

Test Report

Report Number:

F251788E1

Equipment under Test (EUT):

**ZONESCAN AI Leak Logger
and
Programming JIG**

Applicant:

Gutermann Technology GmbH

Manufacturer:

Gutermann Technology GmbH



Deutsche
Akkreditierungsstelle
D-PL-17186-01-00

References

- [1] **ANSI C63.4-2014+C63.4a-2017** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- [2] **FCC 47 CFR Part 2:** General Rules and Regulations
- [3] **FCC 47 CFR Part 15:** Radio Frequency Devices (Subpart B)
- [4] **ICES-003 Issue 7: (October 2020)** Spectrum Management and Telecommunications. Interference-Causing Equipment Standard. Information Technology Equipment (Including Digital Apparatus) —Limits and Methods of Measurement

Test Result

The requirements of the tests performed as shown in the overview (clause 4) were fulfilled by the equipment under test. The complete test results are presented in the following.

“Passed” indicates that the equipment under test conforms with the relevant limits of the testing standard without taking any measurement uncertainty into account as stated in clause 10.2.8.2 of ANSI C63.4 (2014). However, the measurement uncertainty is calculated and shown in this test report.

Tested and written
by:

Signature

Reviewed and
approved by:

Signature

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The test results herein refer only to the tested sample. PHOENIX TESTLAB GmbH is not responsible for any generalisations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TESTLAB Logo and the TEST REPORT NUMBER.

Contents:	Page
1 Identification	5
1.1 Applicant.....	5
1.2 Manufacturer	5
1.3 Test Laboratory	5
1.4 EUT (Equipment under Test)	6
1.5 Technical Data of Equipment	7
1.6 Dates	7
2 Operational States	8
3 Additional Information	9
4 Overview.....	10
5 Results.....	11
5.1 Test setups.....	11
5.2 Radiated emissions	15
6 Measurement Uncertainties	20
7 Test Equipment used for Tests	20
8 Test site Verification.....	21
9 Report History.....	21
10 List of Annexes	21

1 Identification

1.1 Applicant

Name:	Gutermann Technology GmbH
Address:	Gottlieb Daimler Str. 10, 88214 Ravensburg
Country:	Germany
Name for contact purposes:	Mr. Carles ESTELLERS CASAS
Phone:	+49 751-359016-89
eMail address:	carles.estellers@gutermann-water.com
Applicant represented during the test by the following person:	None

1.2 Manufacturer

Name:	Gutermann Technology GmbH
Address:	Gottlieb Daimler Str. 10, 88214 Ravensburg
Country:	Germany
Name for contact purposes:	Mr. Carles ESTELLERS CASAS
Phone:	+49 751-359016-89
eMail address:	carles.estellers@gutermann-water.com
Manufacturer represented during the test by the following person:	None

1.3 Test Laboratory

The tests were carried out by: **PHOENIX TESTLAB GmbH**
Königswinkel 10
32825 Blomberg
Germany

accredited by *Deutsche Akkreditierungsstelle GmbH (DAkS)* according to DIN EN ISO/IEC 17025:2018. The accreditation is only valid for the scope of accreditation listed in the annex of the certificate D-PL-17186-01-00. FCC Test Firm Designation Number DE0004, FCC Test Firm Registration Number 469623, CAB Identifier DE0003 and ISED# 3469A.

1.4 EUT (Equipment under Test)

Type of equipment: *	ZONESCAN HYDRO LOGGER	ZONESCAN AI Programming Jig
Type / PMN: *	ZONESCAN HYDR Correlating NB-IoT Hydrophone Leak Logger	ZONESCAN AI Programming Jig
Product number: *	ZSHY-DN-L20	ZSAI-JIG10
Serial number: *	515000071	JIG281
FCC ID: *	ZSS-ZSAIL20	ZSS-ZSAIJIG
EUT marking: *	ZSHY-DN-L20	ZSAI-JIG10
PCB identifier: *	ZSNB210B	ZSNB40B
Hardware version: *	ZSHY-DN-L20	NA
Software version: *	NBAI01	NA
Contains FCC ID: *	ZSS-ZSAIBC660K	NA
Contains IC ID: *	9789A-ZSAIBC660K	NA

* Declared by the applicant

One EUT was used for all tests.

Note: PHOENIX TESTLAB GmbH does not take samples. The samples used for tests are provided exclusively by the applicant.

