



RF - TEST REPORT

- FCC Part 15B -

Type / Model Name : 60117 - Empfängerbox WLAN – Receiver Box WLAN

Product Description : WLAN Interface for mobile model railway control

Applicant : Gebr. Märklin & Cie. GmbH

Address : Stuttgarter Straße 55-57

73033 GÖPPINGEN, GERMANY

Manufacturer : Gebr. Märklin & Cie. GmbH

Address : Stuttgarter Straße 55-57

73033 GÖPPINGEN, GERMANY

Test Result according to the standards listed in clause 1 test standards:

POSITIVE

Test Report No. :

80110021-04 Rev_1

04. August 2023

Date of issue



Deutsche
Akkreditierungsstelle
D-PL-12030-01-03
D-PL-12030-01-04

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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15 Subpart B - Unintentional Radiators (July 2022)

Part 15, Subpart B, Section 15.107

AC Line conducted emission

Class A device

Class B device

Part 15, Subpart B, Section 15.109

Radiated emission, general requirements

Class A device

Class B device

ANSI C63.4: 2014

Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

CISPR 16-4-2: 2011 + A1: 2014
EN 55016-4-2: 2011

Uncertainty in EMC measurement

ISED Canada Rules and Regulations - Information Technology Equipment (Including Digital Apparatus)

ICES-003, Issue 7, October 15, 2020

AC Power Line Conducted Emissions

Class A device

Class B device

ICES-003, Issue 7, October 15, 2020

Radiated emission

Class A device

Class B device

ANSI C63.4: 2014

Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

2 TEST RESULT SUMMARY

FCC Rule Part	ISED Standard	Description
15.107	ICES-003 3.2.1	AC power line conducted emissions
15.109	ICES-003 3.2.2	Radiated Emissions

Type of test	Test result
Emission:	
A4 Conducted emission (AC mains power / DC power)	passed
A5 Radiated emission (< 1 GHz)	passed
SER 3 Radiated emission (> 1 GHz)	passed

2.1 Revision history of test report

Test report No	Rev.	Issue Date	Changes
80110021-04	0	16 September 2022	Initial test report
80110021-04	1	3 August 2023	Correction of the Model name, Term Receiver Box WLAN added

The test report with the highest revision number replaces the previous test reports.

2.2 Final assessment

The equipment under test fulfills the requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 19 July 2022

Testing concluded on : 09 August 2022

Checked by:

Tested by:

Klaus Gegenfurtner
Teamleader Radio

Laurin Roth
Radio Team

3 EQUIPMENT UNDER TEST

3.1 Information provided by the Client

Please note, we do not take any responsibility for information provided by the client or his representative which may have an influence on the validity of the test results.

3.2 Sampling

The customer is responsible for the choice of sample. Sample configuration, start-up and operation is carried out by the customer or according his/her instructions.

3.3 Photo documentation of the EUT – Detailed photos see ATTACHMENT A

3.4 General remarks

None.

3.5 Power supply system utilised

Power supply voltage, V_{nom} : 120V / 60Hz

All tests were carried out with a supply voltage of 120 V, 60 Hz unless otherwise stated.

3.6 Highest internal frequency

Highest internal frequency : 2483.5 MHz

3.7 Short description of the Equipment under Test (EUT)

The EUT is a WLAN Interface for mobile model railway control.

Number of tested samples: 1
Serial number: 190522000001

3.8 EUT operation mode

The equipment under test was operated during the measurement under the following conditions:

- Device is powered // no communication

3.9 EUT configuration

(The CDF filled by the applicant can be viewed at the test laboratory.)

The following peripheral devices and interface cables were connected during the measurements:

- Power Supply 120V / 60Hz Model : SP103 / 3.5-60 (02-02/50-05-182)
- Laptop Model : HP EliteBook 840
- Mobile Station Model : 60657
- Decoder tester Model : 60970
- Digital connection box Model : 60116
- Power Supply 18VDC Model : 66367

Port	Cable	Screening	Transmission	Status	Length
1	AC power line	unshielded	analogue	active	1.6m
2	Cable 370389	unshielded	digital	active	0.8m

Modifications during the EMC test: **None**

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15 - 35 °C

Humidity: 30 - 60 %

Atmospheric pressure: 86 - 106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor $k = 2$. The true value is located in the corresponding interval with a probability of 95 %. The measurement uncertainty was calculated for all measurements listed in this test report on basis of the ETSI Technical Report TR 100 028 Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1 and Part 2. The results are documented in the quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

4.4 Conformity Decision Rule

The applied conformity decision rule is based on ILAC G8:09/2019 clause 4.2.1 Binary Statement for Simple Acceptance Rule ($w = 0$).

Details can be found in the procedure CSA_B_V50_29.

4.5 Measurement protocol for FCC and ISED

4.5.1 General information

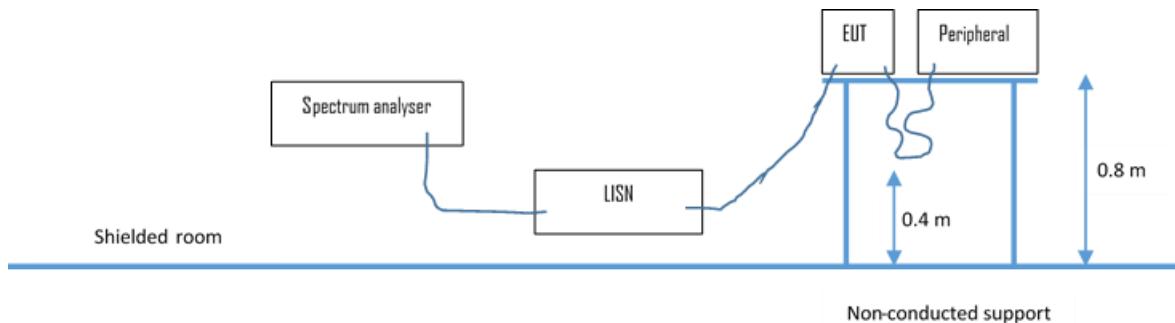
CSA Group Bayern GmbH is recognized as wireless testing laboratory under the CAB identifier:

FCC: DE 0011
ISED: DE0009

4.5.2 Details of test procedures

4.5.2.1 Conducted emission

Test setup according ANSI C63.4



Description of measurement

The final level, expressed in $\text{dB}\mu\text{V}$, is arrived at by taking the reading directly from the Spectrum analyser. This level is compared to the limit.

