

EMI - TEST REPORT

- FCC Part 15B -

Type / Model Name : VIB 5.200

Product Description : Vibration meter

Applicant : PRÜFTECHNIK Condition Monitoring GmbH

Address : Oskar-Messter-Straße 19-21

85737 ISMANING, GERMANY

Manufacturer : PRÜFTECHNIK Condition Monitoring GmbH

Address : Oskar-Messter-Straße 19-21

85737 ISMANING, GERMANY

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

POSITIVE

Test Report No. : **T42136-02-05GK**

19. December 2017

Date of issue



Deutsche
Akkreditierungsstelle
D-PL-12030-01-01
D-PL-12030-01-02

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test results
without the written permission of the test laboratory.

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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15 Subpart A - General (September, 2016)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15 Subpart B - Unintentional Radiators (September, 2016)

Part 15, Subpart B, Section 15.107	AC Line conducted emission <input type="checkbox"/> Class A device <input checked="" type="checkbox"/> Class B device
Part 15, Subpart B, Section 15.109	Radiated emission, general requirements
Part 15, Subpart B, Section 15.111	Antenna power conduction

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.
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CISPR 16-4-2: 2011 EN 55016-4-2: 2011	Uncertainty in EMC measurement
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CISPR 22: 2008 EN 55022: 2010	Information technology equipment
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2 EQUIPMENT UNDER TEST

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

2.2 Equipment category

Portable device

2.3 Short description of the equipment under test (EUT)

The EUT is a vibration meter with four integrated radio technologies (NFC, Bluetooth, Bluetooth low energy and WLAN).

Number of tested samples : 1
Serial number : 5200 0121
Firmware version : 0.87

2.4 Variants of the EUT

None

2.5 Operation frequency and channel plan

NFC is working at 13.56 MHz
Bluetooth and BLE are working in the 2.4 GHz range
WLAN is working in the 2.4 GHz and 5 GHz range

2.6 Transmit operating modes

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

- Mode 1 Active USB link to a laptop

Note: During the USB link to a laptop the radio technologies are shut off.

2.7 Power supply system utilised

Power supply voltage : 7.2 V DC (battery powered)

Mains adaptor:

Power supply voltage : 100 V – 240 V AC / 50 Hz – 60 Hz (output 12 V DC)

2.8 Peripheral devices and interface cables

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

- USB cable Model : _____
- Laptop Model : Fujitsu Lifebook E 780
- _____ Model : _____

2.9 Determination of worst case conditions for final measurement

2.9.1 Test Jig

No test jig was used.

2.9.2 Test software

None

3 TEST RESULT SUMMARY

3.1 Final assessment

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

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

Testing commenced on : 19 September 2017

Testing concluded on : 29 November 2017

Checked by:

Tested by:

Klaus Gegenfurtner
Teamleader Radio

Konrad Graßl
Radio Team

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 acc. to CISPR 16-4-2 / 11.2003 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, CSA Group Bayern GmbH, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. 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 Measurement protocol for FCC

4.4.1 General information

4.4.1.1 Test methodology

Conducted and radiated disturbance testing is performed according to the procedures set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

4.4.1.2 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.4.2 Details of test procedures

4.4.2.1 General standard information

The test methods used comply with CISPR Publication 22, EN 55022 - "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.4 - "Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.4.3 Conducted emission

4.4.3.1 Description of measurement

The final level, expressed in dB μ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit or to the CISPR limit.

To convert between dB μ V and μ V, the following conversions apply:

$$\begin{aligned} \text{dB}\mu\text{V} &= 20 \cdot \log(\mu\text{V}) \\ \mu\text{V} &= 10^{(\text{dB}\mu\text{V}/20)} \end{aligned}$$

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 Ω / 50 μ H (CISPR 16) characteristics. 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 emissions are re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

4.4.4 Radiated emission (electrical field 30 MHz - 1 GHz)

4.4.4.1 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 polarised 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 m 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 in horizontal polarisation and is repeated vertically. To locate maximum emission from the test sample the antenna is varied in height from 1 to 4 metres and the EUT is rotated 360 degrees.

