

Test Report

Report Number:

F221756E1

Equipment under Test (EUT):

DeltaVarioMon 8,4" Type 3 DMXC1132-1

Applicant:

Delta Components GmbH

Manufacturer:

Delta Components GmbH



Deutsche
Akkreditierungsstelle
D-PL-17186-01-01
D-PL-17186-01-02
D-PL-17186-01-03

References

- [1] **ANSI C63.4:2014** 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.

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1 Identification

1.1 Applicant

Name:	Delta Components GmbH
Address:	Auweg 27, 79761 Waldshut-Tiengen
Country:	Germany
Name for contact purposes:	Mr. Sascha Noll
Phone:	07751-8399-20
eMail address:	Sascha.Noll@delta-components.de
Applicant represented during the test by the following person:	Mr. Martin JAEGER

1.2 Manufacturer

Name:	Delta Components GmbH
Address:	Auweg 27, 79761 Waldshut-Tiengen
Country:	Germany
Name for contact purposes:	Mr. Sascha Noll
Phone:	07751-8399-20
eMail address:	Sascha.Noll@delta-components.de
Manufacturer represented during the test by the following person:	Mr. Martin JAEGER

1.3 Test Laboratory

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

Accredited by Deutsche Akkreditierungsstelle GmbH (DAkS) in compliance with DIN EN ISO/IEC 17025 under Reg. No. D-PL-17186-01-06 and D-PL-17186-01-05, FCC Test Firm Designation Number DE0004, FCC Test Firm Registration Number 469623, CAB Identifier DE0003 and ISED# 3469A.

1.4 EUT (Equipment under Test)

Test object: *	Display with DVI, VGA and USB for vehicular use
Model name: *	DeltaVarioMon 8,4" Type 3 DMXC1132-1
Model number: *	Type 3
Order number: *	DMXC1132-1
FCC ID: *	2A5IM-DVM84MM

	EUT number		
	1	2	3
Serial number: *	606222300209	-	-
PCB identifier: *	DAIV1073-1, BPPB2032-V15, BPPB2035-V14, BPPB2036-V14, LID08, PZER1007-R	-	-
Hardware version: *	A	-	-
Software version: *	8_4_V30	-	-

* 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

General			
Power supply EUT: *	DC		
Supply voltage EUT: *	$U_{nom} = 28 \text{ V}$	$U_{min} = 7.5 \text{ V}$	$U_{max} = 33 \text{ V}$
Temperature range: *	-20 °C to +70 °C		
Lowest / highest internal frequency: *	60Hz / 290MHz		

* Declared by the applicant

Ports / Connectors				
Identification	Connector		Length during test	Shielding (Yes / No)
	EUT	Ancillary		
Power supply	Lemo (type 1b) 2 pin	Banana plug	5 m	No
DVI	Single link	Single link	5 m	Yes
VGA	HD Sub 15	-	-	-
USB	USB-B (2.0)	USB-A (2.0)	5 m	Yes
Line in	-	-	-	-

Equipment used for testing	
Host PC: *1	Delta Components GmbH, VCT 1011-C2VK, (Art. No.: PKBX5326)
Power supply: *2	Toellner TOE 8852 (PM 480233)
-	-

*1 Provided by the applicant

*2 Provided by the laboratory

Ancillary equipment	
-	-

1.6 Dates

Date of receipt of test sample:	06.12.2022
Start of test:	06.12.2022
End of test:	06.12.2022

2 Operational States

Description of function of the EUT:

The EUT is a display with speaker for vehicular use running in normal operation mode.

The following states were defined as the operating conditions:

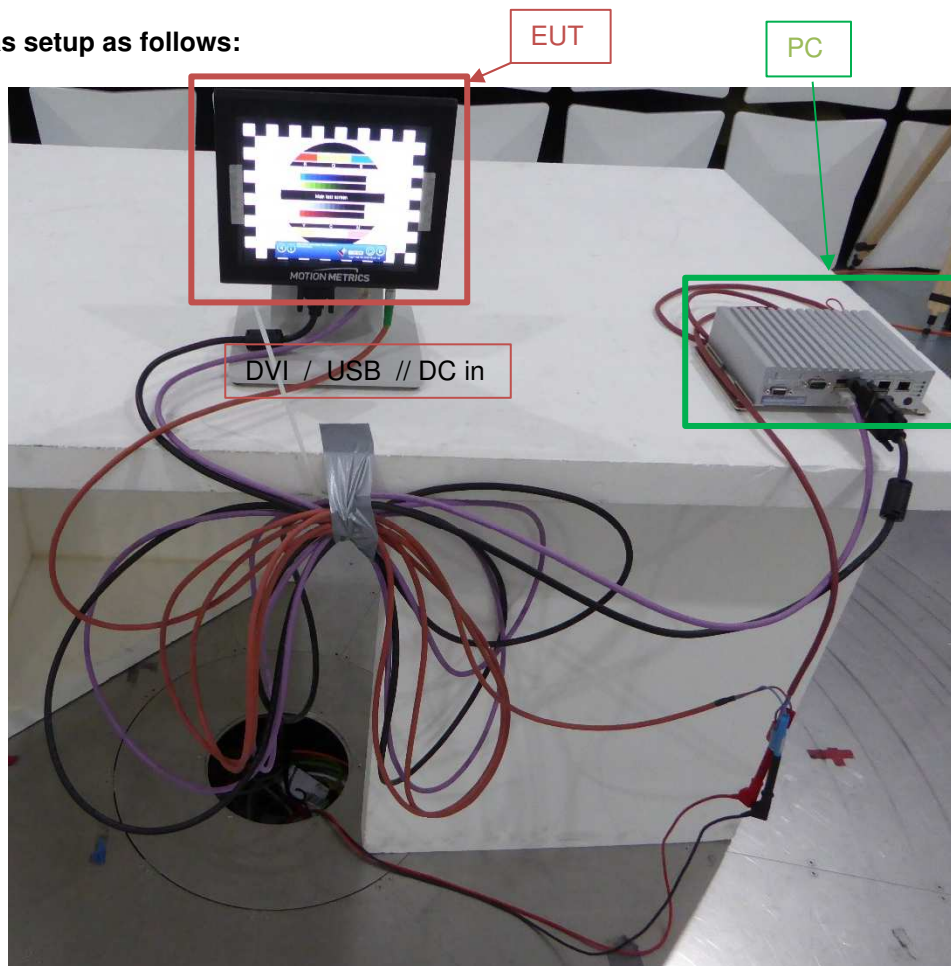
The EUT was supplied by 28 V DC during all tests.

During all tests, the EUT was connected to an industrial PC, a monitor test picture was shown, a music file was playing via USB from the connected PC.

The line in was not connected because it is not to be used in final application.

The VGA video port was not connected because it is not to be used in final application.

The system was setup as follows:



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 A	0.15 to 0.5 MHz 0.5 to 30 MHz	79 dB(μV) QP 66 dB(μV) AV 73 dB(μV) QP 60 dB(μV) AV	ANSI C63.4	-	-
*: Decreases with the logarithm of the frequency					

Radiated emissions FCC 47 CFR Part 15 section 15.109 (a), (b) [3]					
Application	Frequency range	Limits	Reference standard	Tested EUT	Status
Radiated Emission Class A @10m	30 to 88 MHz 88 to 216 MHz 216 to 960 MHz 960 to 1000 MHz above 1000 MHz	39.0 dB(μV/m) QP at 10 m 43.5 dB(μV/m) QP at 10 m 46.5 dB(μV/m) QP at 10 m 49.5 dB(μV/m) QP at 10 m 49.5 dB(μV/m) AV at 10 m and 69.5 dB(μV/m) PK at 10 m	ANSI C63.4	-	-
Radiated Emission Class A @3m*	30 to 88 MHz 88 to 216 MHz 216 to 960 MHz 960 to 1000 MHz above 1000 MHz	49.5 dB(μV/m) QP at 3 m 54.0 dB(μV/m) QP at 3 m 54.9 dB(μV/m) QP at 3 m 60 dB(μV/m) QP at 3 m 60.0 dB(μV/m) AV at 3 m and 80.0 dB(μV/m) PK at 3 m	ANSI C63.4	1	Passed

* Limit was recalculated as described in 47 CFR 15.31 (f) (1)

Radiated emissions ICES-003 Issue 7 section 3.2.2 [4]					
Application	Frequency range	Limits	Reference standard	Tested EUT	Status
Radiated Emission Class A @3m	30 to 88 MHz 88 to 216 MHz 216 to 230 MHz 230 to 960 MHz 960 to 1000 MHz above 1000 MHz	50.0 dB(μV/m) QP at 3 m 54.0 dB(μV/m) QP at 3 m 56.9 dB(μV/m) QP at 3 m 57.0 dB(μV/m) QP at 3 m 60.0 dB(μV/m) QP at 3 m 60.0 dB(μV/m) AV at 3 m and 80.0 dB(μV/m) PK at 3 m	ANSI C63.4	1	Passed

Remark: As declared by the applicant the highest internal clock frequency is below 1 GHz.
Therefore the radiated emission measurement was carried out up to 13 GHz.