1.5 Technical Data of Equipment

Logger	
Power supply EUT: *	Battery powered
Supply voltage EUT: *	U = 3.6 V
Temperature range: *	-30 °C to +70 °C
Highest internal clock / generated frequency: *	1915 MHz

* Declared by the applicant

Programming JIG	
Power supply EUT: *	DC via USB
Supply voltage EUT: *	U _{nom} = 5 V
Temperature range: *	-30 °C to +70 °C

* Declared by the applicant

Ports / Connectors				
Identification			Length during test	Shielding (Yes / No)
	EUT	Ancillary		
Antenna / programming port	SMA plug	Clamp	0.25 m	Yes
USB Connector	closed	USB A	0.5 m	Yes

*1 Provided by the laboratory

*2 Provided by the applicant

Equipment used for testing	
Laptop with software* ¹	Hp Laptop (Gutermann inventory no GT-0196-RV) with NBloT Laboratory Tester v3.0.11
-	-

*¹ Provided by the applicant

Ancillary equipment	
Antenna	ANT-BASE-06 with ANT-ROD-76
-	-
-	-

*¹ Provided by the applicant

1.6 Dates

Date of receipt of test sample:	03.12.2025
Start of test:	04.12.2025
End of test:	04.12.2025

2 Operational States

Description of function of the EUT:

The EUT is a Logger that allows to find leaks in water pipes underground. The logger will measure the noise of the pipe every night and transmit the data with narrow band modem (NB-IoT). The data will be processed by Gutermann servers to present the leaks in ZONESCAN.NET.

The sensor element of the logger is built around a neodymium magnet, and this attaches the logger magnetically to the pipe.

The logger is deployed underground, to maximize its connectivity an optimized antenna is needed. Because different telecom operators use different bands around the world, an antenna must be chosen to match the application.

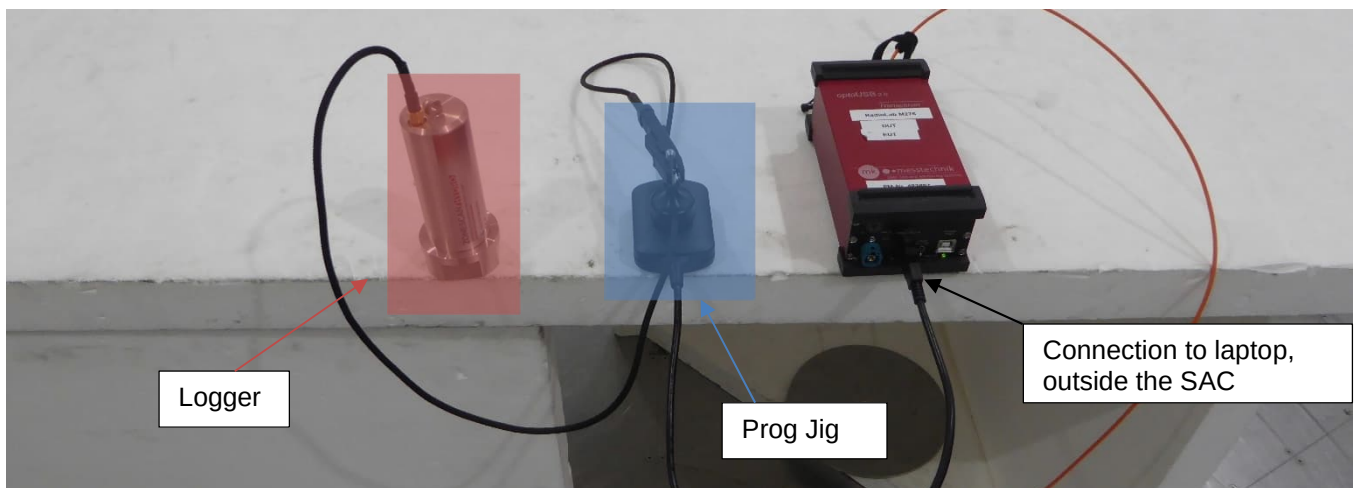
The programming jig for the ZONESCAN AI Logger used as a tool to set up the device using a USB connection to a PC. The jig connects with a clamp on the antenna.