The final level in dB μ V/m is calculated by add the antenna correction factor and cable loss factor (dB) on the reading from the EMI receiver (dB μ V). The FCC or CISPR limit is subtracted from this result in order to provide the delta to limit listed in the measurement protocol.

Example:

Frequency (MHz)	Reading level (dB μ V)	+	Correction Factor (dB/m)	=	Level (dB μ V/m)	-	CISPR Limit (dB μ V/m)	=	Delta (dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

4.4.5 Radiated emission (electrical field 1 GHz - 40 GHz)

4.4.5.1 Description of measurement

Radiated emission from the EUT are measured in the frequency range 1 GHz up to the maximum frequency as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. 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 following set out in 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 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. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyser set to max peak detector function and a resolution 1 MHz and video bandwidth 3 MHz for peak and 10 Hz for average measurement. The conditions determined as worst case will then be used for the final measurements. When the EUT is larger than the beam width of the measuring antenna it will be moved over the surface for the four sides of the equipment. Where appropriate, the test distance may be reduced in order to detect emission under better uncertainty and is calculated to the specified test 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 set-up

Please see Attachment B

5.1.3 Applicable standard

According to FCC Part 15, Section 15.107(a):

Except for Class A devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the given limits.

5.1.4 Description of Measurement

The measurements are performed following the procedures set out in ANSI C63.4. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emission are re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin 11.57 dB at 0.1635 MHz

Limit according to FCC Part 15, Section 15.107(a):