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

5 Results

5.1 Test setups

5.1.1 Radiated: 30 MHz to 1 GHz

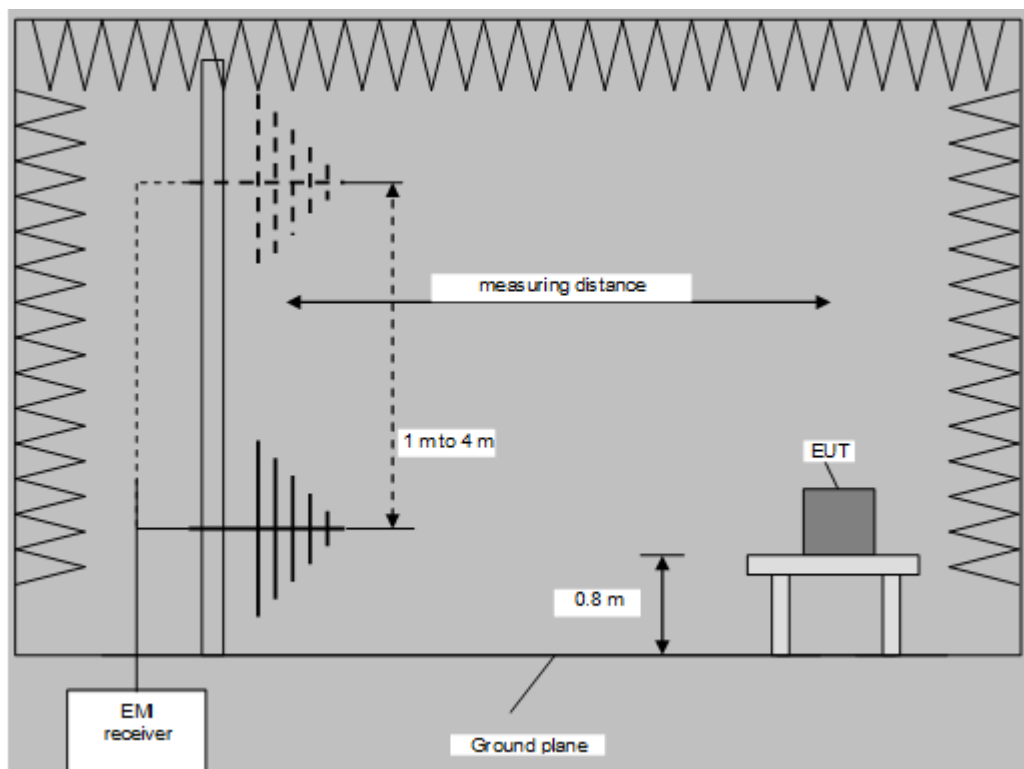
5.1.1.1 Preliminary and final measurement 30 MHz to 1 GHz

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

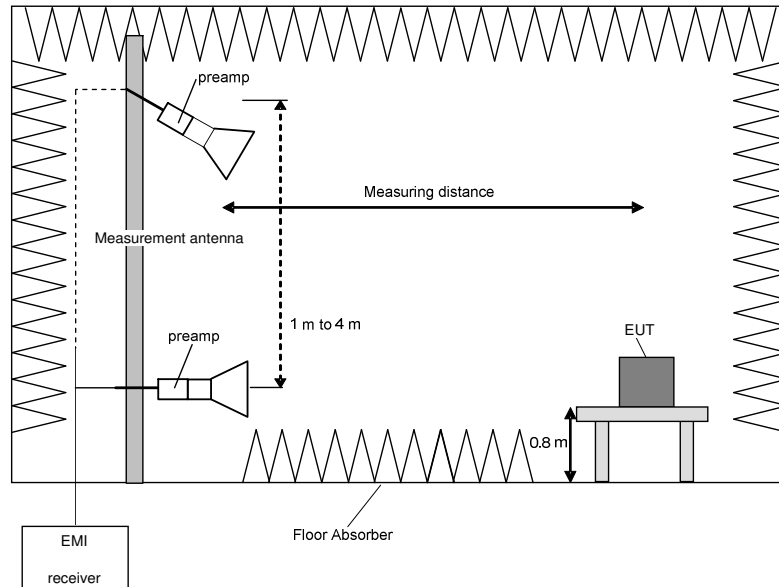
5.1.2.1 Preliminary and final measurement 1 to 40 GHz

