conditions	Frequency range [MHz]	Test Level [V/m]	Modulation	Polarization, Antenna direction	Compliance Pass/ Fail/ N/A
measurement mode	80 – 1000	10	80 % AM, 1 kHz	horizontal, front	**PASS**
measurement mode	80 – 1000	10	80 % AM, 1 kHz	vertical, front	**PASS**
measurement mode	80 – 1000	10	80 % AM, 1 kHz	horizontal, left	**PASS**
measurement mode	80 – 1000	10	80 % AM, 1 kHz	vertical, left	**PASS**
measurement mode	80 – 1000	10	80 % AM, 1 kHz	horizontal, right	**PASS**
measurement mode	80 – 1000	10	80 % AM, 1 kHz	vertical, right	**PASS**
measurement mode	80 – 1000	10	80 % AM, 1 kHz	horizontal, back	**PASS**
measurement mode	80 – 1000	10	80 % AM, 1 kHz	vertical, back	**PASS**
measurement mode	80 – 1000	10	80 % AM, 1 kHz	horizontal, top	**PASS**
measurement mode	80 – 1000	10	80 % AM, 1 kHz	vertical, top	**PASS**
measurement mode	80 – 1000	10	80 % AM, 1 kHz	horizontal, bottom	**PASS**
measurement mode	80 – 1000	10	80 % AM, 1 kHz	vertical, bottom	**PASS**
measurement mode	1400 – 6000	3	80 % AM, 1 kHz	horizontal, front	**PASS**
measurement mode	1400 – 6000	3	80 % AM, 1 kHz	vertical, front	**PASS**
measurement mode	1400 – 6000	3	80 % AM, 1 kHz	horizontal, left	**PASS**
measurement mode	1400 – 6000	3	80 % AM, 1 kHz	vertical, left	**PASS**
measurement mode	1400 – 6000	3	80 % AM, 1 kHz	horizontal, right	**PASS**
measurement mode	1400 – 6000	3	80 % AM, 1 kHz	vertical, right	**PASS**
measurement mode	1400 – 6000	3	80 % AM, 1 kHz	horizontal, back	**PASS**
measurement mode	1400 – 6000	3	80 % AM, 1 kHz	vertical, back	**PASS**
measurement mode	1400 – 6000	3	80 % AM, 1 kHz	horizontal, top	**PASS**
measurement mode	1400 – 6000	3	80 % AM, 1 kHz	vertical, top	**PASS**
measurement mode	1400 – 6000	3	80 % AM, 1 kHz	horizontal, bottom	**PASS**
measurement mode	1400 – 6000	3	80 % AM, 1 kHz	vertical, bottom	**PASS**

Functional test after test procedure: PASS

Test results:
In the frequency range from 220 to 250 MHz (only horizontal polarization, all sides) a maximum deviation of -0,7% O_2 could be detected during the test. The performance criterion for the immunity was met (deviation is inside the specified accuracy). There was no function failure nor loss of data, neither was there any change in the working conditions.

According to the above test set-up the equipment under test specified in chapter 3 complies with the immunity requirements in respect of high frequency electromagnetic field in accordance with IEC 61326-1:2020.

5.3. Magnetic Field with Power-frequency

Required performance criterion: A

Test set-up:
The tests were performed in accordance to IEC 61000-4-8.
The main parts of the configuration are a sufficient big inductance coil with a well-known coil factor for producing a homogeny magnetic field and a programmable power supply with sufficient current supply.
A square inductance coil with 1 m x 1 m was used for generation of the magnetic field.

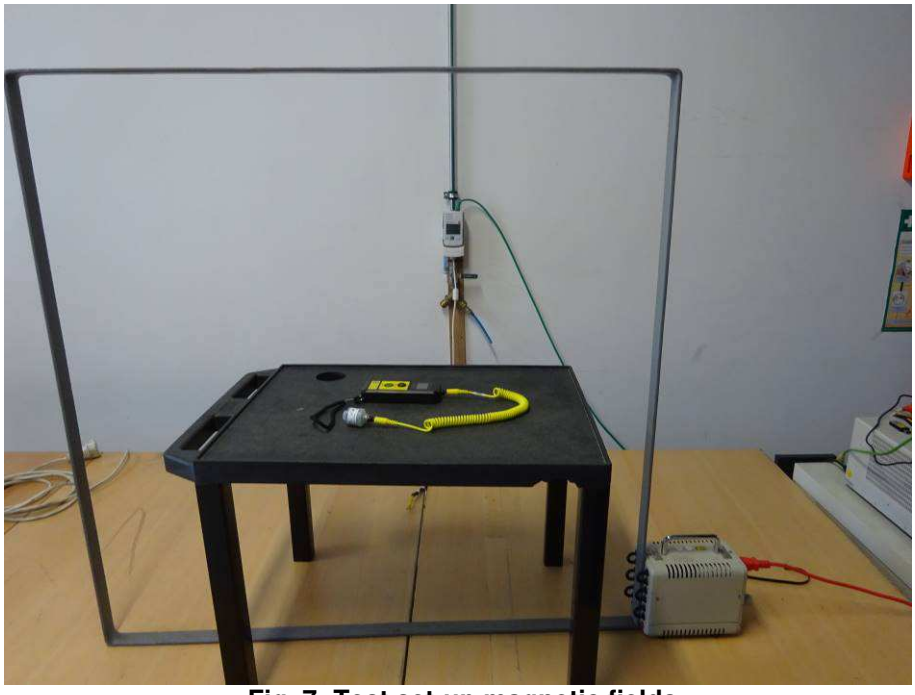


Fig. 7: Test set-up magnetic fields

Test Equipment:

Description	Model	Identifier	Manufacturer	Cal/Ver. Date	Cal//Ver. Due
7 - channel power meter	LMG670	017/02	ZES	2024,03	2025,03
Data logger temp./humid. *	Testo 150 TUC4, Probe 0572 2164	065/25	Testo	2024,01	2025,03
Magnetic field with energy frequencies	H05VV-F	PHM 013/12	Harvest	N/A	N/A
Loop antenna	MF 1000	PHM 018/01	EMC Partner	2024,04	2025,03
programmable power supply	6560	PHM 055/18	Chroma	2024,04	2025,03

*) used for ambient monitoring
ICO initial calibration only

Tests:

Working conditions	Equipment	Test level	Duration	Compliance Pass/ Fail/ N/A
measurement mode	whole configuration x-axis	**30 A/m, 50 Hz**	5 min	**PASS**
measurement mode	whole configuration y-axis	**30 A/m, 50 Hz**	5 min	**PASS**
measurement mode	whole configuration z-axis	**30 A/m, 50 Hz**	5 min	**PASS**
measurement mode	whole configuration x-axis	**30 A/m, 60 Hz**	5 min	**PASS**
measurement mode	whole configuration y-axis	**30 A/m, 60 Hz**	5 min	**PASS**
measurement mode	whole configuration z-axis	**30 A/m, 60 Hz**	5 min	**PASS**

Functional test after test procedure: PASS

Test results:
No relevant influencing functions of the equipment were detected during this EMC-Test. The performance criterion for the immunity was met. There was no function failure nor loss of data, neither was there any change in the working conditions.

According to the above test set-up the equipment under test specified in part 3 complies with the magnetic field requirements with power-frequency in accordance with IEC 61326-1:2020.

Appendix List:

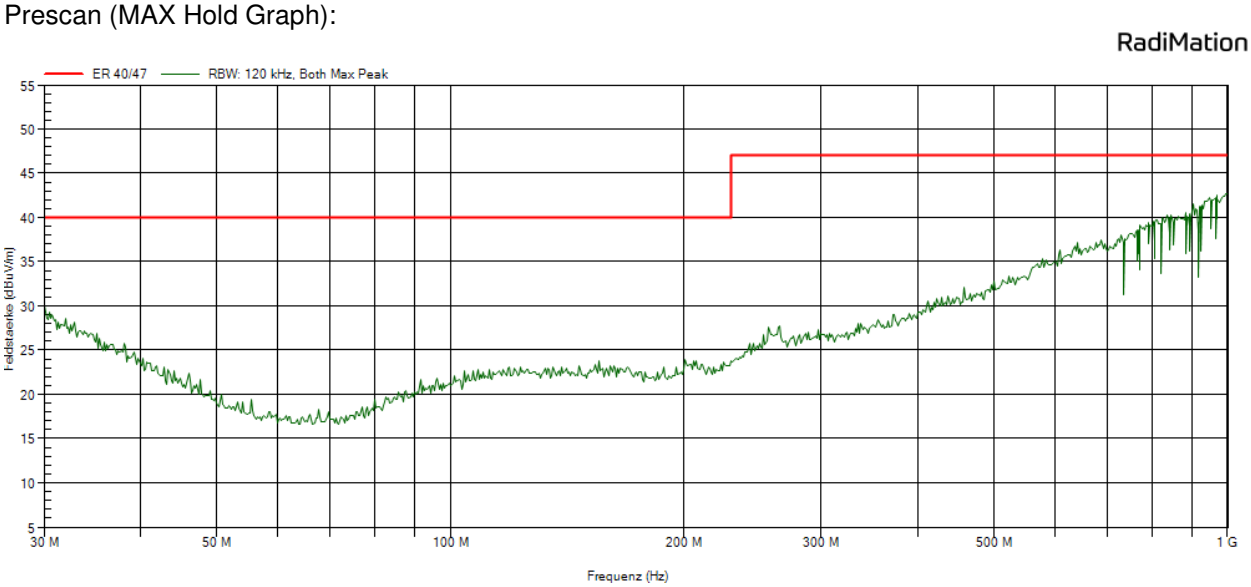
CEcert GmbH **Radiated Emissions**

EUT: VN202 mkII
Serial Number: --
Manufacturer: VANDAGRAPH Ltd.
Operating Condition: measurement mode
Comment:

Scan Settings:

Frequency Range: 30 MHz – 1000 MHz
Receiver Bandwidth: 120 kHz
Measure Time: 15 ms (Prescan), 3 s (Final Measurement)
Measurement Distance: 3 m

Prescan (MAX Hold Graph):



Detected Peaks:

Frequency [MHz]	PK Value [dBµV/m]	QP Value [dBµV/m]	QP Limit [dBµV/m]	Angle [degrees]	Height [m]	Polarization	Result
765,837	38,1	32,6	47	170	3,3	Vertical	Pass
792,373	39,4	33,2	47	110	3,9	Vertical	Pass
842,366	39,3	34,1	47	-150	1,1	Horizontal	Pass
892,24	39,3	34,4	47	-30	2,2	Vertical	Pass
923,468	40,2	35,1	47	-50	2,75	Horizontal	Pass
970,685	41,6	36,2	47	140	3,25	Horizontal	Pass