The following states were defined as the operating conditions:

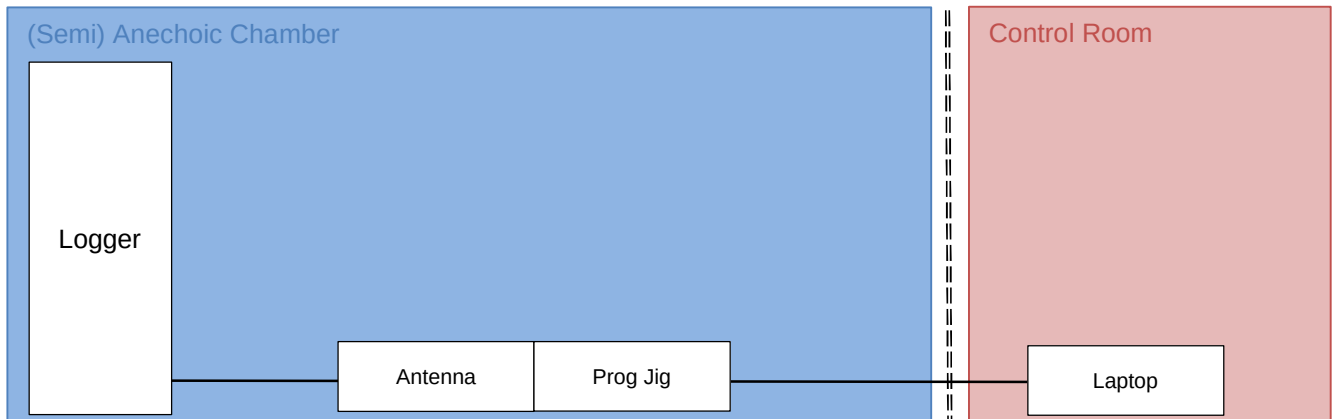
During all tests the EUT was connected to a laptop via the programming jig through a USB port. With a software tool "StartLaborTest" (NBloT Laboratory Tester v3.0.11) the communication was started.

The Software was continuously showing the different sensor values and activity as ADC RMS, 3D Motion sensor, Temperature, Humidity, Fuel Gauge.

The system was setup as follows:



2.1.1 Block Diagram (Radiated)



3 Additional Information

The EUT was not labeled as required by FCC / IC.

4 Overview

Conducted emissions FCC 47 CFR Part 15 section 15.107 (a), (b) [3] ICES-003 Issue 7 section 3.2.1[4]					
Application	Frequency range	Limits	Reference standard	Tested EUT	Status
AC supply line Class B	0.15 to 0.5 MHz 0.5 to 5 MHz 5 to 30 MHz	66 to 56 dB(μV) QP* 56 to 46 dB(μV) AV* 56 dB(μV) QP 46 dB(μV) AV 60 dB(μV) QP 50 dB(μV) AV	ANSI C63.4	N/A, battery powered	-
*: Decreases with the logarithm of the frequency					

Radiated emissions FCC 47 CFR Part 15 section 15.109 (a) [3]					
Application	Frequency range	Limits	Reference standard	Tested EUT	Status
Radiated Emission Class B	30 to 88 MHz 88 to 216 MHz 216 to 960 MHz 960 to 1000 MHz above 1000 MHz	40.0 dB(μV/m) QP at 3 m 43.5 dB(μV/m) QP at 3 m 46.0 dB(μV/m) QP at 3 m 54.0 dB(μV/m) QP at 3 m 54.0 dB(μV/m) AV at 3 m and 74.0 dB(μV/m) PK at 3 m	ANSI C63.4	1	Passed

Radiated emissions ICES-003 Issue 7 section 3.2.2 [4]					
Application	Frequency range	Limits	Reference standard	Tested EUT	Status
Radiated Emission Class B	30 to 88 MHz 88 to 216 MHz 216 to 230 MHz 230 to 960 MHz 960 to 1000 MHz above 1000 MHz	40.0 dB(μV/m) QP at 3 m 43.5 dB(μV/m) QP at 3 m 46.0 dB(μV/m) QP at 3 m 47.0 dB(μV/m) QP at 3 m 54.0 dB(μV/m) QP at 3 m 54 dB(μV/m) AV at 3 m and 74 dB(μV/m) PK at 3 m	ANSI C63.4	1	Passed

Remark: As declared by the applicant the highest internal clock frequency is 1.9149 GHz.
Therefore, the radiated emission measurement must be carried out up to 5th of the highest internal clock frequency.

The EUT was classified by the applicant as CLASS B equipment.