To convert between $\text{dB}\mu\text{V}$ and μV , the following conversions apply:

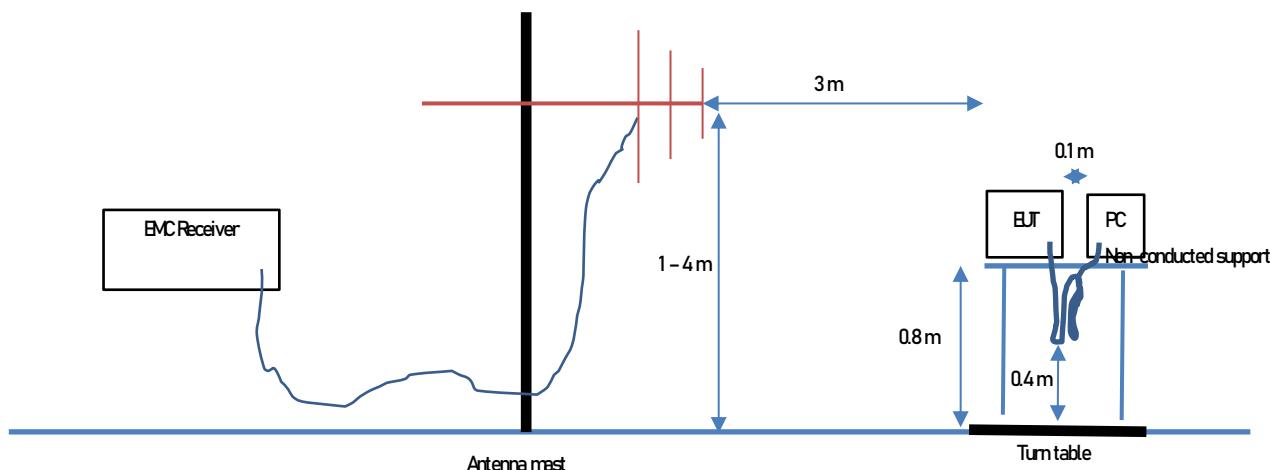
$$\begin{aligned}\text{dB}\mu\text{V} &= 20(\log \mu\text{V}) \\ \mu\text{V} &= \text{Inverse log}(\text{dB}\mu\text{V}/20)\end{aligned}$$

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a Line Impedance Stabilization Network (LISN) with $50 \Omega / 50 \mu\text{H}$ (CISPR 16) characteristics. The receiver is protected by means of an impedance matched pulse limiter connected directly to the RF input. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emission is re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

4.5.2.2 Radiated emission

4.5.2.2.1 OATS1 test site (30 MHz - 1 GHz)

Test setup according ANSI C63.4



Description of measurement

Spurious emission from the EUT is measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 metre non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is established in accordance with ANSI C63.4. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the centre in a serpentine fashion so that they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the centre of the table and to a screened room located outside the test area.

The antenna is positioned 3 or 10 metres horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 metres, measurement scans are made with both horizontal and vertical antenna polarization planes and the EUT is rotated 360 degrees.

The final level is calculated in a calculation sheet by taking the reading from the EMI receiver (Level dB μ V) and adding the correction factors and cable loss factor (Factor dB) on to it. The limit is subtracted from this result in order to provide the limit margin listed in the measurement protocols.

Example:

Frequency (MHz)	Reading (dB μ V)	+	Correction* (dB/m)	=	Level (dB μ V/m)	-	Limit (dB μ V/m)	=	Dlimit (dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

*Correction Factor = Antenna Factor + Cable Attenuation = 30 dB/m + 2.6 dB = 32.6 dB/m

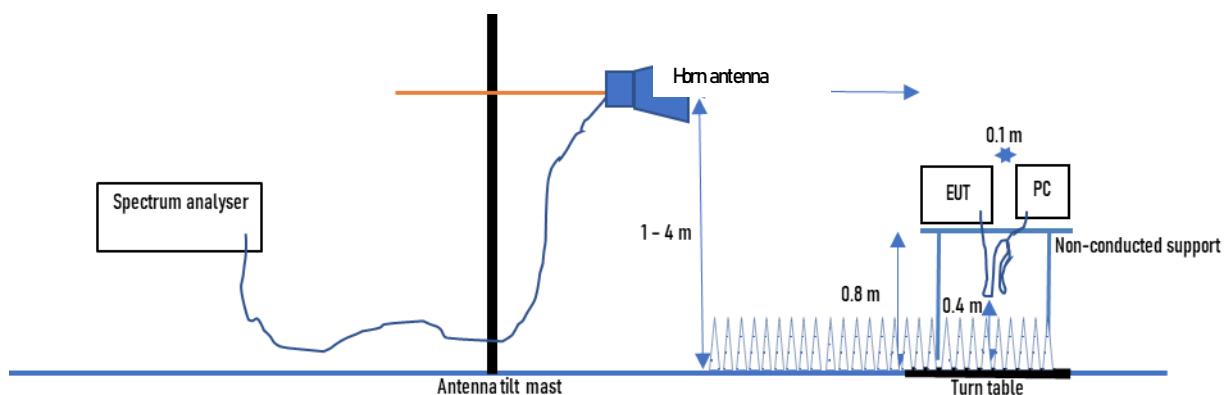
The resolution bandwidth during the measurement is as follows:

30 MHz – 1000 MHz:

RBW: 120 kHz

4.5.2.2.2 Anechoic chamber 1, 1000 MHz – 18000 MHz

Test setup according ANSI C63.4

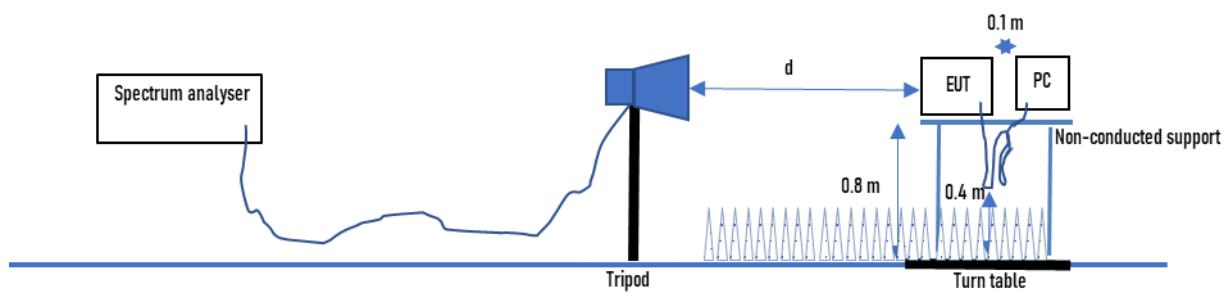


Description of measurement

Radiated emission from the EUT are measured in the frequency range of 1 GHz to the maximum frequency as specified in 47 CFR Part 15 Subpart A section 15.33, using a tuned receiver (spectrum analyser) and appropriate linearly polarized antennas. Table top equipment is placed on a 0.65 X 1.0 metre non-conducting table 80 centimetres above the ground plane. The turntable is fully covered with the appropriate absorber (Type VHP-12). The interface cables that are closer than 40 centimetres to the ground plane are bundled in the centre in a serpentine fashion, so they are at least 40 centimetres from the ground plane. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyser set to a peak detector function and a RBW= 1 MHz and VBW = 3 MHz. All tests are performed at a test distance of 3 metres. Hand-held or body-worn devices are rotated around three orthogonal axes in order to determine the position, angle and configuration having the maximum emission. The antenna height is then adjusted from 1 m to 4 m maximizing the measured value. The antenna is mounted to a boresight axis, so the antenna centre always points to the EUT. The turntable is rotated 360° until the spectrum analyser displays the maximum level at the observed frequency. The antenna height is then adjusted from 1 m to 4 m maximizing the measured value. The turntable is re-adjusted to re-affirm the maximum emission value which is then recorded. This procedure is repeated for all frequencies of interest.

4.5.2.2.3 Anechoic chamber 1, 18 GHz – 40 GHz

Test setup according ANSI C63.4



Description of measurement

Radiated emission from the EUT are measured in the frequency range of 1 GHz to the maximum frequency as specified in 47 CFR Part 15 Subpart A section 15.33, using a tuned receiver (spectrum analyser) and appropriate linearly polarized antennas. Table top equipment is placed on a 0.65 X 1.0 metre non-conducting table 80 centimetres above the ground plane. The turntable is fully covered with the appropriate absorber (Type VHP-12).

The interface cables that are closer than 40 centimetres to the ground plane are bundled in the centre in a serpentine fashion, so they are at least 40 centimetres from the ground plane. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyser set to a peak detector function and an RBW= 1 MHz and VBW = 3 MHz. All tests are performed at a test distance of 3 metres. Hand-held or body-worn devices are rotated around three orthogonal axes in order to determine the position, angle and configuration having the maximum emission. The turntable is rotated 360° until the spectrum analyser displays the maximum level at the observed frequency, the maximum emission value is then recorded. This procedure is repeated for all frequencies of interest.

Where appropriate in frequency range 18 GHz - 40 GHz, the test distance may be reduced to 1 m in order to reduce the noise level to hold a minimum distance between noise level and limit. The limit will be adopted to the measurement distance.

5 TEST CONDITIONS AND RESULTS

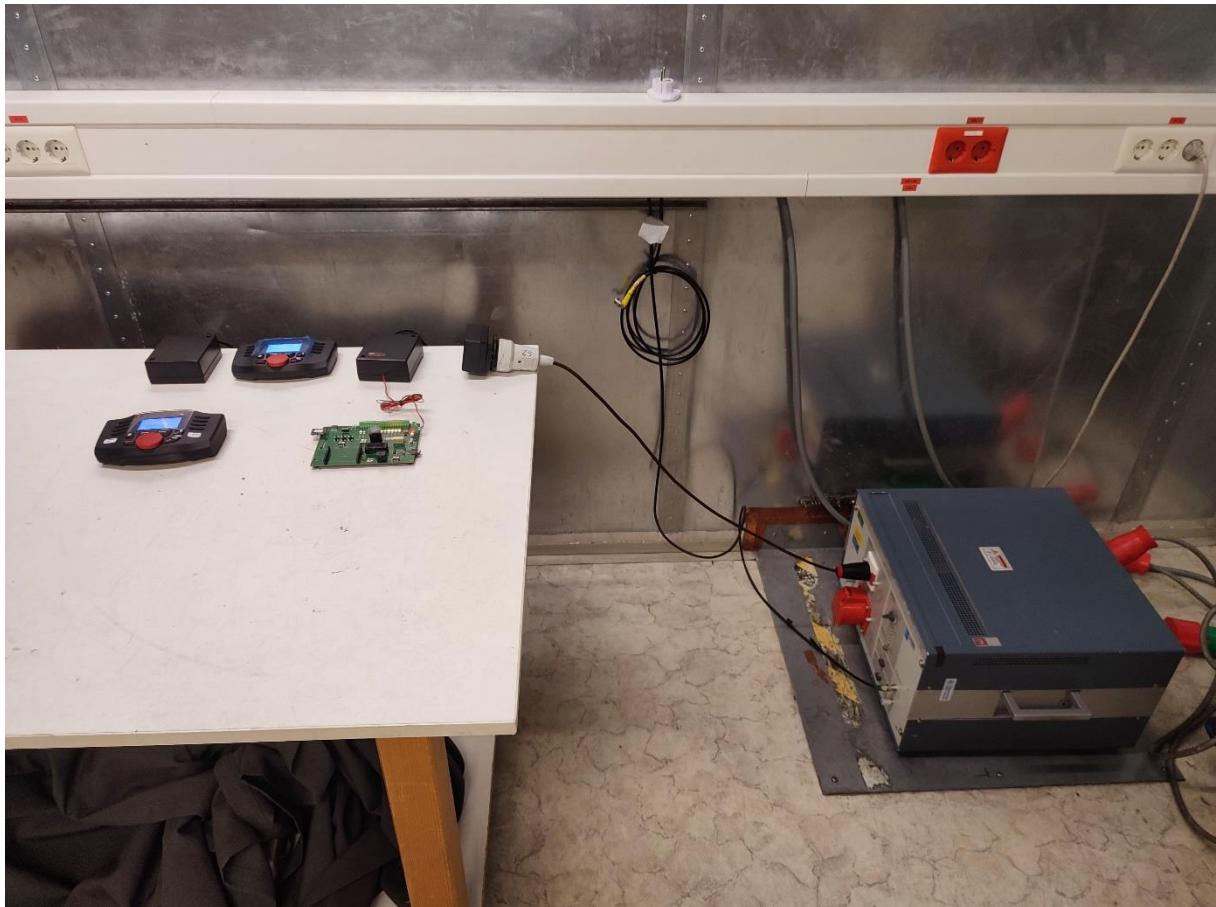
5.1 Conducted emission

For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test setup



5.1.3 Test result

Frequency range: 0.15 MHz - 30 MHz
Min. limit margin 15.25 dB at 0.15 MHz

Limit according to FCC Part 15, Section 15.107 and ICES-003 3.2.1 table 1:

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

The requirements are **FULFILLED**.