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:	23 %

Date:	06.12.2022
Tested by:	B. ROHDE

Position of EUT: For tests for f between 30 MHz to 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 detail information of test set-up and the cable guide refer to the pictures in the annex A in the test report.

Test record: One plot for the frequency range is submitted below.

Remark: Only nominal position was tested

Calculations:

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

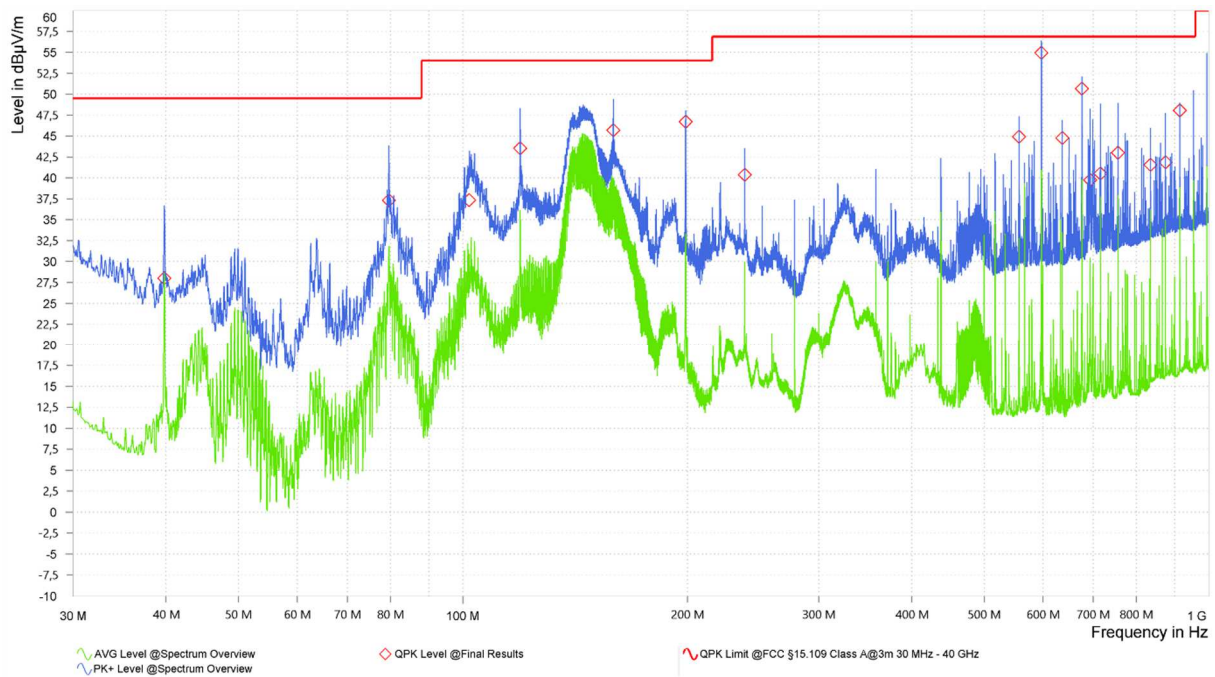
Correction [dB/m] = AF [dB/m] + Cable attenuation [dB] + optional preamp gain [dB]

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 CFR §15.109 Class A@3m:

(Operation mode 1):