5 Results

5.1 Test setups

5.1.1 Radiated: 30 MHz to 1 GHz

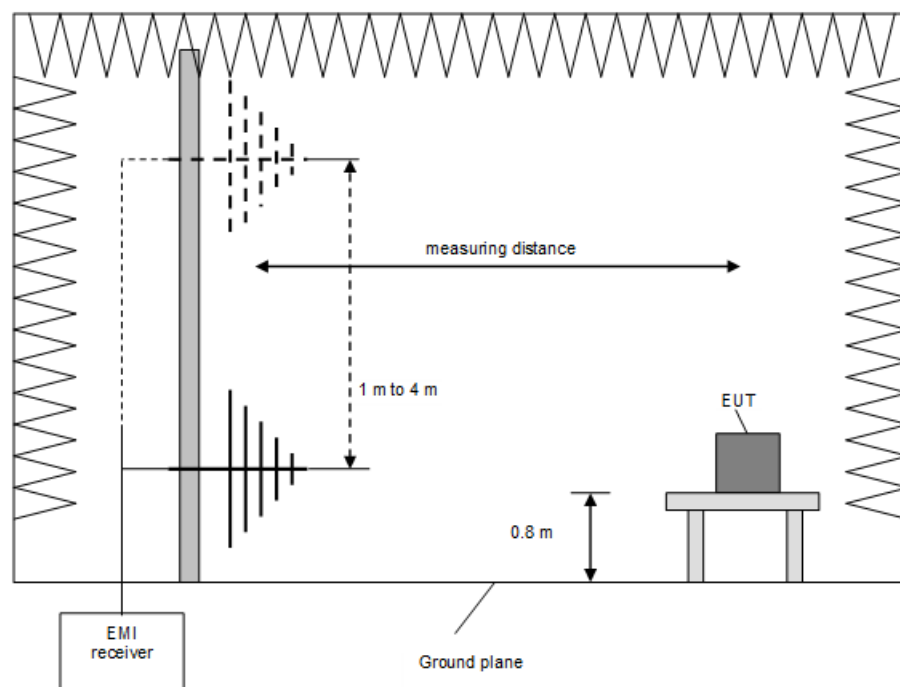
5.1.1.1 Preliminary and final measurement 30 MHz to 1 GHz

The preliminary and final measurements are performed in a semi-anechoic chamber with a metal ground plane at a measuring distance of 3 meters. Table-top devices are set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices are placed directly on the turntable / ground plane. The setup of the equipment under test is in accordance with [1].

During the tests the EUT is rotated in the range of 0 ° to 360 °, the measuring antenna is set to horizontal and vertical polarization and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

The resolution bandwidth of the EMI receiver is set to the following values:

Test	Frequency range	Step-size	Resolution bandwidth	Measuring time	Detector
Preliminary measurement	30 MHz to 1 GHz	30 kHz	120 kHz	-	Peak Average
Frequency peak search	± 120 kHz	10 kHz	120 kHz	1 s	Peak
Final measurement	30 MHz to 1 GHz	-	120 kHz	1 s	QuasiPeak



Procedure preliminary measurement:

The following procedure is used:

- 1) Set the measuring antenna to 1 m height.
- 2) Monitor the frequency range at horizontal polarization of the measuring antenna and an EUT / turntable azimuth of 0 °.
- 3) Rotate the EUT by 360° to maximize the detected signals.
- 4) Repeat steps 2 to 3 with the vertical polarization of the measuring antenna.
- 5) Increase the height of the measuring antenna for 0.5 m and repeat steps 2 to 4 until the final height of 4 m is reached.
- 6) The highest values for each frequency are saved by the software, including the measuring antenna height and polarization and the turntable azimuth for that value.

Procedure final measurement:

The following procedure is used:

- 1) Select the highest frequency peaks (lowest margin to the limit) for the final measurement.
- 2) The software determines the exact peak frequencies by doing a partial scan with reduced step size of the pre-scan of the selected peaks.
- 3) If the EUT is portable or ceiling mounted, find the worst-case EUT orientation (x,y,z) for the final test.
- 4) The worst-case measuring antenna height is found via varying the height by +/- 0.5 m from the value obtained in the preliminary measurement while monitoring the emission level.
- 5) The worst-case turntable position is found via varying the turntable azimuth by +/- 30° from the value obtained in the preliminary measurement while monitoring the emission level.
- 6) The final measurement is performed at the worst-case measuring antenna height and the worst-case turntable azimuth.
- 7) Steps 2 to 6 are repeated for each frequency peak selected in step 1.