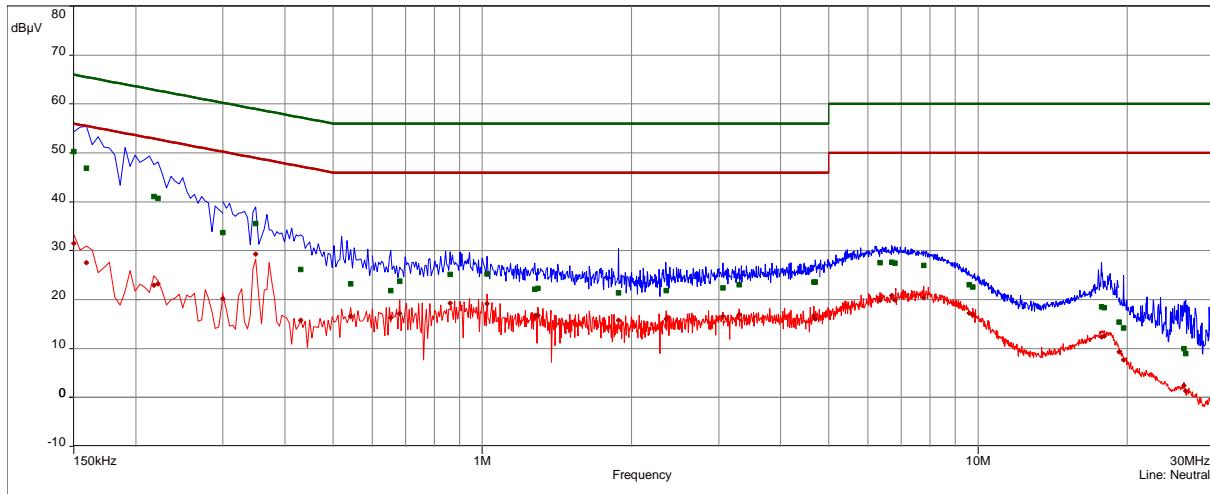
Remarks: For detailed results, please see the following page(s).

For description of the measurement see 4.5.2.

5.1.4 Test protocol

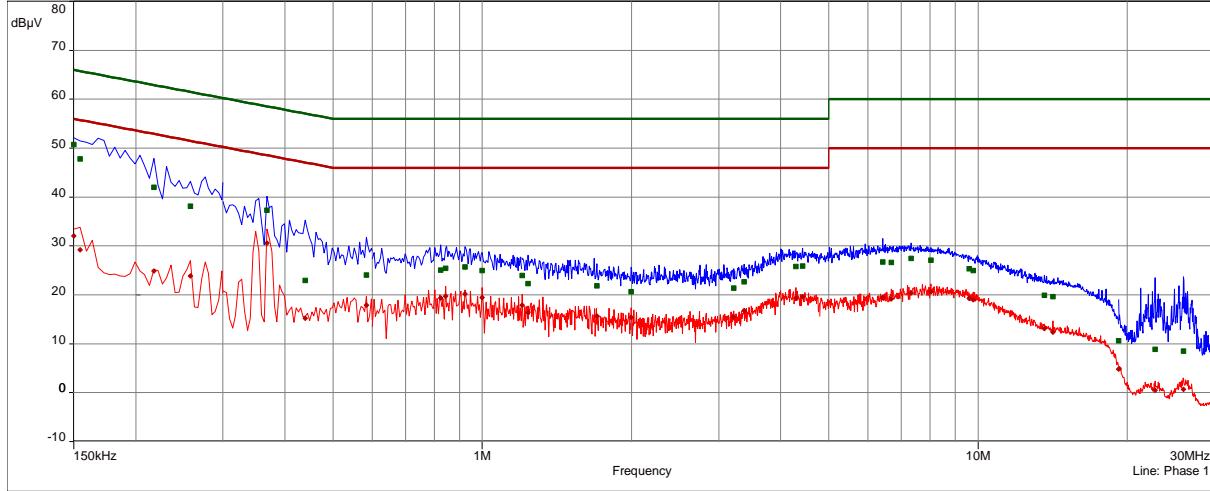
File No.:	80110021-00 Rev-0	Result	passed
Operation mode:	Device is powered // no communication		
Tested by:	LR		
Location:	S2	Date:	09.08.2022
Remarks:	/		

— FCC/FCC Part 15C (15.207) B - Avg/
— FCC/FCC Part 15C (15.207) B - Q-Peak/
— Peak (Neutral)
— CISPR.AVG (Neutral)
■ QuasiPeak (Finals) (Neutral)
● CISPR AV (Finals) (Neutral)



FCC/FCC Part 15C (15.207)B

— FCC/FCC Part 15C (15.207) B - Avg/
— FCC/FCC Part 15C (15.207) B - Q-Peak/
— Peak (Phase 1)
— CISPR.AVG (Phase 1)
■ QuasiPeak (Finals) (Phase 1)
● CISPR AV (Finals) (Phase 1)