Frequency [MHz]	QPK Level [dBμV/m]	QPK Limit [dBμV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Meas. Time [ms]
39.780	28.0	49.5	21.5	20.2	V	80.38	1.02	120	1,000
79.620	37.3	49.5	12.2	16.4	V	322.44	1.25	120	1,000
101.970	37.4	54.0	16.6	17.4	V	261	1.03	120	1,000
119.370	43.5	54.0	10.5	17.6	V	331.64	1.06	120	1,000
145.110	42.1	54.0	11.9	15.7	H	232.44	3.18	120	1,000
159.150	45.7	54.0	8.3	15.4	V	291	1.02	120	1,000
198.960	46.7	54.0	7.3	15.5	H	110.52	1.13	120	1,000
238.740	40.4	56.9	16.5	17.2	H	83.79	1.02	120	1,000
557.040	44.9	56.9	12.0	25.2	H	81.6	1.35	120	1,000
596.820	54.9	56.9	2.0	26.0	H	65.67	1	120	1,000
636.630	44.8	56.9	12.1	26.5	H	37.69	1.08	120	1,000
676.410	50.7	56.9	6.2	27.0	H	71.72	1	120	1,000
693.480	39.7	56.9	17.2	27.3	H	67.69	1.05	120	1,000
716.130	40.5	56.9	16.4	27.7	H	51.6	1.02	120	1,000
755.970	43.0	56.9	13.9	28.1	H	75.75	1.43	120	1,000

Frequency [MHz]	QPK Level [dBμV/m]	QPK Limit [dBμV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Meas. Time [ms]
835.560	41.6	56.9	15.3	29.3	H	63.66	1.42	120	1,000
875.310	41.9	56.9	15.0	29.6	H	169.17	1.5	120	1,000
915.120	48.1	56.9	8.8	30.2	V	154.84	1.37	120	1,000

Result tables ICES-003 Class A@3m:

(Operation mode 1):

Frequency [MHz]	QPK Level [dBμV/m]	QPK Limit [dBμV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Meas. Time [ms]
39.780	28.0	50.0	22.0	20.2	V	80.38	1.02	120	1,000
79.620	37.3	50.0	12.7	16.4	V	322.44	1.25	120	1,000
101.970	37.4	54.0	16.6	17.4	V	261	1.03	120	1,000
119.370	43.5	54.0	10.5	17.6	V	331.64	1.06	120	1,000
145.110	42.1	54.0	11.9	15.7	H	232.44	3.18	120	1,000
159.150	45.7	54.0	8.3	15.4	V	291	1.02	120	1,000
198.960	46.7	54.0	7.3	15.5	H	110.52	1.13	120	1,000
238.740	40.4	57.0	16.6	17.2	H	83.79	1.02	120	1,000
557.040	44.9	57.0	12.1	25.2	H	81.6	1.35	120	1,000
596.820	54.9	57.0	2.1	26.0	H	65.67	1	120	1,000
636.630	44.8	57.0	12.2	26.5	H	37.69	1.08	120	1,000
676.410	50.7	57.0	6.3	27.0	H	71.72	1	120	1,000
693.480	39.7	57.0	17.3	27.3	H	67.69	1.05	120	1,000
716.130	40.5	57.0	16.5	27.7	H	51.6	1.02	120	1,000
755.970	43.0	57.0	14.0	28.1	H	75.75	1.43	120	1,000
835.560	41.6	57.0	15.4	29.3	H	63.66	1.42	120	1,000
875.310	41.9	57.0	15.1	29.6	H	169.17	1.5	120	1,000
915.120	48.1	57.0	8.9	30.2	V	154.84	1.37	120	1,000

Test result: Passed

Test equipment (please refer to chapter 7 for details)
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5.2.3.2 Test results (radiated 1 to 40 GHz)

Ambient temperature:	22 °C
Relative humidity:	23 %

Date:	06.12.2022
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 detail information of test set-up and the cable guide refer to the pictures in the annex A in the test report.

Test record: One Plot for frequency range is 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]