5.1.2 Radiated: 1 GHz to 40 GHz

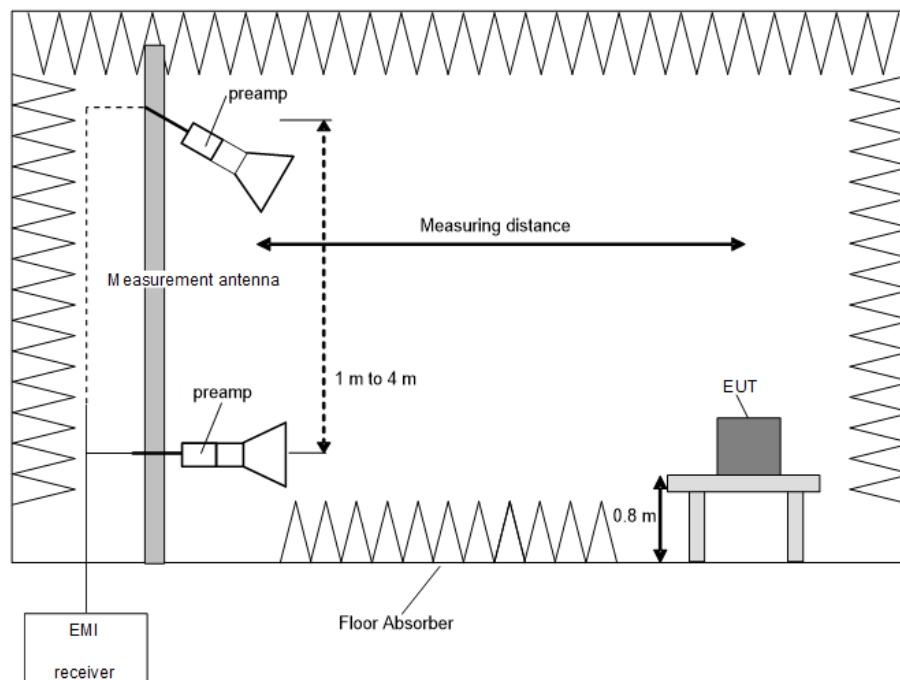
5.1.2.1 Preliminary and final measurement 1 to 40 GHz

The preliminary and final measurements are performed in a semi-anechoic chamber at a measuring distance of 3 meters, with floor absorbers between EUT and measuring antenna. Table-top devices are set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices are placed directly on the turntable / ground plane. The setup of the equipment under test is in accordance with [1].

During the tests the EUT is rotated in the range of 0 ° to 360 °, the measuring antenna is set to horizontal and vertical polarization and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions. While changing the height, the measuring antenna gets tilted so that it is always aiming at the EUT.

The resolution bandwidth of the EMI receiver is set to the following values:

Test	Frequency range	Step-size	Resolution bandwidth	Measuring time	Detector
Preliminary measurement	1 - 40 GHz	250 kHz	1 MHz	-	Peak Average
Frequency peak search	+ / - 1 MHz	50 kHz	1 MHz	100 ms	Peak
Final measurement	1 - 40 GHz	-	1 MHz	100 ms	Peak Average



Procedure preliminary measurement:

The following procedure is used:

- 1) Set the measuring antenna to 1 m height.
- 2) Monitor the frequency range at horizontal polarization of the measuring antenna and an EUT / turntable azimuth of 0 °.
- 3) Rotate the EUT by 360° to maximize the detected signals.
- 4) Repeat steps 2 to 3 with the vertical polarization of the measuring antenna.
- 5) Increase the height of the measuring antenna for 0.5 m and repeat steps 2 to 4 until the final height of 4 m is reached.
- 6) The highest values for each frequency are saved by the software, including the measuring antenna height and polarization and the turntable azimuth for that value.

Procedure final measurement:

The following procedure is used:

- 1) Select the highest frequency peaks (lowest margin to the limit) for the final measurement.
- 2) The software determines the exact peak frequencies by doing a partial scan with reduced step size of the pre-scan of the selected peaks.
- 3) If the EUT is portable or ceiling mounted, find the worst-case EUT orientation (x,y,z) for the final test.
- 4) The worst-case measuring antenna height is found via varying the height by +/- 0.5 m from the value obtained in the preliminary measurement while monitoring the emission level.
- 5) The worst-case turntable position is found via varying the turntable azimuth by +/- 30° from the value obtained in the preliminary measurement while monitoring the emission level.
- 6) The final measurement is performed at the worst-case measuring antenna height and the worst-case turntable azimuth.
- 7) Steps 2 to 6 are repeated for each frequency peak selected in step 1.

5.2 Radiated emissions

5.2.1 Test setup (Maximum unwanted emissions)

Test setup (Maximum unwanted emissions)			
Used	Setup	See sub-clause	Comment
☒	Radiated: 30 MHz to 1 GHz / 1 GHz to 40 GHz	5.1.1 / 5.1.2	-

5.2.2 Test method (Maximum unwanted emissions)

☒ Test method (radiated) see sub-clause 5.1.1 / 5.1.2 as described herein

5.2.3 Test results (Maximum unwanted emissions)

5.2.3.1 Test results (30 MHz – 1 GHz)

Ambient temperature:	22 °C
Relative humidity:	22 %

Date:	04.12.2025
Tested by:	B. ROHDE

Position of EUT: For tests for f between 30 MHz and 1 GHz, the EUT was set up on a table with a height of 80 cm. The distance between EUT and antenna was 3 m.