FCC/FCC Part 15C (15.207)B

Frequency (MHz)	QuasiP eak (dB μ V)	QP Margin (dB)	QP Limit (dB μ V)	CISPR AV (dB μ V)	CISPR AV Margin (dB)	AV Limit (dB μ V)	Line	RBW	Meas. Time	Correction (dB)
0.15	50.75	-15.25	66.00	32.06	-23.94	56.00	Phase 1	9k	1.00	9.92
0.1545	47.83	-17.93	65.75	29.19	-26.56	55.75	Phase 1	9k	1.00	9.92
0.2175	42.05	-20.87	62.91	24.90	-28.02	52.91	Phase 1	9k	1.00	9.91
0.258	38.15	-23.35	61.50	23.83	-27.66	51.50	Phase 1	9k	1.00	9.91
0.3675	37.26	-21.30	58.56	30.62	-17.94	48.56	Phase 1	9k	1.00	9.93
0.4395	22.97	-34.11	57.07	15.25	-31.82	47.07	Phase 1	9k	1.00	9.94
0.5835	24.09	-31.91	56.00	17.90	-28.10	46.00	Phase 1	9k	1.00	9.96
0.825	25.04	-30.96	56.00	19.35	-26.65	46.00	Phase 1	9k	1.00	10.01
0.843	25.42	-30.58	56.00	19.70	-26.30	46.00	Phase 1	9k	1.00	10.02
0.924	25.68	-30.32	56.00	20.20	-25.80	46.00	Phase 1	9k	1.00	10.03
1.0005	24.97	-31.03	56.00	19.48	-26.52	46.00	Phase 1	9k	1.00	10.05
1.2045	23.96	-32.04	56.00	17.89	-28.11	46.00	Phase 1	9k	1.00	10.09
1.236	22.28	-33.72	56.00	16.39	-29.61	46.00	Phase 1	9k	1.00	10.09
1.704	21.86	-34.14	56.00	15.65	-30.35	46.00	Phase 1	9k	1.00	10.17
1.9965	20.69	-35.31	56.00	15.39	-30.61	46.00	Phase 1	9k	1.00	10.20
3.219	21.35	-34.65	56.00	15.48	-30.52	46.00	Phase 1	9k	1.00	10.30
3.372	22.66	-33.34	56.00	16.81	-29.19	46.00	Phase 1	9k	1.00	10.31
4.2945	25.79	-30.21	56.00	19.41	-26.59	46.00	Phase 1	9k	1.00	10.34
4.4295	25.92	-30.08	56.00	19.68	-26.32	46.00	Phase 1	9k	1.00	10.34
6.429	26.73	-33.27	60.00	19.49	-30.51	50.00	Phase 1	9k	1.00	10.42
6.681	26.68	-33.32	60.00	19.19	-30.81	50.00	Phase 1	9k	1.00	10.44
7.3335	27.44	-32.56	60.00	20.37	-29.63	50.00	Phase 1	9k	1.00	10.47
8.04	27.12	-32.88	60.00	20.66	-29.34	50.00	Phase 1	9k	1.00	10.50
9.6045	25.31	-34.69	60.00	19.28	-30.72	50.00	Phase 1	9k	1.00	10.56
9.789	24.94	-35.06	60.00	18.98	-31.02	50.00	Phase 1	9k	1.00	10.57
13.605	19.88	-40.12	60.00	13.07	-36.93	50.00	Phase 1	9k	1.00	10.83
14.172	19.64	-40.36	60.00	12.38	-37.62	50.00	Phase 1	9k	1.00	10.88
19.2045	10.59	-49.41	60.00	4.78	-45.22	50.00	Phase 1	9k	1.00	11.21
22.746	8.86	-51.14	60.00	0.54	-49.46	50.00	Phase 1	9k	1.00	11.30
25.959	8.50	-51.50	60.00	0.69	-49.31	50.00	Phase 1	9k	1.00	11.29

Frequency (MHz)	SR	QuasiPeak (dB μ V)	QP Margin (dB)	QP Limit (dB μ V)	CISPR AV (dB μ V)	CISPR AV Margin (dB)	AV Limit (dB μ V)	Line	RBW	Meas. Time	Correction (dB)
0.15	9	50.24	-15.76	66.00	31.53	-24.47	56.00	Neutral	9k	1.00	9.93
0.159	9	46.84	-18.68	65.52	27.56	-27.96	55.52	Neutral	9k	1.00	9.92
0.2175	9	41.12	-21.80	62.91	22.92	-30.00	52.91	Neutral	9k	1.00	9.92
0.222	9	40.69	-22.05	62.74	23.21	-29.53	52.74	Neutral	9k	1.00	9.92
0.3	10	33.75	-26.49	60.24	20.20	-30.04	50.24	Neutral	9k	1.00	9.93
0.3495	10	35.57	-23.40	58.97	29.29	-19.69	48.97	Neutral	9k	1.00	9.94
0.4305	10	26.14	-31.10	57.24	15.75	-31.49	47.24	Neutral	9k	1.00	9.94
0.543	10	23.20	-32.80	56.00	16.60	-29.40	46.00	Neutral	9k	1.00	9.96
0.654	11	21.85	-34.15	56.00	16.34	-29.66	46.00	Neutral	9k	1.00	9.98
0.681	11	23.76	-32.24	56.00	17.17	-28.83	46.00	Neutral	9k	1.00	9.99
0.861	11	25.18	-30.82	56.00	19.23	-26.77	46.00	Neutral	9k	1.00	10.02
1.023	11	25.24	-30.76	56.00	19.15	-26.85	46.00	Neutral	9k	1.00	10.05
1.2765	12	22.11	-33.89	56.00	16.70	-29.30	46.00	Neutral	9k	1.00	10.10
1.2945	12	22.26	-33.74	56.00	16.76	-29.24	46.00	Neutral	9k	1.00	10.10
1.884	12	21.36	-34.64	56.00	15.80	-30.20	46.00	Neutral	9k	1.00	10.19
2.352	12	21.86	-34.14	56.00	16.06	-29.94	46.00	Neutral	9k	1.00	10.25
3.057	13	22.39	-33.61	56.00	16.63	-29.37	46.00	Neutral	9k	1.00	10.30
3.2955	13	23.01	-32.99	56.00	17.01	-28.99	46.00	Neutral	9k	1.00	10.32
4.6635	13	23.60	-32.40	56.00	16.70	-29.30	46.00	Neutral	9k	1.00	10.36
4.6995	13	23.59	-32.41	56.00	16.09	-29.91	46.00	Neutral	9k	1.00	10.36
6.348	14	27.53	-32.47	60.00	19.94	-30.06	50.00	Neutral	9k	1.00	10.45
6.7035	14	27.65	-32.35	60.00	20.79	-29.21	50.00	Neutral	9k	1.00	10.47
6.798	14	27.49	-32.51	60.00	19.89	-30.11	50.00	Neutral	9k	1.00	10.48
7.779	14	27.02	-32.98	60.00	20.35	-29.65	50.00	Neutral	9k	1.00	10.54
9.6045	15	23.03	-36.97	60.00	17.21	-32.79	50.00	Neutral	9k	1.00	10.64
9.762	15	22.59	-37.41	60.00	16.84	-33.16	50.00	Neutral	9k	1.00	10.64
17.7495	15	18.50	-41.50	60.00	12.35	-37.65	50.00	Neutral	9k	1.00	11.32
17.961	15	18.39	-41.61	60.00	12.52	-37.48	50.00	Neutral	9k	1.00	11.34
19.2495	16	15.43	-44.57	60.00	9.32	-40.68	50.00	Neutral	9k	1.00	11.43
19.6815	16	14.20	-45.80	60.00	7.64	-42.36	50.00	Neutral	9k	1.00	11.47
26.0445	16	9.99	-50.01	60.00	2.44	-47.56	50.00	Neutral	9k	1.00	11.63
26.2245	16	8.95	-51.05	60.00	1.35	-48.65	50.00	Neutral	9k	1.00	11.63