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

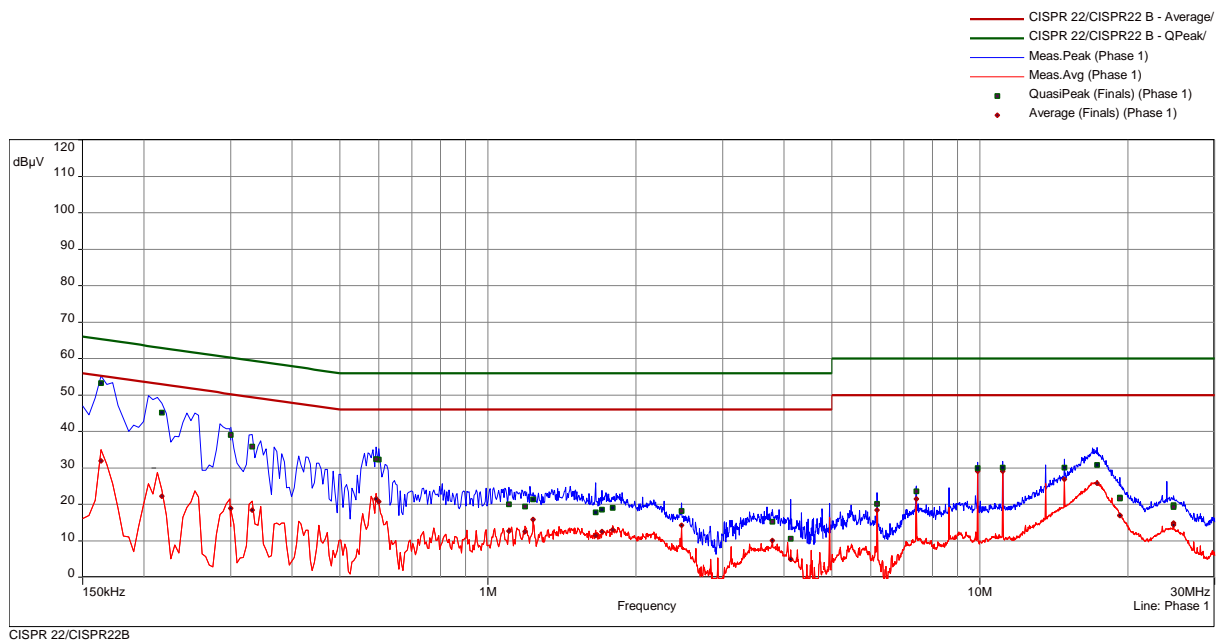
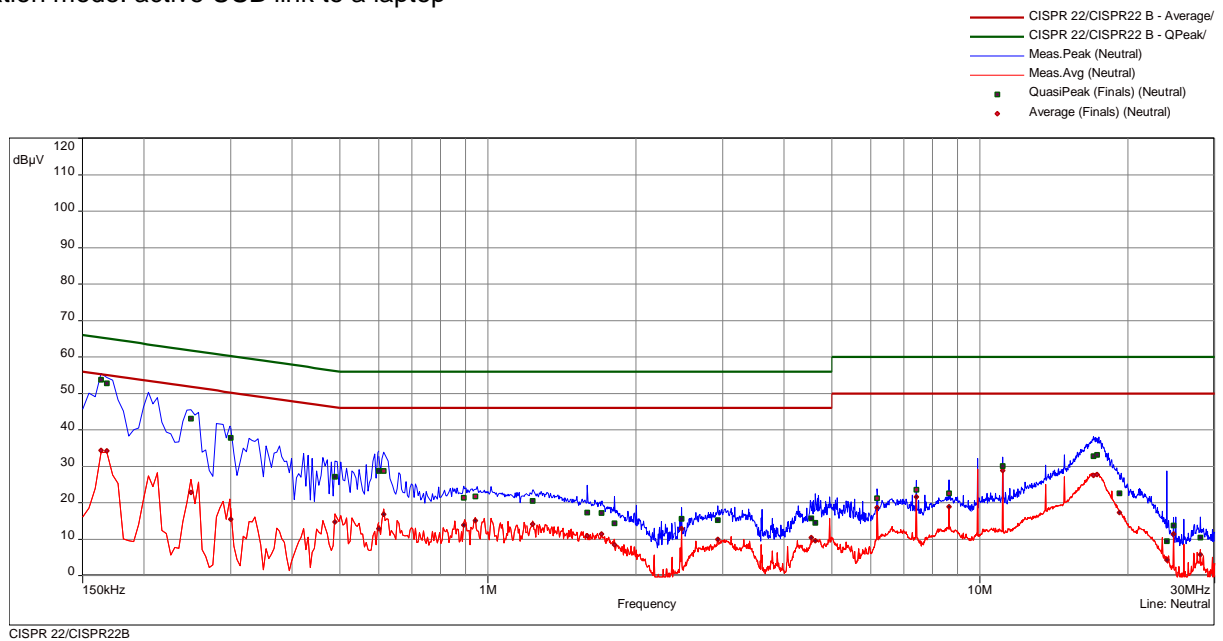
* Decreases with the logarithm of the frequency

The requirements are **FULFILLED**.