Cable guide: For detailed information of test setup and the cable guide refer to the pictures in annex A of this test report.

Test record: Plots for each frequency range are submitted below.

Remark: Only nominal position was tested

Calculations:

Result [dBμV/m] = Reading [dBμV] + Correction [dB/m]

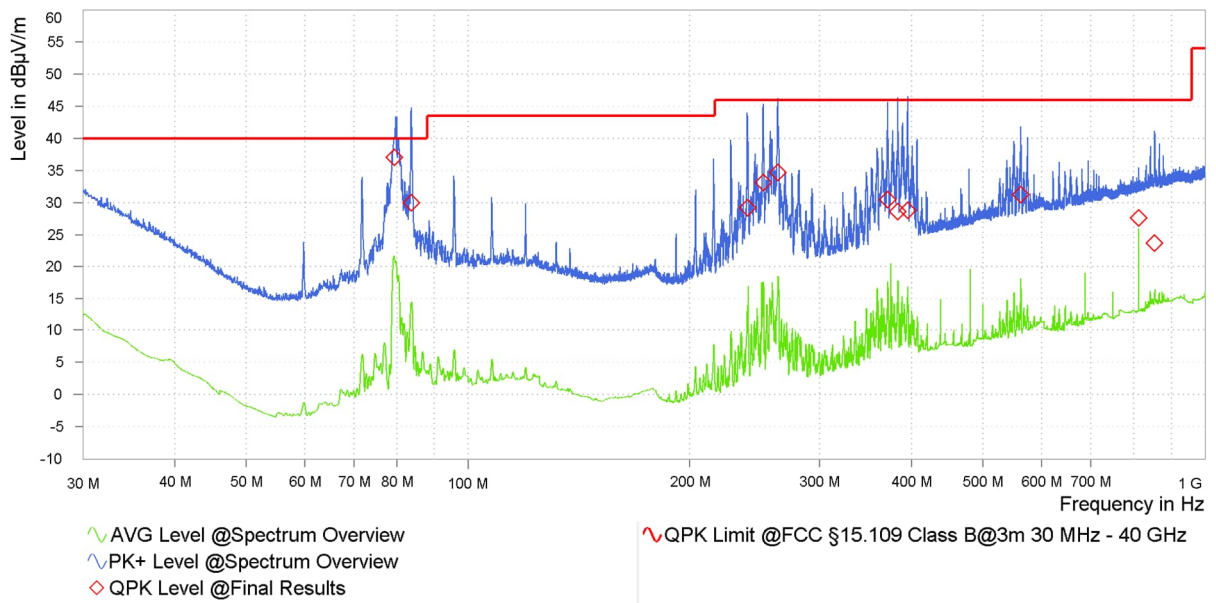
Correction [dB/m] = AF [dB/m] + Cable attenuation [dB] + optional preamp gain [dB]

Margin [dB] = Limit [dBμV/m] - Result [dBμV/m]

The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above-mentioned standard. The measured points marked with “◇” are the measured results of the standard subsequent measurement in a semi-anechoic chamber.

Worst case plot:

Spurious emissions from 30 MHz to 1 GHz (operation mode 1):



Result tables:

(Operation mode 1):

Results according to FCC 47 CFR Part 15 section 15.109 (a), (b) [3]

Frequency [MHz]	Result (QP) [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Correction [dB/m]	Pol. (H/V)	Azimuth [deg]	Antenna Height [m]	Position #
79.47	37.1	40.0	2.9	16.1	H	194	3.86	1
83.82	30.0	40.0	10.0	16.6	H	190	2.42	1
239.46	29.2	46.0	16.8	17.0	H	114	1.64	1
251.46	33.1	46.0	12.9	17.2	H	92	1.48	1
263.43	34.7	46.0	11.3	17.8	H	92	1.24	1
371.28	30.5	46.0	15.5	20.9	H	282	1.17	1
383.19	28.6	46.0	17.4	21.2	H	268	1.28	1
395.19	28.8	46.0	17.2	21.6	H	292	1.08	1
562.50	31.2	46.0	14.8	25.0	H	297	1.73	1
812.49	27.6	46.0	18.4	28.7	H	234	1.04	1
854.04	23.6	46.0	22.4	29.0	H	158	1.12	1

Results according to ICES-003 Issue 7 section 3.2.2 [4]