5.2 Radiated emission < 1 GHz (electric field)

For test instruments and accessories used see section 6 Part A 5.

5.2.1 Description of the test location

Test location: NONE
Test distance: 10 m

5.2.2 Photo documentation of the test setup



5.2.3 Test result

Frequency range: 30 MHz - 1000 MHz
Min. limit margin 13.8 dB at 900 MHz

The requirements are **FULFILLED**.

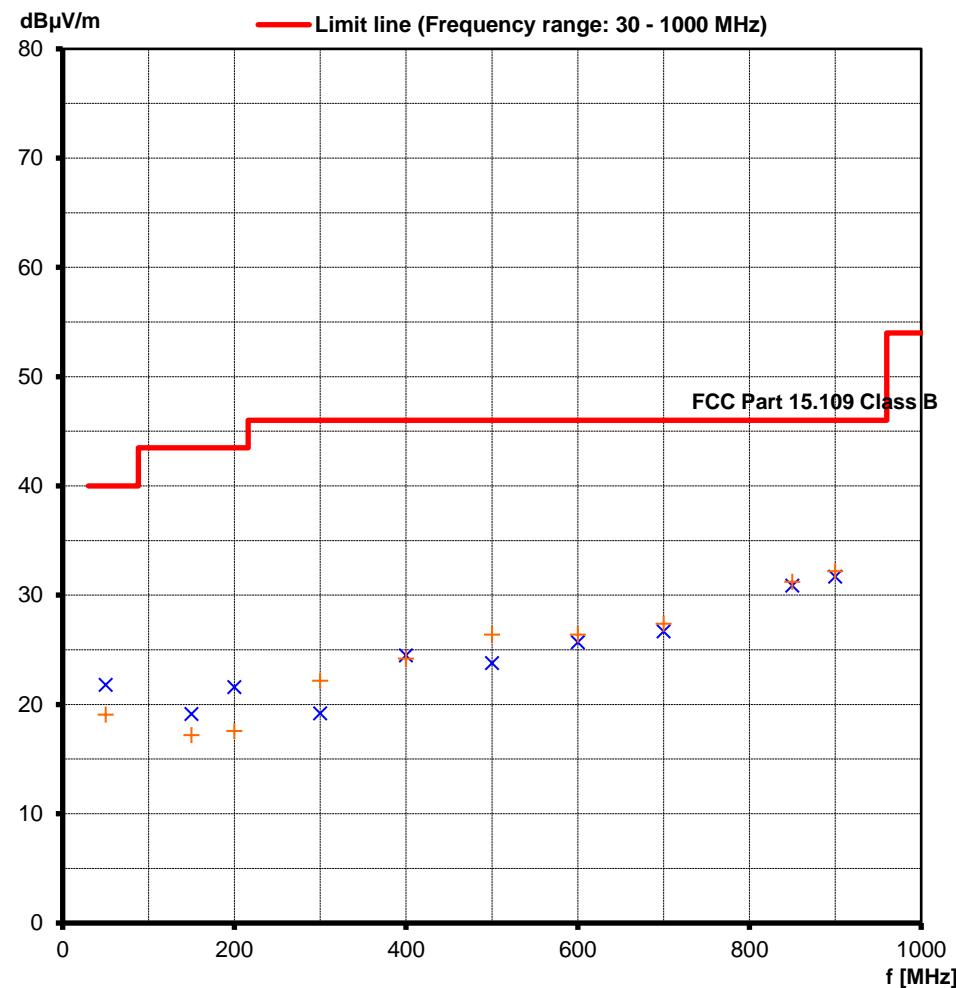
Remarks: For detailed results, please see the following page(s). Listed results are noise.

For description of the measurement see 4.5.2.

5.2.4 Test protocol

File No.:	80110021-04 Rev-1	Result	passed
Operation mode:	Device is powered // no communication		
Tested by:	LR		
Location:	OATS1	Date:	03.08.2022
Remarks:	Only noise from the OATS was detected.		

Frequency (MHz)	Reading Vert. (dB μ V)	Reading Hor. (dB μ V)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dB μ V/m)	Level Hor. (dB μ V/m)	Limit (dB μ V/m)	Dlimit (dB)
50.00	4.3	0.3	17.5	18.8	21.8	19.1	40.0	-18.2
150.00	-0.4	-1.6	19.6	18.8	19.2	17.2	43.5	-24.3
200.00	4.6	1.3	17.0	16.3	21.6	17.6	43.5	-21.9
300.00	-1.0	1.5	20.2	20.7	19.2	22.2	46.0	-23.8
400.00	1.4	0.7	23.1	23.5	24.5	24.2	46.0	-21.5
500.00	-1.9	0.4	25.7	26.0	23.8	26.4	46.0	-19.6
600.00	-2.3	-2.0	28.0	28.4	25.7	26.4	46.0	-19.6
700.00	-2.8	-2.7	29.5	30.1	26.7	27.4	46.0	-18.6
850.00	-1.1	-1.2	32.0	32.5	30.9	31.3	46.0	-14.7
900.00	-0.9	-1.0	32.6	33.2	31.7	32.2	46.0	-13.8