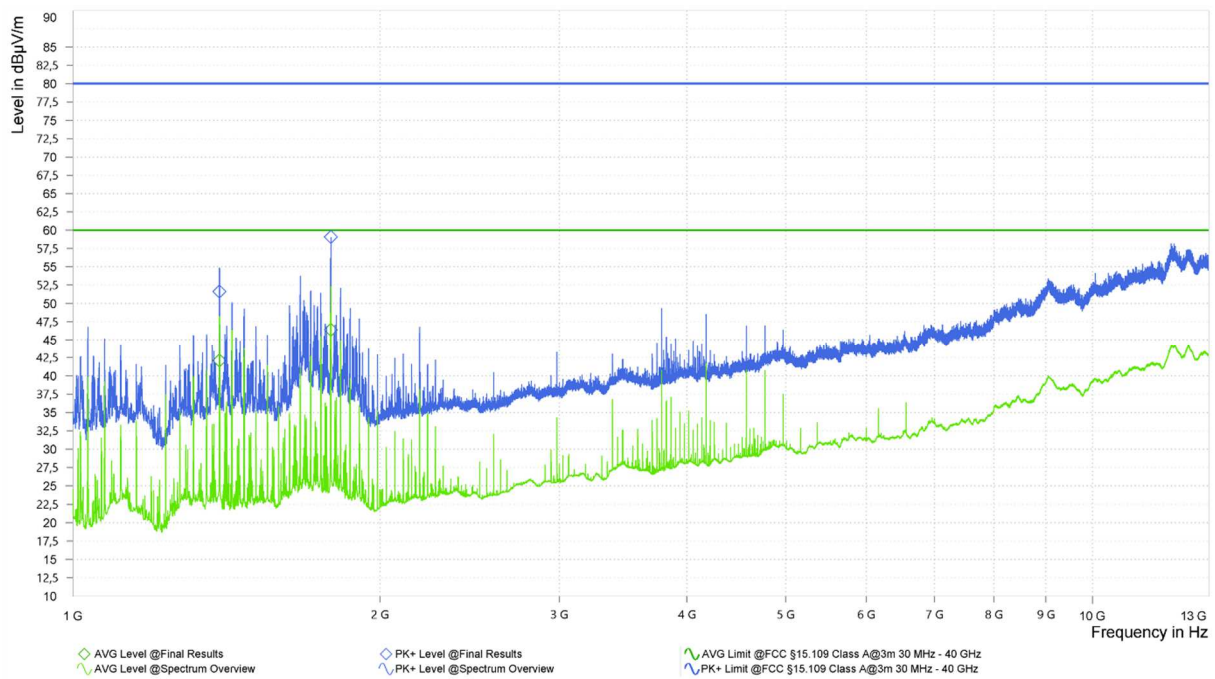
Margin [dB] = Limit [dBμV/m] – Max Peak | Average [dBμV/m]

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 CFR §15.109 Class A@3m & ICES-003 Class A@3m:

Spurious emissions from 1 GHz to 13 GHz (operation mode 1):



Result tables:

Operation mode 1:

Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	AVG Level [dBµV/m]	AVG Limit [dBµV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Meas. Time [ms]
1,392.500	51.6	80.0	28.4	42.1	60.0	17.9	-7.6	V	155.9	3.17	1,000	100
1,790.500	59.1	80.0	20.9	46.4	60.0	13.6	-4.8	V	31.46	2.93	1,000	100

At all emissions the peak was below the average limit

Test result: Passed

Test equipment (please refer to chapter 7 for details)

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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	HL562E	Rohde & Schwarz	101079	482978	18.03.2021	03.2024
3	RF Switch Matrix	OSP220	Rohde & Schwarz		482976	Calibration not necessary	
4	Turntable	TT3.0-3t	Maturo	825/2612/.01	483224	Calibration not necessary	
5	Antennasupport	BAM 4.5-P-10kg	Maturo	222/2612.01	483225	Calibration not necessary	
6	Controller	NCD	Maturo	474/2612.01	483226	Calibration not necessary	
7	Semi Anechoic Chamber M276	SAC5-2	Albatross Projects	C62128-A540-A138-10-0006	483227	Calibration not necessary	
8	EMI Testreceiver	ESW44	Rohde & Schwarz	101828	482979	08.12.2021	12.2023
9	Test software M276	Elektra	Rohde&Schwarz	101381	483755	Calibration not necessary	
10	Low Noise Amplifier 100 MHz - 18 GHz	LNA-30-00101800-25-10P	Narda-Miteq	2110917	482967	18.02.2022	02.2024
11	Log.-Per. antenna	HL050	Rohde & Schwarz	100908	482977	22.09.2022	09.2025

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/RSM	CISPR 16-1-4 + Cor1:2010 + A1:2012 +A2:2017	03.03.2021	02.03.2023
Semi anechoic chamber M276	483227	1 -18 GHz	SVSWR	CISPR 16-1-4 + Cor1:2010 + A1:2012 +A2:2017	25.02.2021	24.02.2023

9 Report History

Report Number	Date	Comment
F221756E1	06.02.2023	Initial Test Report
-	-	-
-	-	-

10 List of Annexes

Annex A	Test Setup Photos	5 pages
Annex B	EUT External Photos	4 pages
Annex C	EUT Internal Photos	10 pages