Frequency [MHz]	Result (QP) [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Correction [dB/m]	Pol. (H/V)	Azimuth [deg]	Antenna Height [m]	Position #
79.47	37.1	40.0	2.9	16.1	H	194	3.86	1
83.82	30.0	40.0	10.0	16.6	H	190	2.42	1
239.46	29.2	47.0	17.8	17.0	H	114	1.64	1
251.46	33.1	47.0	13.9	17.2	H	92	1.48	1
263.43	34.7	47.0	12.3	17.8	H	92	1.24	1
371.28	30.5	47.0	16.5	20.9	H	282	1.17	1
383.19	28.6	47.0	18.4	21.2	H	268	1.28	1
395.19	28.8	47.0	18.2	21.6	H	292	1.08	1
562.50	31.2	47.0	15.8	25.0	H	297	1.73	1
812.49	27.6	47.0	19.4	28.7	H	234	1.04	1
854.04	23.6	47.0	23.4	29.0	H	158	1.12	1

Test result: Passed

Test equipment (please refer to chapter 7 for details)

1 - 9

5.2.3.2 Test results (radiated 1 to 40 GHz)

Ambient temperature:	22 °C
Relative humidity:	22 %

Date:	04.12.2025
Tested by:	B. ROHDE

Position of EUT: For tests for f between 1 GHz and the 5th harmonic, the EUT was set up on a table with a height of 80 cm. The distance between EUT and antenna was 3 m.

Cable guide: For detailed information of test setup and the cable guide refer to the pictures in annex A of this test report.

Test record: Plots for each frequency range are submitted below.

Remark: Only nominal position was tested

Calculation:

Max Peak [dBμV/m] = Reading [dBμV] + Correction [dB/m]

Average [dBμV/m] = Reading [dBμV] + Correction [dB/m]

Correction [dB/m] = AF [dB/m] + Cable attenuation [dB] + optional preamp gain [dB]

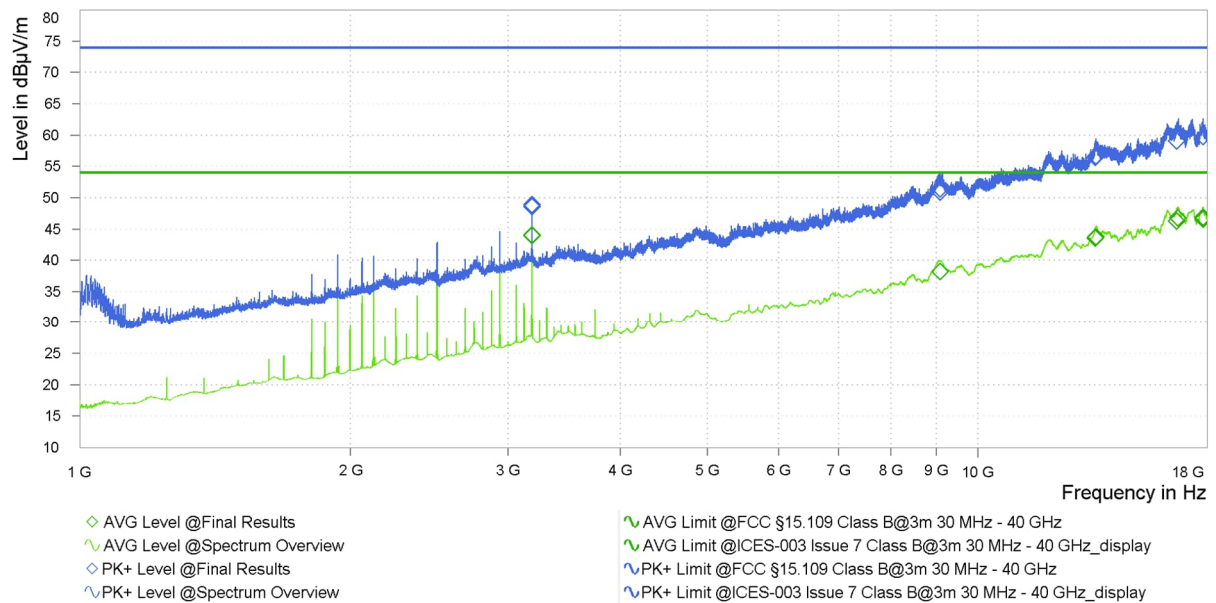
Margin [dB] = Limit [dBμV/m] – Max Peak | Average [dBμV/m]

The curves in the diagram only represent the maximum measured value for each frequency point of all preliminary measurements, which were carried out with various EUT and antenna positions.

The top measured curve represents the peak measurement. The measured points marked with "◊" are frequency points for the final peak detector measurement. These values are indicated in the following table. The bottom measured curve represents the average measurement. The measured points marked with "◊" are frequency points for the final average detector measurement.