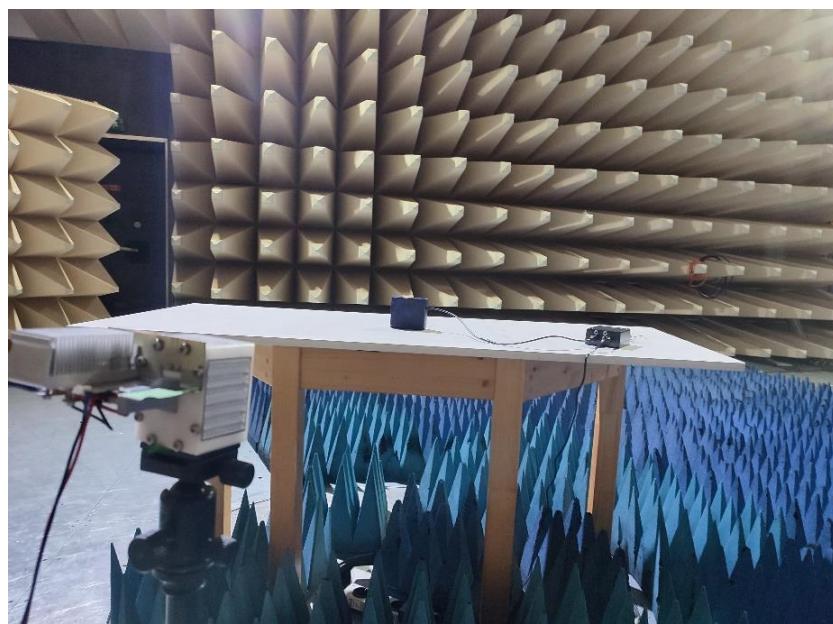
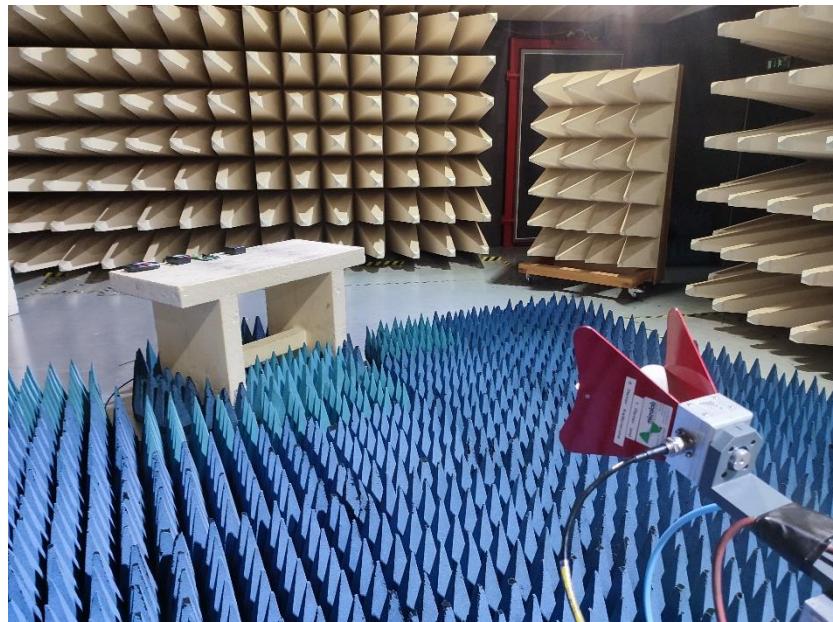
5.3 Radiated emission > 1 GHz (electric field)

For test instruments and accessories used see section 6 Part SER 3.

5.3.1 Description of the test location

Test location: Anechoic chamber 1
Test distance: 3 m

5.3.2 Photo documentation of the test setup



5.3.3 Test result

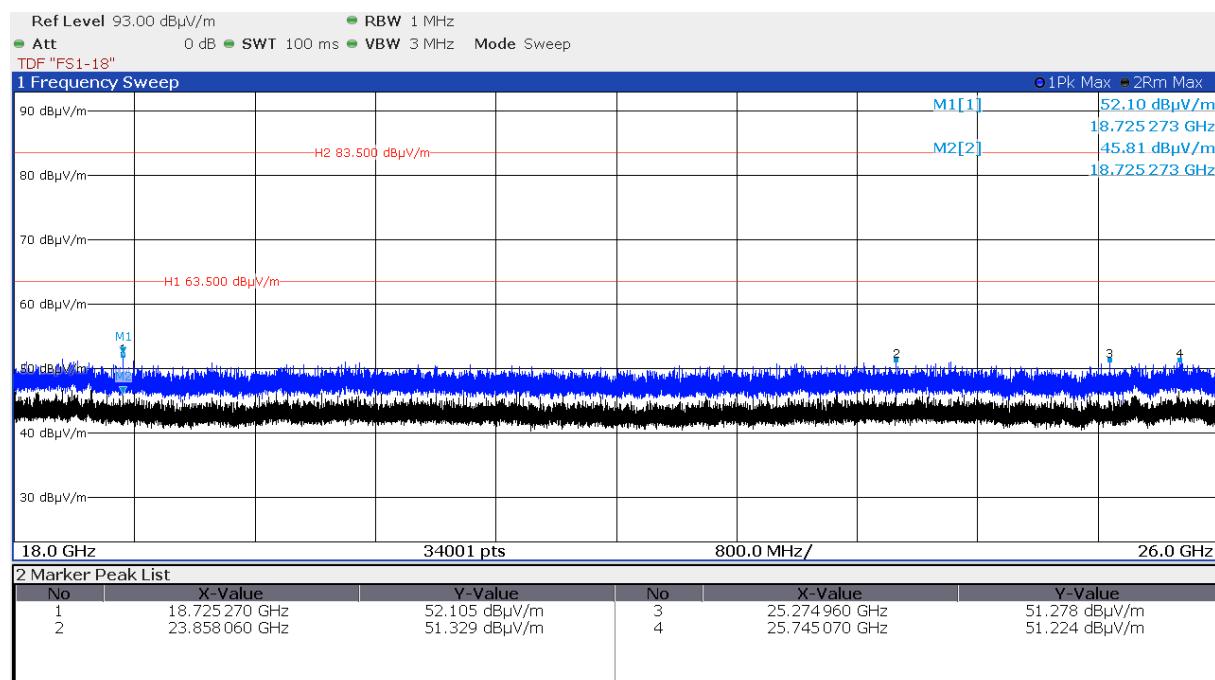
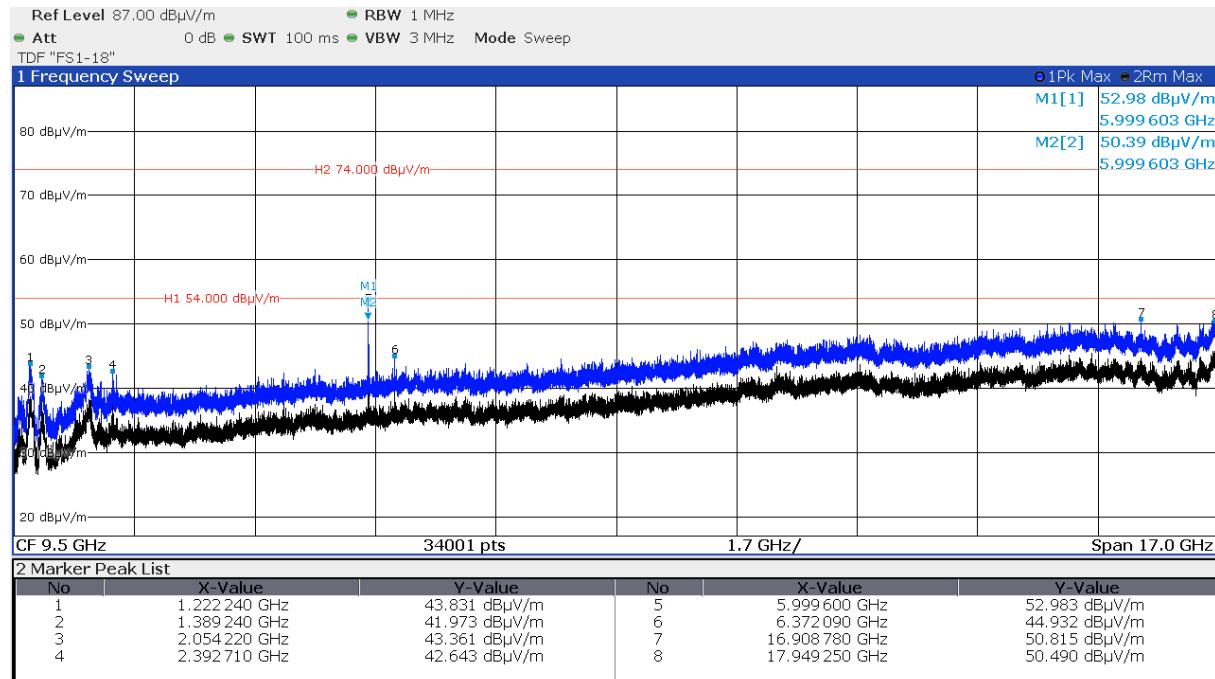
The requirements are **FULFILLED**.