Remarks: For detailed test result please refer to following test protocols

5.1.6 Test protocol

Operation mode: active USB link to a laptop



freq	SR	QP	margin	limit	AV	margin	limit	line
MHz		dB(μV)	dB	dB	dB(μV)	dB	dB	
0.1635	1	53.31	11.97	65.28	31.88	23.41	55.28	Phase 1
0.2175	1	45.17	17.74	62.91	22.26	30.65	52.91	Phase 1
0.3	2	39.09	21.15	60.24	18.87	31.37	50.24	Phase 1
0.3315	2	35.88	23.54	59.41	18.41	31.00	49.41	Phase 1
0.5925	2	32.43	23.57	56.00	21.53	24.47	46.00	Phase 1
0.6	3	32.25	23.75	56.00	20.72	25.28	46.00	Phase 1
1.104	3	20.03	35.97	56.00	12.67	33.33	46.00	Phase 1
1.1895	3	19.44	36.56	56.00	12.51	33.49	46.00	Phase 1
1.236	4	21.41	34.59	56.00	15.85	30.15	46.00	Phase 1
1.6545	4	17.74	38.26	56.00	11.38	34.62	46.00	Phase 1
1.704	4	18.59	37.41	56.00	12.52	33.48	46.00	Phase 1
1.794	4	19.05	36.95	56.00	13.07	32.93	46.00	Phase 1
2.472	5	18.20	37.80	56.00	14.28	31.72	46.00	Phase 1
3.7815	5	15.17	40.83	56.00	10.09	35.91	46.00	Phase 1
4.1235	5	10.51	45.49	56.00	4.87	41.13	46.00	Phase 1
6.1815	6	20.17	39.83	60.00	18.45	31.55	50.00	Phase 1
7.419	6	23.54	36.46	60.00	21.54	28.46	50.00	Phase 1
9.8925	7	29.89	30.11	60.00	29.06	20.94	50.00	Phase 1
11.13	7	30.07	29.93	60.00	29.08	20.92	50.00	Phase 1
14.838	7	30.03	29.97	60.00	26.92	23.08	50.00	Phase 1
17.313	7	30.82	29.18	60.00	25.83	24.17	50.00	Phase 1
19.236	8	21.86	38.14	60.00	16.99	33.01	50.00	Phase 1
19.2585	8	21.64	38.36	60.00	16.90	33.10	50.00	Phase 1
24.726	8	19.83	40.17	60.00	14.86	35.14	50.00	Phase 1
24.7305	8	19.30	40.70	60.00	14.41	35.59	50.00	Phase 1
0.1635	9	53.72	11.57	65.28	34.31	20.97	55.28	Neutral
0.168	9	52.81	12.25	65.06	34.30	20.76	55.06	Neutral
0.249	9	43.10	18.69	61.79	22.84	28.95	51.79	Neutral
0.3	10	37.83	22.41	60.24	15.48	34.77	50.24	Neutral
0.489	10	27.17	29.01	56.18	14.78	31.41	46.18	Neutral
0.6	10	28.77	27.23	56.00	12.83	33.17	46.00	Neutral
0.6135	11	28.77	27.23	56.00	16.82	29.18	46.00	Neutral
0.8925	11	21.35	34.65	56.00	13.91	32.09	46.00	Neutral
0.942	11	21.79	34.21	56.00	15.10	30.90	46.00	Neutral
1.2315	12	20.47	35.53	56.00	14.07	31.93	46.00	Neutral
1.5915	12	17.27	38.73	56.00	10.91	35.09	46.00	Neutral
1.6995	12	17.16	38.84	56.00	11.37	34.63	46.00	Neutral
1.8075	12	14.34	41.66	56.00	8.50	37.50	46.00	Neutral
2.472	13	15.54	40.46	56.00	12.86	33.14	46.00	Neutral
2.931	13	15.28	40.72	56.00	9.96	36.04	46.00	Neutral
4.5375	13	15.68	40.32	56.00	10.50	35.50	46.00	Neutral
4.6275	13	14.48	41.52	56.00	9.62	36.38	46.00	Neutral
6.1815	14	21.28	38.72	60.00	18.68	31.32	50.00	Neutral
7.419	14	23.61	36.39	60.00	21.64	28.36	50.00	Neutral

8.6565	14	22.65	37.35	60.00	18.89	31.11	50.00	Neutral
11.13	15	30.12	29.88	60.00	28.88	21.12	50.00	Neutral
17.0115	15	32.72	27.28	60.00	27.45	22.55	50.00	Neutral
17.3085	15	33.10	26.90	60.00	27.79	22.21	50.00	Neutral
19.2225	16	22.61	37.39	60.00	17.35	32.65	50.00	Neutral
23.997	16	9.47	50.53	60.00	4.27	45.73	50.00	Neutral
24.7305	16	13.74	46.26	60.00	11.36	38.64	50.00	Neutral
28.0425	16	10.42	49.58	60.00	5.73	44.27	50.00	Neutral

5.2 Radiated emission

For test instruments and accessories used see section 6 Part **SER 2**, **SER 3**.

5.2.1 Description of the test location

Test location: OATS 1
Test location: Anechoic chamber 1

Test distance: 10 m (OATS 1)
Test distance: 3 m (Anechoic chamber)

5.2.2 Photo documentation of the test setup

Please see Attachment B

5.2.3 Applicable standard

According to FCC Part 15B, Section 15.109 (a):
Except for Class A digital devices, the field strength of radiated emission from unintentional radiators at a distance of 3 m shall not exceed the given limit.