Worst case plots:

Spurious emissions from 1 GHz to 18 GHz (operation mode 1):



Result tables:

Operation mode 1:

Frequency [MHz]	Pk Level [dB(μV/m)]	Pk Limit [dB(μV/m)]	Pk Margin [dB]	AV Level [dB(μV/m)]	AV Limit [dB(μV/m)]	AV Margin [dB]	Corr. [dB/m]	Pol. [H/V]	Azimuth [deg]	Antenna Height [m]	Position #
3187.50	48.8	74.0	25.2	44.1	54.0	9.9	3.0	H	157	1.00	1
3187.50	48.5	74.0	25.5	43.9	54.0	10.1	3.0	H	159	1.42	1
9080.25	51.4	74.0	22.6	38.2	54.0	15.8	18.3	V	47	2.92	1
9085.00	50.9	74.0	23.1	38.2	54.0	15.8	18.3	V	235	3.88	1
13512.50	56.4	74.0	17.6	43.6	54.0	10.4	23.4	V	141	4.49	1
13550.50	56.6	74.0	17.4	43.7	54.0	10.3	23.7	H	107	3.36	1
16657.75	59.1	74.0	14.9	46.3	54.0	7.7	27.5	H	137	3.36	1
17834.75	59.8	74.0	14.2	46.6	54.0	7.4	28.7	H	159	3.02	1

* All results were below the stricter limits for the restricted bands. Therefore, the indication is omitted.

Test result: Passed

Test equipment (please refer to chapter 7 for details)

3 - 11

6 Measurement Uncertainties

Conducted measurements		
Measurement method	Standard used for calculating measurement uncertainty	Expanded measurement uncertainty (95 %) U_{lab}
Conducted emissions from 150 kHz to 30 MHz with LISN	CISPR 16-4-2	2.8 dB

Radiated measurements		
Radiated field strength M276		
R&S HL562E @ 3 m 30 MHz – 1 GHz	CISPR 16-4-2	4.8 dB
R&S HL050 @ 3 m	-	
1 – 6 GHz	CISPR 16-4-2	5.1 dB
6 – 18 GHz	CISPR 16-4-2	5.4 dB
Flann Standard Gain Horns 18 – 40 GHz	-	5.9 dB

7 Test Equipment used for Tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal Due
1	Attenuator 6 dB	WA2-6	Weinschel		482793	Calibration not necessary	
2	Ultralog antenna 30 MHz - 6 GHz	HL562E	Rohde & Schwarz	101079	482978	24.04.2024	04.2027
3	EMC test software	Elektra V5.21	Rohde & Schwarz	---	483755	Calibration not necessary	
4	RF Switch Matrix	OSP220	Rohde & Schwarz	101391	482976	Calibration not necessary	
5	Turntable	TT3.0-3t	Maturo	825/2612/.01	483224	Calibration not necessary	
6	Antenna support tilt mast	BAM 4.5-P-10kg	Maturo	222/2612.01	483225	Calibration not necessary	
7	Controller	NCD	Maturo	474/2612.01	483226	Calibration not necessary	
8	Semi Anechoic Chamber M276	SAC5-2	Albatross Projects	C62128-A540-A138-10-0006	483227	Calibration not necessary	
9	EMI receiver / Spectrum analyser	ESW44	Rohde & Schwarz	101828	482979	21.02.2024	02.2026
10	Low Noise Amplifier 10 MHz - 18 GHz	LNA-30-00101800-25-10P	Narda-Miteq	2110917	482967	20.02.2024	02.2026
11	Log.-Per. antenna 850 MHz - 26.5 GHz	HL050	Rohde & Schwarz	100908	482977	10.10.2025	10.2028

8 Test site Verification

Test equipment	PM. No.	Frequency range	Type of validation	According to	Val. Date	Val Due
Semi anechoic chamber M276	483227	30 – 1000 MHz	NSA	ANSI C63.4-2014 ANSI C63.4a-2017	01.03.2023	28.02.2026
Semi anechoic chamber M276	483227	1 -18 GHz	SVSWR	CISPR 16-1-4 + Cor1:2010 + A1:2012 +A2:2017	28.02.2023	27.02.2026

9 Report History

Report Number	Date	Comment
F251788E1	18.12.2025	Initial test report
-	-	-
-	-	-

10 List of Annexes

Annex A	Test setup photos	4 pages
Annex B	EUT external photos	5 pages
Annex C	EUT internal photos	6 pages
Annex D	Void	

----- end of test report -----