Remarks: For detailed results, please see the following page(s).

For description of the measurement see 4.5.2.

5.3.4 Test protocol

File No.:	80110021-04 Rev-1	Result	passed
Operation mode:	Device is powered // no communication		
Tested by:	LR		
Location:	A1	Date:	13.07.2022
Remarks:	/		



6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used, in addition to the test accessories, are calibrated and verified regularly.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	BAT-EMC 3.21.0.24	01-02/68-13-001				
	ESCI	02-02/03-15-001	17/06/2023	17/06/2022		
	ESH 2 - Z 5	02-02/20-05-004	31/10/2022	31/10/2019	22/09/2022	22/03/2022
	N-4000-BNC	02-02/50-05-138				
	ESH 3 - Z 2	02-02/50-05-155	13/11/2022	13/11/2019	10/02/2023	10/08/2022
A 5	ESVS 30	02-02/03-05-006	27/07/2023	27/07/2022		
	VULB 9168	02-02/24-05-005	20/12/2022	20/12/2021	03/07/2023	03/07/2022
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
SER 3	50F-003 N 3 dB	02-02/50-21-010				
	FSW43	02-02/11-15-001	22/04/2023	22/04/2022		
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	LNA-40-18004000-33-5P	02-02/17-20-002				
	3117	02-02/24-05-009	23/06/2023	23/06/2022		
	BBHA 9170	02-02/24-05-013	19/05/2023	19/05/2020	10/03/2023	10/03/2022
	BAM 4.5-P	02-02/50-17-024				
	NCD	02-02/50-17-025				
	KK-SF106-2X11N-6,5M	02-02/50-18-016				
	KMS116-GL140SE-KMS116-	02-02/50-20-026				
	BAT-EMC 3.21.0.24	02-02/68-13-001				

7 Detailed measurement uncertainty

7.1 Overview

Measurement instrumentation uncertainty shall be taken into account when determining compliance or non-compliance with a disturbance limit.

The measurement instrumentation uncertainty for a test laboratory shall be evaluated. The standard uncertainty $u(x_i)$ in decibels and the sensitivity coefficient c_i shall be evaluated for the estimate x_i of each quantity. The combined standard uncertainty $u_c(y)$ of the estimate y of the measurand shall be calculated as

$$u_c(y) = \sqrt{\sum_i c_i^2 u^2(x_i)}$$

The expanded measurement instrumentation uncertainty U_{lab} for a test laboratory shall be calculated as $U_{lab} = 2 u_c(y)$

$$U_{lab} = 2 u_c(y)$$

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If U_{lab} is less than or equal to U_{cispr} in the table below, then:

- compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

If U_{lab} is greater than U_{cispr} in the table below, then:

- compliance is deemed to occur if no measured disturbance, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit.
- non-compliance is deemed to occur if any measured disturbance, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit.

7.2 Definitions and symbols

X_i	Input quantity
x_i	estimate of X_i
$u(x_i)$	standard uncertainty of x_i
c_i	sensitivity coefficient
$u_c(y)$	(combined) standard uncertainty of y
Y	result of a measurement, (the estimate of the measured), corrected for all recognised significant systematic effects
U	expanded uncertainty of y

7.3 Measurement uncertainty

Measurement	U_{lab} [dB]
Conducted disturbance	+ 2.53 / - 2.77
Radiated disturbance (electric field)	
- 10 m test distance	+ 3.16 / - 3.22
- 3 m test distance	+ 3.16 / - 3.22
- Frequency range: 30 MHz – 200 MHz	
Radiated disturbance (electric field)	
- 10 m test distance	+ 4.51 / - 4.51
- 3 m test distance	+ 4.51 / - 4.51
- Frequency range: 200 MHz – 1000 MHz	
Radiated disturbance (electric field)	
- 3 m test distance	+ 5.07 / - 3.70
- Frequency range: 1 GHz – 30 GHz	