5.2.4 Description of Measurement

The radiated emissions from the EUT are measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. The setup of the EUT and the measurement procedure is in accordance to ANSI C63.4, Item 8 and 12. In the frequency range above 1 GHz a spectrum analyser is used. If the emission level in peak mode complies with the average limit, testing is stopped and peak values will be reported, otherwise, the emission is measured in average mode again and both are reported. The EUT is measured in RX continuous mode under normal conditions.

Spectrum analyser settings:

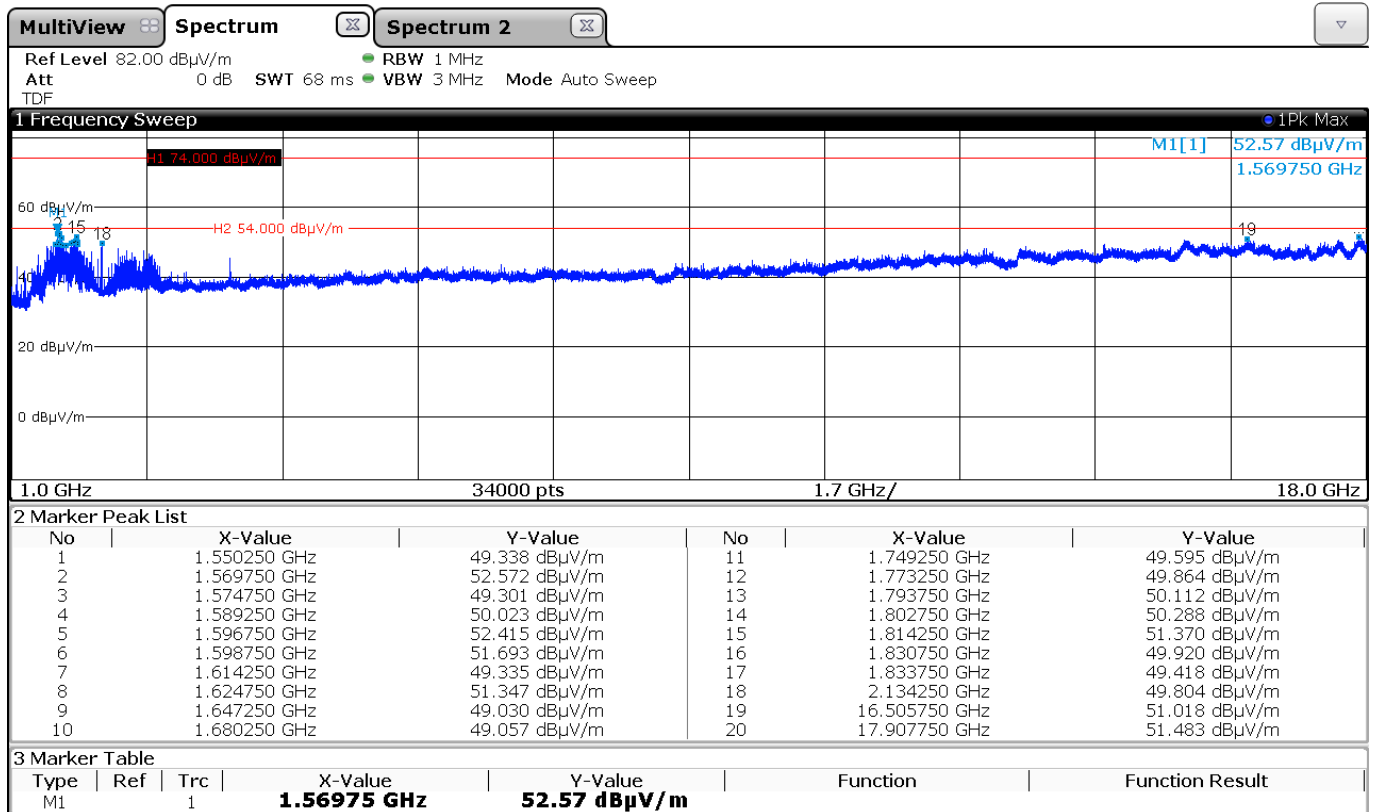
30 MHz – 1000 MHz: RBW: 120 kHz
1000 MHz – 25 GHz: RBW: 1 MHz, VBW: 3 MHz, Sweep: Auto, Detector function: Peak

5.2.5 Test result

Frequency (MHz)	Reading Vert. (dB μ V)	Reading Hor. (dB μ V)	Correct. Vert. (dB/m)	Correct. Hor. (dB/m)	Level Vert. (dB μ V/m)	Level Hor. (dB μ V/m)	Limit (dB μ V/m)	Dlimit (dB)
34.11	4.4	-1.6	14.0	13.6	18.4	12.0	30.0	-11.6
30.01	6.9	1.1	14.2	13.5	21.1	14.6	30.0	-8.9
46.32	3.0	-1.1	15.3	14.9	18.3	13.8	30.0	-11.7
57.28	3.3	-0.8	14.8	14.6	18.1	13.8	30.0	-11.9
73.10	6.1	4.0	12.8	12.7	18.9	16.7	30.0	-11.1
80.45	1.6	1.1	11.2	11.2	12.8	12.3	30.0	-17.2
96.29	7.7		9.8		17.5		30.0	-12.5
169.99	3.5	6.7	15.0	15.1	18.5	21.8	30.0	-8.2
189.99	2.4	6.5	12.8	13.6	15.2	20.1	30.0	-9.9
202.21	0.6	0.6	11.6	12.8	12.2	13.4	30.0	-16.6
209.99	17.9	10.4	12.0	13.2	29.9	23.6	30.0	-0.1
346.48	5.0	10.7	18.4	18.6	23.4	29.3	37.0	-7.7
445.43	7.3	6.6	21.2	21.4	28.5	28.0	37.0	-8.5
480.11	-3.0	-0.6	22.1	22.3	19.1	21.7	37.0	-15.3
536.32	3.7	5.6	23.7	23.8	27.4	29.4	37.0	-7.6
874.95	-1.7	-1.7	30.3	30.5	28.6	28.8	37.0	-8.2
969.88	-1.4	-1.4	31.7	32.0	30.3	30.6	37.0	-6.4

Measurement uncertainty ± 6 dB

Measurement distance: 3 m



Measurement uncertainty ± 6 dB

Note: The plot shows the worst case of the measurements from 1 GHz up to 18 GHz.

Limit according to FCC Part 15B, Section 15.109(a):

Frequency (MHz)	Limit (μV/m)	Limit (dBμV/m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

The requirements are **FULFILLED**.

Remarks:

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	BAT-EMC 3.16.0.73	01-02/68-13-001				
	ESCI	02-02/03-15-001	31/05/2018	31/05/2017		
	ESH 2 - Z 5	02-02/20-05-004	25/10/2019	25/10/2017	25/04/2018	25/10/2017
	N-4000-BNC	02-02/50-05-138				
	N-1500-N	02-02/50-05-140				
	ESH 3 - Z 2 6430	02-02/50-05-155 02-02/50-13-014	18/11/2019	18/11/2016	06/05/2018	06/11/2017
SER 2	ESR 7	02-02/03-17-001	25/07/2018	25/07/2017		
	VULB 9168	02-02/24-05-005	12/04/2018	12/04/2017	28/03/2018	28/09/2017
	EMV D 30000/PAS	02-02/30-05-006	21/02/2018	21/02/2017	21/02/2018	21/02/2017
	AIP 32/3	02-02/30-05-008	17/10/2019	17/10/2016	17/02/2018	17/10/2016
	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	FSW43	02-02/11-15-001	07/04/2018	07/04/2017		
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	3117	02-02/24-05-009	10/05/2018	10/05/2017		
	SF104/11N/11N/300MM	02-02/50-13-008				
	18N-20	02-02/50-17-003				
	NMS111-GL200SC01-NMS11	02-02/50-17-012				
	Bandpass Filter	02-02/50-17-019				